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Species of Aphids Found in Ornamental and Wild Plants in Highland, Pagar Alam, South Sumatra

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Abstract

Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of aphids found in ornamental plants and the wild plants. This study revealed that 15 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis erysimi*.

Keywords: aphids, ornamental plants, wild plants

Introduction

Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy & Stroyan, 1959). One species of aphids can host more than 400 species from 40 families (Blackman & Eastop, 2000). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhawe et al., 2020). A single species of aphids can act as a vector for over 150 viruses (Blackman & Eastop, 2000). In tropical areas, aphids can always be found throughout the year due to their parthenogenetic nature of reproduction (Blackman & Eastop, 2017). Aphids consume plant sap, which can deplete essential nutrients for healthy growth (Müller et al., 2001). Moreover, when aphids transmit viral diseases from one plant to another, this can further weaken and stunt the growth of infected plants (Jones, 2022). According to Kinley et al. (2021), aphids cause yield losses directly (35 - 40%) by sucking the plant sap or indirectly (20 - 80%) through viral transmission. Therefore, aphid infestations can have adverse effects on crop yields and overall plant health (Sarwan Kumar, 2019).

Due to their function as vectors, the presence of aphids on a plant can be highly damaging (Jaouannet et al., 2014). They feed by piercing the plant's tissues and consuming its sap, which can reduce the plant's growth and productivity, ultimately leading to weakness and possible death (Chandel et al., 2022). Additionally, as vectors, aphids can transmit a variety of plant diseases. They are as carriers for various plant viruses, and when they move from infected to healthy plants, these viruses can rapidly spread and cause extensive damage (Guo et al., 2019). In addition, the honeydew that aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh & Singh, 2021). Therefore, it is crucial to control aphid populations in gardens and crops.

Understanding the species diversity of aphids is fundamental to effective aphid control, as it facilitates the development of measures to keep their populations in check. In addition, understanding the diversity of aphid species can provide valuable insights into potential plant diseases, as different aphid species carry distinct viruses. Methods used to control aphids often encompass various techniques, including the use of natural enemies such as predators (like ladybugs, lacewings, and parasitic wasps) (Singh & Singh, 2021; Völkl et al., 2023), parasitoids (Boivin et al., 2012), entomopathogens (Hullé et al., 2020), the use of essential oils as botanical pesticides to control aphids (Ikbali & Pavele, 2019), and crop rotation techniques (Degani et al., 2019). Regular monitoring of aphid populations and diversity can help in detecting when population sizes may be reaching harmful levels, allowing for prompt implementation of the necessary countermeasures.

According to Irsan *et al.* (1998), many aphid species were found on plants that were not their actual hosts. Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al., 2020). An alternative host can also be a collateral host belonging to the same plant family as the primary host, helping crop pests to survive when the primary hosts are unavailable (Sileshi et al., 2008). These secondary hosts may offer less adequate nutrition for insects (Capinera, 2005). However, they may provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al., 2021). According to Liu et al. (2017), since hibiscus serves as an overwintering host for cotton-specialized aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during times of food shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin et al., 2010). They maintain a cycle of host alternation, shifting between their primary hosts (typically a woody

plant) and secondary hosts (often herbaceous plants) (Moran, 1992). Weeds pose a continuous threat in both cropped and non-crop areas, providing food, shelter and reproductive sites for various pest organisms (Kumar et al., 2021). This indicates that weeds can serve as alternative hosts for aphids.

A study of aphid species on horticultural plants has been conducted (Maharani et al., 2018), However, information about aphid species on ornamental and wild plants has not received as much attention and remains largely unexplored. In South Sumatra, particularly in the highland areas like Pagaralam, there are numerous ornamental and native plants. The research on the diversity of aphid species in ornamental and wild plants has received little attention. Therefore, this study was conducted in Pagaralam, a highland region of South Sumatra, with the aim of obtaining information on the diversity of aphid species found in ornamental and wild plants. The findings from this study can serve as a valuable resource for aphid management.

Methods

The field research employed a purposive and direct observation approach to inventory cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing fruit, vegetable, and ornamental varieties, as well as wild plants or weeds. The collection and identification of host plants, aphids, and their natural enemies involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. Any plants colonized by aphids were documented as aphid hosts. Aphids, along with their natural enemies within the aphid colonies, were systematically collected. All components of the collected observations were then identified.

Guidelines for finding host plants were written by Blackman & Eastop 1994, 2000; Irsan 1998; Kranz *et al.* 1978). Aphid identification was conducted using identification keys made by Blackman & Eastop (1994, 2000); Heie (1992, 1994, 1995); Irsan (1998); Kranz *et al.* (1978); Martin (1983). Identification of aphid species took place in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on morphological characteristics. The host plants were identified based on identification keys made by van Steenis (1988). The location and size of aphid colonies, morphology of aphids including their shape and color, as well as any symptoms observed in the host plants were recorded, and photographs of the aphid colonies and their host plants were taken.

Results

The results showed that 15 aphid species were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipapis erysimi*. Based on the observation, these aphids were found on various ornamental plants (Table 1). The primary colony locations were generally in flowers, and this study documented these colony locations in ornamental plants (Figure 1).

Table 1: Aphid species found in ornamental plants and their colony locations

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Sitobion luteum</i>	flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	flower
3	<i>Caladium</i> sp.	<i>Pentalonia</i> sp.	flower
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	flower
5	<i>Canna indica</i>	<i>Pentalonia nigronervosa</i>	flower
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	flower
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	flower
9	<i>Cosmos caudatus</i>	<i>Uroleucon</i> sp.	flower
10	<i>Dahlia Kelvin</i>	<i>Aphis gossypii</i>	flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	flower
13	<i>Helianthus</i> sp.	<i>Aphis glycines</i> <i>Hyperomyzus</i> sp.	flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	flower
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	flower
20	<i>Spondiras dulcissoland</i>	<i>Aphis citricola</i> <i>Hysteroneura setariae</i>	flower

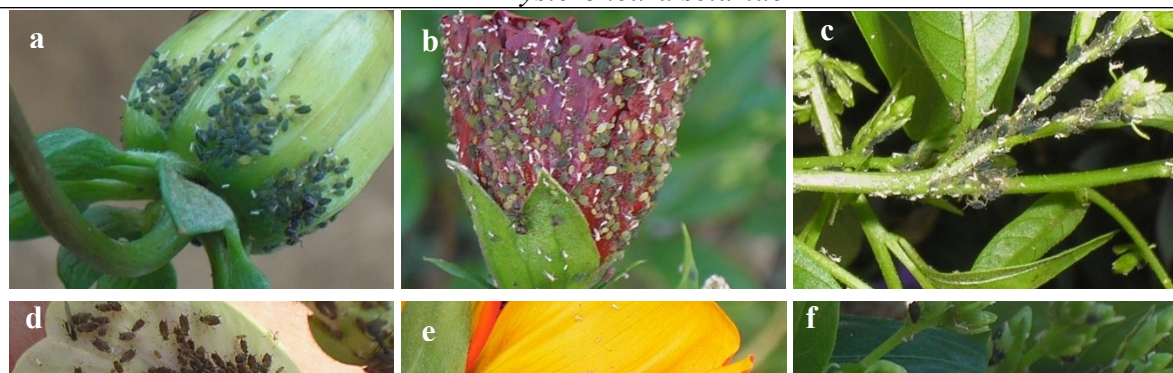


Fig 1. The location of aphid colonization on various plant parts. a) *A. gossypii* in *D. Kelvin* flower b) *A. gossypii* in *H. rosasinensis* flower c) *A. gossypii* in tuberos flower, d) *A. craccivora* in *Clitoria ternatea* flower, e) *A. citricola* in *Helianthus* sp., f) *A. aurantii* on the *M. paniculata* flower, g) *T. odinae* in the *S. dulcissoland*, h) *Uroleucon* sp. in chrysanthemums, i) *Macrosiphum rosae* in *R. indica* flower, j) *Pentalonia nigronervosa* in *C. indica* leaves

In addition, this study documented the presence of weeds, which might serve as alternative hosts for aphids (Table 2). The location of aphid colonies also varied, namely on flowers, stalks, plant tops, young leaves and old leaves of wild plants (Figure 2). The presence of specific plants or host plants within a habitat influenced the types of aphids found. Many aphid species are found on a broad range of plants or host plants, while others are highly specialized and are only found on specific plants or host plants. This is closely related to the polyphagous, oligophagous or monophagous nature of aphids (Blackman & Eastop 2000).

Table 2: Species of aphids found in wild plants and their colony locations.

No	Host Plant	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	<i>Aphis gossypii</i>	Shoots, buds
3	<i>Alternanthera sessilis</i>	<i>Aphis gossypii</i>	Shoots, buds
4	<i>Amaranthus gracilis</i>	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
6	<i>Croton hirtus</i>	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
8	<i>Cyperus rotundus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	<i>Hysteronura setariae</i>	Flower, flower stalks
11	<i>Echinochloa crusgali</i>	<i>Hiperomyzus</i> sp.	Young leaves, old leaves
12	<i>Ecliptica prostrata</i>	<i>Aphis gossypii</i>	Shoots, young leaves
13	<i>Eleusin indica</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	<i>Hysteronura setariae</i>	Flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	<i>Aphis gossypii</i>	Young leaves, old leaves
17	<i>Eupotarium odoratum</i>	<i>Aphis gossypii</i> , <i>Aphis glycine</i>	Young leaves, old leaves, young twigs
18	<i>Hymenochera acutigluma</i>	<i>Hysteronura setariae</i>	Flowers, flower stalks, leaf axils
19	<i>Lagerstromia</i> Sp.	<i>Greenidea</i> sp.	Young leaves
20	<i>Lophatherum gracile</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	<i>Aphis gossypii</i>	Shoots, young leaves

No	Host Plant	Aphid species	Colony location
22	<i>Mikania mikranta</i>	<i>Aphis gossypii</i> <i>Aphis glycine</i>	Shoots, young leaves, old leaves
23	<i>Mimosa invisa</i>	<i>Aphis craccivora</i>	Shoots, pods
24	<i>Mimosa pudica</i>	<i>Aphis craccivora</i>	Shoots, pods, flowers
25	<i>Mimosa vigma</i>	<i>Aphis craccivora</i>	Shoots, pods
26	<i>Oryza rufipogon</i>	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	Old leaves, young leaves (pupus), leaf axils
27	<i>Oxonopus compressus</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, seeds
29	<i>Phyllanthus neruri</i>	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	<i>Aphis craccivora</i>	Shoots, young leaves, flower
31	<i>Physalis angulata</i>	<i>Aphis craccivora</i> , <i>A. gossypii</i>	Shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	<i>Lipapis erysimi</i>	Flower, fruit, shoots, young leaves
33	<i>Sida rhombifolia</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arvensis</i>	<i>Lipapis erysimi</i>	Young leaves, fruit stalks, flower, fruit



Figure 2. Aphids found on wild plants a) *A. gossypii* on the weed *Ageratum conyzoides*, b) *A. gossypii* on Croton weed *hirtus* c) *A. gossypii* on the weed *Eupatorium odoratum*, d) *A. gossypii* on plants *Pachystochys* sp., e) *A. gossypii* on plants *Caladium* sp., f) *A. gossypii* on the weed *Alternanthera sessilis*, g) *A. gossypii* in *Portulaca oleraceae* weeds, h) *A. gossypii* on the weed *Euphorbia hirta*, i) *A. citricola* on the weed *Phylantus nerruri*, j) *A. citricola* on *Sida rhombifolia* weed, k) *A. citricola* on plants *Annona muricata*, l) *A. citricola* on the weed *Ludwigia peruviana*, m) *A. craccivora* on *Mimosa pudica* weed, n) *A. craccivora* on weeds *Amaranthus gracilis*, o) *A. glycine* in *Mikania micranta* weed, p) *Hysteneura* sp. in *Eleusin* weeds, q) *Greenidae* sp. in kenidai trees (shrubs) *indica*, r) *Hyperomyzus* sp. in *Echinocloa crusgali* Weed, s) *L. erysimi* on weed *sonchus arventris*, t) *Rhopalosiphum rice* on the weed *Oryza rufipogon*, u) *Rhopalosiphum Maidis* on the weed *Oryza rufipogon*.

Discussion

The plant species or host plant influences the distribution of aphids. There are aphid species that can be found on a wide range of host plants, which is closely related to the polyphagous nature of aphids, allowing them to colonize many different species of host plants. Host plants can also affect the distribution of aphids, as evidenced by the presence of aphid species exclusively found on certain host plants (Peccoud et al., 2010). But there are some species of aphids found only on one particular host and are not found on other host plants (Döring, 2014). *A. gossypii*, and *Aphis aurantii* have been found on many host plants because both aphids are classified as polyphagous aphids (Margaritopoulos et al., 2006; Piron et al., 2019).

Aphids can commonly be found infesting a variety of ornamental plants. They are attracted to these plants due to the rich nutrient content in the plant sap (Wäckers & Van Rijn, 2012). In this present study, some aphid species were found on some ornamental plants in Pagaralam. The location of aphid colonization on the plants varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and on newly emerging leaves. The aphids displayed brown and black coloration. The aphid colonies found were small, and the colonized plant parts showed no signs of disease. The identification results showed that the

aphids were *Neotoxoptera* sp., and notably, they were not associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The identification results showed that the aphids were *Uroleucon* sp., and they were associated with ants.

On the *Brugmansia suaveolens* (angel's trumpet), *M. persicae* were found on the undersides of old leaves or leaves that have started to turn yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. (taro) was found one species of aphids: *A. gossypii*. The aphids formed colonies under the surface of young and older leaves. The occupied leaf areas did not display severe symptoms. The aphids were yellow green to dark green. The wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black in color. The colonies of *T. aurantii* were found to be associated with black ants.

Aphids on *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body. The identification results showed that the aphids were *P. nigronervosa*. The colonies of *P. nigronervosa* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and the colonized plant parts did not show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the undersides of young leaves, shoots, and within flower parts, especially between petals or flower stalks that had not fully bloomed. The colonies were quite large. The body color of aphids was green to dark green with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated with ants.

Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems and young leaves. The aphids were brown to black in color. Colonized plant parts, especially shoots and young leaves, showed stunting symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently

associated with ants. On the plant *Cosmos caudatus*, aphids were found on the flower petals. The colonies were not very large. The body color was green and light green. The identification results showed that the aphids were *A. gossypii*, and they were also associated with ants. The aphids on the *Dahlia kelvin plant* formed colonies on unopened flower buds, with a significant population among the blooming petals. The body color was green to dark green. The identification results showed that the aphids were *A. gossypii*. Aphids on *Datura metel* (amethyst) were found to form colonies on the undersides of old leaves. The aphids were medium-sized with a green body color. The colonized plant parts did not show any symptoms of disease. The identification results showed that the aphids were *Myzus ornatus*. The aphid colonies were not associated with ants. Within *Dendrobium* sp., aphid colonies were found on the young leaves. The aphids were yellow, green to dark green. The colonized plants did not show any disease symptoms. The identification results showed that the aphids were *A. gossypii*, and they were associated with ants. On *Duranta* sp. (bonsai), colonies of aphids were located on the undersides of young leaves. The colonized plant parts showed stunting symptoms. The colonies were very large. The aphids were green in color. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants.

On the *Helianthus annuus* (sunflower) plants, aphid colonies were found between the flower petals. The colonized flowers, especially the crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid colonies were not associated with ants. Within the colonies, mummified aphids that were parasitized by Aphidiidae were found.

On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Two types of aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and

slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, similar to sugar. The aphids had yellow, green or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The identification results showed that the aphids were

A. gossypii, and they were almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants.

In *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied the shoots, young leaves and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from yellow and green to a slightly darker green. Sometimes the upper surface of the wingless imago's body appeared white, resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost always associated with ants. Another species of aphids were founded and formed colonies on flower stalks that had not yet bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms of plant disease. The aphids were yellow or yellow-green, with black cauda and siphunculi. Their bodies were very small to small in size. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also frequently found in association with ants.

Two types of aphids were found on *Mussaenda frondosa*, each forming colonies in different locations. The first type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease symptoms. The aphids were yellow, green, and some with dark green. The identification results showed that the aphids were *A. gossypii*. The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could also be found on young leaves, shoots and within flower parts. The plant parts they infested showed no signs of diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had tiny to small bodies. The identification results showed that the aphids were *A. citricola*.

The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This indicated that multiple species of aphids colonized various

host plants. The aphid species colonizing these plants were generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green, yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots, flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves. They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi* aphids. These aphids were bright green, and of medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow-green to dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to red-brown. They were associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies were found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants. The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis rotundiventris* aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or buds. Small colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crussgali* or water hyacinth plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black, and formed large colonies on the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids were bright green to blackish green. The aphid colonies were also consistently associated with ants.

Eleusin indica was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H. setariae* formed colonies in flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body color ranged from red-brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis* formed colonies in the leaf axils and undersides of leaves and on leaf shoots that had not yet opened. The colonies were not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants. The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids were yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves.

Eragrostis tenella was infested by *Hysteroneura setariae* aphids. The aphids were brown to red-brown. Small colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by *Aphis gossypii*. The aphids formed colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupotarium odoratum* was colonized by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young twigs. Young leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this plant showed yellow-green to dark green in body colour. The colonies of *A. citricola* formed on the young twigs near the shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.

Hymenochera acutigluma or hair axis was colonized by *Hysteroneura setariae*, which formed colonies on the flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves, leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids

were brown to red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis* aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two species of aphids on *L. gracile* to mix.

Melastoma affine was colonized by *Aphis gossypi*. The colonies formed on shoots, particularly near newly emerging shoots and on newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The colonized plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony.

Mimosa invisa (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisa* plants formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots, and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were shiny black. The colonized plant parts did not show any disease symptoms.

Oryza rufipogon was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species could be distinguished by their body color. *R. maidis* appeared green with black siphunculi and cauda, while *R. rice* appeared white. The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants. *Oxonopus compressus* or *pait* grass was colonized by *Hysteroneura setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed, and they were also consistently associated with ants.

Paspalum conjugatum was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus niruri* was colonized by *Aphis citricola*. The colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted, and

wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large. *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants formed colonies on the undersides of leaves, especially young leaves, shoots and in flowers. The colonized plant parts became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that appeared glossy black.

Physalis angulata plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant parts did not show any symptoms of disease. *Rorippa indica* or mustard land was colonized by *Lipaphis erysimi*. The colonies formed on the flowers, fruits, flower stalks and the lower surface of leaves. The colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia* or cacabeen was colonized by *Aphis gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks and flower petals. The colonized plant parts, especially the shoots, showed curling. and the leaf edges curled downward. *Sonchus arvensis* plants were colonized by *L. erysimi*. The aphids had green to whitish green body colours, and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves. These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid infestations.

The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to grow, resulting in some parts developing normally while others become stunted (Pettersson et al., 2017). This condition could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or

stunted leaf growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to recognize through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids had colonized the plant (Tegelaar et al., 2012). Therefore, the presence of ants could serve as an indicator of the presence of aphid colonies.

Throughout their life cycle, aphids exhibited host alternation by switching between two distinct host plants (Peccoud et al., 2010). They overwintered on woody plants, reproduced in the spring, and migrated to herbaceous plants during the summer before returning to their primary host in the autumn (Yamamoto et al., 2020). This allowed aphids to maximize resource utilization, avoid congestion and competition, evade predators and parasites, circumvent plant defenses, and colonize new areas. Aphids could distribute their population efficiently, thereby avoiding overcrowding, predators and parasites, and plant defenses developing over time through host switching (Yamamoto et al., 2020). This behavior was essential for the survival and environmental adaptation of aphids.

Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new growth or reproductive parts of plants. Flowers contain nutrient-rich nature (Jakubczyk et al., 2022) and easy access to sap, therefore aphids were attractive to sap the flowers. Some aphid species were drawn to certain colors (Chittka, 2007), while others preferred different types of plants and plant parts (Sorensen, 2009). It's worth noting that different aphid species often had distinct preferences for plant ty(Harrington et al., 2007)pes and parts.

Herbs served as an alternative host for aphids in this present study. Aphids consumed sugar-rich liquid in plants, known as "sap". Aphids considered herbs and other green vegetation as abundant food sources. Aphids utilized needle-like mouthparts to penetrate plant tissues and access this fluid (Brožek et al., 2015). Numerous herbs had structural characteristics, such as folds, crevices, and concealed flowering portions (Harrington et al., 2007), that provided aphids with refuge .

Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson & Mooney, 2022). The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Detrain et al., 2010). Ants were drawn to this nutrient-rich food source and would often

'farm' aphids for it. In exchange for honeydew, ants provided aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and parasitic wasps (Karami-jamour et al., 2018). Certain species of ants would transport aphids to new host plants for improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al., 2021). Honeydew not only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain species) and provided energy for the growth of their own progeny (Biedermann & Vega, 2020).

References

- Biedermann, P. H. W., & Vega, F. E. (2020). Ecology and evolution of insect–fungus mutualisms. *Annual Review of Entomology*, *65*, 431–455.
- Blackman, R. L., & Eastop, V. F. (2000). *Aphids on the world's crops: an identification and information guide*. (Issue Ed. 2). John Wiley & Sons Ltd.
- Blackman, R. L., & Eastop, V. F. (2017). Taxonomic issues. In *Aphids as crop pests* (pp. 1–36). CABI Wallingford UK.
- Boivin, G., Hance, T., & Brodeur, J. (2012). Aphid parasitoids in biological control. *Canadian Journal of Plant Science*, *92*(1), 1–12.
- Brożek, J., Mróz, E., Wyleżek, D., Depa, Ł., & Węgierek, P. (2015). The structure of extremely long mouthparts in the aphid genus *Stomaphis* Walker (Hemiptera: Sternorrhyncha: Aphididae). *Zoomorphology*, *134*, 431–445.
- Capinera, J. L. (2005). Relationships between insect pests and weeds: an evolutionary perspective. *Weed Science*, *53*(6), 892–901.
- Chandel, R. S., Chandla, V. K., Verma, K. S., & Pathania, M. (2022). *Chapter 21 - Insect pests of potato in India: biology and management* (A. Alyokhin, S. I. Rondon, & Y. B. T.-I. P. of P. (Second E. Gao (eds.); pp. 371–400). Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-821237-0.11001-7>
- Chittka, Æ. L. (2007). *Visual ecology of aphids—a critical review on the role of colours in host finding* *Visual ecology of aphids — a critical review on the role of colours in host finding*. June 2014. <https://doi.org/10.1007/s11829-006-9000-1>
- Clarke, R., Kehoe, M. A., Broughton, S., & Jones, R. A. C. (2020). Host plant affiliations of aphid vector species found in a remote tropical environment. *Virus Research*, *281*(December 2019), 197934. <https://doi.org/10.1016/j.virusres.2020.197934>
- Degani, E., Leigh, S. G., Barber, H. M., Jones, H. E., Lukac, M., Sutton, P., & Potts, S. G. (2019). Crop rotations in a climate change scenario: short-term effects of crop diversity on resilience and ecosystem service provision under drought. *Agriculture, Ecosystems & Environment*, *285*, 106625.
- Detrain, C., Verheggen, F. J., Diez, L., Wathelet, B., & Haubruge, E. (2010). Aphid–ant mutualism: how honeydew sugars influence the behaviour of ant scouts. *Physiological Entomology*, *35*(2), 168–174.
- Döring, T. F. (2014). How aphids find their host plants, and how they don't. *Annals of Applied Biology*, *165*(1), 3–26. <https://doi.org/https://doi.org/10.1111/aab.12142>
- Gadhawe, K. R., Gautam, S., Rasmussen, D. A., & Srinivasan, R. (2020). Aphid transmission of Potyvirus: the largest plant-infecting RNA virus genus. *Viruses*, *12*(7), 773.
- Giannetti, D., Mandrioli, M., Schifani, E., Castracani, C., Spotti, F. A., Mori, A., & Grasso, D. A. (2021). First report on the acrobat ant *Crematogaster scutellaris* storing live aphids in its oak-gall nests. *Insects*, *12*(2), 108.

- Guo, H., Gu, L., Liu, F., Chen, F., Ge, F., & Sun, Y. (2019). Aphid-borne Viral Spread Is Enhanced by Virus-induced Accumulation of Plant Reactive Oxygen Species 1. *Plant Physiol*, 179(January), 143–155. <https://doi.org/10.1104/pp.18.00437>
- Harrington, R., Clark, S. J., Welham, S. J., Verrier, P. J., Denholm, C. H., Hulle, M., Maurice, D., Rounsevell, M. D., Cocu, N., & Consortium, E. U. E. (2007). Environmental change and the phenology of European aphids. *Global Change Biology*, 13(8), 1550–1564.
- Hullé, M., Chaubet, B., Turpeau, E., & Simon, J.-C. (2020). Encyclop'Aphid: A website on aphids and their natural enemies. *Entomologia Generalis*, 40(1).
- Ikbal, C., & Pavela, R. (2019). Essential oils as active ingredients of botanical insecticides against aphids. *Journal of Pest Science*, 92, 971–986.
- Jakubczyk, K., Koprowska, K., Gottschling, A., & Janda-Milczarek, K. (2022). Edible Flowers as a Source of Dietary Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement. *Nutrients*, 14(12). <https://doi.org/10.3390/nu14122470>
- Jaouannet, M., Rodriguez, P. A., Thorpe, P., Lenoir, C. J. G., & Macleod, R. (2014). Plant immunity in plant – aphid interactions. *Front Plant Sci.*, 5(December), 1–10. <https://doi.org/10.3389/fpls.2014.00663>
- Jones, R. A. C. (2022). Alteration of plant species mixtures by virus infection: Managed pastures the forgotten dimension. *Plant Pathology*, 71(6), 1255–1281.
- Jousselin, E., Gwenaëlle, G., & Armelle, C. D. A. (2010). Evolutionary lability of a complex life cycle in the aphid genus *Brachycaudus*. *BMC Evolutionary Biology*, 10(1). <https://doi.org/10.1186/1471-2148-10-295>
- Karami-jamour, T., Mirmoayedi, A., Zamani, A., & Khajehzadeh, Y. (2018). The impact of ant attendance on protecting *Aphis gossypii* against two aphidophagous predators and its role on the intraguild predation between them. *Journal of Insect Behavior*, 31, 222–239.
- Kennedy, J. S., & Stroyan, H. L. G. (1959). Biology of aphids. *Annual Review of Entomology*, 4(1), 139–160.
- Kinley, C., Banu, A. N., Raut, A. M., Wahengbam, J., & Jamtsho, T. (2021). A review on past, present and future approaches for Aphids management. *Journal of Entomological Research*, 45(2), 336–346. <https://doi.org/10.5958/0974-4576.2021.00053.0>
- Kumar, Sarwan. (2019). Aphid-Plant Interactions: Implications for Pest Management. In M. T. Oliveira, F. Candan, & A. Fernandes-Silva (Eds.), *Plant Communities and Their Environment* (p. Ch. 7). IntechOpen. <https://doi.org/10.5772/intechopen.84302>
- Kumar, Sushil, Bhowmick, M. K., & Ray, P. (2021). Weeds as alternate and alternative hosts of crop pests. *Indian Journal of Weed Science*, 53(1), 14–29. <https://doi.org/10.5958/0974-8164.2021.00002.2>
- Liu, X. D., Xu, T. T., & Lei, H. X. (2017). Refuges and host shift pathways of host-specialized aphids *Aphis gossypii*. *Scientific Reports*, 7(1), 1–9. <https://doi.org/10.1038/s41598-017-02248-4>
- Maharani, Y., Hidayat, P., Rauf, A., & Maryana, N. (2018). Short communication: New records of aphid species subfamily aphidinae (Hemiptera: Aphididae) in West Java, Indonesia. *Biodiversitas*, 19(2), 460–465. <https://doi.org/10.13057/biodiv/d190219>
- Margaritopoulos, J. T., Tzortzi, M., Zarpas, K. D., Tsitsipis, J. A., & Blackman, R. L. (2006). Morphological discrimination of *Aphis gossypii* (Hemiptera: Aphididae) populations feeding on Compositae. *Bulletin of Entomological Research*, 96(2), 153–165. <https://doi.org/10.1079/ber2005410>
- Moran, N. A. (1992). The Evolution of Aphid Life Cycles. *Annual Review of Entomology*, 37(1), 321–348. <https://doi.org/10.1146/annurev.en.37.010192.001541>
- Müller, C. B., Williams, I. S., & Hardie, J. (2001). The role of nutrition, crowding and

- interspecific interactions in the development of winged aphids. *Ecological Entomology*, 26(3), 330–340.
- Nelson, A. S., & Mooney, K. A. (2022). The evolution and ecology of interactions between ants and honeydew-producing hemipteran insects. *Annual Review of Ecology, Evolution, and Systematics*, 53, 379–402.
- Peccoud, J., Simon, J.-C., von Dohlen, C., Coeur d'acier, A., Plantegenest, M., Vanlerberghe-Masutti, F., & Jousselin, E. (2010). Evolutionary history of aphid-plant associations and their role in aphid diversification. *Comptes Rendus Biologies*, 333(6), 474–487. <https://doi.org/https://doi.org/10.1016/j.crv.2010.03.004>
- Pettersson, J., Tjallingii, W. F., & Hardie, J. (2017). Host-plant selection and feeding. In *Aphids as crop pests* (pp. 173–195). CABI Wallingford UK.
- Piron, P., de Haas, M., & Sonnemans, M. (2019). The presence of *Aphis* (Toxoptera) *aurantii* (Homoptera: Aphididae) in the Netherlands. *Entomologische Berichten*, 79(5), 162–164.
- Sileshi, G., Schroth, G., Rao, M. R., & Girma, H. (2008). Weeds, diseases, insect pests and tri-trophic interactions in tropical agroforestry. *Ecological Basis of Agroforestry*, 73–94.
- Singh, R., & Singh, G. (2021). Aphids. *Polyphagous Pests of Crops*, 105–182.
- Sorensen, J. T. (2009). *Chapter 8 - Aphids* (V. H. Resh & R. T. B. T.-E. of I. (Second E. Cardé (eds.); pp. 27–31). Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-374144-8.00008-4>
- Tegelaar, K., Hagman, M., Glinwood, R., Pettersson, J., & Leimar, O. (2012). Ant-aphid mutualism: the influence of ants on the aphid summer cycle. *Oikos*, 121(1), 61–66. <https://doi.org/https://doi.org/10.1111/j.1600-0706.2011.19387.x>
- Völkl, W., Mackauer, M., Pell, J. K., & Brodeur, J. (2023). Predators, parasitoids and pathogens. In *CABI Books*. CABI Books. <https://doi.org/10.1079/9780851998190.0187>
- Wäckers, F. ., & Van Rijn, P. . (2012). Pick and mix: selecting flowering plants to meet the requirements of target biological control insects. *Biodiversity and Insect Pests: Key Issues for Sustainable Management*, 9(April), 139–165. <https://doi.org/10.1002/9781118231838.ch9>
- Yamamoto, T., Hattori, M., & Itino, T. (2020). *Seasonal Migration in the Aphid Genus Stomaphis (Hemiptera : Aphididae) : Discovery of Host Alternation Between Woody Plants in Subfamily Lachninae*. 20. <https://doi.org/10.1093/jisesa/ieaa103>

Species of aphids found in ornamental and wild Plants in Highland, Pagar Alam, South Sumatra

Abstract. Aphids are one of the crucial pests in ~~the~~ tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species ~~were found on plants that were not actually hosts such as wild plan, such as wild plants, were found on plants that were not actually hosts~~. Therefore, this study reported the species of aphids found in ornamental ~~plants and the~~ wild plants. The field research employed ~~a~~ purposive and direct observation ~~methods approach~~ to inventory cultivated or wild plants hosting ~~aphids~~ and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host plants; and aphids; involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that 21 species of aphids were found in **Pagaralam**, namely *Aphis gossypii*, *Aphis citricola*, *Aphis craccivora*, *Aphis glycines*, *Aulacorthum solani*, *Greenidae* sp., *Hyperomyzus* sp., *Hysteroneura setariae*, *Lipaphis erysimi*, *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*, *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Rhopalosiphum padi*, *Sinemogoura citricola*, *Toxoptera aurantii*, *Toxoptera citricidus*, *Toxoptera odinae*, and *Schizaphis rotundiventris*.

Keywords: Aphids, ornamental plants, wild plants

Running title: Aphids found in ornamental and wild plants.

INTRODUCTION

Aphids are ~~one of the~~ crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhve et al. 2020); ~~a-~~ Aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can be found throughout the year due to their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids suck phloem sap of tender plant parts, which can deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, vector species can further weaken and stunt the growth of infected plants (Jones 2022). ~~—~~ Therefore, it is crucial to control aphid populations in gardens and crops.

Many aphid species are found on plants that are not their actual hosts (Maharani et al. 2018). Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al. 2020). Alternative plants provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al.; 2021). In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and native plants. Research on the diversity of aphid species in ornamental and wild plants has ~~less noticed~~ **received little attention**. This study reports ~~the~~ diversity of aphid species found in ornamental and wild plants found in this area. The findings from this study can serve as a valuable resource for aphid management.

MATERIALS AND METHODS

The field research employed a purposive and direct observation ~~approach~~ to inventory ~~of cultivated or wild plants hosting aphids~~ **cultivated or wild plants hosting** and collecting aphids. The plant selection ~~process~~ included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. ~~The collection and identification of host plants;~~

50 | ~~and aphids, and natural enemies where available.~~Where available, collecting and identifying host plants, aphids, and
51 | ~~natural enemies~~ involved systematic searches of all existing plant species to find those colonized by aphids. Any plants
52 | colonized by aphids are documented as aphid hosts. Aphid identification was done using identification keys (Blackman
53 | and Eastop 2008) in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on
54 | morphological characteristics. The host plants were identified using [the weed identification hand-book](#) (Kallas; 2010;
55 | Meuninck; 2023; Naidu; 2012). The location and ~~size of~~aphid ~~colony~~colony sizes, including their life color, and
56 | photographs of the aphid colonies and their host plants were recorded.

57 RESULTS AND DISCUSSION

58 Result

59 Aphids infesting in ornamental plants

60 | The results showed that 15 aphid species were found in Pagar Alam(Tables 1 ~~and~~ 2). These aphids mostly
61 | ~~colonised~~colonized flowers of various ornamental plants (Table 1, Figure 1).
62 |

63 | **Table 1.-** Aphid species recorded in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Macrosiphoniella sanborni</i>	Leaves, young twig, flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	Leaves, flower Leaves Leaves, flower
3	<i>Caladium</i> sp.	<i>Pentalonia caladii</i>	Leaves,
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	Leaves, flower
5	<i>Canna indica</i>	<i>Rhopalosiphum nymphaeae</i>	Leaf
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	Shoot, young leaves, flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	Shoot, flower Young leaves
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	Flower
9	<i>Chrysanthemum</i> sp.	<i>Macrosiphoniella sanborni</i>	Shoot, twig
10	<i>Dahlia</i> sp.	<i>Aphis gossypii</i>	Flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	Flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	Shoot, flower
13	<i>Helianthus giganteus</i> .	<i>Aphis glycines</i>	Flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	Flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	Flower Shoot, young leaves
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	Flower Flower Shoot, flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	Young Twig Shoot, flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	Shoot, flower Shoot, flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	Flower
20	<i>Spondias dulcis</i>	<i>Aphis citricola</i>	Flower

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71 | **Fig 1.** Photos showing colonies of different aphid species in ornamental plants: a) *Aphis gossypii* in *Dahlia* sp. flower, b) *Aphis gossypii*
 72 | in *Hibiscus rosasinensis* flower, c) *Aphis gossypii* in ~~*cestrum*~~-*Cestrum* twig and flower, d) *Aphis craccivora* in *Clitoria ternatea* flower,
 73 | e) *Aphis glycines* in *Helianthus giganteus* flower, f) *Aphis craccivora* on the *Murayya paniculata* flower, g) *Toxoptera odinae* in the
 74 | *Mussaenda frondosa*, h) *Macrosiphoniella sanborni*. in *Chrysanthemum* sp. leaves i) *Macrosiphum rosae* in *Rosa indica* flower, j)
 75 | *Rhopalosiphum nymphaeae* in *Canna indica* leaves. ~~All the photos were captured by Chandra Irsan~~Chandra Irsan captured all the
 76 | [photos](#).
 77

78

79 | The relationship between aphids and ants was also recorded. Aphids produce a sweet, sticky substance called
 80 | honeydew. ~~Ants~~Ants are attracted to this honey because it serves as a food source for them. When aphids are present, they
 81 | secrete honeydew, which attracts ants. This research recorded the presence of ants on plant parts colonized by aphids
 82 | (Table 2).
 83

84

86 | **Table 2.-** Aphid species recorded in ornamental plants and the presence of the ants in the plant parts colonized

No	Aphid Species	Ornamental plants	Aphids life colour	Plant parts colonized	Ant attendance
1	<i>Aphis craccivora</i>	<i>Clitoria ternatea</i>	black	flowers	+
		<i>Murraya paniculata</i>	black	flowers	+
2	<i>Aphis citricola</i>	<i>Catharanthus roseus</i>	greenish yellow	flowers	+
		<i>Ixora</i> sp.	greenish yellow	flowers	+
		<i>Mussaenda frondosa</i>	greenish yellow	shoots, flowers	+
		<i>Spondias dulcis</i>	greenish yellow	flowers	+
3	<i>Aphis glycines</i>	<i>Helianthus giganteus</i>	greenish yellow	flowers	+
4	<i>Aphis gossypii</i>	<i>Cestrum</i> sp.	green	shoots, flowers	+
		<i>Cananga odoratum</i>	light green	shoots, flowers	+
		<i>Dahlia</i> sp.	green dark	flowers	+
		<i>Duranta</i> sp.	light green	shoots, flowers	+
		<i>Hibiscus rosasinensis</i>	dark green	flowers	+
		<i>Ixora paludosa</i>	light green	flowers	+
		<i>Ixora</i> sp.	light green	flowers	+
5	<i>Aulacorthum solani</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-
6	<i>Macrosiphoniella sanborni</i>	<i>Aster alpinus</i>	brown black	leaves, twigs, flowers	+
		<i>Chrysanthemum</i> sp.	reddish brown	leaves, twigs	+
7	<i>Macrosiphum rosae</i>	<i>Rosa indica</i>	green	flowers	-
8	<i>Myzus persicae</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-
9	<i>Neomyzus circumflexus</i>	<i>Cestrum</i> sp.	light green	young leaves,	-
		<i>Brugmansia suaveolens</i>	light green	flowers	
				flowers	
10	<i>Pentalonia caladii</i>	<i>Caladium</i> sp.	brown-black	leaves	+
11	<i>Rhopalosiphum nymphaeae</i>	<i>Canna indica</i>	green black	leaves	+
12	<i>Sinemegoura citricola</i>	<i>Dendrobium</i> sp.	brown	flowers	-
13	<i>Toxoptera aurantii</i>	<i>Ixora paludosa</i>	brown black	flowers	+
		<i>Ixora</i> sp.	brown black	flowers	+
14	<i>Toxoptera citricidus</i>	<i>Murraya paniculata</i>	black	stems	+
15	<i>Toxoptera odinae</i>	<i>Mussaenda frondosa</i>	reddish-brown	flowers	+

87 (+): present, (-): absent

88

89 **Aphids infesting in wild plants (weed or non-weed plants)**

90

91 | In addition, this study documented aphid colonies on flowers, stalks, plant tops, young leaves, and old leaves of wild
92 plants (Table 3, Figure 2).

93

94 | **Table 3.-** Species of aphids found in wild (weed or non-weed) plants and their colony locations.

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	weed	<i>Aphis gossypii</i>	shoots, buds
3	<i>Alternanthera sessilis</i>	weed	<i>Aphis gossypii</i>	shoots, buds
4	<i>Amaranthus gracilis</i>	weed	<i>Aphis craccivora</i>	flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	weed	<i>Lipaphis erysimi</i>	flowers, shoots, and buds
6	<i>Croton hirtus</i>	weed	<i>Aphis gossypii</i>	flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks
8	<i>Cyperus rotundus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks
11	<i>Echinochloa crusgali</i>	weed	<i>Hiperomyzus</i> sp.	young leaves, old leaves
12	<i>Ecliptica prostrata</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves
13	<i>Eleusine indica</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks, leaf axils
			<i>Rhopalosiphum maidis</i>	flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	weed	<i>Aphis gossypii</i>	flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves
17	<i>Eupotarium odoratum</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves,
			<i>Aphis glycines</i>	shoot, young twigs
18	<i>Hymenochera acutigluma</i>	Weed	<i>Hysteronura setariae</i>	flowers, flower stalks, leaf axils

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
19	<i>Bridelia tomentosa</i>	Non-weed	<i>Greenidea</i> sp.	young leaves
20	<i>Lophatherum gracile</i>	Weed	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	young leaves, old leaves, leaf axils young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	Non-weed	<i>Aphis gossypii</i>	shoots, young leaves
22	<i>Mikania mickrantha</i>	Weed - liana	<i>Aphis gossypii</i> <i>Aphis glycines</i>	shoots, young leaves, old leaves shoot, young twig
23	<i>Mimosa invisa</i>	weed	<i>Aphis craccivora</i>	shoots, pods
24	<i>Mimosa pudica</i>	weed	<i>Aphis craccivora</i>	shoots, pods, flowers
25	<i>Mimosa vigra</i>	Non-weed	<i>Aphis craccivora</i>	shoots, pods
26	<i>Oryza rufipogon</i>	weed	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	old leaves, young leaves (shoot), leaf axils old leaves, young leaves (shoot), leaf axils
27	<i>Oxonopus compressus</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, leaf axils
28	<i>Paspalum conjugatum</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, seeds
29	<i>Phyllanthus neruri</i>	weed	<i>Aphis citricola</i>	shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	weed	<i>Aphis craccivora</i>	shoots, young leaves, flowers
31	<i>Physalis angulata</i>	weed	<i>Aphis craccivora</i> <i>Aphis gossypii</i>	shoots, young leaves, old leaves shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	weed	<i>Lipapis erysimi</i>	flowers, fruits, shoots, young leaves
33	<i>Sida rhombifolia</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arvensis</i>	weed	<i>Lipapis erysimi</i>	young leaves, fruit stalks, flowers, fruits

95

96 The presence of ants in aphid colonization symbolizes a mutually beneficial relationship where the ants receive food
97 from the aphids while providing protection to protect them from aphids. This study recorded the ant attendance in aphids
98 colonization (Table 4).

99 **Table 4.-** Aphid species were recorded in ornamental plants, and the presence of the ants in the plant parts colonized.

No	Aphid Species	Wild plants	Aphids life colour	Plant parts colonized	Ant attendance
1	<i>Aphis gossypii</i>	<i>Ageratum conyzoides</i> <i>Alternanthera philoxeroides</i> <i>Alternanthera sessilis</i> <i>Croton hirtus</i> <i>Ecliptica prostrata</i> <i>Emilia sonchifolia</i> <i>Euphorbia hirta</i> <i>Eupotarium</i> — <i>Eupatorium</i> <i>odoratum</i> <i>Melastoma affine</i> <i>Mikania mickrantha</i> <i>Physalis angulata</i> <i>Sida rhombifolia</i>	Light green Light green Light green Dark green green green light green light green light green light green light green yellowish green yellowish green	shoots, young leaves, old leaves, flowers shoots, buds shoots, buds flowers, shoots, young leaves, old leaves, young twigs shoots, young leaves flower, flower stalks, shoots young leaves, old leaves young leaves, old leaves, young twigs shoots, young leaves shoots, young leaves, old leaves shoots, young leaves, old leaves, fruit/seeds	+ + - + + + + + + + + -
2	<i>Aphis craccivora</i>	<i>Amaranthus gracilis</i> <i>Mimosa invisa</i> <i>Mimosa pudica</i> <i>Mimosa vigra</i> <i>Portulaca oleraceae</i> <i>Physalis angulata</i>	black black black black black black	flowers, shoots, young leaves, old leaves shoots, pods shoots, pods, flowers shoots, pods shoots, young leaves, flowers shoots, young leaves, old leaves	+ + + + + +
3	<i>Aphis glycines</i>	<i>Eupotarium</i> — <i>Eupatorium</i> <i>odoratum</i> <i>Mikania mickrantha</i>	Greenish yellow Light green	young leaves, old leaves, young twigs shoots, young leaves, old leaves	+ +
4	<i>Aphis citricola</i>	<i>Phyllanthus neruri</i>	Greenish Yellow	shoot, young leaves, young twigs, petioles	+
5	<i>Greenidea</i> sp.	<i>Bridelia tomentosa</i>	Greenish Yellow	young leaves	-
6	<i>Hysteroneura setariae</i>	<i>Digitaria ciliaris</i> <i>Eleusine indica</i> <i>Eragrostis tenella</i> <i>Hymenochera acutigluma</i> <i>Lophatherum gracile</i> <i>Oxonopus compressus</i> <i>Paspalum conjugatum</i>	reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown	flower, flower stalks flower, flower stalks, leaf axils flower, flower stalks, seeds flowers, flower stalks, leaf axils young leaves, old leaves, leaf axils flower, flower stalk, leaf axils flower, flower stalk, seeds	+ + + + + + +
7	<i>Hiperomyzus</i> sp.	<i>Echinocloa crussgali</i>	Black	young leaves, old leaves	-
8	<i>Lipaphis erysimi</i>	<i>Blumea lacera</i> <i>Rorippa indica</i> <i>Sonchus arvensis</i>	Whitish green Whitish green Whitish green	flowers, shoots, and buds flower, fruit, shoots, young leaves young leaves, fruit stalks, flowers, fruit	+ + +
9	<i>Rhopalosiphum maidis</i>	<i>Eleusine indica</i> <i>Lophatherum gracile</i> <i>Oryza rufipogon</i>	green green green	flower, flower stalks, leaf axils young leaves, old leaves, leaf axils old leaves, young leaves (shoot), leaf axils	+ + -
10	<i>Rhopalosiphum padi</i>	<i>Oryza rufipogon</i>	Whitish green	old leaves, young leaves (shoot), leaf axils	+
11	<i>Schizaphis rotundiventris</i>	<i>Cynodon dactylon</i> <i>Cyperus rotundus</i> <i>Cyperus compressus</i>	Green green green	flowers, flower stalks flowers, flower stalks, leaf axils flowers, flower stalks, leaf axils	+ + +

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(+): present, (-): absent



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Figure 2. Aphids found infesting wild plants a) *Aphis gossypii* in *Ageratum conyzoides*, b) *Aphis gossypii* in *Croton hirtus* c) *A. gossypii* in *Eupatorium odoratum*, d) *Aphis gossypii* in *Pachystochys* sp., e) *Pentalonia caladii* in *Caladium* sp., f) *Aphis. gossypii* in *Alternanthera sessilis*, g) *Aphis gossypii* in *Portulaca oleraceae* h) *Aphis gossypii* in *Euphorbia hirta*, i) *Aphis citricola* in *Phyllanthus nerruri*, j) *Aphis citricola* in *Sida rhombifolia*, k) *Aphis citricola* in *Annona muricata*, l) *Aphis citricola* in *Ludwigia peruviana*, m) *A. craccivora* in *Mimosa pudica*, n) *Aphis craccivora* in *Amaranthus gracilis*, o) *Aphis glycine* in *Mikania micranta*, p) *Hysteneura* sp. in *Eleusin*, q) *Greenidae* sp. in *Bridelia tomentosa* young leaves., r) *Hyperomyzus* sp. in *Echinocloa crusgali*, s) *Lipaphis erysimi* in *sonchus arventris*, t) *Rhopalosiphum padi* in *Oryza rufipogon*, u) *Rhopalosiphum Maidis* in *Oryza rufipogon*. All the photos were captured by Chandra Irsan.

127 Discussion

128

129 In the present study, some aphid species were found on ~~several~~ ornamental plants in Pagar Alam. ~~t-~~The location
 130 of aphid colonization on the plants varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and
 131 ~~on~~ newly emerging leaves. The aphids displayed brown and black coloration. The aphid colonies found were small, and
 132 the colonized plant parts showed no signs of disease. The identification results showed that the aphids were *Neotoxoptera*
 133 sp., and notably, they were not associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or
 134 young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized
 135 plant parts showed symptoms of stunting. The identification results showed that the aphids were *Macrosiphoniella*
 136 ~~sanborni, and they were and~~ associated with ants. On the *Brugmansia suaveolens*, *M. persicae* were found on the
 137 undersides of old leaves or leaves that have ~~started to turn~~ yellow. The colonies were relatively small. The aphids
 138 found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. was
 139 found one species of aphids: *P. caladii*. *P. caladii* was known and found in taro plants; ~~;~~ the aphids formed colonies under
 140 the surface of young and older leaves (Bhadra and Agarwala 2014). ~~According to this present study, This study found that~~
 141 the occupied leaf areas did not display severe symptoms; ~~t-~~The aphids were ~~yellow-yellow-green~~ to dark green. The
 142 wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odoratum* (ylang-ylang),
 143 colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T.*
 144 *aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids
 145 found were brown to black ~~in color~~. The colonies of *T. aurantii* were found to be associated with black ants. Aphids on *C.*
 146 *indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the
 147 leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body and
 148 the identification results showed that the aphids were *Rhopalosiphum nymphaeae* (Acharya and Singh 2004). ~~-~~ The colonies
 149 of *R. nymphaeae* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were
 150 found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and
 151 the colonized plant parts ~~did not show any~~ showed no symptoms of disease ~~disease symptoms~~. On *Cestrum* sp. (Bastard
 152 jasmine), aphids formed colonies on the undersides of young leaves, shoots, and within flower parts, especially between
 153 petals or ~~flower~~ stalks that had not fully bloomed; ~~t-~~The colonies were quite large. The body color of aphids was green to
 154 dark green, with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms.
 155 The identification results showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated
 156 with ants. Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems, and young
 157 leaves. The aphids were brown to black ~~in color~~. Colonized plant parts, especially shoots and young leaves, showed
 158 stunting symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently
 159 associated with ants. The aphids on the *Dahlia* sp. formed colonies on unopened flower buds, with a significant population
 160 among the blooming petals. The body color was green to dark green. The identification results showed that the aphids
 161 were *A. gossypii*. According to this present study, *Sinemegoura citricola* colonies were found on the young leaves of
 162 *Dendrobium* sp., with the color body of the *S. citricola* aphids were yellow, green to dark green, and the colonized plants
 163 ~~did not showing no any~~ disease symptoms, and ~~they~~ were associated with ants. On *Duranta* sp., colonies of aphids were
 164 ~~located~~ on the undersides of young leaves, and the colonized plant parts showed stunting symptoms. The colonies were
 165 very large. The aphids were green ~~in color~~. The identification results showed that the aphids were *A. gossypii*. The aphid
 166 colonies were consistently associated with ants. Furthermore, on the *Helianthus annuus*, aphid colonies were found

167 | between the flower petals. The colonized flowers, especially the crowns, exhibited a tendency tended to fall off easily. The
168 | aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A.*
169 | *gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides
170 | of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant
171 | parts did not show any disease symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid
172 | colonies were not associated with ants. Within the colonies, mummified aphids that were parasitized by
173 | Aphidiidae Aphidiidae parasitized were found. On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark
174 | green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the undersides of aging
175 | leaves. The colonies grew to be very large. The identification results showed that the aphids were *A. gossypii*. The aphid
176 | colonies were consistently associated with ants. Two types of aphids were found on the flowering plant *Ixora paludosa*.
177 | First, the aphids formed colonies on the undersides of young leaves that were still red or light green and sometimes on
178 | flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf growth, leaf
179 | shrinkage, necrotic spots on the leaf surface, and slightly downward-curved leaf edges. The upper leaf surface looked wet
180 | and sticky, like sugar. The aphids had yellow, green, or slightly dark green bodies, with some wingless adults having a
181 | powdery white upper surface. The identification results showed that the aphids were *A. gossypii*, and they were and they
182 | were almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface
183 | of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts
184 | occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched
185 | stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids
186 | were also associated with ants. Moreover, in *Ixora* sp. flower plants, two forms of aphids were discovered two forms of
187 | aphids were discovered in *Ixora* sp. flower plants. These aphids occupied the shoots, young leaves, and unopened flowers;
188 | t. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from yellow and green to
189 | a slightly darker green. Sometimes, the upper surface of the wingless imago's body appeared white, resembling flour. The
190 | identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost always associated with
191 | ants. Another species of aphids was founded and formed colonies on flower stalks that had not yet bloomed and on newly
192 | emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms of plant disease plant
193 | disease symptoms. The aphids were yellow or yellowish green, with black cauda and siphunculi. Their bodies were very
194 | small to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also
195 | frequently found in association with ants. Two types of aphids were found on *Mussaenda frondosa*, each forming colonies
196 | in different locations. The first type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied
197 | showed no obvious disease symptoms. The identification results showed that the aphids were *Toxoptera odinae*. The
198 | aphids were yellow, green, and some with dark green (Blackman et al. 2011). The second type of aphids formed colonies
199 | on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could also be found on young
200 | leaves, shoots, and within flower parts. The plant parts they infested showed no signs of diseases. The aphids were yellow
201 | or yellow-yellow-green, with black cauda and siphunculi. They had tiny to small bodies. The identification results showed
202 | that the aphids were *A. citricola*. Many aphid species infest a variety of various ornamental plants because these insects are
203 | attracted to such plants due to the rich nutrient content in the plant sap (Braham et al. 2023).

204 | The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This
205 | indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
206 | generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
207 | colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
208 | yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides*, or alligator grass, was also
209 | colonized by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were
210 | green, ranging from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies
211 | on shoots, flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants.
212 | *Amaranthus gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers, and young
213 | and old leaves. They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were
214 | associated with both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi*. These aphids were bright
215 | green, and of medium size. The colonies formed on flowers, flower stalks, and the undersides of the leaves at the top. The
216 | aphid colonies were not associated with ants. *Croton hirtus*, or fire grass, was infested by *Aphis gossypii*. The aphids
217 | were yellow-yellow-green to dark green. The colonies were found on the stems, leaves, buds, and flowers, often forming
218 | large colonies. *Cynodon dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the
219 | flowers, flower stalks, and sometimes in the plant leaf axils of the plant. Small colonies were formed. The aphids were
220 | brown to reddish brown. They were associated with ants. *Cyperus rotundus*, or nut grass, was infested by *Schizaphis*
221 | *rotundiventris* aphids. The colonies were found on flower stalks, flowers, and leaf axils. The colonies were quite large and
222 | associated with both black and red ants. The aphids were dark brown in color. *Cyperus compressus*, or grass puzzle, was
223 | colonized by *Schizaphis rotundiventris* aphids, forming colonies in the flowers, flower stalks, and sometimes in the axils
224 | and leaves of the shoots or buds. Small colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae*
225 | aphids, with small colonies scattered on the flowers and flower stalks. These aphids were light brown to brown in color.
226 | *Echinocloa crussgali*, or water hyacinth plants, were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown

227 to black and formed large colonies on the undersides of both young and old leaves. The aphid colonies were never found
 228 in association with ants. *Ecliptica prostrata*, or urang-aring, was colonized by *Aphis gossypii*, forming small colonies on
 229 the shoots and flowers. The aphids were bright green to blackish green. The aphid colonies were also consistently
 230 associated with ants. *Eleusin indica* was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum*
 231 *maidis*. *H. setariae* formed colonies in flower parts, flower stalks, and leaf axils, resulting in quite large colonies. *H.*
 232 *setariae*'s body color ranged from red-red-brown to dark brown. The colonies were consistently associated with ants. The
 233 aphids of *R. maidis* formed colonies in the leaf axils and undersides of leaves and on-leaf shoots that had not yet opened.
 234 The colonies were not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and
 235 cauda. These aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated
 236 with ants. The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids
 237 were yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves. *Eragrostis tenella* was
 238 infested by *Hysteroneura setariae* aphids. The aphids were brown to red-red-brown. Small colonies formed on flowers
 239 near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were consistently associated
 240 with ants. *Euphorbia hirta*, or wart grass, was colonized by *Aphis gossypii*. The aphids formed colonies on the undersides
 241 of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in color. *A. gossypii* colonies on
 242 *E. hirta* plants were consistently associated with ants. *Eupotarium-Eupatorium odoratum* was colonized by both *Aphis*
 243 *gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young twigs. Young
 244 leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this plant showed
 245 yellow-green to dark-dark-green in-body colour. The colonies of *A. citricola* formed on the young twigs near the shoots,
 246 with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of both *A.*
 247 *gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants. *Hymenochera acutigluma*, or
 248 hair axis, was colonized by *Hysteroneura setariae*, which formed colonies on the flower stalks and flowers. The colonized
 249 parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or *kenidai*, was infested by *Greenidae* sp.
 250 These aphids had bright green bodies and distinctive elongated siphunculi with thorns. The aphids formed colonies on the
 251 undersides of leaves, especially on young leaves. The colonized leaves did not show any disease symptoms. *Lophatherum*
 252 *gracile* or bamboo grass plants, were colonized by two species of aphids: *hysteroneura setariae* and *Rhopalosiphum*
 253 *maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves, leaf shoots, and leaf axils. The colonized
 254 leaves did not show any disease symptoms. *H. setariae* aphids were brown to red-red-brown. *R. maidis* aphids also formed
 255 colonies on the undersides of leaves, but the colonies were small. *R. maidis* aphids were green to bright green in-color,
 256 with black siphunculi and cauda. It was possible for colonies of the two species of aphids on *L. gracile* to mix. In addition,
 257 *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly emerging
 258 shoots and on-newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The colonized
 259 plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis glycine*. *A.*
 260 *gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A.*
 261 *glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were light green to green
 262 in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony. *Mimosa*
 263 *invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisita plants* formed colonies
 264 only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa pudica* was
 265 observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots, and
 266 occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the colonized
 267 plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of aphids
 268 occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were shiny
 269 black. The colonized plant parts did not show any disease symptoms. *Oryza rufipogon* was colonized by two species of
 270 aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both aphids colonized the same plant parts, namely the unopened
 271 leaves and the leaf axils with large colonies. The two species could be distinguished by their body color. *R. maidis*
 272 appeared green with black siphunculi and cauda, while *R. rice* appeared white. The colonies of *R. maidis* and *R. rice* in *O.*
 273 *rufipogon* plants were associated with the presence of red ants. *Oxonopus compressus*, or *pait grass*, was colonized by
 274 *Hysteroneura setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes in-in-the leaf axils. The
 275 aphids were brown to dark brown in-color. Small colonies were formed, and they were also consistently associated with
 276 ants. *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds
 277 and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus niruri* was colonized by *Aphis citricola*. The
 278 colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted,
 279 and wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large.
 280 *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae plants*
 281 formed colonies on the undersides of leaves, especially young leaves, shoots, and in flowers. The colonized plant parts
 282 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
 283 appeared glossy black. *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black
 284 bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The
 285 colonized plant parts did not show any symptoms-of-disease symptoms. *Rorippa indica*, or mustard land, was colonized by
 286 *Lipaphis erysimi*. The colonies formed on the flowers, fruits, flower stalks, and the lower leaf's surface-of-leaves. The

287 | colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia*, or cacabean, was colonized by
288 | *Aphis gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves,
289 | stalks, and flower petals. The colonized plant parts, especially the shoots, showed curling, and the leaf edges curled
290 | downward. *Sonchus arvensis* plants were colonized by *L. erysimi*. The aphids had green to whitish green body colours,
291 | and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became
292 | stunted over time.

293 | In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
294 | displayed typical ~~damage~~ symptoms ~~of damage~~, but some did not show any symptoms ~~at all~~. Generally, the ~~plants'~~
295 | symptoms ~~of the plants due to caused by~~ aphid colonies were relatively the same, such as stunted growth, abnormal shape,
296 | and stunted or curly leaves. These characteristic symptoms serve as indicators of aphid infestations. However, some plants
297 | or plant parts did not show symptoms when colonized by aphids. This condition ~~occurrehappened~~ because the colonized
298 | parts had reached ~~their~~ maximum growth or development. It indicated that the colonized part was not currently undergoing
299 | a growth phase. The colonies that did not induce symptoms typically occurred when the colonized leaves had reached their
300 | maximum growth or when the leaves and plant parts were old. ~~Furthermore, t~~The old leaves or twigs might not show the
301 | typical symptoms associated with aphid infestations. ~~The plant parts of the plant exhibiting characteristic symptoms when~~
302 | ~~colonized by aphids also often experienced a cessation in growth due to the piercing by the aphids. In contrast, the areas~~
303 | ~~surrounding the puncture site continued to grow, resulting in some parts developing normally while others~~
304 | ~~becomegrowing, resulting in some parts developing ordinary while others became~~ stunted (Pettersson, Tjallingii, and
305 | Hardie 2017). This condition could lead to ~~the bending of shoots or young stems, curling of bending shoots or young stems,~~
306 | ~~curling~~ leaves, downward curling of leaf edges, or stunted leaf growth. In this observation, monocot plants or groups of
307 | grasses with narrow leaves generally did not display any distinctive symptoms when colonized by aphids. This might be
308 | because the growth or development of their leaves differed from that of dicot plants. Therefore, the presence of aphids in
309 | ~~monocot plants or plants~~ was often easier to recognize through the presence of ants. If a plant was found to have a
310 | significant number of ants, there was a possibility that aphids had colonized the plant (Tegelaar et al. 2012). Therefore, the
311 | presence of ants could serve as an indicator of the ~~presence of~~ aphid colonies. According to this ~~present study, ants were~~
312 | ~~present in some aphids colonies from the subfamily aphidini, while the ants were absent in some aphids present study, ants~~
313 | ~~were present in some aphid colonies from the subfamily aphidini, while the ants were absent in some aphid~~ colonies from
314 | the ~~macrocytini~~ subfamily. The ~~absent-absence~~ of ants in aphids colonies could be ~~because~~ the colonies have just formed;
315 | or the population is still low (Kummel, Brown, and Bruder 2013). Aphids colonized flowers because they may offer an
316 | accessible and rich food source, sugary plant sap found in new growth or reproductive ~~plant parts of plants~~. Flowers
317 | contain a nutrient-rich nature and easy access to sap, therefore, aphids were attracted ~~edive~~ to ~~flower saps. In addition, the~~
318 | ~~flowers s.~~ Some aphid species were drawn to certain colors (Jakubczyk et al. 2022). Herbs served as an alternative host for
319 | aphids in this present study. Aphids consume sugar-rich liquid in plants, known as "sap". Aphids considered herbs and
320 | other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate plant tissues and
321 | access this fluid (Brozek et al. 2015). Several aphids colonized herbs such as Indian mustards, *Lipaphis erysimi*, and
322 | *Myzus persicae*, ~~are~~ the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al. 2022). Due to a
323 | symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance
324 | known as honeydew as a waste product, which ants found highly attractive ~~as a food sources~~ (Nelson and Mooney 2022).
325 | The honeydew contained ~~n abundance of abundant~~ sugars, extracted by aphids from the plant juice (Zheng et al. 2022).
326 | Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for honeydew, ants
327 | ~~provided aphids with protection~~ ~~tected aphids~~ from other insects and predators, such as ladybugs, lacewing larvae, and
328 | parasitic wasps (Karami-jamour et al. 2018). Certain ~~ant species of ants~~ would transport aphids to new host plants for
329 | improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not
330 | only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
331 | species) and provided energy for the growth of their ~~own~~ progeny (Biedermann and Vega 2020).

332

CONCLUSION

333 | ~~Moreover,~~ 21 species of aphids were found in ~~Pagar Alam~~, namely *Aphis gossypii*, *Aphis citricola*, *Aphis craccivora*,
334 | *Aphis glycines*, *Aulacorthum solani*, *Greenida* sp., *Hyperomyzus* sp., *Hysteronera setariae*, *Lipaphis erysimi*,
335 | *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*,
336 | *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Rhopalosiphum padi*, *Sinemogoura citricola*, *Toxoptera aurantii*,
337 | *Toxoptera citricidus*, *Toxoptera odinae*, and *Schizaphis rotundiventris*.

338

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- 342 | Acharya, Shelley, and Rajendra Singh. 2004. "Aphids on Medicinal Plants in North East India (Insecta : Homoptera : Aphididae)". *Rec. Zool. Surv. India* 102(June 2004). doi: 10.26515/rzsi/v103/i1-2/2004/159495.
- 344 | Bass, Chris, Alin M. Puinean, Christoph T. Zimmer, Ian Denholm, Linda M. Field, Stephen P. Foster, Oliver Gutbrod, Ralf Nauen, Russell Slater, and Martin S. Williamson. 2014. "The Evolution of Insecticide Resistance in the Peach Potato Aphid, Myzus persicae". *Insect Biochemistry and Molecular Biology* 51:41–51. doi: 10.1016/j.ibmb.2014.05.003.
- 347 | Bhadra, Parna, and Basant Kumar Agarwala. 2014. "On the Morphological and Genotypic Variations of Two Congeneric Species of Banana Aphid Pentalonia (Homoptera : Aphididae) from India". (March). doi: 10.5932/j.als.20120203.06.
- 349 | Biedermann, Peter H. W., and Fernando E. Vega. 2020. "Ecology and Evolution of Insect–Fungus Mutualisms". *Annual Review of Entomology* 65:431–55. doi: <https://doi.org/10.1146/annurev-ento-011019-024910>.
- 351 | Blackman, Roger L., and Victor F. Eastop. 2008. *Aphids on the World's World's Herbaceous Plants and Shrubs, 2 Volume Set*. John Wiley & Sons.
- 352 | Blackman, Roger L., and Victor F. Eastop. 2017. "Taxonomic Issues". Pp. 1–36 in *Aphids as crop pests*. CABI Wallingford UK.
- 353 | Blackman, Roger Laurence, Masato Sorin, and Masahisa Miyazaki. 2011. "Sexual Morphs and Colour Variants of Aphis (Formerly Toxoptera) Odinae (Hemiptera, Aphididae) in Japan". *Zootaxa* (November 2011):53–60. doi: 10.11646/zootaxa.3110.1.5.
- 354 | Braham, Mohamed, Synda Boulahia-kheder, Mouna Kahia, and Siwar Nourira. 2023. "Aphids and Citrus Responses to Nitrogen Fertilization". *Journal of the Saudi Society of Agricultural Sciences* 22(6):374–83. doi: 10.1016/j.jssas.2023.03.003.
- 355 | Brożek, Jolanta, Ewa Mróz, Dominika Wylęzek, Łukasz Depa, and Piotr Wegierek. 2015. "The Structure of Extremely Long Mouthparts in the Aphid Genus Stomaphis Walker (Hemiptera: Sternorrhyncha: Aphididae)". *Zoomorphology* 134:431–45. doi: <https://doi.org/10.1007/s00435-015-0266-7>.
- 360 | Cao, He-he, Zhan-feng Zhang, Xiao-feng Wang, and Tong-xian Liu. 2018. "Nutrition versus Defense : Why Myzus persicae (Green Peach Aphid) Prefers and Performs Better on Young Leaves of Cabbage?". *PLoS One* 13(4):1–16. doi: <https://doi.org/10.1371/journal.pone.0196219>.
- 362 | Clarke, Rebecca, Monica A. Kehoe, Sonya Broughton, and Roger A. C. Jones. 2020. "Host Plant Affiliations of Aphid Vector Species Found in a Remote Tropical Environment". *Virus Research* 281(December 2019):197934. doi: 10.1016/j.virusres.2020.197934.
- 364 | Ertunc, Filiz. 2020. "Chapter 46 - Emerging Plant Viruses". Pp. 1041–62 in, edited by M. M. B. T.-E. and R. V. P. Ennaji. Academic Press.
- 365 | Gadhave, Kiran R., Saurabh Gautam, David A. Rasmussen, and Rajagopalbabu Srinivasan. 2020. "Aphid Transmission of Potyvirus: The Largest Plant-Infecting RNA Virus Genus". *Viruses* 12(7):773. doi: 10.3390/v12070773.
- 367 | Giannetti, Daniele, Mauro Mandrioli, Enrico Schifani, Cristina Castracani, Fiorenza A. Spotti, Alessandra Mori, and Donato A. Grasso. 2021. "First Report on the Acrobat Ant Crematogaster Scutellaris Storing Live Aphids in Its Oak-Gall Nests". *Insects* 12(2):108. doi: <https://doi.org/10.3390/insects12020108>.
- 370 | Jakubczyk, Karolina, Klaudia Koprowska, Aleksandra Gottschling, and Katarzyna Janda-Milczarek. 2022. "Edible Flowers as a Source of Dietary Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement". *Nutrients* 14(12). doi: 10.3390/nu14122470.
- 372 | Jayaswal, Deepanshu, Pawan Mainkar, Kuldeep Kumar, Yamini Agarwal, and Ratna Prabha. 2022. "Pyramiding and Evaluation of Segregating Lines Containing Lectin and Protease Inhibitor Genes for Aphid Resistance in Brassica Juncea". *Indian Journal of Biochemistry & Biophysics* 59(August):800–807. doi: 10.56042/ijbb.v59i8.62319.
- 375 | Jones, Roger A. C. 2022. "Alteration of Plant Species Mixtures by Virus Infection: Managed Pastures the Forgotten Dimension". *Plant Pathology* 71(6):1255–81. doi: DOI: 10.1111/ppa.13571.
- 377 | Kallas, John. 2010. *Edible Wild Plants*. Gibbs Smith.
- 378 | Karami-jamour, Tahereh, Alinaghi Mirmoayed, Abbasali Zamani, and Yadolah Khajehzadeh. 2018. "The Impact of Ant Attendance on Protecting Aphis Gossypii against Two Aphidophagous Predators and Its Role on the Intraguild Predation between Them". *Journal of Insect Behavior* 31:222–39. doi: DOI: 10.1007/s10905-018-9670-4.
- 381 | Kennedy, J. S., and H. L. G. Stroyan. 1959. "Biology of Aphids". *Annual Review of Entomology* 4(1):139–60.
- 382 | Kumar, Sushil, Malay K. Bhowmick, and Puja Ray. 2021. "Weeds as Alternate and Alternative Hosts of Crop Pests". *Indian Journal of Weed Science* 53(1):14–29. doi: 10.5958/0974-8164.2021.00002.2.
- 384 | Kummel, Miroslav, David Brown, and Andrea Bruder. 2013. "How the Aphids Got Their Spots: Predation Drives Self-Organization of Aphid Colonies in a Patchy Habitat". *Oikos* 122(6):896–906. doi: <https://doi.org/10.1111/j.1600-0706.2012.20805.x>.
- 386 | Maharani, Yani, Purnama Hidayat, Aunu Rauf, and Nina Maryana. 2018. "Short Communication: New Records of Aphid Species Subfamily Aphidinae (Hemiptera: Aphididae) in West Java, Indonesia". *Biodiversitas* 19(2):460–65. doi: 10.13057/biodiv/d190219.
- 388 | Meuninck, Jim. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.
- 389 | Naidu, VSGR. 2012. "Hand Book on Weed Identification".
- 390 | Nelson, Annika S., and Kailen A. Mooney. 2022. "The Evolution and Ecology of Interactions between Ants and Honeydew-Producing Hemipteran Insects". *Annual Review of Ecology, Evolution, and Systematics* 53:379–402. doi: <https://doi.org/10.1146/annurev-ecolsys-102220-014840>.
- 392 | Pettersson, Jan, W. Fred Tjallingii, and Jim Hardie. 2017. "Host-Plant Selection and Feeding". Pp. 173–95 in *Aphids as crop pests*. CABI Wallingford UK.
- 394 | Tegelaar, Karolina, Mattias Hagman, Robert Glinwood, Jan Pettersson, and Olof Leimar. 2012. "Ant–Aphid Mutualism: The Influence of Ants on the Aphid Summer Cycle". *Oikos* 121(1):61–66. doi: <https://doi.org/10.1111/j.1600-0706.2011.19387.x>.
- 396 | Zheng, Zhou, Mengqin Zhao, Zhijun Zhang, Xin Hu, Yang Xu, and Cong Wei. 2022. "Lactic Acid Bacteria Are Prevalent in the Infrabuccal Pockets and Crops of Ants That Prefer Aphid Honeydew". *Front. Microbiol.* 12(January):1–17. doi: 10.3389/fmicb.2021.785016.
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39 Title:

Species of Aphids Found in Ornamental and Wild Plants in Highland, Pagar Alam, South Sumatra

40
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54 **Novelty:**

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This paper described the alternative host of aphids in high land, South Sumatera. The knowledge regarding the alternative of insect pest could be beneficial resource for basic control of aphids.

56
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62
63 **Place and date:**

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Dr. Chandra Irsan

67
68 **Species of Aphids Found in Ornamental and Wild Plants in Highland,**
69 **Pagar Alam, South Sumatra**

70
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80 **Abstract**

81 Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be
82 very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported
83 about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid
84 species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of
85 aphids found in ornamental plants and the wild plants. This study revealed that 15 species of aphids were found in
86 Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis*
87 *craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp.,
88 *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis erysimi*.

89 **Keywords:** aphids, ornamental plants, wild plants

90 **Running title:** Aphids Found in Ornamental and Wild Plants

91
92 **INTRODUCTION**

93 Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous,
94 and monophagous characteristics (Kennedy & Stroyan, 1959). One species of aphids can host more than 400 species from
95 40 families (Bass et al., 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhawe et al.,
96 2020). Aphids can transmit 275 viruses (Ertunc, 2020). In tropical areas, aphids can always be found throughout the year
97 due to their parthenogenetic nature of reproduction (Blackman & Eastop, 2017). Aphids consume young leaves sap, which
98 can deplete essential nutrients for healthy growth (Cao et al., 2018). Moreover, when aphids transmit viral diseases from
99 one plant to another, this can further weaken and stunt the growth of infected plants (Jones, 2022). According to Kinley et
100 al. (2021), aphids cause yield losses directly (35 - 40%) by sucking the plant sap or indirectly (20 - 80%) through viral
101 transmission. Therefore, aphid infestations can have adverse effects on crop yields and overall plant health (Sarwan
102 Kumar, 2019).

103 Due to their function as vectors, the presence of aphids on a plant can be highly damaging (Jaouannet et al.,
104 2014). They feed by piercing the plant's tissues and consuming its sap, which can reduce the plant's growth and
105 productivity, ultimately leading to weakness and possible death (Chandel et al., 2022). Additionally, as vectors, aphids can
106 transmit a variety of plant diseases. They are as carriers for various plant viruses, and when they move from infected to
107 healthy plants, these viruses can rapidly spread and cause extensive damage (Guo et al., 2019). In addition, the honeydew
108 that aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's
109 leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh & Singh, 2021). Therefore, it is
110 crucial to control aphid populations in gardens and crops.

111 Understanding the species diversity of aphids is fundamental to effective aphid control, as it facilitates the
112 development of measures to keep their populations in check. In addition, understanding the diversity of aphid species can

113 provide valuable insights into potential plant diseases, as different aphid species carry distinct viruses. Methods used to
114 control aphids often encompass various techniques, including the use of natural enemies such as predators (like ladybugs,
115 lacewings, and parasitic wasps) (Singh & Singh, 2021; Völkl et al., 2023), parasitoids (Boivin et al., 2012),
116 entomopathogens (Hullé et al., 2020), the use of essential oils as botanical pesticides to control aphids (Ikbāl & Pavela,
117 2019), and crop rotation techniques (Degani et al., 2019). Regular monitoring of aphid populations and diversity can help
118 in detecting when population sizes may be reaching harmful levels, allowing for prompt implementation of the necessary
119 countermeasures.

120 Many aphid species were found on plants that were not their actual hosts (Peccoud et al., 2010). Aphids have one
121 or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they
122 feed on most frequently (Clarke et al., 2020). An alternative host can also be a collateral host belonging to the same plant
123 family as the primary host, helping crop pests to survive when the primary hosts are unavailable (Kumar et al., 2021).
124 These secondary hosts may offer less adequate nutrition for insects (Mo & Smilanich, 2023), However, they may provide a
125 means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions
126 (Kumar et al., 2021). According to Liu et al. (2017), since hibiscus serves as an overwintering host for cotton-specialized
127 aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during times of food
128 shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin et al., 2010). They maintain a cycle
129 of host alternation, shifting between their primary hosts (typically a woody plant) and secondary hosts (often herbaceous
130 plants) (Yamamoto et al., 2020). Weeds pose a continuous threat in both cropped and non-crop areas, providing food,
131 shelter and reproductive sites for various pest organisms (Kumar et al., 2021). This indicates that weeds can serve as
132 alternative hosts for aphids.

133 A study of aphid species on horticultural plants has been conducted (Maharani et al., 2018), However,
134 information about aphid species on ornamental and wild plants has not received as much attention and remains largely
135 unexplored. In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and
136 native plants. The research on the diversity of aphid species in ornamental and wild plants has received little attention.
137 Therefore, this study was conducted in Pagar Alam, a highland region of South Sumatra, with the aim of obtaining
138 information on the diversity of aphid species found in ornamental and wild plants. The findings from this study can serve
139 as a valuable resource for aphid management.

140 MATERIALS AND METHODS

141 The field research employed a purposive and direct observation approach to inventory cultivated or wild plants
142 hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing fruit, vegetable,
143 and ornamental varieties, as well as wild plants or weeds. The collection and identification of host plants, aphids, and their
144 natural enemies involved systematic searches for the selected plants and subsequent examination for the presence of
145 aphids. Observations were made to all existing plant species to find those colonized by aphids. Any plants colonized by
146 aphids were documented as aphid hosts. Aphids, along with their natural enemies within the aphid colonies, were
147 systematically collected. All components of the collected observations were then identified.

148 Aphid identification was conducted using identification keys (Blackman & Eastop, 2008). Identification of aphid
149 species took place in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on
150 morphological characteristics. The host plants were identified using weed identification hand book (Kallas, 2010;
151 Meuninck, 2023; Naidu, 2012). The location and size of aphid colonies, morphology of aphids including their shape and

152 color, as well as any symptoms observed in the host plants were recorded, and photographs of the aphid colonies and their
 153 host plants were taken.

154 RESULT AND DISCUSSION

155 Result

156 The results showed that 15 aphid species were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
 157 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*,
 158 *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipapis*
 159 *erysimi*. Based on the observation, these aphids were found on various ornamental plants (Table 1). The primary colony
 160 locations were generally in flowers, and this study documented these colony locations in ornamental plants (Figure 1).

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162 Table 1: Aphid species found in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Sitobion luteum</i>	flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	flower
3	<i>Caladium</i> sp.	<i>Pentalonia</i> sp.	flower
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	flower
5	<i>Canna indica</i>	<i>Pentalonia nigronervosa</i>	flower
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	flower
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	flower
9	<i>Cosmos caudatus</i>	<i>Uroleucon</i> sp.	flower
10	<i>Dahlia Kelvin</i>	<i>Aphis gossypii</i>	flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	flower
13	<i>Helianthus</i> sp.	<i>Aphis glycines</i> <i>Hyperomyzus</i> sp.	flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	flower
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	flower
20	<i>Spondiras dulcissoland</i>	<i>Aphis citricola</i> <i>Hysteroneura setariae</i>	flower



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Fig 1. The location of aphid colonization on various plant parts. a) *A. gossypii* in *D. Kelvin* flower b) *A. gossypii* in *H. rosinensis* flower c) *A. gossypii* in tuberose flower, d) *A. craccivora* in *Clitoria ternatea* flower, e) *A. citricola* in *Helianthus* sp., f) *A. aurantii* on the *M. paniculata* flower, g) *T. odinae* in the *S. dulcissoland*, h) *Uroleucon* sp. in chrysanthemums, i) *Macrosiphum rosae* in *R. indica* flower, j) *Pentalonia nigronervosa* in *C. indica* leaves

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In addition, this study documented the presence of weeds, which might serve as alternative hosts for aphids (Table 2). The location of aphid colonies also varied, namely on flowers, stalks, plant tops, young leaves and old leaves of wild plants (Figure 2). The presence of specific plants or host plants within a habitat influenced the types of aphids found. Many aphid species are found on a broad range of plants or host plants, while others are highly specialized and are only found on specific plants or host plants. This is closely related to the polyphagous, oligophagous or monophagous nature of aphids (Blackman & Eastop 2000).

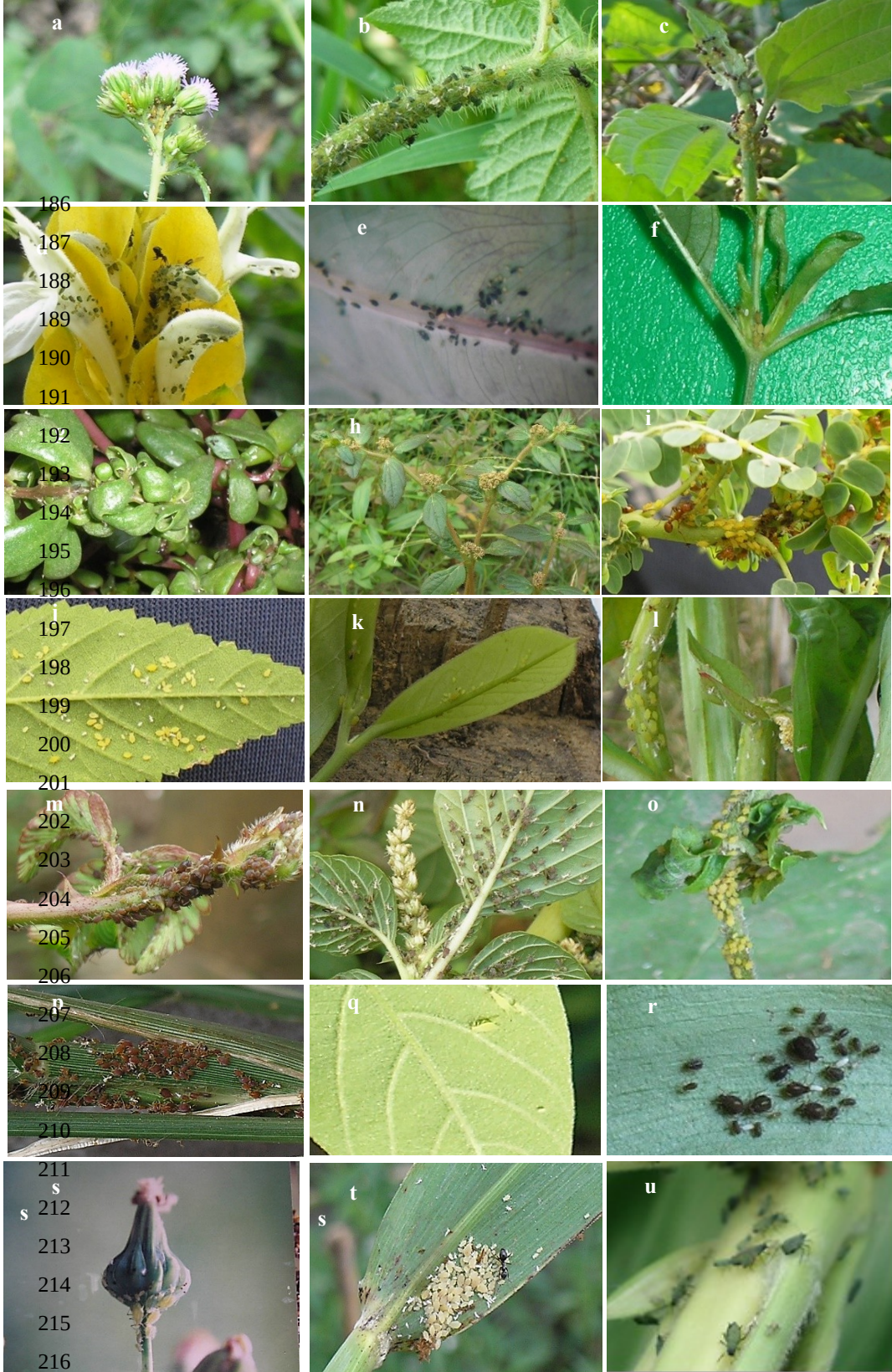
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185 Table 2: Species of aphids found in wild plants and their colony locations.

No	Host Plant	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	<i>Aphis gossypii</i>	Shoots, buds
3	<i>Alternanthera sessilis</i>	<i>Aphis gossypii</i>	Shoots, buds
4	<i>Amaranthus gracilis</i>	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
6	<i>Croton hirtus</i>	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
8	<i>Cyperus rotundus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	<i>Hysteronura setariae</i>	Flower, flower stalks
11	<i>Echinochloa crusgali</i>	<i>Hiperomyzus</i> sp.	Young leaves, old leaves
12	<i>Ecliptica prostrata</i>	<i>Aphis gossypii</i>	Shoots, young leaves
13	<i>Eleusin indica</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	<i>Hysteronura setariae</i>	Flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	<i>Aphis gossypii</i>	Young leaves, old leaves
17	<i>Eupotarium odoratum</i>	<i>Aphis gossypii</i> , <i>Aphis glycine</i>	Young leaves, old leaves, young twigs
18	<i>Hymenochera acutigluma</i>	<i>Hysteronura setariae</i>	Flowers, flower stalks, leaf axils
19	<i>Lagerstromea</i> Sp.	<i>Greenidea</i> sp.	Young leaves
20	<i>Lophatherum gracile</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	<i>Aphis gossypii</i>	Shoots, young leaves
22	<i>Mikania mikranta</i>	<i>Aphis gossypii</i> <i>Aphis glycine</i>	Shoots, young leaves, old leaves
23	<i>Mimosa invisa</i>	<i>Aphis craccivora</i>	Shoots, pods
24	<i>Mimosa pudica</i>	<i>Aphis craccivora</i>	Shoots, pods, flowers
25	<i>Mimosa vigra</i>	<i>Aphis craccivora</i>	Shoots, pods
26	<i>Oryza rufipogon</i>	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	Old leaves, young leaves (pupus), leaf axils
27	<i>Oxonopus compressus</i>	<i>Hysteronura setariae</i>	Flower, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	<i>Hysteronura setariae</i>	Flower, flower stalk, seeds
29	<i>Phyllanthus neruri</i>	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	<i>Aphis craccivora</i>	Shoots, young leaves, flower
31	<i>Physalis angulata</i>	<i>Aphis craccivora</i> , <i>A. gossypii</i>	Shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	<i>Lipapis erysimi</i>	Flower, fruit, shoots, young leaves
33	<i>Sida rhombifolia</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arventris</i>	<i>Lipapis erysimi</i>	Young leaves, fruit stalks, flower, fruit



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224 Figure 2. Aphids found on wild plants a) *A. gossypii* on the weed *Ageratum conyzoides*, b) *A. gossypii* on Croton weed *hirtus* c) *A.*
 225 *gossypii* on the weed *Eupatorium odoratum*, d) *A.gossypii* on plants *Pachystochys* sp., e) *A.gossypii* on plants *Caladium* sp., f) *A.*
 226 *gossypii* on the weed *Alternanthera sessilis*, g) *A.gossypii* in *Portulaca oleraceae* weeds, h) *A.gossypii* on the weed *Euphorbia hirta*, i)
 227 *A. citricola* on the weed *Phyllanthus nerruri*, j) *A. citricola* on *Sida rhombifolia* weed, k) *A. citricola* on plants *Annona muricata*, l)

228 *A. citricola* on the weed *Ludwigia peruviana*, m) *A. craccivora* on *Mimosa pudica* weed, n) *A. craccivora* on weeds *Amaranthus gracilis*,
229 o) *A. glycine* in *Mikania micranta* weed, p) *Hysteneura* sp. in *Eleusin* weeds, q) *Greenidae* sp. in kenidai trees (shrubs) *indica*,
230 r) *Hyperomyzus* sp. in *Echinochloa crusgali* Weed, s) *L. erysimi* on weed *sonchus arventris*, t) *Rhopalosiphum* rice on the weed *Oryza*
231 *rufipogon*, u) *Rhopalosiphum Maidis* on the weed *Oryza rufipogon*.

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233 Discussion

234 The plant species or host plant influences the distribution of aphids. There are aphid species that can be found on
235 a wide range of host plants, which is closely related to the polyphagous nature of aphids, allowing them to colonize many
236 different species of host plants. Host plants can also affect the distribution of aphids, as evidenced by the presence of aphid
237 species exclusively found on certain host plants (Peccoud et al., 2010). But there are some species of aphids found only on
238 one particular host and are not found on other host plants (Döring, 2014). *A. gossypii*, and *Aphis aurantii* have been found
239 on many host plants because both aphids are classified as polyphagous aphids (Margaritopoulos et al., 2006; Alotaibi et
240 al., 2023).

241 Aphids can commonly be found infesting a variety of ornamental plants. They are attracted to these plants due to
242 the rich nutrient content in the plant sap (Wäckers & Van Rijn, 2012). In this present study, some aphid species were
243 found on some ornamental plants in Pagaralam. The location of aphid colonization on the plants varied. On *Adiantum*
244 *predatum* plants, aphids formed colonies on young leaf stalks and on newly emerging leaves. The aphids displayed brown
245 and black coloration. The aphid colonies found were small, and the colonized plant parts showed no signs of disease. The
246 identification results showed that the aphids were *Neotoxoptera* sp., and notably, they were not associated with ants. On
247 *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively
248 large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The
249 identification results showed that the aphids were *Uroleucon* sp., and they were associated with ants.

250 On the *Brugmansia suaveolens* (angel's trumpet), *M. persicae* were found on the undersides of old leaves or
251 leaves that have started to turn yellow. The colonies were relatively small. The aphids found were green and large bodies.
252 The colonized plant parts did not show any signs of disease. On *Caladium* sp. (taro) was found one species of aphids: *A.*
253 *gossypii*. The aphids formed colonies under the surface of young and older leaves. The occupied leaf areas did not display
254 severe symptoms. The aphids were yellow green to dark green. The wingless adult aphids often had a white, flour-like
255 appearance on their bodies. On the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides
256 of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large.
257 Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black in color. The colonies
258 of *T. aurantii* were found to be associated with black ants.

259 Aphids on *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the
260 leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a
261 medium-sized body. The identification results showed that the aphids were *P. nigronervosa*. The colonies of *P.*
262 *nigronervosa* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were
263 found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and
264 the colonized plant parts did not show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed
265 colonies on the undersides of young leaves, shoots, and within flower parts, especially between petals or flower stalks that
266 had not fully bloomed. The colonies were quite large. The body color of aphids was green to dark green with small to
267 medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results
268 showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated with ants.

269 Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems and young leaves.
270 The aphids were brown to black in color. Colonized plant parts, especially shoots and young leaves, showed stunting
271 symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently
272 associated with ants. On the plant *Cosmos caudatus*, aphids were found on the flower petals. The colonies were not very
273 large. The body color was green and light green. The identification results showed that the aphids were *A. gossypii*, and
274 they were also associated with ants. The aphids on the *Dahlia kelvin plant* formed colonies on unopened flower buds, with
275 a significant population among the blooming petals. The body color was green to dark green. The identification results
276 showed that the aphids were *A. gossypii*. Aphids on *Datura metel* (amethyst) were found to form colonies on the
277 undersides of old leaves. The aphids were medium sized with a green body color. The colonized plant parts did not show
278 any symptoms of disease. The identification results showed that the aphids were *Myzus ornatus*. The aphid colonies were
279 not associated with ants. Within *Dendrobium* sp., aphid colonies were found on the young leaves. The aphids were yellow,
280 green to dark green. The colonized plants did not show any disease symptoms. The identification results showed that the
281 aphids were *A. gossypii*, and they were associated with ants. On *Duranta* sp. (bonsai), colonies of aphids were located on
282 the undersides of young leaves. The colonized plant parts showed stunting symptoms. The colonies were very large. The
283 aphids were green in color. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were
284 consistently associated with ants.

285 On the *Helianthus annuus* (sunflower) plants, aphid colonies were found between the flower petals. The
286 colonized flowers, especially the crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in
287 color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies
288 were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies
289 were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease
290 symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid colonies were not associated with
291 ants. Within the colonies, mummified aphids that were parasitized by Aphidiidae were found.

292 On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark green were found. The aphids formed
293 colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large.
294 The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with
295 ants. Two types of aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the
296 undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The
297 occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and
298 slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, similar to sugar. The aphids had
299 yellow, green, or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The
300 identification results showed that the aphids were *A. gossypii*, and they were almost always associated with ants. The
301 second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could
302 also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs
303 of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The
304 identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants.

305 In *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied the shoots, young leaves
306 and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from
307 yellow and green to a slightly darker green. Sometimes the upper surface of the wingless imago's body appeared white,
308 resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost

309 always associated with ants. Another species of aphids was founded and formed colonies on flower stalks that had not yet
310 bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms
311 of plant disease. The aphids were yellow or yellow green, with black cauda and siphunculi. Their bodies were very small
312 to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also
313 frequently found in association with ants.

314 Two types of aphids were found on *Mussaenda frondosa*, each forming colonies in different locations. The first
315 type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease
316 symptoms. The aphids were yellow, green, and some with dark green. The identification results showed that the aphids
317 were *A. gossypii*. The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as
318 if piled up. The aphid colonies could also be found on young leaves, shoots and within flower parts. The plant parts they
319 infested showed no signs of diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had
320 tiny to small bodies. The identification results showed that the aphids were *A. citricola*.

321 The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids.
322 This indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
323 generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
324 colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
325 yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized
326 by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging
327 from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots,
328 flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus*
329 *gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves.
330 They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with
331 both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi* aphids. These aphids were bright green, and of
332 medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies
333 were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow-green to
334 dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon*
335 *dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks
336 and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to red-brown. They were
337 associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies were
338 found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants.
339 The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis rotundiventris*
340 aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or buds. Small
341 colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on
342 the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crusgali* or water hyacinth
343 plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large colonies on
344 the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica*
345 *prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids
346 were bright green to blackish green. The aphid colonies were also consistently associated with ants.

347 *Eleusin indica* was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H.*
348 *setariae* formed colonies in flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body

349 color ranged from red brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis*
350 formed colonies in the leaf axils and undersides of leaves and on leaf shoots that had not yet opened. The colonies were
351 not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These
352 aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants.
353 The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids were
354 yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves.

355 *Eragrostis tenella* was infested by *Hysteroneura setariae* aphids. The aphids were brown to red brown. Small
356 colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae*
357 were consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by *Aphis gossypii*. The aphids formed
358 colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in
359 color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupotarium odoratum* was colonized
360 by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young
361 twigs. Young leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this
362 plant showed yellow-green to dark green in body colour. The colonies of *A. citricola* formed on the young twigs near the
363 shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of
364 both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.

365 *Hymenochera acutigluma* or hair axis was colonized by *Hysteroneura setariae*, which formed colonies on the
366 flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or
367 *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with
368 thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not
369 show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of aphids:
370 *hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves,
371 leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were brown to
372 red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis*
373 aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two species
374 of aphids on *L. gracile* to mix.

375 *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly
376 emerging shoots and on newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The
377 colonized plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis*
378 *glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and
379 curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were
380 light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a
381 single colony.

382 *Mimosa invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisa* plants
383 formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa*
384 *pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots,
385 and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the
386 colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of
387 aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were
388 shiny black. The colonized plant parts did not show any disease symptoms.

389 *Oryza rufipogon* was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both
390 aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species
391 could be distinguished by their body color. *R. maidis* appeared green with black sifunculi and cauda, while *R. rice*
392 appeared white. The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants.
393 *Oxonopus compressus* or *pait* grass was colonized by *Hysteroneura setariae* aphids. The colonies occupied flowers, flower
394 stalks, seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed,
395 and they were also consistently associated with ants.

396 *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the
397 seeds and flower stalks. Aphids had brown to dark brown bodies. *Phylanthus niruri* was colonized by *Aphis citricola*. The
398 colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted,
399 and wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large.
400 *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants
401 formed colonies on the undersides of leaves, especially young leaves, shoots and in flowers. The colonized plant parts
402 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
403 appeared glossy black.

404 *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with
405 glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant
406 parts did not show any symptoms of disease. *Rorippa indica* or mustard land was colonized by *Lipaphis erysimi*. The
407 colonies formed on the flowers, fruits, flower stalks and the lower surface of leaves. The colonized plant parts showed
408 symptoms such as curling and stunting. *Sida rhombifolia* or cacabean was colonized by *Aphis gossypii*. The aphids had
409 green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks and flower petals. The
410 colonized plant parts, especially the shoots, showed curling, and the leaf edges curled downward. *Sonchus arvensis* plants
411 were colonized by *L. erysimi*. The aphids had green to whitish green body colours, and the colonies formed on flower
412 stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

413 In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
414 displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants
415 caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves.
416 These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show
417 symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum
418 growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that
419 did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the
420 leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid
421 infestations.

422 The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a
423 cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to
424 grow, resulting in some parts developing normally while others become stunted (Pettersson et al., 2017). This condition
425 could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or stunted leaf
426 growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any
427 distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed
428 from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to recognize

429 through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids
430 had colonized the plant (Tegelaar et al., 2012). Therefore, the presence of ants could serve as an indicator of the presence
431 of aphid colonies.

432 Throughout their life cycle, aphids exhibited host alternation by switching between two distinct host plants
433 (Peccoud et al., 2010). They overwintered on woody plants, reproduced in the spring, and migrated to herbaceous plants
434 during the summer before returning to their primary host in the autumn (Yamamoto et al., 2020). This allowed aphids to
435 maximize resource utilization, avoid congestion and competition, evade predators and parasites, circumvent plant
436 defenses, and colonize new areas. Aphids could distribute their population efficiently, thereby avoiding overcrowding,
437 predators and parasites, and plant defenses developing over time through host switching (Yamamoto et al., 2020). This
438 behavior was essential for the survival and environmental adaptation of aphids.

439 Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in
440 new growth or reproductive parts of plants. Flowers contain nutrient-rich nature (Jakubczyk et al., 2022) and easy access
441 to sap, therefore aphids were attractive to sap the flowers. Some aphid species were drawn to certain colors (Chittka,
442 2007), while others preferred different types of plants and plant parts (Sorensen, 2009). It's worth noting that different
443 aphid species often had distinct preferences for plant ty(Harrington et al., 2007)pes and parts.

444 Herbs served as an alternative host for aphids in this present study. Aphids consumed sugar-rich liquid in plants,
445 known as "sap". Aphids considered herbs and other green vegetation as abundant food sources. Aphids utilized needle-like
446 mouthparts to penetrate plant tissues and access this fluid (Brožek et al., 2015). Numerous herbs had structural
447 characteristics, such as folds, crevices, and concealed flowering portions (Harrington et al., 2007), that provided aphids
448 with refuge .

449 Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a
450 delicious substance known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson &
451 Mooney, 2022). The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Detrain et al.,
452 2010). Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for honeydew,
453 ants provided aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and parasitic
454 wasps (Karami-jamour et al., 2018). Certain species of ants would transport aphids to new host plants for improved
455 foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al., 2021). Honeydew not only
456 nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
457 species) and provided energy for the growth of their own progeny (Biedermann & Vega, 2020).

458 CONCLUSION

459 15 species of aphids were found in ornamental and wild plants in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
460 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia*
461 *nigronevosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus*
462 sp. *Lipaphis erysimi*.

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467 REFERENCES

468 Alotaibi, N. J., Alsufyani, T., M, N. H., & Almalki, M. A. (2023). Rapid Identification of Aphid Species by Headspace
469 GC-MS and Discriminant Analysis. *Insects*. <https://doi.org/https://doi.org/10.3390/insects14070589>

- 470 Bass, C., Puinean, A. M., Zimmer, C. T., Denholm, I., Field, L. M., Foster, S. P., Gutbrod, O., Nauen, R., Slater, R., &
471 Williamson, M. S. (2014). The evolution of insecticide resistance in the peach potato aphid, *Myzus persicae*. *Insect*
472 *Biochemistry and Molecular Biology*, *51*, 41–51. <https://doi.org/10.1016/j.ibmb.2014.05.003>
- 473 Biedermann, P. H. W., & Vega, F. E. (2020). Ecology and evolution of insect–fungus mutualisms. *Annual Review of*
474 *Entomology*, *65*, 431–455. <https://doi.org/https://doi.org/10.1146/annurev-ento-011019-024910>
- 475 Blackman, R. L., & Eastop, V. F. (2008). *Aphids on the world's herbaceous plants and shrubs, 2 volume set*. John Wiley
476 & Sons.
- 477 Blackman, R. L., & Eastop, V. F. (2017). Taxonomic issues. In *Aphids as crop pests* (pp. 1–36). CABI Wallingford UK.
- 478 Boivin, G., Hance, T., & Brodeur, J. (2012). Aphid parasitoids in biological control. *Canadian Journal of Plant Science*,
479 *92*(1), 1–12. <https://doi.org/DOI:10.4141/cjps2011-045>
- 480 Brożek, J., Mróz, E., Wylężek, D., Depa, Ł., & Węgierek, P. (2015). The structure of extremely long mouthparts in the
481 aphid genus *Stomaphis* Walker (Hemiptera: Sternorrhyncha: Aphididae). *Zoomorphology*, *134*, 431–445.
482 <https://doi.org/https://doi.org/10.1007/s00435-015-0266-7>
- 483 Cao, H., Zhang, Z., Wang, X., & Liu, T. (2018). Nutrition versus defense: Why *Myzus persicae* (green peach aphid)
484 prefers and performs better on young leaves of cabbage. *PloS One*, *13*(4), 1–16.
485 <https://doi.org/https://doi.org/10.1371/journal.pone.0196219>
- 486 Chandel, R. S., Chandla, V. K., Verma, K. S., & Pathania, M. (2022). Chapter 21 - Insect pests of potato in India: biology
487 and management (A. Alyokhin, S. I. Rondon, & Y. B. T.-I. P. of P. (Second E. Gao (eds.); pp. 371–400). Academic
488 Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-821237-0.11001-7>
- 489 Chittka, A. L. (2007). *Visual ecology of aphids—a critical review on the role of colours in host finding* *Visual ecology of*
490 *aphids — a critical review on the role of colours in host finding*. June 2014. [https://doi.org/10.1007/s11829-006-](https://doi.org/10.1007/s11829-006-9000-1)
491 [9000-1](https://doi.org/10.1007/s11829-006-9000-1)
- 492 Clarke, R., Kehoe, M. A., Broughton, S., & Jones, R. A. C. (2020). Host plant affiliations of aphid vector species found
493 in a remote tropical environment. *Virus Research*, *281*(December 2019), 197934.
494 <https://doi.org/10.1016/j.virusres.2020.197934>
- 495 Degani, E., Leigh, S. G., Barber, H. M., Jones, H. E., Lukac, M., Sutton, P., & Potts, S. G. (2019). Crop rotations in a
496 climate change scenario: short-term effects of crop diversity on resilience and ecosystem service provision under
497 drought. *Agriculture, Ecosystems & Environment*, *285*, 106625.
498 <https://doi.org/https://doi.org/10.1016/j.agee.2019.106625>
- 499 Detrain, C., Verheggen, F. J., Diez, L., Wathelet, B., & Haubruge, E. (2010). Aphid–ant mutualism: how honeydew sugars
500 influence the behaviour of ant scouts. *Physiological Entomology*, *35*(2), 168–174. [https://doi.org/DOI:](https://doi.org/DOI:10.1111/j.1365-3032.2010.00730.x)
501 [10.1111/j.1365-3032.2010.00730.x](https://doi.org/DOI:10.1111/j.1365-3032.2010.00730.x)
- 502 Döring, T. F. (2014). How aphids find their host plants, and how they don't. *Annals of Applied Biology*, *165*(1), 3–26.
503 <https://doi.org/https://doi.org/10.1111/aab.12142>
- 504 Ertunc, F. (2020). Chapter 46 - Emerging Plant Viruses (M. M. B. T.-E. and R. V. P. Ennaji (ed.); pp. 1041–1062).
505 Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-819400-3.00046-6>
- 506 Gadhve, K. R., Gautam, S., Rasmussen, D. A., & Srinivasan, R. (2020). Aphid transmission of Potyvirus: the largest
507 plant-infecting RNA virus genus. *Viruses*, *12*(7), 773. <https://doi.org/doi:10.3390/v12070773>
- 508 Giannetti, D., Mandrioli, M., Schifani, E., Castracani, C., Spotti, F. A., Mori, A., & Grasso, D. A. (2021). First report on
509 the acrobat ant *Crematogaster scutellaris* storing live aphids in its oak-gall nests. *Insects*, *12*(2), 108.
510 <https://doi.org/https://doi.org/10.3390/insects12020108>
- 511 Guo, H., Gu, L., Liu, F., Chen, F., Ge, F., & Sun, Y. (2019). Aphid-borne Viral Spread Is Enhanced by Virus-induced
512 Accumulation of Plant Reactive Oxygen Species 1. *Plant Physiol*, *179*(January), 143–155.
513 <https://doi.org/10.1104/pp.18.00437>
- 514 Harrington, R., Clark, S. J., Welham, S. J., Verrier, P. J., Denholm, C. H., Hulle, M., Maurice, D., Rounsevell, M. D.,
515 Cocu, N., & Consortium, E. U. E. (2007). Environmental change and the phenology of European aphids. *Global*
516 *Change Biology*, *13*(8), 1550–1564. <https://doi.org/DOI:10.1111/j.1365-2486.2007.01394.x>
- 517 Hullé, M., Chaubet, B., Turpeau, E., & Simon, J.-C. (2020). Encyclop'Aphid: A website on aphids and their natural
518 enemies. *Entomologia Generalis*, *40*(1). <https://doi.org/DOI:10.1127/entomologia/2019/0867>
- 519 Ikbāl, C., & Pavela, R. (2019). Essential oils as active ingredients of botanical insecticides against aphids. *Journal of Pest*
520 *Science*, *92*, 971–986. <https://doi.org/DOI:10.1007/s10340-019-01089-6>
- 521 Jakubczyk, K., Koprowska, K., Gottschling, A., & Janda-Milczarek, K. (2022). Edible Flowers as a Source of Dietary
522 Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement. *Nutrients*, *14*(12).
523 <https://doi.org/10.3390/nu14122470>
- 524 Jaouannet, M., Rodriguez, P. A., Thorpe, P., Lenoir, C. J. G., & Macleod, R. (2014). Plant immunity in plant – aphid
525 interactions. *Front Plant Sci.*, *5*(December), 1–10. <https://doi.org/10.3389/fpls.2014.00663>
- 526 Jones, R. A. C. (2022). Alteration of plant species mixtures by virus infection: Managed pastures the forgotten dimension.
527 *Plant Pathology*, *71*(6), 1255–1281. <https://doi.org/DOI:10.1111/ppa.13571>
- 528 Jouselin, E., Gwenaëlle, G., & Armelle, C. D. A. (2010). Evolutionary lability of a complex life cycle in the aphid genus
529 *Brachycaudus*. *BMC Evolutionary Biology*, *10*(1). <https://doi.org/10.1186/1471-2148-10-295>

530 Kallas, J. (2010). *Edible wild plants*. Gibbs Smith.

531 Karami-jamour, T., Mirmoayedi, A., Zamani, A., & Khajehzadeh, Y. (2018). The impact of ant attendance on protecting
532 *Aphis gossypii* against two aphidophagous predators and its role on the intraguild predation between them. *Journal*
533 *of Insect Behavior*, 31, 222–239. <https://doi.org/DOI: 10.1007/s10905-018-9670-4>

534 Kennedy, J. S., & Stroyan, H. L. G. (1959). Biology of aphids. *Annual Review of Entomology*, 4(1), 139–160.

535 Kinley, C., Banu, A. N., Raut, A. M., Wahengbam, J., & Jamtsho, T. (2021). A review on past, present and future
536 approaches for Aphids management. *Journal of Entomological Research*, 45(2), 336–346.
537 <https://doi.org/10.5958/0974-4576.2021.00053.0>

538 Kumar, Sarwan. (2019). Aphid-Plant Interactions: Implications for Pest Management. In M. T. Oliveira, F. Candan, & A.
539 Fernandes-Silva (Eds.), *Plant Communities and Their Environment* (p. Ch. 7). IntechOpen.
540 <https://doi.org/10.5772/intechopen.84302>

541 Kumar, Sushil, Bhowmick, M. K., & Ray, P. (2021). Weeds as alternate and alternative hosts of crop pests. *Indian Journal*
542 *of Weed Science*, 53(1), 14–29. <https://doi.org/10.5958/0974-8164.2021.00002.2>

543 Liu, X. D., Xu, T. T., & Lei, H. X. (2017). Refuges and host shift pathways of host-specialized aphids *Aphis gossypii*.
544 *Scientific Reports*, 7(1), 1–9. <https://doi.org/10.1038/s41598-017-02248-4>

545 Maharani, Y., Hidayat, P., Rauf, A., & Maryana, N. (2018). Short communication: New records of aphid species
546 subfamily aphidinae (Hemiptera: Aphididae) in West Java, Indonesia. *Biodiversitas*, 19(2), 460–465.
547 <https://doi.org/10.13057/biodiv/d190219>

548 Margaritopoulos, J. T., Tzortzi, M., Zarpas, K. D., Tsitsipis, J. A., & Blackman, R. L. (2006). Morphological
549 discrimination of *Aphis gossypii* (Hemiptera: Aphididae) populations feeding on Compositae. *Bulletin of*
550 *Entomological Research*, 96(2), 153–165. <https://doi.org/10.1079/ber2005410>

551 Meuninck, J. (2023). *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.

552 Mo, C., & Smilanich, A. M. (2023). Feeding on an exotic host plant enhances plasma levels of phenoloxidase by
553 modulating feeding efficiency in a specialist insect herbivore. *Frontiers in Physiology*, 14(February), 1–10.
554 <https://doi.org/10.3389/fphys.2023.1127670>

555 Naidu, V. (2012). *Hand book on weed identification*. Dr. VSGR Naidu.

556 Nelson, A. S., & Mooney, K. A. (2022). The evolution and ecology of interactions between ants and honeydew-producing
557 hemipteran insects. *Annual Review of Ecology, Evolution, and Systematics*, 53, 379–402.
558 <https://doi.org/https://doi.org/10.1146/annurev-ecolsys-102220-014840>

559 Peccoud, J., Simon, J.-C., von Dohlen, C., Coeur d'acier, A., Plantegenest, M., Vanlerberghe-Masutti, F., & Jousset, E.
560 (2010). Evolutionary history of aphid-plant associations and their role in aphid diversification. *Comptes Rendus*
561 *Biologies*, 333(6), 474–487. <https://doi.org/https://doi.org/10.1016/j.crv.2010.03.004>

562 Pettersson, J., Tjallingii, W. F., & Hardie, J. (2017). Host-plant selection and feeding. In *Aphids as crop pests* (pp. 173–
563 195). CABI Wallingford UK. <https://doi.org/DOI: 10.1079/9780851998190.0087>

564 Singh, R., & Singh, G. (2021). Aphids. *Polyphagous Pests of Crops*, 105–182. https://doi.org/DOI: 10.1007/978-981-15-8075-8_3

565

566 Sorensen, J. T. (2009). *Chapter 8 - Aphids* (V. H. Resh & R. T. B. T.-E. of I. (Second E. Cardé (eds.); pp. 27–31).
567 Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-374144-8.00008-4>

568 Tegelaar, K., Hagman, M., Glinwood, R., Pettersson, J., & Leimar, O. (2012). Ant-aphid mutualism: the influence of ants
569 on the aphid summer cycle. *Oikos*, 121(1), 61–66. <https://doi.org/https://doi.org/10.1111/j.1600-0706.2011.19387.x>

570 Völkl, W., Mackauer, M., Pell, J. K., & Brodeur, J. (2023). Predators, parasitoids and pathogens. In *CABI Books*. CABI
571 Books. <https://doi.org/10.1079/9780851998190.0187>

572 Wäckers, F. ., & Van Rijn, P. . (2012). Pick and mix: selecting flowering plants to meet the requirements of target
573 biological control insects. *Biodiversity and Insect Pests: Key Issues for Sustainable Management*, 9(April), 139–165.
574 <https://doi.org/10.1002/9781118231838.ch9>

575 Yamamoto, T., Hattori, M., & Itino, T. (2020). *Seasonal Migration in the Aphid Genus Stomaphis (Hemiptera :*
576 *Aphididae): Discovery of Host Alternation Between Woody Plants in Subfamily Lachninae*. 20.
577 <https://doi.org/10.1093/jisesa/ieaa103>

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CHANDRA IRSAN, ERISE ANGGRAINI, WENNY RAMADHANI:

We have reached a decision regarding your submission to Biodiversitas Journal of Biological Diversity, "Species of aphids found in ornamental and wild plants in Pagar Alam District, South Sumatra, Indonesia".

Our decision is to: Accept Submission

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TO WHOM IT MAY CONCERN

Number: 0025/UN9/UPT.BHS/2023

UPT Bahasa Universitas Sriwijaya, hereby verifies that the scientific paper entitled “**Species of Aphids Found in Ornamental and Wild Plants in Highland, Pagar Alam, South Sumatra**” written by Chandra Irsan, Erise Anggraini, and Wenny Ramadhani has been professionally proofread by providing some input (such as the consistency and accuracy in grammar, spelling, punctuation, and wording) so that the English used in the paper is academically correct and appropriate.

Thus this certificate is made for proper use.

Palembang, 6 September 2023

Head,

Drs. Djunaidi, MSLS

NIP. 1962013021988031004

Species of aphids found in ornamental and wild Plants in Highland, Pagar Alam, South Sumatra

Abstract. Aphids are one of the crucial pests in ~~the~~ tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species ~~were found on plants that were not actually hosts such as wild plan, such as wild plants, were found on plants that were not actually hosts~~. Therefore, this study reported the species of aphids found in ornamental ~~plants and the~~ wild plants. The field research employed ~~a~~ purposive and direct observation ~~methods~~ approach to inventory cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host plants; and aphids; involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that 21 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Aphis citricola*, *Aphis craccivora*, *Aphis glycines*, *Aulacorthum solani*, *Greenidae* sp., *Hyperomyzus* sp., *Hysteroneura setariae*, *Lipaphis erysimi*, *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*, *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Rhopalosiphum padi*, *Sinemogoura citricola*, *Toxoptera aurantii*, *Toxoptera citricidus*, *Toxoptera odinae*, and *Schizaphis rotundiventris*.

Keywords: Aphids, ornamental plants, wild plants

Running title: Aphids found in ornamental and wild plants.

INTRODUCTION

Aphids are ~~one of the~~ crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhve et al. 2020); ~~a-~~ Aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can be found throughout the year due to their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids suck phloem sap of tender plant parts, which can deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, vector species can further weaken and stunt the growth of infected plants (Jones 2022). ~~—~~ Therefore, it is crucial to control aphid populations in gardens and crops.

Many aphid species are found on plants that are not their actual hosts (Maharani et al. 2018). Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al. 2020). Alternative plants provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al.; 2021). In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and native plants. Research on the diversity of aphid species in ornamental and wild plants has ~~less noticed~~ received little attention. This study reports ~~the~~ diversity of aphid species found in ornamental and wild plants found in this area. The findings from this study can serve as a valuable resource for aphid management.

MATERIALS AND METHODS

The field research employed a purposive and direct observation ~~approach~~ to inventory ~~of cultivated or wild plants hosting aphids~~ cultivated or wild plants hosting and collecting aphids. The plant selection ~~process~~ included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. ~~The collection and identification of host plants;~~

50 | ~~and aphids, and natural enemies where available.~~Where available, collecting and identifying host plants, aphids, and
 51 | ~~natural enemies~~ involved systematic searches of all existing plant species to find those colonized by aphids. Any plants
 52 | colonized by aphids are documented as aphid hosts. Aphid identification was done using identification keys (Blackman
 53 | and Eastop 2008) in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on
 54 | morphological characteristics. The host plants were identified using ~~the~~ weed identification hand-book (Kallas; 2010;
 55 | Meuninck; 2023; Naidu; 2012). The location and ~~size of~~aphid ~~colony~~colony sizes, including their life color, and
 56 | photographs of the aphid colonies and their host plants were recorded.

57 | RESULTS AND DISCUSSION

58 | Result

59 | Aphids infesting in ornamental plants

60 | The results showed that 15 aphid species were found in Pagar Alam(Tables 1 ~~and~~- 2)-. These aphids mostly
 61 | ~~colonised~~colonized flowers of various ornamental plants (Table 1, Figure 1).
 62 |

63 | **Table 1.-** Aphid species recorded in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Macrosiphoniella sanborni</i>	Leaves, young twig, flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	Leaves, flower Leaves Leaves, flower
3	<i>Caladium</i> sp.	<i>Pentalonia caladii</i>	Leaves,
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	Leaves, flower
5	<i>Canna indica</i>	<i>Rhopalosiphum nymphaeae</i>	Leaf
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	Shoot, young leaves, flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	Shoot, flower Young leaves
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	Flower
9	<i>Chrysanthemum</i> sp.	<i>Macrosiphoniella sanborni</i>	Shoot, twig
10	<i>Dahlia</i> sp.	<i>Aphis gossypii</i>	Flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	Flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	Shoot, flower
13	<i>Helianthus giganteus</i> .	<i>Aphis glycines</i>	Flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	Flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	Flower Shoot, young leaves
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	Flower Flower Shoot, flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	Young Twig Shoot, flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	Shoot, flower Shoot, flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	Flower
20	<i>Spondias dulcis</i>	<i>Aphis citricola</i>	Flower

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71 | **Fig 1.** Photos showing colonies of different aphid species in ornamental plants: a) *Aphis gossypii* in *Dahlia* sp. flower, b) *Aphis gossypii*
 72 | in *Hibiscus rosasinensis* flower, c) *Aphis gossypii* in ~~*cestrum*~~ *Cestrum* twig and flower, d) *Aphis craccivora* in *Clitoria ternatea* flower,
 73 | e) *Aphis glycines* in *Helianthus giganteus* flower, f) *Aphis craccivora* on the *Murayya paniculata* flower, g) *Toxoptera odinae* in the
 74 | *Mussaenda frondosa*, h) *Macrosiphoniella sanborni*. in *Chrysanthemum* sp. leaves i) *Macrosiphum rosae* in *Rosa indica* flower, j)
 75 | *Rhopalosiphum nymphaeae* in *Canna indica* leaves. ~~All the photos were captured by Chandra Irsan~~ [Chandra Irsan captured all the](#)
 76 | [photos.](#)
 77

78

79 | The relationship between aphids and ants was also recorded. Aphids produce a sweet, sticky substance called
 80 | honeydew. ~~Ants~~ [Ants](#) are attracted to this honey because it serves as a food source for them. When aphids are present, they
 81 | secrete honeydew, which attracts ants. This research recorded the presence of ants on plant parts colonized by aphids
 82 | (Table 2).
 83

84

86 | **Table 2.-** Aphid species recorded in ornamental plants and the presence of the ants in the plant parts colonized

No	Aphid Species	Ornamental plants	Aphids life colour	Plant parts colonized	Ant attendance
1	<i>Aphis craccivora</i>	<i>Clitoria ternatea</i>	black	flowers	+
		<i>Murraya paniculata</i>	black	flowers	+
2	<i>Aphis citricola</i>	<i>Catharanthus roseus</i>	greenish yellow	flowers	+
		<i>Ixora</i> sp.	greenish yellow	flowers	+
		<i>Mussaenda frondosa</i>	greenish yellow	shoots, flowers	+
		<i>Spondias dulcis</i>	greenish yellow	flowers	+
3	<i>Aphis glycines</i>	<i>Helianthus giganteus</i>	greenish yellow	flowers	+
4	<i>Aphis gossypii</i>	<i>Cestrum</i> sp.	green	shoots, flowers	+
		<i>Cananga odoratum</i>	light green	shoots, flowers	+
		<i>Dahlia</i> sp.	green dark	flowers	+
		<i>Duranta</i> sp.	light green	shoots, flowers	+
		<i>Hibiscus rosasinensis</i>	dark green	flowers	+
		<i>Ixora paludosa</i>	light green	flowers	+
		<i>Ixora</i> sp.	light green	flowers	+
5	<i>Aulacorthum solani</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-
6	<i>Macrosiphoniella sanborni</i>	<i>Aster alpinus</i>	brown black	leaves, twigs, flowers	+
		<i>Chrysanthemum</i> sp.	reddish brown	leaves, twigs	+
7	<i>Macrosiphum rosae</i>	<i>Rosa indica</i>	green	flowers	-
8	<i>Myzus persicae</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-
9	<i>Neomyzus circumflexus</i>	<i>Cestrum</i> sp.	light green	young leaves,	-
		<i>Brugmansia suaveolens</i>	light green	flowers	
				flowers	
10	<i>Pentalonia caladii</i>	<i>Caladium</i> sp.	brown-black	leaves	+
11	<i>Rhopalosiphum nymphaeae</i>	<i>Canna indica</i>	green black	leaves	+
12	<i>Sinemegoura citricola</i>	<i>Dendrobium</i> sp.	brown	flowers	-
13	<i>Toxoptera aurantii</i>	<i>Ixora paludosa</i>	brown black	flowers	+
		<i>Ixora</i> sp.	brown black	flowers	+
14	<i>Toxoptera citricidus</i>	<i>Murraya paniculata</i>	black	stems	+
15	<i>Toxoptera odinae</i>	<i>Mussaenda frondosa</i>	reddish-brown	flowers	+

87 (+): present, (-): absent

88

89 **Aphids infesting in wild plants (weed or non-weed plants)**

90

91 | In addition, this study documented aphid colonies on flowers, stalks, plant tops, young leaves, and old leaves of wild
92 plants (Table 3, Figure 2).

93

94 | **Table 3.-** Species of aphids found in wild (weed or non-weed) plants and their colony locations.

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	weed	<i>Aphis gossypii</i>	shoots, buds
3	<i>Alternanthera sessilis</i>	weed	<i>Aphis gossypii</i>	shoots, buds
4	<i>Amaranthus gracilis</i>	weed	<i>Aphis craccivora</i>	flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	weed	<i>Lipaphis erysimi</i>	flowers, shoots, and buds
6	<i>Croton hirtus</i>	weed	<i>Aphis gossypii</i>	flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks
8	<i>Cyperus rotundus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks
11	<i>Echinochloa crusgali</i>	weed	<i>Hiperomyzus</i> sp.	young leaves, old leaves
12	<i>Ecliptica prostrata</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves
13	<i>Eleusine indica</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks, leaf axils
			<i>Rhopalosiphum maidis</i>	flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	weed	<i>Aphis gossypii</i>	flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves
17	<i>Eupotarium odoratum</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves,
			<i>Aphis glycines</i>	shoot, young twigs
18	<i>Hymenochera acutigluma</i>	Weed	<i>Hysteronura setariae</i>	flowers, flower stalks, leaf axils

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
19	<i>Bridelia tomentosa</i>	Non-weed	<i>Greenidea</i> sp.	young leaves
20	<i>Lophatherum gracile</i>	Weed	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	young leaves, old leaves, leaf axils young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	Non-weed	<i>Aphis gossypii</i>	shoots, young leaves
22	<i>Mikania mickrantha</i>	Weed - liana	<i>Aphis gossypii</i> <i>Aphis glycines</i>	shoots, young leaves, old leaves shoot, young twig
23	<i>Mimosa invisa</i>	weed	<i>Aphis craccivora</i>	shoots, pods
24	<i>Mimosa pudica</i>	weed	<i>Aphis craccivora</i>	shoots, pods, flowers
25	<i>Mimosa vigra</i>	Non-weed	<i>Aphis craccivora</i>	shoots, pods
26	<i>Oryza rufipogon</i>	weed	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	old leaves, young leaves (shoot), leaf axils old leaves, young leaves (shoot), leaf axils
27	<i>Oxonopus compressus</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, leaf axils
28	<i>Paspalum conjugatum</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, seeds
29	<i>Phyllanthus neruri</i>	weed	<i>Aphis citricola</i>	shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	weed	<i>Aphis craccivora</i>	shoots, young leaves, flowers
31	<i>Physalis angulata</i>	weed	<i>Aphis craccivora</i> <i>Aphis gossypii</i>	shoots, young leaves, old leaves shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	weed	<i>Lipapis erysimi</i>	flowers, fruits, shoots, young leaves
33	<i>Sida rhombifolia</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arvensis</i>	weed	<i>Lipapis erysimi</i>	young leaves, fruit stalks, flowers, fruits

95

96 The presence of ants in aphid colonization symbolizes a mutually beneficial relationship where the ants receive food
97 from the aphids while providing protection to protect them aphids. This study recorded the ant attendance in aphids
98 colonization (Table 4).

99 **Table 4.-** Aphid species were recorded in ornamental plants, and the presence of the ants in the plant parts colonized.

No	Aphid Species	Wild plants	Aphids life colour	Plant parts colonized	Ant attendance
1	<i>Aphis gossypii</i>	<i>Ageratum conyzoides</i> <i>Alternanthera philoxeroides</i> <i>Alternanthera sessilis</i> <i>Croton hirtus</i> <i>Ecliptica prostrata</i> <i>Emilia sonchifolia</i> <i>Euphorbia hirta</i> <i>Eupotarium</i> — <i>Eupatorium</i> <i>odoratum</i> <i>Melastoma affine</i> <i>Mikania mickrantha</i> <i>Physalis angulata</i> <i>Sida rhombifolia</i>	Light green Light green Light green Dark green green green light green light green light green light green light green yellowish green yellowish green	shoots, young leaves, old leaves, flowers shoots, buds shoots, buds flowers, shoots, young leaves, old leaves, young twigs shoots, young leaves flower, flower stalks, shoots young leaves, old leaves young leaves, old leaves, young twigs shoots, young leaves shoots, young leaves, old leaves shoots, young leaves, old leaves, fruit/seeds	+ + - + + + + + + + + -
2	<i>Aphis craccivora</i>	<i>Amaranthus gracilis</i> <i>Mimosa invisa</i> <i>Mimosa pudica</i> <i>Mimosa vigra</i> <i>Portulaca oleraceae</i> <i>Physalis angulata</i>	black black black black black black	flowers, shoots, young leaves, old leaves shoots, pods shoots, pods, flowers shoots, pods shoots, young leaves, flowers shoots, young leaves, old leaves	+ + + + + +
3	<i>Aphis glycines</i>	<i>Eupotarium</i> — <i>Eupatorium</i> <i>odoratum</i> <i>Mikania mickrantha</i>	Greenish yellow Light green	young leaves, old leaves, young twigs shoots, young leaves, old leaves	+ +
4	<i>Aphis citricola</i>	<i>Phyllanthus neruri</i>	Greenish Yellow	shoot, young leaves, young twigs, petioles	+
5	<i>Greenidea</i> sp.	<i>Bridelia tomentosa</i>	Greenish Yellow	young leaves	-
6	<i>Hysteroneura setariae</i>	<i>Digitaria ciliaris</i> <i>Eleusine indica</i> <i>Eragrostis tenella</i> <i>Hymenochera acutigluma</i> <i>Lophatherum gracile</i> <i>Oxonopus compressus</i> <i>Paspalum conjugatum</i>	reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown	flower, flower stalks flower, flower stalks, leaf axils flower, flower stalks, seeds flowers, flower stalks, leaf axils young leaves, old leaves, leaf axils flower, flower stalk, leaf axils flower, flower stalk, seeds	+ + + + + + +
7	<i>Hiperomyzus</i> sp.	<i>Echinocloa crussgali</i>	Black	young leaves, old leaves	-
8	<i>Lipaphis erysimi</i>	<i>Blumea lacera</i> <i>Rorippa indica</i> <i>Sonchus arvensis</i>	Whitish green Whitish green Whitish green	flowers, shoots, and buds flower, fruit, shoots, young leaves young leaves, fruit stalks, flowers, fruit	+ + +
9	<i>Rhopalosiphum maidis</i>	<i>Eleusine indica</i> <i>Lophatherum gracile</i> <i>Oryza rufipogon</i>	green green green	flower, flower stalks, leaf axils young leaves, old leaves, leaf axils old leaves, young leaves (shoot), leaf axils	+ + -
10	<i>Rhopalosiphum padi</i>	<i>Oryza rufipogon</i>	Whitish green	old leaves, young leaves (shoot), leaf axils	+
11	<i>Schizaphis rotundiventris</i>	<i>Cynodon dactylon</i> <i>Cyperus rotundus</i> <i>Cyperus compressus</i>	Green green green	flowers, flower stalks flowers, flower stalks, leaf axils flowers, flower stalks, leaf axils	+ + +

100
101
102
103

(+): present, (-): absent



104
105

Figure 2. Aphids found infesting wild plants a) *Aphis gossypii* in *Ageratum conyzoides*, b) *Aphis gossypii* in *Croton hirtus* c) *A. gossypii* in *Eupatorium odoratum*, d) *Aphis gossypii* in *Pachystochys* sp., e) *Pentalonia caladii* in *Caladium* sp., f) *Aphis. gossypii* in *Alternanthera sessilis*, g) *Aphis gossypii* in *Portulaca oleraceae* h) *Aphis gossypii* in *Euphorbia hirta*, i) *Aphis citricola* in *Phyllanthus nerruri*, j) *Aphis citricola* in *Sida rhombifolia*, k) *Aphis citricola* in *Annona muricata*, l) *Aphis citricola* in *Ludwigia peruviana*, m) *A. craccivora* in *Mimosa pudica*, n) *Aphis craccivora* in *Amaranthus gracilis*, o) *Aphis glycine* in *Mikania micranta*, p) *Hysteneura* sp. in *Eleusin*, q) *Greenidae* sp. in *Bridelia tomentosa* young leaves., r) *Hyperomyzus* sp. in *Echinocloa crusgali*, s) *Lipaphis erysimi* in *sonchus arventris*, t) *Rhopalosiphum padi* in *Oryza rufipogon*, u) *Rhopalosiphum Maidis* in *Oryza rufipogon*. All the photos were captured by Chandra Irsan.

127 Discussion

128

129 In the present study, some aphid species were found on ~~severalome~~ ornamental plants in Pagar Alam. ~~t-~~The location
 130 of aphid colonization on the plants varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and
 131 ~~on~~ newly emerging leaves. The aphids displayed brown and black coloration. The aphid colonies found were small, and
 132 the colonized plant parts showed no signs of disease. The identification results showed that the aphids were *Neotoxoptera*
 133 sp., and notably, they were not associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or
 134 young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized
 135 plant parts showed symptoms of stunting. The identification results showed that the aphids were *Macrosiphoniella*
 136 ~~sanborni, and they were and~~ associated with ants. On the *Brugmansia suaveolens*, *M. persicae* were found on the
 137 undersides of old leaves or leaves that have ~~started to turn~~ turned yellow. The colonies were relatively small. The aphids
 138 found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. was
 139 found one species of aphids: *P. caladii*. *P. caladii* was known and found in taro plants; the aphids formed colonies under
 140 the surface of young and older leaves (Bhadra and Agarwala 2014). ~~According to this present study, This study found that~~
 141 the occupied leaf areas did not display severe symptoms; ~~t-~~The aphids were ~~yellow-yellow-green~~ to dark green. The
 142 wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odoratum* (ylang-ylang),
 143 colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T.*
 144 *aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids
 145 found were brown to black ~~in color~~. The colonies of *T. aurantii* were found to be associated with black ants. Aphids on *C.*
 146 *indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the
 147 leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body and
 148 the identification results showed that the aphids were *Rhopalosiphum nymphaeae* (Acharya and Singh 2004).- The colonies
 149 of *R. nymphaeae* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were
 150 found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and
 151 the colonized plant parts ~~did not show any~~ showed no symptoms of disease ~~disease symptoms~~. On *Cestrum* sp. (Bastard
 152 jasmine), aphids formed colonies on the undersides of young leaves, shoots, and within flower parts, especially between
 153 petals or ~~flower~~ stalks that had not fully bloomed; ~~t-~~The colonies were quite large. The body color of aphids was green to
 154 dark green, with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms.
 155 The identification results showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated
 156 with ants. Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems, and young
 157 leaves. The aphids were brown to black ~~in color~~. Colonized plant parts, especially shoots and young leaves, showed
 158 stunting symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently
 159 associated with ants. The aphids on the *Dahlia* sp. formed colonies on unopened flower buds, with a significant population
 160 among the blooming petals. The body color was green to dark green. The identification results showed that the aphids
 161 were *A. gossypii*. According to this present study, *Sinemegoura citricola* colonies were found on the young leaves of
 162 *Dendrobium* sp., with the color body of the *S. citricola* aphids were yellow, green to dark green, and the colonized plants
 163 ~~did not showing no any~~ disease symptoms, and they were associated with ants. On *Duranta* sp., colonies of aphids were
 164 ~~located~~ on the undersides of young leaves, and the colonized plant parts showed stunting symptoms. The colonies were
 165 very large. The aphids were green ~~in color~~. The identification results showed that the aphids were *A. gossypii*. The aphid
 166 colonies were consistently associated with ants. Furthermore, on the *Helianthus annuus*, aphid colonies were found

167 | between the flower petals. The colonized flowers, especially the crowns, exhibited a tendency tended to fall off easily. The
168 | aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A.*
169 | *gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides
170 | of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant
171 | parts did not show any disease symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid
172 | colonies were not associated with ants. Within the colonies, mummified aphids that were parasitized by
173 | Aphidiidae Aphidiidae parasitized were found. On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark
174 | green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the undersides of aging
175 | leaves. The colonies grew to be very large. The identification results showed that the aphids were *A. gossypii*. The aphid
176 | colonies were consistently associated with ants. Two types of aphids were found on the flowering plant *Ixora paludosa*.
177 | First, the aphids formed colonies on the undersides of young leaves that were still red or light green and sometimes on
178 | flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf growth, leaf
179 | shrinkage, necrotic spots on the leaf surface, and slightly downward-curved leaf edges. The upper leaf surface looked wet
180 | and sticky, like sugar. The aphids had yellow, green, or slightly dark green bodies, with some wingless adults having a
181 | powdery white upper surface. The identification results showed that the aphids were *A. gossypii*, and they were and they
182 | were almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface
183 | of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts
184 | occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched
185 | stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids
186 | were also associated with ants. Moreover, in *Ixora* sp. flower plants, two forms of aphids were discovered two forms of
187 | aphids were discovered in *Ixora* sp. flower plants. These aphids occupied the shoots, young leaves, and unopened flowers;
188 | t. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from yellow and green to
189 | a slightly darker green. Sometimes, the upper surface of the wingless imago's body appeared white, resembling flour. The
190 | identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost always associated with
191 | ants. Another species of aphids was founded and formed colonies on flower stalks that had not yet bloomed and on newly
192 | emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms of plant disease plant
193 | disease symptoms. The aphids were yellow or yellowish green, with black cauda and siphunculi. Their bodies were very
194 | small to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also
195 | frequently found in association with ants. Two types of aphids were found on *Mussaenda frondosa*, each forming colonies
196 | in different locations. The first type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied
197 | showed no obvious disease symptoms. The identification results showed that the aphids were *Toxoptera odinae*. The
198 | aphids were yellow, green, and some with dark green (Blackman et al. 2011). The second type of aphids formed colonies
199 | on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could also be found on young
200 | leaves, shoots, and within flower parts. The plant parts they infested showed no signs of diseases. The aphids were yellow
201 | or yellow-yellow-green, with black cauda and siphunculi. They had tiny to small bodies. The identification results showed
202 | that the aphids were *A. citricola*. Many aphid species infest a variety of various ornamental plants because these insects are
203 | attracted to such plants due to the rich nutrient content in the plant sap (Braham et al. 2023).

204 | The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This
205 | indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
206 | generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
207 | colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
208 | yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides*, or alligator grass, was also
209 | colonized by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were
210 | green, ranging from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies
211 | on shoots, flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants.
212 | *Amaranthus gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers, and young
213 | and old leaves. They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were
214 | associated with both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi*. These aphids were bright
215 | green, and of medium size. The colonies formed on flowers, flower stalks, and the undersides of the leaves at the top. The
216 | aphid colonies were not associated with ants. *Croton hirtus*, or fire grass, was infested by *Aphis gossypii*. The aphids
217 | were yellow-yellow-green to dark green. The colonies were found on the stems, leaves, buds, and flowers, often forming
218 | large colonies. *Cynodon dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the
219 | flowers, flower stalks, and sometimes in the plant leaf axils of the plant. Small colonies were formed. The aphids were
220 | brown to reddish brown. They were associated with ants. *Cyperus rotundus*, or nut grass, was infested by *Schizaphis*
221 | *rotundiventris* aphids. The colonies were found on flower stalks, flowers, and leaf axils. The colonies were quite large and
222 | associated with both black and red ants. The aphids were dark brown in color. *Cyperus compressus*, or grass puzzle, was
223 | colonized by *Schizaphis rotundiventris* aphids, forming colonies in the flowers, flower stalks, and sometimes in the axils
224 | and leaves of the shoots or buds. Small colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae*
225 | aphids, with small colonies scattered on the flowers and flower stalks. These aphids were light brown to brown in color.
226 | *Echinocloa crussgali*, or water hyacinth plants, were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown

227 to black and formed large colonies on the undersides of both young and old leaves. The aphid colonies were never found
 228 in association with ants. *Ecliptica prostrata*, or urang-aring, was colonized by *Aphis gossypii*, forming small colonies on
 229 the shoots and flowers. The aphids were bright green to blackish green. The aphid colonies were also consistently
 230 associated with ants. *Eleusin indica* was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum*
 231 *maidis*. *H. setariae* formed colonies in flower parts, flower stalks, and leaf axils, resulting in quite large colonies. *H.*
 232 *setariae*'s body color ranged from red-red-brown to dark brown. The colonies were consistently associated with ants. The
 233 aphids of *R. maidis* formed colonies in the leaf axils and undersides of leaves and on-leaf shoots that had not yet opened.
 234 The colonies were not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and
 235 cauda. These aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated
 236 with ants. The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids
 237 were yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves. *Eragrostis tenella* was
 238 infested by *Hysteroneura setariae* aphids. The aphids were brown to red-red-brown. Small colonies formed on flowers
 239 near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were consistently associated
 240 with ants. *Euphorbia hirta*, or wart grass, was colonized by *Aphis gossypii*. The aphids formed colonies on the undersides
 241 of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in color. *A. gossypii* colonies on
 242 *E. hirta* plants were consistently associated with ants. *Eupotarium-Eupatorium odoratum* was colonized by both *Aphis*
 243 *gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young twigs. Young
 244 leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this plant showed
 245 yellow-green to dark-dark-green in-body colour. The colonies of *A. citricola* formed on the young twigs near the shoots,
 246 with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of both *A.*
 247 *gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants. *Hymenochera acutigluma*, or
 248 hair axis, was colonized by *Hysteroneura setariae*, which formed colonies on the flower stalks and flowers. The colonized
 249 parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or *kenidai*, was infested by *Greenidae* sp.
 250 These aphids had bright green bodies and distinctive elongated siphunculi with thorns. The aphids formed colonies on the
 251 undersides of leaves, especially on young leaves. The colonized leaves did not show any disease symptoms. *Lophatherum*
 252 *gracile* or bamboo grass plants, were colonized by two species of aphids: *hysteroneura setariae* and *Rhopalosiphum*
 253 *maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves, leaf shoots, and leaf axils. The colonized
 254 leaves did not show any disease symptoms. *H. setariae* aphids were brown to red-red-brown. *R. maidis* aphids also formed
 255 colonies on the undersides of leaves, but the colonies were small. *R. maidis* aphids were green to bright green in-color,
 256 with black siphunculi and cauda. It was possible for colonies of the two species of aphids on *L. gracile* to mix. In addition,
 257 *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly emerging
 258 shoots and on-newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The colonized
 259 plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis glycine*. *A.*
 260 *gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A.*
 261 *glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were light green to green
 262 in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony. *Mimosa*
 263 *invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisita* plants formed colonies
 264 only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa pudica* was
 265 observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots, and
 266 occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the colonized
 267 plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of aphids
 268 occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were shiny
 269 black. The colonized plant parts did not show any disease symptoms. *Oryza rufipogon* was colonized by two species of
 270 aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both aphids colonized the same plant parts, namely the unopened
 271 leaves and the leaf axils with large colonies. The two species could be distinguished by their body color. *R. maidis*
 272 appeared green with black siphunculi and cauda, while *R. rice* appeared white. The colonies of *R. maidis* and *R. rice* in *O.*
 273 *rufipogon* plants were associated with the presence of red ants. *Oxonopus compressus*, or *pait* grass, was colonized by
 274 *Hysteroneura setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes in-in-the leaf axils. The
 275 aphids were brown to dark brown in-color. Small colonies were formed, and they were also consistently associated with
 276 ants. *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds
 277 and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus niruri* was colonized by *Aphis citricola*. The
 278 colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted,
 279 and wrinkled. The aphids had yellow bodies with black siphunculi and cauda, and the colonies formed were quite large.
 280 *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants
 281 formed colonies on the undersides of leaves, especially young leaves, shoots, and in flowers. The colonized plant parts
 282 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
 283 appeared glossy black. *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black
 284 bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The
 285 colonized plant parts did not show any symptoms-of-disease symptoms. *Rorippa indica*, or mustard land, was colonized by
 286 *Lipaphis erysimi*. The colonies formed on the flowers, fruits, flower stalks, and the lower leaf's surface-of-leaves. The

287 | colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia*, or cacabea, was colonized by
288 | *Aphis gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves,
289 | stalks, and flower petals. The colonized plant parts, especially the shoots, showed curling, and the leaf edges curled
290 | downward. *Sonchus arvensis* plants were colonized by *L. erysimi*. The aphids had green to whitish green body colours,
291 | and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became
292 | stunted over time.

293 | In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
294 | displayed typical ~~damage~~ symptoms of damage, but some did not show any symptoms at all. Generally, the plants'
295 | symptoms of the plants due to caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape,
296 | and stunted or curly leaves. These characteristic symptoms serve as indicators of aphid infestations. However, some plants
297 | or plant parts did not show symptoms when colonized by aphids. This condition occurred because the colonized
298 | parts had reached their maximum growth or development. It indicated that the colonized part was not currently undergoing
299 | a growth phase. The colonies that did not induce symptoms typically occurred when the colonized leaves had reached their
300 | maximum growth or when the leaves and plant parts were old. Furthermore, the old leaves or twigs might not show the
301 | typical symptoms associated with aphid infestations. The plant parts of the plant exhibiting characteristic symptoms when
302 | colonized by aphids also often experienced a cessation in growth due to the piercing by the aphids. In contrast, the areas
303 | surrounding the puncture site continued to grow, resulting in some parts developing normally while others
304 | become growing, resulting in some parts developing ordinary while others became stunted (Pettersson, Tjallingii, and
305 | Hardie 2017). This condition could lead to the bending of shoots or young stems, curling of bending shoots or young stems,
306 | curling leaves, downward curling of leaf edges, or stunted leaf growth. In this observation, monocot plants or groups of
307 | grasses with narrow leaves generally did not display any distinctive symptoms when colonized by aphids. This might be
308 | because the growth or development of their leaves differed from that of dicot plants. Therefore, the presence of aphids in
309 | monocot plants or plants was often easier to recognize through the presence of ants. If a plant was found to have a
310 | significant number of ants, there was a possibility that aphids had colonized the plant (Tegelaar et al. 2012). Therefore, the
311 | presence of ants could serve as an indicator of the presence of aphid colonies. According to this present study, ants were
312 | present in some aphids colonies from the subfamily aphidini, while the ants were absent in some aphids present study, ants
313 | were present in some aphid colonies from the subfamily aphidini, while the ants were absent in some aphid colonies from
314 | the macrocypini subfamily. The absent absence of ants in aphids colonies could be because the colonies have just formed;
315 | or the population is still low (Kummel, Brown, and Bruder 2013). Aphids colonized flowers because they may offer an
316 | accessible and rich food source, sugary plant sap found in new growth or reproductive plant parts of plants. Flowers
317 | contain a nutrient-rich nature and easy access to sap; therefore, aphids were attracted to flower saps. In addition, the
318 | flowers s. Some aphid species were drawn to certain colors (Jakubczyk et al. 2022). Herbs served as an alternative host for
319 | aphids in this present study. Aphids consume sugar-rich liquid in plants, known as "sap". Aphids considered herbs and
320 | other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate plant tissues and
321 | access this fluid (Brozek et al. 2015). Several aphids colonized herbs such as Indian mustards, *Lipaphis erysimi*, and
322 | *Myzus persicae*, are the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al. 2022). Due to a
323 | symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance
324 | known as honeydew as a waste product, which ants found highly attractive as a food sources (Nelson and Mooney 2022).
325 | The honeydew contained an abundance of abundant sugars; extracted by aphids from the plant juice (Zheng et al. 2022).
326 | Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for honeydew, ants
327 | provided aphids with protection tected aphids from other insects and predators, such as ladybugs, lacewing larvae, and
328 | parasitic wasps (Karami-jamour et al. 2018). Certain ant species of ants would transport aphids to new host plants for
329 | improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not
330 | only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
331 | species) and provided energy for the growth of their own progeny (Biedermann and Vega 2020).

332

CONCLUSION

333 | Moreover, 21 species of aphids were found in Pagar Alam, namely *Aphis gossypii*, *Aphis citricola*, *Aphis craccivora*,
334 | *Aphis glycines*, *Aulacorthum solani*, *Greenida* sp., *Hyperomyzus* sp., *Hysteronera setariae*, *Lipaphis erysimi*,
335 | *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*,
336 | *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Rhopalosiphum padi*, *Sinemogoura citricola*, *Toxoptera aurantii*,
337 | *Toxoptera citricidus*, *Toxoptera odinae*, and *Schizaphis rotundiventris*.

338

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- 342 | Acharya, Shelley, and Rajendra Singh. 2004. "Aphids on Medicinal Plants in North East India (Insecta : Homoptera : Aphididae)". *Rec. Zool. Surv. India* 102(June 2004). doi: 10.26515/rzsi/v103/i1-2/2004/159495.
- 344 | Bass, Chris, Alin M. Puinean, Christoph T. Zimmer, Ian Denholm, Linda M. Field, Stephen P. Foster, Oliver Gutbrod, Ralf Nauen, Russell Slater, and Martin S. Williamson. 2014. "The Evolution of Insecticide Resistance in the Peach Potato Aphid, Myzus persicae". *Insect Biochemistry and Molecular Biology* 51:41–51. doi: 10.1016/j.ibmb.2014.05.003.
- 347 | Bhadra, Parna, and Basant Kumar Agarwala. 2014. "On the Morphological and Genotypic Variations of Two Congeneric Species of Banana Aphid Pentalonia (Homoptera : Aphididae) from India". (March). doi: 10.5932/j.als.20120203.06.
- 349 | Biedermann, Peter H. W., and Fernando E. Vega. 2020. "Ecology and Evolution of Insect–Fungus Mutualisms". *Annual Review of Entomology* 65:431–55. doi: <https://doi.org/10.1146/annurev-ento-011019-024910>.
- 351 | Blackman, Roger L., and Victor F. Eastop. 2008. *Aphids on the World's World's Herbaceous Plants and Shrubs, 2 Volume Set*. John Wiley & Sons.
- 352 | Blackman, Roger L., and Victor F. Eastop. 2017. "Taxonomic Issues". Pp. 1–36 in *Aphids as crop pests*. CABI Wallingford UK.
- 353 | Blackman, Roger Laurence, Masato Sorin, and Masahisa Miyazaki. 2011. "Sexual Morphs and Colour Variants of Aphis (Formerly Toxoptera) Odinae (Hemiptera, Aphididae) in Japan". *Zootaxa* (November 2011):53–60. doi: 10.11646/zootaxa.3110.1.5.
- 354 | Braham, Mohamed, Synda Boulahia-kheder, Mouna Kahia, and Siwar Nourira. 2023. "Aphids and Citrus Responses to Nitrogen Fertilization". *Journal of the Saudi Society of Agricultural Sciences* 22(6):374–83. doi: 10.1016/j.jssas.2023.03.003.
- 355 | Brożek, Jolanta, Ewa Mróz, Dominika Wylęzek, Łukasz Depa, and Piotr Wegierek. 2015. "The Structure of Extremely Long Mouthparts in the Aphid Genus Stomaphis Walker (Hemiptera: Sternorrhyncha: Aphididae)". *Zoomorphology* 134:431–45. doi: <https://doi.org/10.1007/s00435-015-0266-7>.
- 360 | Cao, He-he, Zhan-feng Zhang, Xiao-feng Wang, and Tong-xian Liu. 2018. "Nutrition versus Defense : Why Myzus persicae (Green Peach Aphid) Prefers and Performs Better on Young Leaves of Cabbage?". *PLoS One* 13(4):1–16. doi: <https://doi.org/10.1371/journal.pone.0196219>.
- 362 | Clarke, Rebecca, Monica A. Kehoe, Sonya Broughton, and Roger A. C. Jones. 2020. "Host Plant Affiliations of Aphid Vector Species Found in a Remote Tropical Environment". *Virus Research* 281(December 2019):197934. doi: 10.1016/j.virusres.2020.197934.
- 364 | Ertunc, Filiz. 2020. "Chapter 46 - Emerging Plant Viruses". Pp. 1041–62 in, edited by M. M. B. T.-E. and R. V. P. Ennaji. Academic Press.
- 365 | Gadhave, Kiran R., Saurabh Gautam, David A. Rasmussen, and Rajagopalbabu Srinivasan. 2020. "Aphid Transmission of Potyvirus: The Largest Plant-Infecting RNA Virus Genus". *Viruses* 12(7):773. doi: 10.3390/v12070773.
- 367 | Giannetti, Daniele, Mauro Mandrioli, Enrico Schifani, Cristina Castracani, Fiorenza A. Spotti, Alessandra Mori, and Donato A. Grasso. 2021. "First Report on the Acrobat Ant Crematogaster Scutellaris Storing Live Aphids in Its Oak-Gall Nests". *Insects* 12(2):108. doi: <https://doi.org/10.3390/insects12020108>.
- 370 | Jakubczyk, Karolina, Klaudia Koprowska, Aleksandra Gottschling, and Katarzyna Janda-Milczarek. 2022. "Edible Flowers as a Source of Dietary Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement". *Nutrients* 14(12). doi: 10.3390/nu14122470.
- 372 | Jayaswal, Deepanshu, Pawan Mainkar, Kuldeep Kumar, Yamini Agarwal, and Ratna Prabha. 2022. "Pyramiding and Evaluation of Segregating Lines Containing Lectin and Protease Inhibitor Genes for Aphid Resistance in Brassica Juncea". *Indian Journal of Biochemistry & Biophysics* 59(August):800–807. doi: 10.56042/ijbb.v59i8.62319.
- 375 | Jones, Roger A. C. 2022. "Alteration of Plant Species Mixtures by Virus Infection: Managed Pastures the Forgotten Dimension". *Plant Pathology* 71(6):1255–81. doi: DOI: 10.1111/ppa.13571.
- 377 | Kallas, John. 2010. *Edible Wild Plants*. Gibbs Smith.
- 378 | Karami-jamour, Tahereh, Alinaghi Mirmoayed, Abbasali Zamani, and Yadolah Khajehzadeh. 2018. "The Impact of Ant Attendance on Protecting Aphis Gossypii against Two Aphidophagous Predators and Its Role on the Intraguild Predation between Them". *Journal of Insect Behavior* 31:222–39. doi: DOI: 10.1007/s10905-018-9670-4.
- 381 | Kennedy, J. S., and H. L. G. Stroyan. 1959. "Biology of Aphids". *Annual Review of Entomology* 4(1):139–60.
- 382 | Kumar, Sushil, Malay K. Bhowmick, and Puja Ray. 2021. "Weeds as Alternate and Alternative Hosts of Crop Pests". *Indian Journal of Weed Science* 53(1):14–29. doi: 10.5958/0974-8164.2021.00002.2.
- 384 | Kummel, Miroslav, David Brown, and Andrea Bruder. 2013. "How the Aphids Got Their Spots: Predation Drives Self-Organization of Aphid Colonies in a Patchy Habitat". *Oikos* 122(6):896–906. doi: <https://doi.org/10.1111/j.1600-0706.2012.20805.x>.
- 386 | Maharani, Yani, Purnama Hidayat, Aunu Rauf, and Nina Maryana. 2018. "Short Communication: New Records of Aphid Species Subfamily Aphidinae (Hemiptera: Aphididae) in West Java, Indonesia". *Biodiversitas* 19(2):460–65. doi: 10.13057/biodiv/d190219.
- 388 | Meuninck, Jim. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.
- 389 | Naidu, VSGR. 2012. "Hand Book on Weed Identification".
- 390 | Nelson, Annika S., and Kailen A. Mooney. 2022. "The Evolution and Ecology of Interactions between Ants and Honeydew-Producing Hemipteran Insects". *Annual Review of Ecology, Evolution, and Systematics* 53:379–402. doi: <https://doi.org/10.1146/annurev-ecolsys-102220-014840>.
- 392 | Pettersson, Jan, W. Fred Tjallingii, and Jim Hardie. 2017. "Host-Plant Selection and Feeding". Pp. 173–95 in *Aphids as crop pests*. CABI Wallingford UK.
- 394 | Tegelaar, Karolina, Mattias Hagman, Robert Glinwood, Jan Pettersson, and Olof Leimar. 2012. "Ant–Aphid Mutualism: The Influence of Ants on the Aphid Summer Cycle". *Oikos* 121(1):61–66. doi: <https://doi.org/10.1111/j.1600-0706.2011.19387.x>.
- 396 | Zheng, Zhou, Mengqin Zhao, Zhijun Zhang, Xin Hu, Yang Xu, and Cong Wei. 2022. "Lactic Acid Bacteria Are Prevalent in the Infrabuccal Pockets and Crops of Ants That Prefer Aphid Honeydew". *Front. Microbiol.* 12(January):1–17. doi: 10.3389/fmicb.2021.785016.
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Species of Aphids Found in Ornamental and Wild Plants in Highland, Pagar Alam, South Sumatra

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Abstract

Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of aphids found in ornamental plants and the wild plants. This study revealed that 15 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis erysimi*.

Keywords: aphids, ornamental plants, wild plants

Introduction

Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy & Stroyan, 1959). One species of aphids can host more than 400 species from 40 families (Blackman & Eastop, 2000). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhawe et al., 2020). A single species of aphids can act as a vector for over 150 viruses (Blackman & Eastop, 2000). In tropical areas, aphids can always be found throughout the year due to their parthenogenetic nature of reproduction (Blackman & Eastop, 2017). Aphids consume plant sap, which can deplete essential nutrients for healthy growth (Müller et al., 2001). Moreover, when aphids transmit viral diseases from one plant to another, this can further weaken and stunt the growth of infected plants (Jones, 2022). According to Kinley et al. (2021), aphids cause yield losses directly (35 - 40%) by sucking the plant sap or indirectly (20 - 80%) through viral transmission. Therefore, aphid infestations can have adverse effects on crop yields and overall plant health (Sarwan Kumar, 2019).

Due to their function as vectors, the presence of aphids on a plant can be highly damaging (Jaouannet et al., 2014). They feed by piercing the plant's tissues and consuming its sap, which can reduce the plant's growth and productivity, ultimately leading to weakness and possible death (Chandel et al., 2022). Additionally, as vectors, aphids can transmit a variety of plant diseases. They are as carriers for various plant viruses, and when they move from infected to healthy plants, these viruses can rapidly spread and cause extensive damage (Guo et al., 2019). In addition, the honeydew that aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh & Singh, 2021). Therefore, it is crucial to control aphid populations in gardens and crops.

Understanding the species diversity of aphids is fundamental to effective aphid control, as it facilitates the development of measures to keep their populations in check. In addition, understanding the diversity of aphid species can provide valuable insights into potential plant diseases, as different aphid species carry distinct viruses. Methods used to control aphids often encompass various techniques, including the use of natural enemies such as predators (like ladybugs, lacewings, and parasitic wasps) (Singh & Singh, 2021; Völkl et al., 2023), parasitoids (Boivin et al., 2012), entomopathogens (Hullé et al., 2020), the use of essential oils as botanical pesticides to control aphids (Ikbal & Pavela, 2019), and crop rotation techniques (Degani et al., 2019). Regular monitoring of aphid populations and diversity can help in detecting when population sizes may be reaching harmful levels, allowing for prompt implementation of the necessary countermeasures.

According to Irsan *et al.* (1998), many aphid species were found on plants that were not their actual hosts. Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al., 2020). An alternative host can also be a collateral host belonging to the same plant family as the primary host, helping crop pests to survive when the primary hosts are unavailable (Sileshi et al., 2008). These secondary hosts may offer less adequate nutrition for insects (Capinera, 2005). However, they may provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al., 2021). According to Liu et al. (2017), since hibiscus serves as an overwintering host for cotton-specialized aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during times of food shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin et al., 2010). They maintain a cycle of host alternation, shifting between their primary hosts (typically a woody

plant) and secondary hosts (often herbaceous plants) (Moran, 1992). Weeds pose a continuous threat in both cropped and non-crop areas, providing food, shelter and reproductive sites for various pest organisms (Kumar et al., 2021). This indicates that weeds can serve as alternative hosts for aphids.

A study of aphid species on horticultural plants has been conducted (Maharani et al., 2018), However, information about aphid species on ornamental and wild plants has not received as much attention and remains largely unexplored. In South Sumatra, particularly in the highland areas like Pagaralam, there are numerous ornamental and native plants. The research on the diversity of aphid species in ornamental and wild plants has received little attention. Therefore, this study was conducted in Pagaralam, a highland region of South Sumatra, with the aim of obtaining information on the diversity of aphid species found in ornamental and wild plants. The findings from this study can serve as a valuable resource for aphid management.

Methods

The field research employed a purposive and direct observation approach to inventory cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing fruit, vegetable, and ornamental varieties, as well as wild plants or weeds. The collection and identification of host plants, aphids, and their natural enemies involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. Any plants colonized by aphids were documented as aphid hosts. Aphids, along with their natural enemies within the aphid colonies, were systematically collected. All components of the collected observations were then identified.

Guidelines for finding host plants were written by Blackman & Eastop 1994, 2000; Irsan 1998; Kranz *et al.* 1978). Aphid identification was conducted using identification keys made by Blackman & Eastop (1994, 2000); Heie (1992, 1994, 1995); Irsan (1998); Kranz *et al.* (1978); Martin (1983). Identification of aphid species took place in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on morphological characteristics. The host plants were identified based on identification keys made by van Steenis (1988). The location and size of aphid colonies, morphology of aphids including their shape and color, as well as any symptoms observed in the host plants were recorded, and photographs of the aphid colonies and their host plants were taken.

Results

The results showed that 15 aphid species were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipapis erysimi*. Based on the observation, these aphids were found on various ornamental plants (Table 1). The primary colony locations were generally in flowers, and this study documented these colony locations in ornamental plants (Figure 1).

Table 1: Aphid species found in ornamental plants and their colony locations

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Sitobion luteum</i>	flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	flower
3	<i>Caladium</i> sp.	<i>Pentalonia</i> sp.	flower
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	flower
5	<i>Canna indica</i>	<i>Pentalonia nigronervosa</i>	flower
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	flower
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	flower
9	<i>Cosmos caudatus</i>	<i>Uroleucon</i> sp.	flower
10	<i>Dahlia Kelvin</i>	<i>Aphis gossypii</i>	flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	flower
13	<i>Helianthus</i> sp.	<i>Aphis glycines</i> <i>Hyperomyzus</i> sp.	flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	flower
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	flower
20	<i>Spondiras dulcissoland</i>	<i>Aphis citricola</i> <i>Hysteroneura setariae</i>	flower

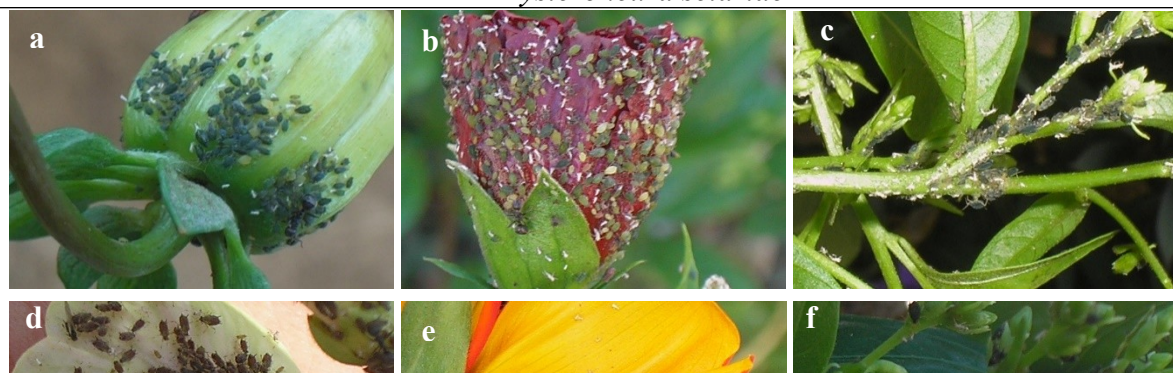


Fig 1. The location of aphid colonization on various plant parts. a) *A. gossypii* in *D. Kelvin* flower b) *A. gossypii* in *H. rosasinensis* flower c) *A. gossypii* in tuberose flower, d) *A. craccivora* in *Clitoria ternatea* flower, e) *A. citricola* in *Helianthus* sp., f) *A. aurantii* on the *M. paniculata* flower, g) *T. odinae* in the *S. dulcissoland*, h) *Uroleucon* sp. in chrysanthemums, i) *Macrosiphum rosae* in *R. indica* flower, j) *Pentalonia nigronervosa* in *C. indica* leaves

In addition, this study documented the presence of weeds, which might serve as alternative hosts for aphids (Table 2). The location of aphid colonies also varied, namely on flowers, stalks, plant tops, young leaves and old leaves of wild plants (Figure 2). The presence of specific plants or host plants within a habitat influenced the types of aphids found. Many aphid species are found on a broad range of plants or host plants, while others are highly specialized and are only found on specific plants or host plants. This is closely related to the polyphagous, oligophagous or monophagous nature of aphids (Blackman & Eastop 2000).

Table 2: Species of aphids found in wild plants and their colony locations.

No	Host Plant	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	<i>Aphis gossypii</i>	Shoots, buds
3	<i>Alternanthera sessilis</i>	<i>Aphis gossypii</i>	Shoots, buds
4	<i>Amaranthus gracilis</i>	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
6	<i>Croton hirtus</i>	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
8	<i>Cyperus rotundus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	<i>Hysteronura setariae</i>	Flower, flower stalks
11	<i>Echinochloa crusgali</i>	<i>Hiperomyzus</i> sp.	Young leaves, old leaves
12	<i>Ecliptica prostrata</i>	<i>Aphis gossypii</i>	Shoots, young leaves
13	<i>Eleusin indica</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	<i>Hysteronura setariae</i>	Flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	<i>Aphis gossypii</i>	Young leaves, old leaves
17	<i>Eupotarium odoratum</i>	<i>Aphis gossypii</i> , <i>Aphis glycine</i>	Young leaves, old leaves, young twigs
18	<i>Hymenochera acutigluma</i>	<i>Hysteronura setariae</i>	Flowers, flower stalks, leaf axils
19	<i>Lagerstromea</i> Sp.	<i>Greenidea</i> sp.	Young leaves
20	<i>Lophatherum gracile</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	<i>Aphis gossypii</i>	Shoots, young leaves

No	Host Plant	Aphid species	Colony location
22	<i>Mikania mikranta</i>	<i>Aphis gossypii</i> <i>Aphis glycine</i>	Shoots, young leaves, old leaves
23	<i>Mimosa invisa</i>	<i>Aphis craccivora</i>	Shoots, pods
24	<i>Mimosa pudica</i>	<i>Aphis craccivora</i>	Shoots, pods, flowers
25	<i>Mimosa vigma</i>	<i>Aphis craccivora</i>	Shoots, pods
26	<i>Oryza rufipogon</i>	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	Old leaves, young leaves (pupus), leaf axils
27	<i>Oxonopus compressus</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, seeds
29	<i>Phyllanthus neruri</i>	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	<i>Aphis craccivora</i>	Shoots, young leaves, flower
31	<i>Physalis angulata</i>	<i>Aphis craccivora</i> , <i>A. gossypii</i>	Shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	<i>Lipapis erysimi</i>	Flower, fruit, shoots, young leaves
33	<i>Sida rhombifolia</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arvensis</i>	<i>Lipapis erysimi</i>	Young leaves, fruit stalks, flower, fruit

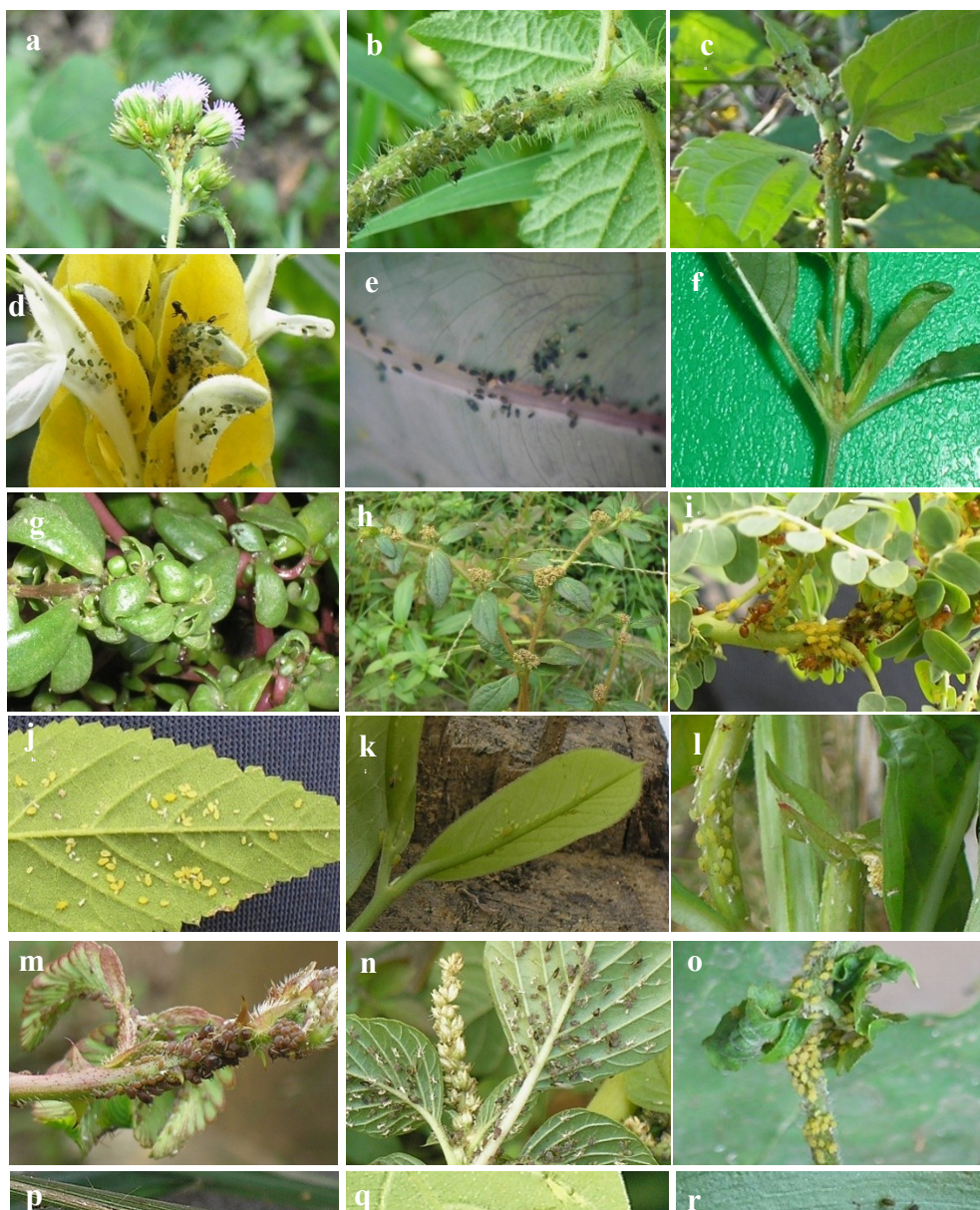


Figure 2. Aphids found on wild plants a) *A. gossypii* on the weed *Ageratum conyzoides*, b) *A. gossypii* on Croton weed *hirtus* c) *A. gossypii* on the weed *Eupatorium odoratum*, d) *A. gossypii* on plants *Pachystochys* sp., e) *A. gossypii* on plants *Caladium* sp., f) *A. gossypii* on the weed *Alternanthera sessilis*, g) *A. gossypii* in *Portulaca oleraceae* weeds, h) *A. gossypii* on the weed *Euphorbia hirta*, i) *A. citricola* on the weed *Phylantus nerruri*, j) *A. citricola* on *Sida rhombifolia* weed, k) *A. citricola* on plants *Annona muricata*, l) *A. citricola* on the weed *Ludwigia peruviana*, m) *A. craccivora* on *Mimosa pudica* weed, n) *A. craccivora* on weeds *Amaranthus gracilis*, o) *A. glycine* in *Mikania micranta* weed, p) *Hysteneura* sp. in *Eleusin* weeds, q) *Greenidae* sp. in kenidai trees (shrubs) *indica*, r) *Hyperomyzus* sp. in *Echinocloa crusgali* Weed, s) *L. erysimi* on weed *sonchus arventris*, t) *Rhopalosiphum rice* on the weed *Oryza rufipogon*, u) *Rhopalosiphum Maidis* on the weed *Oryza rufipogon*.

Discussion

The plant species or host plant influences the distribution of aphids. There are aphid species that can be found on a wide range of host plants, which is closely related to the polyphagous nature of aphids, allowing them to colonize many different species of host plants. Host plants can also affect the distribution of aphids, as evidenced by the presence of aphid species exclusively found on certain host plants (Peccoud et al., 2010). But there are some species of aphids found only on one particular host and are not found on other host plants (Döring, 2014). *A. gossypii*, and *Aphis aurantii* have been found on many host plants because both aphids are classified as polyphagous aphids (Margaritopoulos et al., 2006; Piron et al., 2019).

Aphids can commonly be found infesting a variety of ornamental plants. They are attracted to these plants due to the rich nutrient content in the plant sap (Wäckers & Van Rijn, 2012). In this present study, some aphid species were found on some ornamental plants in Pagaralam. The location of aphid colonization on the plants varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and on newly emerging leaves. The aphids displayed brown and black coloration. The aphid colonies found were small, and the colonized plant parts showed no signs of disease. The identification results showed that the

aphids were *Neotoxoptera* sp., and notably, they were not associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The identification results showed that the aphids were *Uroleucon* sp., and they were associated with ants.

On the *Brugmansia suaveolens* (angel's trumpet), *M. persicae* were found on the undersides of old leaves or leaves that have started to turn yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. (taro) was found one species of aphids: *A. gossypii*. The aphids formed colonies under the surface of young and older leaves. The occupied leaf areas did not display severe symptoms. The aphids were yellow green to dark green. The wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black in color. The colonies of *T. aurantii* were found to be associated with black ants.

Aphids on *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body. The identification results showed that the aphids were *P. nigronervosa*. The colonies of *P. nigronervosa* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were found. The aphids were yellow-green, *sifunculi*, and black cauda. The aphids formed colonies on flowers and shoots, and the colonized plant parts did not show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the undersides of young leaves, shoots, and within flower parts, especially between petals or flower stalks that had not fully bloomed. The colonies were quite large. The body color of aphids was green to dark green with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated with ants.

Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems and young leaves. The aphids were brown to black in color. Colonized plant parts, especially shoots and young leaves, showed stunting symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently

associated with ants. On the plant *Cosmos caudatus*, aphids were found on the flower petals. The colonies were not very large. The body color was green and light green. The identification results showed that the aphids were *A. gossypii*, and they were also associated with ants. The aphids on the *Dahlia kelvin plant* formed colonies on unopened flower buds, with a significant population among the blooming petals. The body color was green to dark green. The identification results showed that the aphids were *A. gossypii*. Aphids on *Datura metel* (amethyst) were found to form colonies on the undersides of old leaves. The aphids were medium-sized with a green body color. The colonized plant parts did not show any symptoms of disease. The identification results showed that the aphids were *Myzus ornatus*. The aphid colonies were not associated with ants. Within *Dendrobium* sp., aphid colonies were found on the young leaves. The aphids were yellow, green to dark green. The colonized plants did not show any disease symptoms. The identification results showed that the aphids were *A. gossypii*, and they were associated with ants. On *Duranta* sp. (bonsai), colonies of aphids were located on the undersides of young leaves. The colonized plant parts showed stunting symptoms. The colonies were very large. The aphids were green in color. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants.

On the *Helianthus annuus* (sunflower) plants, aphid colonies were found between the flower petals. The colonized flowers, especially the crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid colonies were not associated with ants. Within the colonies, mummified aphids that were parasitized by Aphidiidae were found.

On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Two types of aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and

slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, similar to sugar. The aphids had yellow, green or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The identification results showed that the aphids were

A. gossypii, and they were almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants.

In *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied the shoots, young leaves and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from yellow and green to a slightly darker green. Sometimes the upper surface of the wingless imago's body appeared white, resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost always associated with ants. Another species of aphids were founded and formed colonies on flower stalks that had not yet bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms of plant disease. The aphids were yellow or yellow-green, with black cauda and siphunculi. Their bodies were very small to small in size. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also frequently found in association with ants.

Two types of aphids were found on *Mussaenda frondosa*, each forming colonies in different locations. The first type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease symptoms. The aphids were yellow, green, and some with dark green. The identification results showed that the aphids were *A. gossypii*. The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could also be found on young leaves, shoots and within flower parts. The plant parts they infested showed no signs of diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had tiny to small bodies. The identification results showed that the aphids were *A. citricola*.

The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This indicated that multiple species of aphids colonized various

host plants. The aphid species colonizing these plants were generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green, yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots, flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves. They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi* aphids. These aphids were bright green, and of medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow-green to dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to red-brown. They were associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies were found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants. The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis rotundiventris* aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or buds. Small colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crussgali* or water hyacinth plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black, and formed large colonies on the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids were bright green to blackish green. The aphid colonies were also consistently associated with ants.

Eleusin indica was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H. setariae* formed colonies in flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body color ranged from red-brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis* formed colonies in the leaf axils and undersides of leaves and on leaf shoots that had not yet opened. The colonies were not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants. The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids were yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves.

Eragrostis tenella was infested by *Hysteroneura setariae* aphids. The aphids were brown to red-brown. Small colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by *Aphis gossypii*. The aphids formed colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupotarium odoratum* was colonized by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young twigs. Young leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this plant showed yellow-green to dark green in body colour. The colonies of *A. citricola* formed on the young twigs near the shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.

Hymenochera acutigluma or hair axis was colonized by *Hysteroneura setariae*, which formed colonies on the flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of aphids: *hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves, leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids

were brown to red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis* aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two species of aphids on *L. gracile* to mix.

Melastoma affine was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly emerging shoots and on newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The colonized plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony.

Mimosa invisa (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisa* plants formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots, and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were shiny black. The colonized plant parts did not show any disease symptoms.

Oryza rufipogon was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species could be distinguished by their body color. *R. maidis* appeared green with black siphunculi and cauda, while *R. rice* appeared white. The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants. *Oxonopus compressus* or *pait* grass was colonized by *Hysteroneura setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed, and they were also consistently associated with ants.

Paspalum conjugatum was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds and flower stalks. Aphids had brown to dark brown bodies. *Phylanthus niruri* was colonized by *Aphis citricola*. The colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted, and

wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large. *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants formed colonies on the undersides of leaves, especially young leaves, shoots and in flowers. The colonized plant parts became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that appeared glossy black.

Physalis angulata plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant parts did not show any symptoms of disease. *Rorippa indica* or mustard land was colonized by *Lipaphis erysimi*. The colonies formed on the flowers, fruits, flower stalks and the lower surface of leaves. The colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia* or cacabeen was colonized by *Aphis gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks and flower petals. The colonized plant parts, especially the shoots, showed curling. and the leaf edges curled downward. *Sonchus arvensis* plants were colonized by *L. erysimi*. The aphids had green to whitish green body colours, and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves. These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid infestations.

The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to grow, resulting in some parts developing normally while others become stunted (Pettersson et al., 2017). This condition could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or

stunted leaf growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to recognize through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids had colonized the plant (Tegelaar et al., 2012). Therefore, the presence of ants could serve as an indicator of the presence of aphid colonies.

Throughout their life cycle, aphids exhibited host alternation by switching between two distinct host plants (Peccoud et al., 2010). They overwintered on woody plants, reproduced in the spring, and migrated to herbaceous plants during the summer before returning to their primary host in the autumn (Yamamoto et al., 2020). This allowed aphids to maximize resource utilization, avoid congestion and competition, evade predators and parasites, circumvent plant defenses, and colonize new areas. Aphids could distribute their population efficiently, thereby avoiding overcrowding, predators and parasites, and plant defenses developing over time through host switching (Yamamoto et al., 2020). This behavior was essential for the survival and environmental adaptation of aphids.

Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new growth or reproductive parts of plants. Flowers contain nutrient-rich nature (Jakubczyk et al., 2022) and easy access to sap, therefore aphids were attractive to sap the flowers. Some aphid species were drawn to certain colors (Chittka, 2007), while others preferred different types of plants and plant parts (Sorensen, 2009). It's worth noting that different aphid species often had distinct preferences for plant ty(Harrington et al., 2007)pes and parts.

Herbs served as an alternative host for aphids in this present study. Aphids consumed sugar-rich liquid in plants, known as "sap". Aphids considered herbs and other green vegetation as abundant food sources. Aphids utilized needle-like mouthparts to penetrate plant tissues and access this fluid (Brožek et al., 2015). Numerous herbs had structural characteristics, such as folds, crevices, and concealed flowering portions (Harrington et al., 2007), that provided aphids with refuge .

Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson & Mooney, 2022). The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Detrain et al., 2010). Ants were drawn to this nutrient-rich food source and would often

'farm' aphids for it. In exchange for honeydew, ants provided aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and parasitic wasps (Karami-jamour et al., 2018). Certain species of ants would transport aphids to new host plants for improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al., 2021). Honeydew not only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain species) and provided energy for the growth of their own progeny (Biedermann & Vega, 2020).

References

- Biedermann, P. H. W., & Vega, F. E. (2020). Ecology and evolution of insect–fungus mutualisms. *Annual Review of Entomology*, *65*, 431–455.
- Blackman, R. L., & Eastop, V. F. (2000). *Aphids on the world's crops: an identification and information guide*. (Issue Ed. 2). John Wiley & Sons Ltd.
- Blackman, R. L., & Eastop, V. F. (2017). Taxonomic issues. In *Aphids as crop pests* (pp. 1–36). CABI Wallingford UK.
- Boivin, G., Hance, T., & Brodeur, J. (2012). Aphid parasitoids in biological control. *Canadian Journal of Plant Science*, *92*(1), 1–12.
- Brożek, J., Mróz, E., Wyleżek, D., Depa, Ł., & Węgierek, P. (2015). The structure of extremely long mouthparts in the aphid genus *Stomaphis* Walker (Hemiptera: Sternorrhyncha: Aphididae). *Zoomorphology*, *134*, 431–445.
- Capinera, J. L. (2005). Relationships between insect pests and weeds: an evolutionary perspective. *Weed Science*, *53*(6), 892–901.
- Chandel, R. S., Chandla, V. K., Verma, K. S., & Pathania, M. (2022). *Chapter 21 - Insect pests of potato in India: biology and management* (A. Alyokhin, S. I. Rondon, & Y. B. T.-I. P. of P. (Second E. Gao (eds.); pp. 371–400). Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-821237-0.11001-7>
- Chittka, Æ. L. (2007). *Visual ecology of aphids—a critical review on the role of colours in host finding* *Visual ecology of aphids — a critical review on the role of colours in host finding*. June 2014. <https://doi.org/10.1007/s11829-006-9000-1>
- Clarke, R., Kehoe, M. A., Broughton, S., & Jones, R. A. C. (2020). Host plant affiliations of aphid vector species found in a remote tropical environment. *Virus Research*, *281*(December 2019), 197934. <https://doi.org/10.1016/j.virusres.2020.197934>
- Degani, E., Leigh, S. G., Barber, H. M., Jones, H. E., Lukac, M., Sutton, P., & Potts, S. G. (2019). Crop rotations in a climate change scenario: short-term effects of crop diversity on resilience and ecosystem service provision under drought. *Agriculture, Ecosystems & Environment*, *285*, 106625.
- Detrain, C., Verheggen, F. J., Diez, L., Wathelet, B., & Haubruge, E. (2010). Aphid–ant mutualism: how honeydew sugars influence the behaviour of ant scouts. *Physiological Entomology*, *35*(2), 168–174.
- Döring, T. F. (2014). How aphids find their host plants, and how they don't. *Annals of Applied Biology*, *165*(1), 3–26. <https://doi.org/https://doi.org/10.1111/aab.12142>
- Gadhawe, K. R., Gautam, S., Rasmussen, D. A., & Srinivasan, R. (2020). Aphid transmission of Potyvirus: the largest plant-infecting RNA virus genus. *Viruses*, *12*(7), 773.
- Giannetti, D., Mandrioli, M., Schifani, E., Castracani, C., Spotti, F. A., Mori, A., & Grasso, D. A. (2021). First report on the acrobat ant *Crematogaster scutellaris* storing live aphids in its oak-gall nests. *Insects*, *12*(2), 108.

- Guo, H., Gu, L., Liu, F., Chen, F., Ge, F., & Sun, Y. (2019). Aphid-borne Viral Spread Is Enhanced by Virus-induced Accumulation of Plant Reactive Oxygen Species 1. *Plant Physiol*, 179(January), 143–155. <https://doi.org/10.1104/pp.18.00437>
- Harrington, R., Clark, S. J., Welham, S. J., Verrier, P. J., Denholm, C. H., Hulle, M., Maurice, D., Rounsevell, M. D., Cocu, N., & Consortium, E. U. E. (2007). Environmental change and the phenology of European aphids. *Global Change Biology*, 13(8), 1550–1564.
- Hullé, M., Chaubet, B., Turpeau, E., & Simon, J.-C. (2020). Encyclop'Aphid: A website on aphids and their natural enemies. *Entomologia Generalis*, 40(1).
- Ikbal, C., & Pavela, R. (2019). Essential oils as active ingredients of botanical insecticides against aphids. *Journal of Pest Science*, 92, 971–986.
- Jakubczyk, K., Koprowska, K., Gottschling, A., & Janda-Milczarek, K. (2022). Edible Flowers as a Source of Dietary Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement. *Nutrients*, 14(12). <https://doi.org/10.3390/nu14122470>
- Jaouannet, M., Rodriguez, P. A., Thorpe, P., Lenoir, C. J. G., & Macleod, R. (2014). Plant immunity in plant – aphid interactions. *Front Plant Sci.*, 5(December), 1–10. <https://doi.org/10.3389/fpls.2014.00663>
- Jones, R. A. C. (2022). Alteration of plant species mixtures by virus infection: Managed pastures the forgotten dimension. *Plant Pathology*, 71(6), 1255–1281.
- Jousselin, E., Gwenaëlle, G., & Armelle, C. D. A. (2010). Evolutionary lability of a complex life cycle in the aphid genus *Brachycaudus*. *BMC Evolutionary Biology*, 10(1). <https://doi.org/10.1186/1471-2148-10-295>
- Karami-jamour, T., Mirmoayedi, A., Zamani, A., & Khajehzadeh, Y. (2018). The impact of ant attendance on protecting *Aphis gossypii* against two aphidophagous predators and its role on the intraguild predation between them. *Journal of Insect Behavior*, 31, 222–239.
- Kennedy, J. S., & Stroyan, H. L. G. (1959). Biology of aphids. *Annual Review of Entomology*, 4(1), 139–160.
- Kinley, C., Banu, A. N., Raut, A. M., Wahengbam, J., & Jamtsho, T. (2021). A review on past, present and future approaches for Aphids management. *Journal of Entomological Research*, 45(2), 336–346. <https://doi.org/10.5958/0974-4576.2021.00053.0>
- Kumar, Sarwan. (2019). Aphid-Plant Interactions: Implications for Pest Management. In M. T. Oliveira, F. Candan, & A. Fernandes-Silva (Eds.), *Plant Communities and Their Environment* (p. Ch. 7). IntechOpen. <https://doi.org/10.5772/intechopen.84302>
- Kumar, Sushil, Bhowmick, M. K., & Ray, P. (2021). Weeds as alternate and alternative hosts of crop pests. *Indian Journal of Weed Science*, 53(1), 14–29. <https://doi.org/10.5958/0974-8164.2021.00002.2>
- Liu, X. D., Xu, T. T., & Lei, H. X. (2017). Refuges and host shift pathways of host-specialized aphids *Aphis gossypii*. *Scientific Reports*, 7(1), 1–9. <https://doi.org/10.1038/s41598-017-02248-4>
- Maharani, Y., Hidayat, P., Rauf, A., & Maryana, N. (2018). Short communication: New records of aphid species subfamily aphidinae (Hemiptera: Aphididae) in West Java, Indonesia. *Biodiversitas*, 19(2), 460–465. <https://doi.org/10.13057/biodiv/d190219>
- Margaritopoulos, J. T., Tzortzi, M., Zarpas, K. D., Tsitsipis, J. A., & Blackman, R. L. (2006). Morphological discrimination of *Aphis gossypii* (Hemiptera: Aphididae) populations feeding on Compositae. *Bulletin of Entomological Research*, 96(2), 153–165. <https://doi.org/10.1079/ber2005410>
- Moran, N. A. (1992). The Evolution of Aphid Life Cycles. *Annual Review of Entomology*, 37(1), 321–348. <https://doi.org/10.1146/annurev.en.37.010192.001541>
- Müller, C. B., Williams, I. S., & Hardie, J. (2001). The role of nutrition, crowding and

- interspecific interactions in the development of winged aphids. *Ecological Entomology*, 26(3), 330–340.
- Nelson, A. S., & Mooney, K. A. (2022). The evolution and ecology of interactions between ants and honeydew-producing hemipteran insects. *Annual Review of Ecology, Evolution, and Systematics*, 53, 379–402.
- Peccoud, J., Simon, J.-C., von Dohlen, C., Coeur d'acier, A., Plantegenest, M., Vanlerberghe-Masutti, F., & Jousselin, E. (2010). Evolutionary history of aphid-plant associations and their role in aphid diversification. *Comptes Rendus Biologies*, 333(6), 474–487. <https://doi.org/https://doi.org/10.1016/j.crv.2010.03.004>
- Pettersson, J., Tjallingii, W. F., & Hardie, J. (2017). Host-plant selection and feeding. In *Aphids as crop pests* (pp. 173–195). CABI Wallingford UK.
- Piron, P., de Haas, M., & Sonnemans, M. (2019). The presence of *Aphis* (Toxoptera) *aurantii* (Homoptera: Aphididae) in the Netherlands. *Entomologische Berichten*, 79(5), 162–164.
- Sileshi, G., Schroth, G., Rao, M. R., & Girma, H. (2008). Weeds, diseases, insect pests and tri-trophic interactions in tropical agroforestry. *Ecological Basis of Agroforestry*, 73–94.
- Singh, R., & Singh, G. (2021). Aphids. *Polyphagous Pests of Crops*, 105–182.
- Sorensen, J. T. (2009). *Chapter 8 - Aphids* (V. H. Resh & R. T. B. T.-E. of I. (Second E. Cardé (eds.); pp. 27–31). Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-374144-8.00008-4>
- Tegelaar, K., Hagman, M., Glinwood, R., Pettersson, J., & Leimar, O. (2012). Ant-aphid mutualism: the influence of ants on the aphid summer cycle. *Oikos*, 121(1), 61–66. <https://doi.org/https://doi.org/10.1111/j.1600-0706.2011.19387.x>
- Völkl, W., Mackauer, M., Pell, J. K., & Brodeur, J. (2023). Predators, parasitoids and pathogens. In *CABI Books*. CABI Books. <https://doi.org/10.1079/9780851998190.0187>
- Wäckers, F. ., & Van Rijn, P. . (2012). Pick and mix: selecting flowering plants to meet the requirements of target biological control insects. *Biodiversity and Insect Pests: Key Issues for Sustainable Management*, 9(April), 139–165. <https://doi.org/10.1002/9781118231838.ch9>
- Yamamoto, T., Hattori, M., & Itino, T. (2020). *Seasonal Migration in the Aphid Genus Stomaphis (Hemiptera : Aphididae) : Discovery of Host Alternation Between Woody Plants in Subfamily Lachninae*. 20. <https://doi.org/10.1093/jisesa/ieaa103>

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40
41 **Author(s) name:**

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68 **Species of Aphids Found in Ornamental and Wild Plants in Highland,**
69 **Pagar Alam, South Sumatra**

70
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80 **Abstract**

81 Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be
82 very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported
83 about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid
84 species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of
85 aphids found in ornamental plants and the wild plants. This study revealed that 15 species of aphids were found in
86 Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis*
87 *craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp.,
88 *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis erysimi*.

89 **Keywords:** aphids, ornamental plants, wild plants

90 **Running title:** Aphids Found in Ornamental and Wild Plants

91
92 **INTRODUCTION**

93 Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous,
94 and monophagous characteristics (Kennedy & Stroyan, 1959). One species of aphids can host more than 400 species from
95 40 families (Bass et al., 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhawe et al.,
96 2020). Aphids can transmit 275 viruses (Ertunc, 2020). In tropical areas, aphids can always be found throughout the year
97 due to their parthenogenetic nature of reproduction (Blackman & Eastop, 2017). Aphids consume young leaves sap, which
98 can deplete essential nutrients for healthy growth (Cao et al., 2018). Moreover, when aphids transmit viral diseases from
99 one plant to another, this can further weaken and stunt the growth of infected plants (Jones, 2022). According to Kinley et
100 al. (2021), aphids cause yield losses directly (35 - 40%) by sucking the plant sap or indirectly (20 - 80%) through viral
101 transmission. Therefore, aphid infestations can have adverse effects on crop yields and overall plant health (Sarwan
102 Kumar, 2019).

103 Due to their function as vectors, the presence of aphids on a plant can be highly damaging (Jaouannet et al.,
104 2014). They feed by piercing the plant's tissues and consuming its sap, which can reduce the plant's growth and
105 productivity, ultimately leading to weakness and possible death (Chandel et al., 2022). Additionally, as vectors, aphids can
106 transmit a variety of plant diseases. They are as carriers for various plant viruses, and when they move from infected to
107 healthy plants, these viruses can rapidly spread and cause extensive damage (Guo et al., 2019). In addition, the honeydew
108 that aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's
109 leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh & Singh, 2021). Therefore, it is
110 crucial to control aphid populations in gardens and crops.

111 Understanding the species diversity of aphids is fundamental to effective aphid control, as it facilitates the
112 development of measures to keep their populations in check. In addition, understanding the diversity of aphid species can

113 provide valuable insights into potential plant diseases, as different aphid species carry distinct viruses. Methods used to
114 control aphids often encompass various techniques, including the use of natural enemies such as predators (like ladybugs,
115 lacewings, and parasitic wasps) (Singh & Singh, 2021; Völkl et al., 2023), parasitoids (Boivin et al., 2012),
116 entomopathogens (Hullé et al., 2020), the use of essential oils as botanical pesticides to control aphids (Ikbāl & Pavela,
117 2019), and crop rotation techniques (Degani et al., 2019). Regular monitoring of aphid populations and diversity can help
118 in detecting when population sizes may be reaching harmful levels, allowing for prompt implementation of the necessary
119 countermeasures.

120 Many aphid species were found on plants that were not their actual hosts (Peccoud et al., 2010). Aphids have one
121 or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they
122 feed on most frequently (Clarke et al., 2020). An alternative host can also be a collateral host belonging to the same plant
123 family as the primary host, helping crop pests to survive when the primary hosts are unavailable (Kumar et al., 2021).
124 These secondary hosts may offer less adequate nutrition for insects (Mo & Smilanich, 2023), However, they may provide a
125 means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions
126 (Kumar et al., 2021). According to Liu et al. (2017), since hibiscus serves as an overwintering host for cotton-specialized
127 aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during times of food
128 shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin et al., 2010). They maintain a cycle
129 of host alternation, shifting between their primary hosts (typically a woody plant) and secondary hosts (often herbaceous
130 plants) (Yamamoto et al., 2020). Weeds pose a continuous threat in both cropped and non-crop areas, providing food,
131 shelter and reproductive sites for various pest organisms (Kumar et al., 2021). This indicates that weeds can serve as
132 alternative hosts for aphids.

133 A study of aphid species on horticultural plants has been conducted (Maharani et al., 2018), However,
134 information about aphid species on ornamental and wild plants has not received as much attention and remains largely
135 unexplored. In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and
136 native plants. The research on the diversity of aphid species in ornamental and wild plants has received little attention.
137 Therefore, this study was conducted in Pagar Alam, a highland region of South Sumatra, with the aim of obtaining
138 information on the diversity of aphid species found in ornamental and wild plants. The findings from this study can serve
139 as a valuable resource for aphid management.

140 MATERIALS AND METHODS

141 The field research employed a purposive and direct observation approach to inventory cultivated or wild plants
142 hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing fruit, vegetable,
143 and ornamental varieties, as well as wild plants or weeds. The collection and identification of host plants, aphids, and their
144 natural enemies involved systematic searches for the selected plants and subsequent examination for the presence of
145 aphids. Observations were made to all existing plant species to find those colonized by aphids. Any plants colonized by
146 aphids were documented as aphid hosts. Aphids, along with their natural enemies within the aphid colonies, were
147 systematically collected. All components of the collected observations were then identified.

148 Aphid identification was conducted using identification keys (Blackman & Eastop, 2008). Identification of aphid
149 species took place in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on
150 morphological characteristics. The host plants were identified using weed identification hand book (Kallas, 2010;
151 Meuninck, 2023; Naidu, 2012). The location and size of aphid colonies, morphology of aphids including their shape and

152 color, as well as any symptoms observed in the host plants were recorded, and photographs of the aphid colonies and their
 153 host plants were taken.

154 RESULT AND DISCUSSION

155 Result

156 The results showed that 15 aphid species were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
 157 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*,
 158 *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipapis*
 159 *erysimi*. Based on the observation, these aphids were found on various ornamental plants (Table 1). The primary colony
 160 locations were generally in flowers, and this study documented these colony locations in ornamental plants (Figure 1).

161

162 Table 1: Aphid species found in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Sitobion luteum</i>	flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	flower
3	<i>Caladium</i> sp.	<i>Pentalonia</i> sp.	flower
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	flower
5	<i>Canna indica</i>	<i>Pentalonia nigronervosa</i>	flower
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	flower
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	flower
9	<i>Cosmos caudatus</i>	<i>Uroleucon</i> sp.	flower
10	<i>Dahlia Kelvin</i>	<i>Aphis gossypii</i>	flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	flower
13	<i>Helianthus</i> sp.	<i>Aphis glycines</i> <i>Hyperomyzus</i> sp.	flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	flower
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	flower
20	<i>Spondiras dulcissoland</i>	<i>Aphis citricola</i> <i>Hysteroneura setariae</i>	flower



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Fig 1. The location of aphid colonization on various plant parts. a) *A. gossypii* in *D. Kelvin* flower b) *A. gossypii* in *H. rosinensis* flower c) *A. gossypii* in tuberose flower, d) *A. craccivora* in *Clitoria ternatea* flower, e) *A. citricola* in *Helianthus* sp., f) *A. aurantii* on the *M. paniculata* flower, g) *T. odinae* in the *S. dulcissoland*, h) *Uroleucon* sp. in chrysanthemums, i) *Macrosiphum rosae* in *R. indica* flower, j) *Pentalonia nigronervosa* in *C. indica* leaves

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In addition, this study documented the presence of weeds, which might serve as alternative hosts for aphids (Table 2). The location of aphid colonies also varied, namely on flowers, stalks, plant tops, young leaves and old leaves of wild plants (Figure 2). The presence of specific plants or host plants within a habitat influenced the types of aphids found. Many aphid species are found on a broad range of plants or host plants, while others are highly specialized and are only found on specific plants or host plants. This is closely related to the polyphagous, oligophagous or monophagous nature of aphids (Blackman & Eastop 2000).

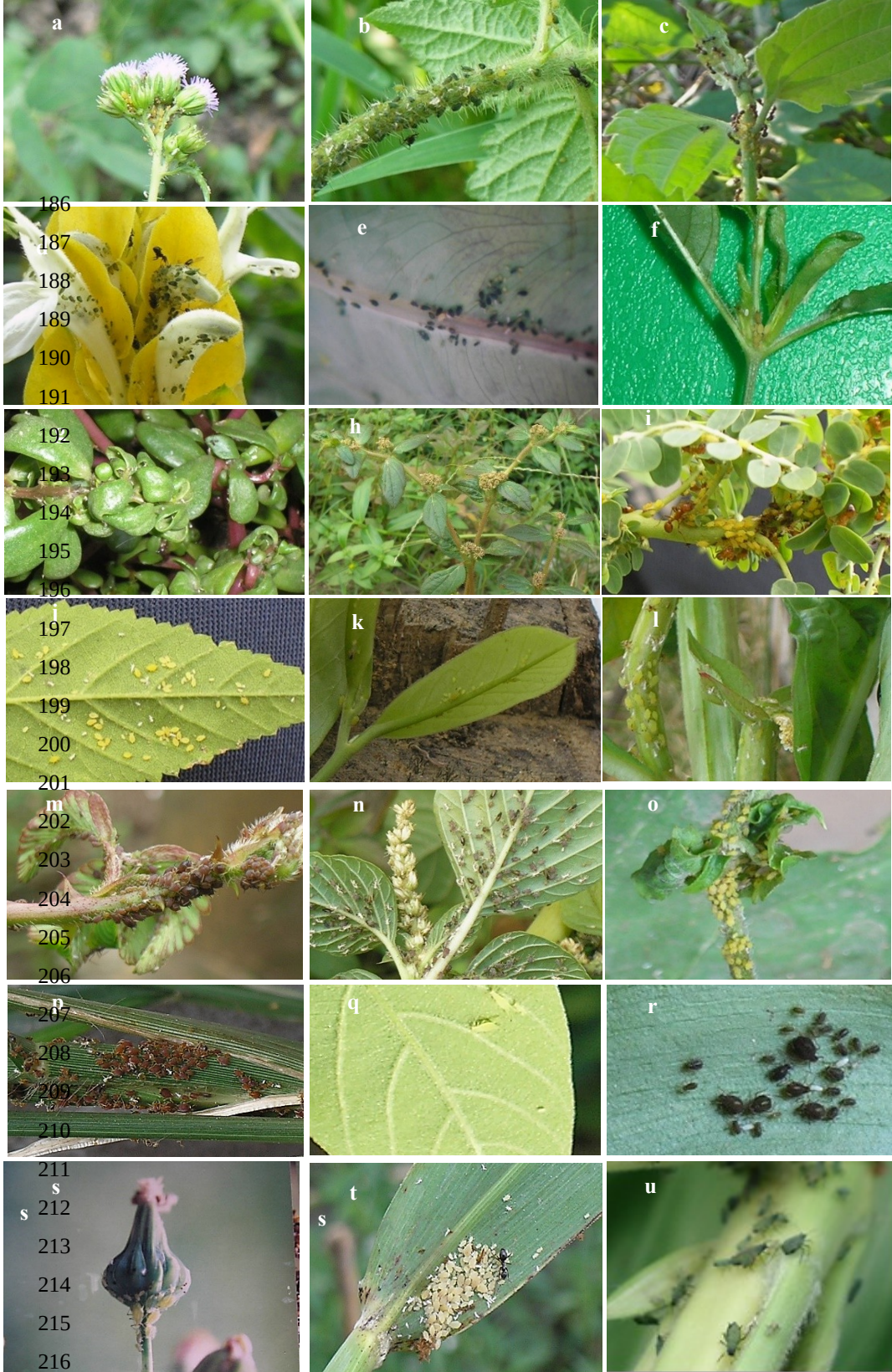
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185 Table 2: Species of aphids found in wild plants and their colony locations.

No	Host Plant	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	<i>Aphis gossypii</i>	Shoots, buds
3	<i>Alternanthera sessilis</i>	<i>Aphis gossypii</i>	Shoots, buds
4	<i>Amaranthus gracilis</i>	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
6	<i>Croton hirtus</i>	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
8	<i>Cyperus rotundus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	<i>Hysteronura setariae</i>	Flower, flower stalks
11	<i>Echinochloa crusgali</i>	<i>Hiperomyzus</i> sp.	Young leaves, old leaves
12	<i>Ecliptica prostrata</i>	<i>Aphis gossypii</i>	Shoots, young leaves
13	<i>Eleusin indica</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	<i>Hysteronura setariae</i>	Flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	<i>Aphis gossypii</i>	Young leaves, old leaves
17	<i>Eupotarium odoratum</i>	<i>Aphis gossypii</i> , <i>Aphis glycine</i>	Young leaves, old leaves, young twigs
18	<i>Hymenochera acutigluma</i>	<i>Hysteronura setariae</i>	Flowers, flower stalks, leaf axils
19	<i>Lagerstromea</i> Sp.	<i>Greenidea</i> sp.	Young leaves
20	<i>Lophatherum gracile</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	<i>Aphis gossypii</i>	Shoots, young leaves
22	<i>Mikania mikranta</i>	<i>Aphis gossypii</i> <i>Aphis glycine</i>	Shoots, young leaves, old leaves
23	<i>Mimosa invisa</i>	<i>Aphis craccivora</i>	Shoots, pods
24	<i>Mimosa pudica</i>	<i>Aphis craccivora</i>	Shoots, pods, flowers
25	<i>Mimosa vigra</i>	<i>Aphis craccivora</i>	Shoots, pods
26	<i>Oryza rufipogon</i>	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	Old leaves, young leaves (pupus), leaf axils
27	<i>Oxonopus compressus</i>	<i>Hysteronura setariae</i>	Flower, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	<i>Hysteronura setariae</i>	Flower, flower stalk, seeds
29	<i>Phyllanthus neruri</i>	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	<i>Aphis craccivora</i>	Shoots, young leaves, flower
31	<i>Physalis angulata</i>	<i>Aphis craccivora</i> , <i>A. gossypii</i>	Shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	<i>Lipapis erysimi</i>	Flower, fruit, shoots, young leaves
33	<i>Sida rhombifolia</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arventris</i>	<i>Lipapis erysimi</i>	Young leaves, fruit stalks, flower, fruit



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224 Figure 2. Aphids found on wild plants a) *A. gossypii* on the weed *Ageratum conyzoides*, b) *A. gossypii* on Croton weed *hirtus* c) *A.*
 225 *gossypii* on the weed *Eupatorium odoratum*, d) *A.gossypii* on plants *Pachystochys* sp., e) *A.gossypii* on plants *Caladium* sp., f) *A.*
 226 *gossypii* on the weed *Alternanthera sessilis*, g) *A.gossypii* in *Portulaca oleraceae* weeds, h) *A.gossypii* on the weed *Euphorbia hirta*, i)
 227 *A. citricola* on the weed *Phyllanthus nerruri*, j) *A. citricola* on *Sida rhombifolia* weed, k) *A. citricola* on plants *Annona muricata*, l)

228 *A. citricola* on the weed *Ludwigia peruviana*, m) *A. craccivora* on *Mimosa pudica* weed, n) *A. craccivora* on weeds *Amaranthus gracilis*,
229 o) *A. glycine* in *Mikania micranta* weed, p) *Hysteneura* sp. in *Eleusin* weeds, q) *Greenidae* sp. in kenidai trees (shrubs) *indica*,
230 r) *Hyperomyzus* sp. in *Echinochloa crusgali* Weed, s) *L. erysimi* on weed *sonchus arventris*, t) *Rhopalosiphum* rice on the weed *Oryza*
231 *rufipogon*, u) *Rhopalosiphum Maidis* on the weed *Oryza rufipogon*.

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233 Discussion

234 The plant species or host plant influences the distribution of aphids. There are aphid species that can be found on
235 a wide range of host plants, which is closely related to the polyphagous nature of aphids, allowing them to colonize many
236 different species of host plants. Host plants can also affect the distribution of aphids, as evidenced by the presence of aphid
237 species exclusively found on certain host plants (Peccoud et al., 2010). But there are some species of aphids found only on
238 one particular host and are not found on other host plants (Döring, 2014). *A. gossypii*, and *Aphis aurantii* have been found
239 on many host plants because both aphids are classified as polyphagous aphids (Margaritopoulos et al., 2006; Alotaibi et
240 al., 2023).

241 Aphids can commonly be found infesting a variety of ornamental plants. They are attracted to these plants due to
242 the rich nutrient content in the plant sap (Wäckers & Van Rijn, 2012). In this present study, some aphid species were
243 found on some ornamental plants in Pagaralam. The location of aphid colonization on the plants varied. On *Adiantum*
244 *predatum* plants, aphids formed colonies on young leaf stalks and on newly emerging leaves. The aphids displayed brown
245 and black coloration. The aphid colonies found were small, and the colonized plant parts showed no signs of disease. The
246 identification results showed that the aphids were *Neotoxoptera* sp., and notably, they were not associated with ants. On
247 *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively
248 large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The
249 identification results showed that the aphids were *Uroleucon* sp., and they were associated with ants.

250 On the *Brugmansia suaveolens* (angel's trumpet), *M. persicae* were found on the undersides of old leaves or
251 leaves that have started to turn yellow. The colonies were relatively small. The aphids found were green and large bodies.
252 The colonized plant parts did not show any signs of disease. On *Caladium* sp. (taro) was found one species of aphids: *A.*
253 *gossypii*. The aphids formed colonies under the surface of young and older leaves. The occupied leaf areas did not display
254 severe symptoms. The aphids were yellow green to dark green. The wingless adult aphids often had a white, flour-like
255 appearance on their bodies. On the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides
256 of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large.
257 Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black in color. The colonies
258 of *T. aurantii* were found to be associated with black ants.

259 Aphids on *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the
260 leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a
261 medium-sized body. The identification results showed that the aphids were *P. nigronervosa*. The colonies of *P.*
262 *nigronervosa* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were
263 found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and
264 the colonized plant parts did not show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed
265 colonies on the undersides of young leaves, shoots, and within flower parts, especially between petals or flower stalks that
266 had not fully bloomed. The colonies were quite large. The body color of aphids was green to dark green with small to
267 medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results
268 showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated with ants.

269 Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems and young leaves.
270 The aphids were brown to black in color. Colonized plant parts, especially shoots and young leaves, showed stunting
271 symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently
272 associated with ants. On the plant *Cosmos caudatus*, aphids were found on the flower petals. The colonies were not very
273 large. The body color was green and light green. The identification results showed that the aphids were *A. gossypii*, and
274 they were also associated with ants. The aphids on the *Dahlia kelvin plant* formed colonies on unopened flower buds, with
275 a significant population among the blooming petals. The body color was green to dark green. The identification results
276 showed that the aphids were *A. gossypii*. Aphids on *Datura metel* (amethyst) were found to form colonies on the
277 undersides of old leaves. The aphids were medium sized with a green body color. The colonized plant parts did not show
278 any symptoms of disease. The identification results showed that the aphids were *Myzus ornatus*. The aphid colonies were
279 not associated with ants. Within *Dendrobium* sp., aphid colonies were found on the young leaves. The aphids were yellow,
280 green to dark green. The colonized plants did not show any disease symptoms. The identification results showed that the
281 aphids were *A. gossypii*, and they were associated with ants. On *Duranta* sp. (bonsai), colonies of aphids were located on
282 the undersides of young leaves. The colonized plant parts showed stunting symptoms. The colonies were very large. The
283 aphids were green in color. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were
284 consistently associated with ants.

285 On the *Helianthus annuus* (sunflower) plants, aphid colonies were found between the flower petals. The
286 colonized flowers, especially the crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in
287 color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies
288 were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies
289 were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease
290 symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid colonies were not associated with
291 ants. Within the colonies, mummified aphids that were parasitized by Aphidiidae were found.

292 On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark green were found. The aphids formed
293 colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large.
294 The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with
295 ants. Two types of aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the
296 undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The
297 occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and
298 slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, similar to sugar. The aphids had
299 yellow, green, or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The
300 identification results showed that the aphids were *A. gossypii*, and they were almost always associated with ants. The
301 second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could
302 also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs
303 of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The
304 identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants.

305 In *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied the shoots, young leaves
306 and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from
307 yellow and green to a slightly darker green. Sometimes the upper surface of the wingless imago's body appeared white,
308 resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost

309 always associated with ants. Another species of aphids was founded and formed colonies on flower stalks that had not yet
310 bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms
311 of plant disease. The aphids were yellow or yellow green, with black cauda and siphunculi. Their bodies were very small
312 to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also
313 frequently found in association with ants.

314 Two types of aphids were found on *Mussaenda frondosa*, each forming colonies in different locations. The first
315 type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease
316 symptoms. The aphids were yellow, green, and some with dark green. The identification results showed that the aphids
317 were *A. gossypii*. The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as
318 if piled up. The aphid colonies could also be found on young leaves, shoots and within flower parts. The plant parts they
319 infested showed no signs of diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had
320 tiny to small bodies. The identification results showed that the aphids were *A. citricola*.

321 The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids.
322 This indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
323 generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
324 colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
325 yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized
326 by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging
327 from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots,
328 flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus*
329 *gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves.
330 They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with
331 both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi* aphids. These aphids were bright green, and of
332 medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies
333 were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow-green to
334 dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon*
335 *dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks
336 and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to red-brown. They were
337 associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies were
338 found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants.
339 The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis rotundiventris*
340 aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or buds. Small
341 colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on
342 the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crusgali* or water hyacinth
343 plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large colonies on
344 the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica*
345 *prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids
346 were bright green to blackish green. The aphid colonies were also consistently associated with ants.

347 *Eleusin indica* was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H.*
348 *setariae* formed colonies in flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body

349 color ranged from red brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis*
350 formed colonies in the leaf axils and undersides of leaves and on leaf shoots that had not yet opened. The colonies were
351 not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These
352 aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants.
353 The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids were
354 yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves.

355 *Eragrostis tenella* was infested by *Hysteroneura setariae* aphids. The aphids were brown to red brown. Small
356 colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae*
357 were consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by *Aphis gossypii*. The aphids formed
358 colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in
359 color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupotarium odoratum* was colonized
360 by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young
361 twigs. Young leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this
362 plant showed yellow-green to dark green in body colour. The colonies of *A. citricola* formed on the young twigs near the
363 shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of
364 both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.

365 *Hymenochera acutigluma* or hair axis was colonized by *Hysteroneura setariae*, which formed colonies on the
366 flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or
367 *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with
368 thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not
369 show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of aphids:
370 *hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves,
371 leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were brown to
372 red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis*
373 aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two species
374 of aphids on *L. gracile* to mix.

375 *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly
376 emerging shoots and on newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The
377 colonized plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis*
378 *glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and
379 curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were
380 light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a
381 single colony.

382 *Mimosa invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisa* plants
383 formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa*
384 *pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots,
385 and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the
386 colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of
387 aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were
388 shiny black. The colonized plant parts did not show any disease symptoms.

389 *Oryza rufipogon* was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both
390 aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species
391 could be distinguished by their body color. *R. maidis* appeared green with black sifunculi and cauda, while *R. rice*
392 appeared white. The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants.
393 *Oxonopus compressus* or *pait* grass was colonized by *Hysteroneura setariae* aphids. The colonies occupied flowers, flower
394 stalks, seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed,
395 and they were also consistently associated with ants.

396 *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the
397 seeds and flower stalks. Aphids had brown to dark brown bodies. *Phylanthus niruri* was colonized by *Aphis citricola*. The
398 colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted,
399 and wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large.
400 *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants
401 formed colonies on the undersides of leaves, especially young leaves, shoots and in flowers. The colonized plant parts
402 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
403 appeared glossy black.

404 *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with
405 glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant
406 parts did not show any symptoms of disease. *Rorippa indica* or mustard land was colonized by *Lipaphis erysimi*. The
407 colonies formed on the flowers, fruits, flower stalks and the lower surface of leaves. The colonized plant parts showed
408 symptoms such as curling and stunting. *Sida rhombifolia* or cacabean was colonized by *Aphis gossypii*. The aphids had
409 green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks and flower petals. The
410 colonized plant parts, especially the shoots, showed curling, and the leaf edges curled downward. *Sonchus arvensis* plants
411 were colonized by *L. erysimi*. The aphids had green to whitish green body colours, and the colonies formed on flower
412 stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

413 In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
414 displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants
415 caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves.
416 These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show
417 symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum
418 growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that
419 did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the
420 leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid
421 infestations.

422 The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a
423 cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to
424 grow, resulting in some parts developing normally while others become stunted (Pettersson et al., 2017). This condition
425 could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or stunted leaf
426 growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any
427 distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed
428 from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to recognize

429 through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids
430 had colonized the plant (Tegelaar et al., 2012). Therefore, the presence of ants could serve as an indicator of the presence
431 of aphid colonies.

432 Throughout their life cycle, aphids exhibited host alternation by switching between two distinct host plants
433 (Peccoud et al., 2010). They overwintered on woody plants, reproduced in the spring, and migrated to herbaceous plants
434 during the summer before returning to their primary host in the autumn (Yamamoto et al., 2020). This allowed aphids to
435 maximize resource utilization, avoid congestion and competition, evade predators and parasites, circumvent plant
436 defenses, and colonize new areas. Aphids could distribute their population efficiently, thereby avoiding overcrowding,
437 predators and parasites, and plant defenses developing over time through host switching (Yamamoto et al., 2020). This
438 behavior was essential for the survival and environmental adaptation of aphids.

439 Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in
440 new growth or reproductive parts of plants. Flowers contain nutrient-rich nature (Jakubczyk et al., 2022) and easy access
441 to sap, therefore aphids were attractive to sap the flowers. Some aphid species were drawn to certain colors (Chittka,
442 2007), while others preferred different types of plants and plant parts (Sorensen, 2009). It's worth noting that different
443 aphid species often had distinct preferences for plant ty(Harrington et al., 2007)pes and parts.

444 Herbs served as an alternative host for aphids in this present study. Aphids consumed sugar-rich liquid in plants,
445 known as "sap". Aphids considered herbs and other green vegetation as abundant food sources. Aphids utilized needle-like
446 mouthparts to penetrate plant tissues and access this fluid (Brožek et al., 2015). Numerous herbs had structural
447 characteristics, such as folds, crevices, and concealed flowering portions (Harrington et al., 2007), that provided aphids
448 with refuge .

449 Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a
450 delicious substance known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson &
451 Mooney, 2022). The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Detrain et al.,
452 2010). Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for honeydew,
453 ants provided aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and parasitic
454 wasps (Karami-jamour et al., 2018). Certain species of ants would transport aphids to new host plants for improved
455 foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al., 2021). Honeydew not only
456 nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
457 species) and provided energy for the growth of their own progeny (Biedermann & Vega, 2020).

458 CONCLUSION

459 15 species of aphids were found in ornamental and wild plants in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
460 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia*
461 *nigronevosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus*
462 sp. *Lipaphis erysimi*.

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467 REFERENCES

468 Alotaibi, N. J., Alsufyani, T., M, N. H., & Almalki, M. A. (2023). Rapid Identification of Aphid Species by Headspace
469 GC-MS and Discriminant Analysis. *Insects*. <https://doi.org/https://doi.org/10.3390/insects14070589>

- 470 Bass, C., Puinean, A. M., Zimmer, C. T., Denholm, I., Field, L. M., Foster, S. P., Gutbrod, O., Nauen, R., Slater, R., &
471 Williamson, M. S. (2014). The evolution of insecticide resistance in the peach potato aphid, *Myzus persicae*. *Insect*
472 *Biochemistry and Molecular Biology*, *51*, 41–51. <https://doi.org/10.1016/j.ibmb.2014.05.003>
- 473 Biedermann, P. H. W., & Vega, F. E. (2020). Ecology and evolution of insect–fungus mutualisms. *Annual Review of*
474 *Entomology*, *65*, 431–455. <https://doi.org/https://doi.org/10.1146/annurev-ento-011019-024910>
- 475 Blackman, R. L., & Eastop, V. F. (2008). *Aphids on the world's herbaceous plants and shrubs, 2 volume set*. John Wiley
476 & Sons.
- 477 Blackman, R. L., & Eastop, V. F. (2017). Taxonomic issues. In *Aphids as crop pests* (pp. 1–36). CABI Wallingford UK.
- 478 Boivin, G., Hance, T., & Brodeur, J. (2012). Aphid parasitoids in biological control. *Canadian Journal of Plant Science*,
479 *92*(1), 1–12. <https://doi.org/DOI:10.4141/cjps2011-045>
- 480 Brożek, J., Mróz, E., Wylężek, D., Depa, Ł., & Węgierek, P. (2015). The structure of extremely long mouthparts in the
481 aphid genus *Stomaphis* Walker (Hemiptera: Sternorrhyncha: Aphididae). *Zoomorphology*, *134*, 431–445.
482 <https://doi.org/https://doi.org/10.1007/s00435-015-0266-7>
- 483 Cao, H., Zhang, Z., Wang, X., & Liu, T. (2018). Nutrition versus defense: Why *Myzus persicae* (green peach aphid)
484 prefers and performs better on young leaves of cabbage. *PloS One*, *13*(4), 1–16.
485 <https://doi.org/https://doi.org/10.1371/journal.pone.0196219>
- 486 Chandel, R. S., Chandla, V. K., Verma, K. S., & Pathania, M. (2022). Chapter 21 - Insect pests of potato in India: biology
487 and management (A. Alyokhin, S. I. Rondon, & Y. B. T.-I. P. of P. (Second E. Gao (eds.); pp. 371–400). Academic
488 Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-821237-0.11001-7>
- 489 Chittka, A. L. (2007). *Visual ecology of aphids—a critical review on the role of colours in host finding* *Visual ecology of*
490 *aphids — a critical review on the role of colours in host finding*. June 2014. [https://doi.org/10.1007/s11829-006-](https://doi.org/10.1007/s11829-006-9000-1)
491 [9000-1](https://doi.org/10.1007/s11829-006-9000-1)
- 492 Clarke, R., Kehoe, M. A., Broughton, S., & Jones, R. A. C. (2020). Host plant affiliations of aphid vector species found
493 in a remote tropical environment. *Virus Research*, *281*(December 2019), 197934.
494 <https://doi.org/10.1016/j.virusres.2020.197934>
- 495 Degani, E., Leigh, S. G., Barber, H. M., Jones, H. E., Lukac, M., Sutton, P., & Potts, S. G. (2019). Crop rotations in a
496 climate change scenario: short-term effects of crop diversity on resilience and ecosystem service provision under
497 drought. *Agriculture, Ecosystems & Environment*, *285*, 106625.
498 <https://doi.org/https://doi.org/10.1016/j.agee.2019.106625>
- 499 Detrain, C., Verheggen, F. J., Diez, L., Wathelet, B., & Haubruge, E. (2010). Aphid–ant mutualism: how honeydew sugars
500 influence the behaviour of ant scouts. *Physiological Entomology*, *35*(2), 168–174. [https://doi.org/DOI:](https://doi.org/DOI:10.1111/j.1365-3032.2010.00730.x)
501 [10.1111/j.1365-3032.2010.00730.x](https://doi.org/DOI:10.1111/j.1365-3032.2010.00730.x)
- 502 Döring, T. F. (2014). How aphids find their host plants, and how they don't. *Annals of Applied Biology*, *165*(1), 3–26.
503 <https://doi.org/https://doi.org/10.1111/aab.12142>
- 504 Ertunc, F. (2020). Chapter 46 - Emerging Plant Viruses (M. M. B. T.-E. and R. V. P. Ennaji (ed.); pp. 1041–1062).
505 Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-819400-3.00046-6>
- 506 Gadhav, K. R., Gautam, S., Rasmussen, D. A., & Srinivasan, R. (2020). Aphid transmission of Potyvirus: the largest
507 plant-infecting RNA virus genus. *Viruses*, *12*(7), 773. <https://doi.org/doi:10.3390/v12070773>
- 508 Giannetti, D., Mandrioli, M., Schifani, E., Castracani, C., Spotti, F. A., Mori, A., & Grasso, D. A. (2021). First report on
509 the acrobat ant *Crematogaster scutellaris* storing live aphids in its oak-gall nests. *Insects*, *12*(2), 108.
510 <https://doi.org/https://doi.org/10.3390/insects12020108>
- 511 Guo, H., Gu, L., Liu, F., Chen, F., Ge, F., & Sun, Y. (2019). Aphid-borne Viral Spread Is Enhanced by Virus-induced
512 Accumulation of Plant Reactive Oxygen Species 1. *Plant Physiol*, *179*(January), 143–155.
513 <https://doi.org/10.1104/pp.18.00437>
- 514 Harrington, R., Clark, S. J., Welham, S. J., Verrier, P. J., Denholm, C. H., Hulle, M., Maurice, D., Rounsevell, M. D.,
515 Cocu, N., & Consortium, E. U. E. (2007). Environmental change and the phenology of European aphids. *Global*
516 *Change Biology*, *13*(8), 1550–1564. <https://doi.org/DOI:10.1111/j.1365-2486.2007.01394.x>
- 517 Hullé, M., Chaubet, B., Turpeau, E., & Simon, J.-C. (2020). Encyclop'Aphid: A website on aphids and their natural
518 enemies. *Entomologia Generalis*, *40*(1). <https://doi.org/DOI:10.1127/entomologia/2019/0867>
- 519 Ikbāl, C., & Pavela, R. (2019). Essential oils as active ingredients of botanical insecticides against aphids. *Journal of Pest*
520 *Science*, *92*, 971–986. <https://doi.org/DOI:10.1007/s10340-019-01089-6>
- 521 Jakubczyk, K., Koprowska, K., Gottschling, A., & Janda-Milczarek, K. (2022). Edible Flowers as a Source of Dietary
522 Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement. *Nutrients*, *14*(12).
523 <https://doi.org/10.3390/nu14122470>
- 524 Jaouannet, M., Rodriguez, P. A., Thorpe, P., Lenoir, C. J. G., & Macleod, R. (2014). Plant immunity in plant – aphid
525 interactions. *Front Plant Sci.*, *5*(December), 1–10. <https://doi.org/10.3389/fpls.2014.00663>
- 526 Jones, R. A. C. (2022). Alteration of plant species mixtures by virus infection: Managed pastures the forgotten dimension.
527 *Plant Pathology*, *71*(6), 1255–1281. <https://doi.org/DOI:10.1111/ppa.13571>
- 528 Jouselin, E., Gwenaëlle, G., & Armelle, C. D. A. (2010). Evolutionary lability of a complex life cycle in the aphid genus
529 *Brachycaudus*. *BMC Evolutionary Biology*, *10*(1). <https://doi.org/10.1186/1471-2148-10-295>

530 Kallas, J. (2010). *Edible wild plants*. Gibbs Smith.

531 Karami-jamour, T., Mirmoayedi, A., Zamani, A., & Khajehzadeh, Y. (2018). The impact of ant attendance on protecting
532 *Aphis gossypii* against two aphidophagous predators and its role on the intraguild predation between them. *Journal*
533 *of Insect Behavior*, *31*, 222–239. <https://doi.org/DOI: 10.1007/s10905-018-9670-4>

534 Kennedy, J. S., & Stroyan, H. L. G. (1959). Biology of aphids. *Annual Review of Entomology*, *4*(1), 139–160.

535 Kinley, C., Banu, A. N., Raut, A. M., Wahengbam, J., & Jamtsho, T. (2021). A review on past, present and future
536 approaches for Aphids management. *Journal of Entomological Research*, *45*(2), 336–346.
537 <https://doi.org/10.5958/0974-4576.2021.00053.0>

538 Kumar, Sarwan. (2019). Aphid-Plant Interactions: Implications for Pest Management. In M. T. Oliveira, F. Candan, & A.
539 Fernandes-Silva (Eds.), *Plant Communities and Their Environment* (p. Ch. 7). IntechOpen.
540 <https://doi.org/10.5772/intechopen.84302>

541 Kumar, Sushil, Bhowmick, M. K., & Ray, P. (2021). Weeds as alternate and alternative hosts of crop pests. *Indian Journal*
542 *of Weed Science*, *53*(1), 14–29. <https://doi.org/10.5958/0974-8164.2021.00002.2>

543 Liu, X. D., Xu, T. T., & Lei, H. X. (2017). Refuges and host shift pathways of host-specialized aphids *Aphis gossypii*.
544 *Scientific Reports*, *7*(1), 1–9. <https://doi.org/10.1038/s41598-017-02248-4>

545 Maharani, Y., Hidayat, P., Rauf, A., & Maryana, N. (2018). Short communication: New records of aphid species
546 subfamily aphidinae (Hemiptera: Aphididae) in West Java, Indonesia. *Biodiversitas*, *19*(2), 460–465.
547 <https://doi.org/10.13057/biodiv/d190219>

548 Margaritopoulos, J. T., Tzortzi, M., Zarpas, K. D., Tsitsipis, J. A., & Blackman, R. L. (2006). Morphological
549 discrimination of *Aphis gossypii* (Hemiptera: Aphididae) populations feeding on Compositae. *Bulletin of*
550 *Entomological Research*, *96*(2), 153–165. <https://doi.org/10.1079/ber2005410>

551 Meuninck, J. (2023). *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.

552 Mo, C., & Smilanich, A. M. (2023). Feeding on an exotic host plant enhances plasma levels of phenoloxidase by
553 modulating feeding efficiency in a specialist insect herbivore. *Frontiers in Physiology*, *14*(February), 1–10.
554 <https://doi.org/10.3389/fphys.2023.1127670>

555 Naidu, V. (2012). *Hand book on weed identification*. Dr. VSGR Naidu.

556 Nelson, A. S., & Mooney, K. A. (2022). The evolution and ecology of interactions between ants and honeydew-producing
557 hemipteran insects. *Annual Review of Ecology, Evolution, and Systematics*, *53*, 379–402.
558 <https://doi.org/https://doi.org/10.1146/annurev-ecolsys-102220-014840>

559 Peccoud, J., Simon, J.-C., von Dohlen, C., Coeur d'acier, A., Plantegenest, M., Vanlerberghe-Masutti, F., & Jousset, E.
560 (2010). Evolutionary history of aphid-plant associations and their role in aphid diversification. *Comptes Rendus*
561 *Biologies*, *333*(6), 474–487. <https://doi.org/https://doi.org/10.1016/j.crv.2010.03.004>

562 Pettersson, J., Tjallingii, W. F., & Hardie, J. (2017). Host-plant selection and feeding. In *Aphids as crop pests* (pp. 173–
563 195). CABI Wallingford UK. <https://doi.org/DOI: 10.1079/9780851998190.0087>

564 Singh, R., & Singh, G. (2021). Aphids. *Polyphagous Pests of Crops*, 105–182. https://doi.org/DOI: 10.1007/978-981-15-8075-8_3

565

566 Sorensen, J. T. (2009). *Chapter 8 - Aphids* (V. H. Resh & R. T. B. T.-E. of I. (Second E. Cardé (eds.); pp. 27–31).
567 Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-374144-8.00008-4>

568 Tegelaar, K., Hagman, M., Glinwood, R., Pettersson, J., & Leimar, O. (2012). Ant-aphid mutualism: the influence of ants
569 on the aphid summer cycle. *Oikos*, *121*(1), 61–66. <https://doi.org/https://doi.org/10.1111/j.1600-0706.2011.19387.x>

570 Völkl, W., Mackauer, M., Pell, J. K., & Brodeur, J. (2023). Predators, parasitoids and pathogens. In *CABI Books*. CABI
571 Books. <https://doi.org/10.1079/9780851998190.0187>

572 Wäckers, F. ., & Van Rijn, P. . (2012). Pick and mix: selecting flowering plants to meet the requirements of target
573 biological control insects. *Biodiversity and Insect Pests: Key Issues for Sustainable Management*, *9*(April), 139–165.
574 <https://doi.org/10.1002/9781118231838.ch9>

575 Yamamoto, T., Hattori, M., & Itino, T. (2020). *Seasonal Migration in the Aphid Genus Stomaphis (Hemiptera :*
576 *Aphididae): Discovery of Host Alternation Between Woody Plants in Subfamily Lachninae*. *20*.
577 <https://doi.org/10.1093/jisesa/ieaa103>

578

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TO WHOM IT MAY CONCERN

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UPT Bahasa Universitas Sriwijaya, hereby verifies that the scientific paper entitled “**Species of Aphids Found in Ornamental and Wild Plants in Highland, Pagar Alam, South Sumatra**” written by Chandra Irsan, Erise Anggraini, and Wenny Ramadhani has been professionally proofread by providing some input (such as the consistency and accuracy in grammar, spelling, punctuation, and wording) so that the English used in the paper is academically correct and appropriate.

Thus this certificate is made for proper use.

Palembang, 6 September 2023

Head,

Drs. Djunaidi, MSLS

NIP. 196201021988031004

Species of aphids found in ornamental and wild Plants in Highland, Pagar Alam, South Sumatra

Abstract. Aphids are one of the crucial pests in ~~the~~ tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species ~~were found on plants that were not actually hosts such as wild plan, such as wild plants, were found on plants that were not actually hosts~~. Therefore, this study reported the species of aphids found in ornamental ~~plants and the~~ wild plants. The field research employed ~~a~~ purposive and direct observation ~~methods approach~~ to inventory cultivated or wild plants hosting ~~aphids~~ and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host plants; and aphids; involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that 21 species of aphids were found in **Pagaralam**, namely *Aphis gossypii*, *Aphis citricola*, *Aphis craccivora*, *Aphis glycines*, *Aulacorthum solani*, *Greenidae* sp., *Hyperomyzus* sp., *Hysteroneura setariae*, *Lipaphis erysimi*, *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*, *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Rhopalosiphum padi*, *Sinemogoura citricola*, *Toxoptera aurantii*, *Toxoptera citricidus*, *Toxoptera odinae*, and *Schizaphis rotundiventris*.

Keywords: Aphids, ornamental plants, wild plants

Running title: Aphids found in ornamental and wild plants.

INTRODUCTION

Aphids are ~~one of the~~ crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhve et al. 2020); ~~a-~~ Aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can be found throughout the year due to their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids suck phloem sap of tender plant parts, which can deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, vector species can further weaken and stunt the growth of infected plants (Jones 2022). ~~—~~ Therefore, it is crucial to control aphid populations in gardens and crops.

Many aphid species are found on plants that are not their actual hosts (Maharani et al. 2018). Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al. 2020). Alternative plants provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al.; 2021). In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and native plants. Research on the diversity of aphid species in ornamental and wild plants has ~~less noticed~~ **received little attention**. This study reports ~~the~~ diversity of aphid species found in ornamental and wild plants found in this area. The findings from this study can serve as a valuable resource for aphid management.

MATERIALS AND METHODS

The field research employed a purposive and direct observation ~~approach~~ to inventory ~~of cultivated or wild plants hosting aphids~~ **cultivated or wild plants hosting** and collecting aphids. The plant selection ~~process~~ included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. ~~The collection and identification of host plants;~~

50 | ~~and aphids, and natural enemies where available.~~Where available, collecting and identifying host plants, aphids, and
 51 | ~~natural enemies~~ involved systematic searches of all existing plant species to find those colonized by aphids. Any plants
 52 | colonized by aphids are documented as aphid hosts. Aphid identification was done using identification keys (Blackman
 53 | and Eastop 2008) in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on
 54 | morphological characteristics. The host plants were identified using ~~the~~ weed identification hand-book (Kallas; 2010;
 55 | Meuninck; 2023; Naidu; 2012). The location and ~~size of~~aphid ~~colony~~colony sizes, including their life color, and
 56 | photographs of the aphid colonies and their host plants were recorded.

57 | RESULTS AND DISCUSSION

58 | Result

59 | Aphids infesting in ornamental plants

60 | The results showed that 15 aphid species were found in Pagar Alam(Tables 1 ~~and~~- 2)-. These aphids mostly
 61 | ~~colonised~~colonized flowers of various ornamental plants (Table 1, Figure 1).
 62 |

63 | **Table 1.-** Aphid species recorded in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Macrosiphoniella sanborni</i>	Leaves, young twig, flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	Leaves, flower Leaves Leaves, flower
3	<i>Caladium</i> sp.	<i>Pentalonia caladii</i>	Leaves,
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	Leaves, flower
5	<i>Canna indica</i>	<i>Rhopalosiphum nymphaeae</i>	Leaf
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	Shoot, young leaves, flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	Shoot, flower Young leaves
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	Flower
9	<i>Chrysanthemum</i> sp.	<i>Macrosiphoniella sanborni</i>	Shoot, twig
10	<i>Dahlia</i> sp.	<i>Aphis gossypii</i>	Flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	Flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	Shoot, flower
13	<i>Helianthus giganteus</i> .	<i>Aphis glycines</i>	Flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	Flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	Flower Shoot, young leaves
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	Flower Flower Shoot, flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	Young Twig Shoot, flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	Shoot, flower Shoot, flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	Flower
20	<i>Spondias dulcis</i>	<i>Aphis citricola</i>	Flower

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71 | **Fig 1.** Photos showing colonies of different aphid species in ornamental plants: a) *Aphis gossypii* in *Dahlia* sp. flower, b) *Aphis gossypii*
 72 | in *Hibiscus rosasinensis* flower, c) *Aphis gossypii* in ~~*cestrum*~~ *Cestrum* twig and flower, d) *Aphis craccivora* in *Clitoria ternatea* flower,
 73 | e) *Aphis glycines* in *Helianthus giganteus* flower, f) *Aphis craccivora* on the *Murayya paniculata* flower, g) *Toxoptera odinae* in the
 74 | *Mussaenda frondosa*, h) *Macrosiphoniella sanborni*. in *Chrysanthemum* sp. leaves i) *Macrosiphum rosae* in *Rosa indica* flower, j)
 75 | *Rhopalosiphum nymphaeae* in *Canna indica* leaves. ~~All the photos were captured by Chandra Irsan~~ [Chandra Irsan captured all the](#)
 76 | [photos.](#)
 77

78

79 | The relationship between aphids and ants was also recorded. Aphids produce a sweet, sticky substance called
 80 | honeydew. ~~Ants~~ [Ants](#) are attracted to this honey because it serves as a food source for them. When aphids are present, they
 81 | secrete honeydew, which attracts ants. This research recorded the presence of ants on plant parts colonized by aphids
 82 | (Table 2).
 83

84

86 | **Table 2.-** Aphid species recorded in ornamental plants and the presence of the ants in the plant parts colonized

No	Aphid Species	Ornamental plants	Aphids life colour	Plant parts colonized	Ant attendance
1	<i>Aphis craccivora</i>	<i>Clitoria ternatea</i>	black	flowers	+
		<i>Murraya paniculata</i>	black	flowers	+
2	<i>Aphis citricola</i>	<i>Catharanthus roseus</i>	greenish yellow	flowers	+
		<i>Ixora</i> sp.	greenish yellow	flowers	+
		<i>Mussaenda frondosa</i>	greenish yellow	shoots, flowers	+
		<i>Spondias dulcis</i>	greenish yellow	flowers	+
3	<i>Aphis glycines</i>	<i>Helianthus giganteus</i>	greenish yellow	flowers	+
4	<i>Aphis gossypii</i>	<i>Cestrum</i> sp.	green	shoots, flowers	+
		<i>Cananga odoratum</i>	light green	shoots, flowers	+
		<i>Dahlia</i> sp.	green dark	flowers	+
		<i>Duranta</i> sp.	light green	shoots, flowers	+
		<i>Hibiscus rosasinensis</i>	dark green	flowers	+
		<i>Ixora paludosa</i>	light green	flowers	+
		<i>Ixora</i> sp.	light green	flowers	+
5	<i>Aulacorthum solani</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-
6	<i>Macrosiphoniella sanborni</i>	<i>Aster alpinus</i>	brown black	leaves, twigs, flowers	+
		<i>Chrysanthemum</i> sp.	reddish brown	leaves, twigs	+
7	<i>Macrosiphum rosae</i>	<i>Rosa indica</i>	green	flowers	-
8	<i>Myzus persicae</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-
9	<i>Neomyzus circumflexus</i>	<i>Cestrum</i> sp.	light green	young leaves,	-
		<i>Brugmansia suaveolens</i>	light green	flowers	
				flowers	
10	<i>Pentalonia caladii</i>	<i>Caladium</i> sp.	brown-black	leaves	+
11	<i>Rhopalosiphum nymphaeae</i>	<i>Canna indica</i>	green black	leaves	+
12	<i>Sinemegoura citricola</i>	<i>Dendrobium</i> sp.	brown	flowers	-
13	<i>Toxoptera aurantii</i>	<i>Ixora paludosa</i>	brown black	flowers	+
		<i>Ixora</i> sp.	brown black	flowers	+
14	<i>Toxoptera citricidus</i>	<i>Murraya paniculata</i>	black	stems	+
15	<i>Toxoptera odinae</i>	<i>Mussaenda frondosa</i>	reddish-brown	flowers	+

87 (+): present, (-): absent

88

89 **Aphids infesting in wild plants (weed or non-weed plants)**

90

91 | In addition, this study documented aphid colonies on flowers, stalks, plant tops, young leaves, and old leaves of wild
92 plants (Table 3, Figure 2).

93

94 | **Table 3.-** Species of aphids found in wild (weed or non-weed) plants and their colony locations.

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	weed	<i>Aphis gossypii</i>	shoots, buds
3	<i>Alternanthera sessilis</i>	weed	<i>Aphis gossypii</i>	shoots, buds
4	<i>Amaranthus gracilis</i>	weed	<i>Aphis craccivora</i>	flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	weed	<i>Lipaphis erysimi</i>	flowers, shoots, and buds
6	<i>Croton hirtus</i>	weed	<i>Aphis gossypii</i>	flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks
8	<i>Cyperus rotundus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks
11	<i>Echinochloa crusgali</i>	weed	<i>Hiperomyzus</i> sp.	young leaves, old leaves
12	<i>Ecliptica prostrata</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves
13	<i>Eleusine indica</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks, leaf axils
			<i>Rhopalosiphum maidis</i>	flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	weed	<i>Aphis gossypii</i>	flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves
17	<i>Eupotarium odoratum</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves,
			<i>Aphis glycines</i>	shoot, young twigs
18	<i>Hymenochera acutigluma</i>	Weed	<i>Hysteronura setariae</i>	flowers, flower stalks, leaf axils

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
19	<i>Bridelia tomentosa</i>	Non-weed	<i>Greenidea</i> sp.	young leaves
20	<i>Lophatherum gracile</i>	Weed	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	young leaves, old leaves, leaf axils young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	Non-weed	<i>Aphis gossypii</i>	shoots, young leaves
22	<i>Mikania mickrantha</i>	Weed - liana	<i>Aphis gossypii</i> <i>Aphis glycines</i>	shoots, young leaves, old leaves shoot, young twig
23	<i>Mimosa invisa</i>	weed	<i>Aphis craccivora</i>	shoots, pods
24	<i>Mimosa pudica</i>	weed	<i>Aphis craccivora</i>	shoots, pods, flowers
25	<i>Mimosa vigra</i>	Non-weed	<i>Aphis craccivora</i>	shoots, pods
26	<i>Oryza rufipogon</i>	weed	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	old leaves, young leaves (shoot), leaf axils old leaves, young leaves (shoot), leaf axils
27	<i>Oxonopus compressus</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, leaf axils
28	<i>Paspalum conjugatum</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, seeds
29	<i>Phyllanthus neruri</i>	weed	<i>Aphis citricola</i>	shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	weed	<i>Aphis craccivora</i>	shoots, young leaves, flowers
31	<i>Physalis angulata</i>	weed	<i>Aphis craccivora</i> <i>Aphis gossypii</i>	shoots, young leaves, old leaves shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	weed	<i>Lipapis erysimi</i>	flowers, fruits, shoots, young leaves
33	<i>Sida rhombifolia</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arvensis</i>	weed	<i>Lipapis erysimi</i>	young leaves, fruit stalks, flowers, fruits

95

96 The presence of ants in aphid colonization symbolizes a mutually beneficial relationship where the ants receive food
97 from the aphids while providing protection to protect them from aphids. This study recorded the ant attendance in aphids
98 colonization (Table 4).

99 **Table 4.-** Aphid species were recorded in ornamental plants, and the presence of the ants in the plant parts colonized.

No	Aphid Species	Wild plants	Aphids life colour	Plant parts colonized	Ant attendance
1	<i>Aphis gossypii</i>	<i>Ageratum conyzoides</i> <i>Alternanthera philoxeroides</i> <i>Alternanthera sessilis</i> <i>Croton hirtus</i> <i>Ecliptica prostrata</i> <i>Emilia sonchifolia</i> <i>Euphorbia hirta</i> <i>Eupotarium</i> — <i>Eupatorium</i> <i>odoratum</i> <i>Melastoma affine</i> <i>Mikania mickrantha</i> <i>Physalis angulata</i> <i>Sida rhombifolia</i>	Light green Light green Light green Dark green green green light green light green light green light green yellowish green yellowish green	shoots, young leaves, old leaves, flowers shoots, buds shoots, buds flowers, shoots, young leaves, old leaves, young twigs shoots, young leaves flower, flower stalks, shoots young leaves, old leaves young leaves, old leaves, young twigs shoots, young leaves shoots, young leaves, old leaves shoots, young leaves, old leaves, fruit/seeds	+ + - + + + + + + + + -
2	<i>Aphis craccivora</i>	<i>Amaranthus gracilis</i> <i>Mimosa invisa</i> <i>Mimosa pudica</i> <i>Mimosa vigra</i> <i>Portulaca oleraceae</i> <i>Physalis angulata</i>	black black black black black black	flowers, shoots, young leaves, old leaves shoots, pods shoots, pods, flowers shoots, pods shoots, young leaves, flowers shoots, young leaves, old leaves	+ + + + + +
3	<i>Aphis glycines</i>	<i>Eupotarium</i> — <i>Eupatorium</i> <i>odoratum</i> <i>Mikania mickrantha</i>	Greenish yellow Light green	young leaves, old leaves, young twigs shoots, young leaves, old leaves	+ +
4	<i>Aphis citricola</i>	<i>Phyllanthus neruri</i>	Greenish Yellow	shoot, young leaves, young twigs, petioles	+
5	<i>Greenidea</i> sp.	<i>Bridelia tomentosa</i>	Greenish Yellow	young leaves	-
6	<i>Hysteroneura setariae</i>	<i>Digitaria ciliaris</i> <i>Eleusine indica</i> <i>Eragrostis tenella</i> <i>Hymenochera acutigluma</i> <i>Lophatherum gracile</i> <i>Oxonopus compressus</i> <i>Paspalum conjugatum</i>	reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown reddish-brown	flower, flower stalks flower, flower stalks, leaf axils flower, flower stalks, seeds flowers, flower stalks, leaf axils young leaves, old leaves, leaf axils flower, flower stalk, leaf axils flower, flower stalk, seeds	+ + + + + + +
7	<i>Hiperomyzus</i> sp.	<i>Echinocloa crussgali</i>	Black	young leaves, old leaves	-
8	<i>Lipaphis erysimi</i>	<i>Blumea lacera</i> <i>Rorippa indica</i> <i>Sonchus arvensis</i>	Whitish green Whitish green Whitish green	flowers, shoots, and buds flower, fruit, shoots, young leaves young leaves, fruit stalks, flowers, fruit	+ + +
9	<i>Rhopalosiphum maidis</i>	<i>Eleusine indica</i> <i>Lophatherum gracile</i> <i>Oryza rufipogon</i>	green green green	flower, flower stalks, leaf axils young leaves, old leaves, leaf axils old leaves, young leaves (shoot), leaf axils	+ + -
10	<i>Rhopalosiphum padi</i>	<i>Oryza rufipogon</i>	Whitish green	old leaves, young leaves (shoot), leaf axils	+
11	<i>Schizaphis rotundiventris</i>	<i>Cynodon dactylon</i> <i>Cyperus rotundus</i> <i>Cyperus compressus</i>	Green green green	flowers, flower stalks flowers, flower stalks, leaf axils flowers, flower stalks, leaf axils	+ + +

100
101
102
103

(+): present, (-): absent



104
105

Figure 2. Aphids found infesting wild plants a) *Aphis gossypii* in *Ageratum conyzoides*, b) *Aphis gossypii* in *Croton hirtus* c) *A. gossypii* in *Eupatorium odoratum*, d) *Aphis gossypii* in *Pachystochys* sp., e) *Pentalonia caladii* in *Caladium* sp., f) *Aphis. gossypii* in *Alternanthera sessilis*, g) *Aphis gossypii* in *Portulaca oleraceae* h) *Aphis gossypii* in *Euphorbia hirta*, i) *Aphis citricola* in *Phyllanthus nerruri*, j) *Aphis citricola* in *Sida rhombifolia*, k) *Aphis citricola* in *Annona muricata*, l) *Aphis citricola* in *Ludwigia peruviana*, m) *A. craccivora* in *Mimosa pudica*, n) *Aphis craccivora* in *Amaranthus gracilis*, o) *Aphis glycine* in *Mikania micranta*, p) *Hysteneura* sp. in *Eleusin*, q) *Greenidae* sp. in *Bridelia tomentosa* young leaves., r) *Hyperomyzus* sp. in *Echinocloa crusgali*, s) *Lipaphis erysimi* in *sonchus arventris*, t) *Rhopalosiphum padi* in *Oryza rufipogon*, u) *Rhopalosiphum Maidis* in *Oryza rufipogon*. All the photos were captured by Chandra Irsan.

127 Discussion

128

129 In the present study, some aphid species were found on ~~several~~ ornamental plants in Pagar Alam. ~~t-~~The location
 130 of aphid colonization on the plants varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and
 131 ~~on~~ newly emerging leaves. The aphids displayed brown and black coloration. The aphid colonies found were small, and
 132 the colonized plant parts showed no signs of disease. The identification results showed that the aphids were *Neotoxoptera*
 133 sp., and notably, they were not associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or
 134 young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized
 135 plant parts showed symptoms of stunting. The identification results showed that the aphids were *Macrosiphoniella*
 136 ~~sanborni, and they were and~~ associated with ants. On the *Brugmansia suaveolens*, *M. persicae* were found on the
 137 undersides of old leaves or leaves that have ~~started to turn~~ yellow. The colonies were relatively small. The aphids
 138 found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. was
 139 found one species of aphids: *P. caladii*. *P. caladii* was known and found in taro plants; ~~;~~ the aphids formed colonies under
 140 the surface of young and older leaves (Bhadra and Agarwala 2014). ~~According to this present study, This study found that~~
 141 the occupied leaf areas did not display severe symptoms; ~~t-~~The aphids were ~~yellow-yellow-green~~ to dark green. The
 142 wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odoratum* (ylang-ylang),
 143 colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T.*
 144 *aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids
 145 found were brown to black ~~in color~~. The colonies of *T. aurantii* were found to be associated with black ants. Aphids on *C.*
 146 *indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the
 147 leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body and
 148 the identification results showed that the aphids were *Rhopalosiphum nymphaeae* (Acharya and Singh 2004). ~~-~~ The colonies
 149 of *R. nymphaeae* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were
 150 found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and
 151 the colonized plant parts ~~did not show any~~ showed no symptoms of disease ~~disease symptoms~~. On *Cestrum* sp. (Bastard
 152 jasmine), aphids formed colonies on the undersides of young leaves, shoots, and within flower parts, especially between
 153 petals or ~~flower~~ stalks that had not fully bloomed; ~~t-~~The colonies were quite large. The body color of aphids was green to
 154 dark green, with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms.
 155 The identification results showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated
 156 with ants. Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems, and young
 157 leaves. The aphids were brown to black ~~in color~~. Colonized plant parts, especially shoots and young leaves, showed
 158 stunting symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently
 159 associated with ants. The aphids on the *Dahlia* sp. formed colonies on unopened flower buds, with a significant population
 160 among the blooming petals. The body color was green to dark green. The identification results showed that the aphids
 161 were *A. gossypii*. According to this present study, *Sinemegoura citricola* colonies were found on the young leaves of
 162 *Dendrobium* sp., with the color body of the *S. citricola* aphids were yellow, green to dark green, and the colonized plants
 163 ~~did not showing no any~~ disease symptoms, and ~~they were~~ associated with ants. On *Duranta* sp., colonies of aphids were
 164 ~~located~~ on the undersides of young leaves, and the colonized plant parts showed stunting symptoms. The colonies were
 165 very large. The aphids were green ~~in color~~. The identification results showed that the aphids were *A. gossypii*. The aphid
 166 colonies were consistently associated with ants. Furthermore, on the *Helianthus annuus*, aphid colonies were found

167 | between the flower petals. The colonized flowers, especially the crowns, exhibited a tendency tended to fall off easily. The
168 | aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A.*
169 | *gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides
170 | of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant
171 | parts did not show any disease symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid
172 | colonies were not associated with ants. Within the colonies, mummified aphids that were parasitized by
173 | Aphidiidae Aphidiidae parasitized were found. On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark
174 | green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the undersides of aging
175 | leaves. The colonies grew to be very large. The identification results showed that the aphids were *A. gossypii*. The aphid
176 | colonies were consistently associated with ants. Two types of aphids were found on the flowering plant *Ixora paludosa*.
177 | First, the aphids formed colonies on the undersides of young leaves that were still red or light green and sometimes on
178 | flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf growth, leaf
179 | shrinkage, necrotic spots on the leaf surface, and slightly downward-curved leaf edges. The upper leaf surface looked wet
180 | and sticky, like sugar. The aphids had yellow, green, or slightly dark green bodies, with some wingless adults having a
181 | powdery white upper surface. The identification results showed that the aphids were *A. gossypii*, and they were and they
182 | were almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface
183 | of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts
184 | occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched
185 | stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids
186 | were also associated with ants. Moreover, in *Ixora* sp. flower plants, two forms of aphids were discovered two forms of
187 | aphids were discovered in *Ixora* sp. flower plants. These aphids occupied the shoots, young leaves, and unopened flowers;
188 | t. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from yellow and green to
189 | a slightly darker green. Sometimes, the upper surface of the wingless imago's body appeared white, resembling flour. The
190 | identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost always associated with
191 | ants. Another species of aphids was founded and formed colonies on flower stalks that had not yet bloomed and on newly
192 | emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms of plant disease plant
193 | disease symptoms. The aphids were yellow or yellowish green, with black cauda and siphunculi. Their bodies were very
194 | small to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also
195 | frequently found in association with ants. Two types of aphids were found on *Mussaenda frondosa*, each forming colonies
196 | in different locations. The first type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied
197 | showed no obvious disease symptoms. The identification results showed that the aphids were *Toxoptera odinae*. The
198 | aphids were yellow, green, and some with dark green (Blackman et al. 2011). The second type of aphids formed colonies
199 | on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could also be found on young
200 | leaves, shoots, and within flower parts. The plant parts they infested showed no signs of diseases. The aphids were yellow
201 | or yellow-yellow-green, with black cauda and siphunculi. They had tiny to small bodies. The identification results showed
202 | that the aphids were *A. citricola*. Many aphid species infest a variety of various ornamental plants because these insects are
203 | attracted to such plants due to the rich nutrient content in the plant sap (Braham et al. 2023).

204 | The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This
205 | indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
206 | generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
207 | colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
208 | yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides*, or alligator grass, was also
209 | colonized by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were
210 | green, ranging from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies
211 | on shoots, flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants.
212 | *Amaranthus gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers, and young
213 | and old leaves. They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were
214 | associated with both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi*. These aphids were bright
215 | green, and of medium size. The colonies formed on flowers, flower stalks, and the undersides of the leaves at the top. The
216 | aphid colonies were not associated with ants. *Croton hirtus*, or fire grass, was infested by *Aphis gossypii*. The aphids
217 | were yellow-yellow-green to dark green. The colonies were found on the stems, leaves, buds, and flowers, often forming
218 | large colonies. *Cynodon dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the
219 | flowers, flower stalks, and sometimes in the plant leaf axils of the plant. Small colonies were formed. The aphids were
220 | brown to reddish brown. They were associated with ants. *Cyperus rotundus*, or nut grass, was infested by *Schizaphis*
221 | *rotundiventris* aphids. The colonies were found on flower stalks, flowers, and leaf axils. The colonies were quite large and
222 | associated with both black and red ants. The aphids were dark brown in color. *Cyperus compressus*, or grass puzzle, was
223 | colonized by *Schizaphis rotundiventris* aphids, forming colonies in the flowers, flower stalks, and sometimes in the axils
224 | and leaves of the shoots or buds. Small colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae*
225 | aphids, with small colonies scattered on the flowers and flower stalks. These aphids were light brown to brown in color.
226 | *Echinocloa crussgali*, or water hyacinth plants, were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown

227 to black and formed large colonies on the undersides of both young and old leaves. The aphid colonies were never found
 228 in association with ants. *Ecliptica prostrata*, or urang-aring, was colonized by *Aphis gossypii*, forming small colonies on
 229 the shoots and flowers. The aphids were bright green to blackish green. The aphid colonies were also consistently
 230 associated with ants. *Eleusin indica* was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum*
 231 *maidis*. *H. setariae* formed colonies in flower parts, flower stalks, and leaf axils, resulting in quite large colonies. *H.*
 232 *setariae*'s body color ranged from red-red-brown to dark brown. The colonies were consistently associated with ants. The
 233 aphids of *R. maidis* formed colonies in the leaf axils and undersides of leaves and on-leaf shoots that had not yet opened.
 234 The colonies were not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and
 235 cauda. These aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated
 236 with ants. The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids
 237 were yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves. *Eragrostis tenella* was
 238 infested by *Hysteroneura setariae* aphids. The aphids were brown to red-red-brown. Small colonies formed on flowers
 239 near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were consistently associated
 240 with ants. *Euphorbia hirta*, or wart grass, was colonized by *Aphis gossypii*. The aphids formed colonies on the undersides
 241 of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in color. *A. gossypii* colonies on
 242 *E. hirta* plants were consistently associated with ants. *Eupotarium-Eupatorium odoratum* was colonized by both *Aphis*
 243 *gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young twigs. Young
 244 leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this plant showed
 245 yellow-green to dark-dark-green in-body colour. The colonies of *A. citricola* formed on the young twigs near the shoots,
 246 with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of both *A.*
 247 *gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants. *Hymenochera acutigluma*, or
 248 hair axis, was colonized by *Hysteroneura setariae*, which formed colonies on the flower stalks and flowers. The colonized
 249 parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or *kenidai*, was infested by *Greenidae* sp.
 250 These aphids had bright green bodies and distinctive elongated siphunculi with thorns. The aphids formed colonies on the
 251 undersides of leaves, especially on young leaves. The colonized leaves did not show any disease symptoms. *Lophatherum*
 252 *gracile* or bamboo grass plants, were colonized by two species of aphids: *hysteroneura setariae* and *Rhopalosiphum*
 253 *maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves, leaf shoots, and leaf axils. The colonized
 254 leaves did not show any disease symptoms. *H. setariae* aphids were brown to red-red-brown. *R. maidis* aphids also formed
 255 colonies on the undersides of leaves, but the colonies were small. *R. maidis* aphids were green to bright green in-color,
 256 with black siphunculi and cauda. It was possible for colonies of the two species of aphids on *L. gracile* to mix. In addition,
 257 *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly emerging
 258 shoots and on-newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The colonized
 259 plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis glycine*. *A.*
 260 *gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A.*
 261 *glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were light green to green
 262 in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony. *Mimosa*
 263 *invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisita* plants formed colonies
 264 only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa pudica* was
 265 observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots, and
 266 occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the colonized
 267 plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of aphids
 268 occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were shiny
 269 black. The colonized plant parts did not show any disease symptoms. *Oryza rufipogon* was colonized by two species of
 270 aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both aphids colonized the same plant parts, namely the unopened
 271 leaves and the leaf axils with large colonies. The two species could be distinguished by their body color. *R. maidis*
 272 appeared green with black siphunculi and cauda, while *R. rice* appeared white. The colonies of *R. maidis* and *R. rice* in *O.*
 273 *rufipogon* plants were associated with the presence of red ants. *Oxonopus compressus*, or *pait* grass, was colonized by
 274 *Hysteroneura setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes in-in the leaf axils. The
 275 aphids were brown to dark brown in-color. Small colonies were formed, and they were also consistently associated with
 276 ants. *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds
 277 and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus niruri* was colonized by *Aphis citricola*. The
 278 colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted,
 279 and wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large.
 280 *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants
 281 formed colonies on the undersides of leaves, especially young leaves, shoots, and in flowers. The colonized plant parts
 282 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
 283 appeared glossy black. *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black
 284 bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The
 285 colonized plant parts did not show any symptoms-of-disease symptoms. *Rorippa indica*, or mustard land, was colonized by
 286 *Lipaphis erysimi*. The colonies formed on the flowers, fruits, flower stalks, and the lower leaf's surface-of-leaves. The

287 | colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia*, or cacabean, was colonized by
288 | *Aphis gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves,
289 | stalks, and flower petals. The colonized plant parts, especially the shoots, showed curling, and the leaf edges curled
290 | downward. *Sonchus arvensis* plants were colonized by *L. erysimi*. The aphids had green to whitish green body colours,
291 | and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became
292 | stunted over time.

293 | In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
294 | displayed typical ~~damage~~ symptoms of damage, but some did not show any symptoms at all. Generally, the plants'
295 | symptoms of the plants due to caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape,
296 | and stunted or curly leaves. These characteristic symptoms serve as indicators of aphid infestations. However, some plants
297 | or plant parts did not show symptoms when colonized by aphids. This condition occurred because the colonized
298 | parts had reached their maximum growth or development. It indicated that the colonized part was not currently undergoing
299 | a growth phase. The colonies that did not induce symptoms typically occurred when the colonized leaves had reached their
300 | maximum growth or when the leaves and plant parts were old. Furthermore, the old leaves or twigs might not show the
301 | typical symptoms associated with aphid infestations. The plant parts of the plant exhibiting characteristic symptoms when
302 | colonized by aphids also often experienced a cessation in growth due to the piercing by the aphids. In contrast, the areas
303 | surrounding the puncture site continued to grow, resulting in some parts developing normally while others
304 | become growing, resulting in some parts developing ordinary while others became stunted (Pettersson, Tjallingii, and
305 | Hardie 2017). This condition could lead to the bending of shoots or young stems, curling of bending shoots or young stems,
306 | curling leaves, downward curling of leaf edges, or stunted leaf growth. In this observation, monocot plants or groups of
307 | grasses with narrow leaves generally did not display any distinctive symptoms when colonized by aphids. This might be
308 | because the growth or development of their leaves differed from that of dicot plants. Therefore, the presence of aphids in
309 | monocot plants or plants was often easier to recognize through the presence of ants. If a plant was found to have a
310 | significant number of ants, there was a possibility that aphids had colonized the plant (Tegelaar et al. 2012). Therefore, the
311 | presence of ants could serve as an indicator of the presence of aphid colonies. According to this present study, ants were
312 | present in some aphids colonies from the subfamily aphidini, while the ants were absent in some aphids present study, ants
313 | were present in some aphid colonies from the subfamily aphidini, while the ants were absent in some aphid colonies from
314 | the macrocypini subfamily. The absent absence of ants in aphids colonies could be because the colonies have just formed,
315 | or the population is still low (Kummel, Brown, and Bruder 2013). Aphids colonized flowers because they may offer an
316 | accessible and rich food source, sugary plant sap found in new growth or reproductive plant parts of plants. Flowers
317 | contain a nutrient-rich nature and easy access to sap, therefore, aphids were attracted to flower saps. In addition, the
318 | flowers s. Some aphid species were drawn to certain colors (Jakubczyk et al. 2022). Herbs served as an alternative host for
319 | aphids in this present study. Aphids consume sugar-rich liquid in plants, known as "sap". Aphids considered herbs and
320 | other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate plant tissues and
321 | access this fluid (Brozek et al. 2015). Several aphids colonized herbs such as Indian mustards, *Lipaphis erysimi*, and
322 | *Myzus persicae*, are the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al. 2022). Due to a
323 | symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance
324 | known as honeydew as a waste product, which ants found highly attractive as a food sources (Nelson and Mooney 2022).
325 | The honeydew contained an abundance of abundant sugars, extracted by aphids from the plant juice (Zheng et al. 2022).
326 | Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for honeydew, ants
327 | provided aphids with protection tected aphids from other insects and predators, such as ladybugs, lacewing larvae, and
328 | parasitic wasps (Karami-jamour et al. 2018). Certain ant species of ants would transport aphids to new host plants for
329 | improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not
330 | only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
331 | species) and provided energy for the growth of their own progeny (Biedermann and Vega 2020).

332

CONCLUSION

333 | Moreover, 21 species of aphids were found in Pagar Alam, namely *Aphis gossypii*, *Aphis citricola*, *Aphis craccivora*,
334 | *Aphis glycines*, *Aulacorthum solani*, *Greenidae* sp., *Hyperomyzus* sp., *Hysteronera setariae*, *Lipaphis erysimi*,
335 | *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*,
336 | *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Rhopalosiphum padi*, *Sinemogoura citricola*, *Toxoptera aurantii*,
337 | *Toxoptera citricidus*, *Toxoptera odinae*, and *Schizaphis rotundiventris*.

338

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- 342 | Acharya, Shelley, and Rajendra Singh. 2004. "Aphids on Medicinal Plants in North East India (Insecta : Homoptera : Aphididae)". *Rec. Zool. Surv. India* 102(June 2004). doi: 10.26515/rzsi/v103/i1-2/2004/159495.
- 344 | Bass, Chris, Alin M. Puinean, Christoph T. Zimmer, Ian Denholm, Linda M. Field, Stephen P. Foster, Oliver Gutbrod, Ralf Nauen, Russell Slater, and Martin S. Williamson. 2014. "The Evolution of Insecticide Resistance in the Peach Potato Aphid, Myzus persicae". *Insect Biochemistry and Molecular Biology* 51:41–51. doi: 10.1016/j.ibmb.2014.05.003.
- 347 | Bhadra, Parna, and Basant Kumar Agarwala. 2014. "On the Morphological and Genotypic Variations of Two Congeneric Species of Banana Aphid Pentalonia (Homoptera : Aphididae) from India". (March). doi: 10.5932/j.als.20120203.06.
- 349 | Biedermann, Peter H. W., and Fernando E. Vega. 2020. "Ecology and Evolution of Insect–Fungus Mutualisms". *Annual Review of Entomology* 65:431–55. doi: <https://doi.org/10.1146/annurev-ento-011019-024910>.
- 351 | Blackman, Roger L., and Victor F. Eastop. 2008. *Aphids on the World's World's Herbaceous Plants and Shrubs, 2 Volume Set*. John Wiley & Sons.
- 352 | Blackman, Roger L., and Victor F. Eastop. 2017. "Taxonomic Issues". Pp. 1–36 in *Aphids as crop pests*. CABI Wallingford UK.
- 353 | Blackman, Roger Laurence, Masato Sorin, and Masahisa Miyazaki. 2011. "Sexual Morphs and Colour Variants of Aphis (Formerly Toxoptera) Odinae (Hemiptera, Aphididae) in Japan". *Zootaxa* (November 2011):53–60. doi: 10.11646/zootaxa.3110.1.5.
- 354 | Braham, Mohamed, Synda Boulahia-kheder, Mouna Kahia, and Siwar Nourira. 2023. "Aphids and Citrus Responses to Nitrogen Fertilization". *Journal of the Saudi Society of Agricultural Sciences* 22(6):374–83. doi: 10.1016/j.jssas.2023.03.003.
- 355 | Brożek, Jolanta, Ewa Mróz, Dominika Wylęzek, Łukasz Depa, and Piotr Wegierek. 2015. "The Structure of Extremely Long Mouthparts in the Aphid Genus Stomaphis Walker (Hemiptera: Sternorrhyncha: Aphididae)". *Zoomorphology* 134:431–45. doi: <https://doi.org/10.1007/s00435-015-0266-7>.
- 360 | Cao, He-he, Zhan-feng Zhang, Xiao-feng Wang, and Tong-xian Liu. 2018. "Nutrition versus Defense : Why Myzus persicae (Green Peach Aphid) Prefers and Performs Better on Young Leaves of Cabbage?". *PLoS One* 13(4):1–16. doi: <https://doi.org/10.1371/journal.pone.0196219>.
- 362 | Clarke, Rebecca, Monica A. Kehoe, Sonya Broughton, and Roger A. C. Jones. 2020. "Host Plant Affiliations of Aphid Vector Species Found in a Remote Tropical Environment". *Virus Research* 281(December 2019):197934. doi: 10.1016/j.virusres.2020.197934.
- 364 | Ertunc, Filiz. 2020. "Chapter 46 - Emerging Plant Viruses". Pp. 1041–62 in, edited by M. M. B. T.-E. and R. V. P. Ennaji. Academic Press.
- 365 | Gadhave, Kiran R., Saurabh Gautam, David A. Rasmussen, and Rajagopalbabu Srinivasan. 2020. "Aphid Transmission of Potyvirus: The Largest Plant-Infecting RNA Virus Genus". *Viruses* 12(7):773. doi: 10.3390/v12070773.
- 367 | Giannetti, Daniele, Mauro Mandrioli, Enrico Schifani, Cristina Castracani, Fiorenza A. Spotti, Alessandra Mori, and Donato A. Grasso. 2021. "First Report on the Acrobat Ant Crematogaster Scutellaris Storing Live Aphids in Its Oak-Gall Nests". *Insects* 12(2):108. doi: <https://doi.org/10.3390/insects12020108>.
- 370 | Jakubczyk, Karolina, Klaudia Koprowska, Aleksandra Gottschling, and Katarzyna Janda-Milczarek. 2022. "Edible Flowers as a Source of Dietary Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement". *Nutrients* 14(12). doi: 10.3390/nu14122470.
- 372 | Jayaswal, Deepanshu, Pawan Mainkar, Kuldeep Kumar, Yamini Agarwal, and Ratna Prabha. 2022. "Pyramiding and Evaluation of Segregating Lines Containing Lectin and Protease Inhibitor Genes for Aphid Resistance in Brassica Juncea". *Indian Journal of Biochemistry & Biophysics* 59(August):800–807. doi: 10.56042/ijbb.v59i8.62319.
- 375 | Jones, Roger A. C. 2022. "Alteration of Plant Species Mixtures by Virus Infection: Managed Pastures the Forgotten Dimension". *Plant Pathology* 71(6):1255–81. doi: DOI: 10.1111/ppa.13571.
- 377 | Kallas, John. 2010. *Edible Wild Plants*. Gibbs Smith.
- 378 | Karami-jamour, Tahereh, Alinaghi Mirmoayedi, Abbasali Zamani, and Yadolah Khajehzadeh. 2018. "The Impact of Ant Attendance on Protecting Aphis Gossypii against Two Aphidophagous Predators and Its Role on the Intraguild Predation between Them". *Journal of Insect Behavior* 31:222–39. doi: DOI: 10.1007/s10905-018-9670-4.
- 381 | Kennedy, J. S., and H. L. G. Stroyan. 1959. "Biology of Aphids". *Annual Review of Entomology* 4(1):139–60.
- 382 | Kumar, Sushil, Malay K. Bhowmick, and Puja Ray. 2021. "Weeds as Alternate and Alternative Hosts of Crop Pests". *Indian Journal of Weed Science* 53(1):14–29. doi: 10.5958/0974-8164.2021.00002.2.
- 384 | Kummel, Miroslav, David Brown, and Andrea Bruder. 2013. "How the Aphids Got Their Spots: Predation Drives Self-Organization of Aphid Colonies in a Patchy Habitat". *Oikos* 122(6):896–906. doi: <https://doi.org/10.1111/j.1600-0706.2012.20805.x>.
- 386 | Maharani, Yani, Purnama Hidayat, Aunu Rauf, and Nina Maryana. 2018. "Short Communication: New Records of Aphid Species Subfamily Aphidinae (Hemiptera: Aphididae) in West Java, Indonesia". *Biodiversitas* 19(2):460–65. doi: 10.13057/biodiv/d190219.
- 388 | Meuninck, Jim. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.
- 389 | Naidu, VSGR. 2012. "Hand Book on Weed Identification".
- 390 | Nelson, Annika S., and Kailen A. Mooney. 2022. "The Evolution and Ecology of Interactions between Ants and Honeydew-Producing Hemipteran Insects". *Annual Review of Ecology, Evolution, and Systematics* 53:379–402. doi: <https://doi.org/10.1146/annurev-ecolsys-102220-014840>.
- 392 | Pettersson, Jan, W. Fred Tjallingii, and Jim Hardie. 2017. "Host-Plant Selection and Feeding". Pp. 173–95 in *Aphids as crop pests*. CABI Wallingford UK.
- 394 | Tegelaar, Karolina, Mattias Hagman, Robert Glinwood, Jan Pettersson, and Olof Leimar. 2012. "Ant–Aphid Mutualism: The Influence of Ants on the Aphid Summer Cycle". *Oikos* 121(1):61–66. doi: <https://doi.org/10.1111/j.1600-0706.2011.19387.x>.
- 396 | Zheng, Zhou, Mengqin Zhao, Zhijun Zhang, Xin Hu, Yang Xu, and Cong Wei. 2022. "Lactic Acid Bacteria Are Prevalent in the Infrabuccal Pockets and Crops of Ants That Prefer Aphid Honeydew". *Front. Microbiol.* 12(January):1–17. doi: 10.3389/fmicb.2021.785016.
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Species of Aphids Found in Ornamental and Wild Plants in Highland, Pagar Alam, South Sumatra

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Abstract

Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of aphids found in ornamental plants and the wild plants. This study revealed that 15 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis erysimi*.

Keywords: aphids, ornamental plants, wild plants

Introduction

Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy & Stroyan, 1959). One species of aphids can host more than 400 species from 40 families (Blackman & Eastop, 2000). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhawe et al., 2020). A single species of aphids can act as a vector for over 150 viruses (Blackman & Eastop, 2000). In tropical areas, aphids can always be found throughout the year due to their parthenogenetic nature of reproduction (Blackman & Eastop, 2017). Aphids consume plant sap, which can deplete essential nutrients for healthy growth (Müller et al., 2001). Moreover, when aphids transmit viral diseases from one plant to another, this can further weaken and stunt the growth of infected plants (Jones, 2022). According to Kinley et al. (2021), aphids cause yield losses directly (35 - 40%) by sucking the plant sap or indirectly (20 - 80%) through viral transmission. Therefore, aphid infestations can have adverse effects on crop yields and overall plant health (Sarwan Kumar, 2019).

Due to their function as vectors, the presence of aphids on a plant can be highly damaging (Jaouannet et al., 2014). They feed by piercing the plant's tissues and consuming its sap, which can reduce the plant's growth and productivity, ultimately leading to weakness and possible death (Chandel et al., 2022). Additionally, as vectors, aphids can transmit a variety of plant diseases. They are as carriers for various plant viruses, and when they move from infected to healthy plants, these viruses can rapidly spread and cause extensive damage (Guo et al., 2019). In addition, the honeydew that aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh & Singh, 2021). Therefore, it is crucial to control aphid populations in gardens and crops.

Understanding the species diversity of aphids is fundamental to effective aphid control, as it facilitates the development of measures to keep their populations in check. In addition, understanding the diversity of aphid species can provide valuable insights into potential plant diseases, as different aphid species carry distinct viruses. Methods used to control aphids often encompass various techniques, including the use of natural enemies such as predators (like ladybugs, lacewings, and parasitic wasps) (Singh & Singh, 2021; Völkl et al., 2023), parasitoids (Boivin et al., 2012), entomopathogens (Hullé et al., 2020), the use of essential oils as botanical pesticides to control aphids (Ikbal & Pavela, 2019), and crop rotation techniques (Degani et al., 2019). Regular monitoring of aphid populations and diversity can help in detecting when population sizes may be reaching harmful levels, allowing for prompt implementation of the necessary countermeasures.

According to Irsan *et al.* (1998), many aphid species were found on plants that were not their actual hosts. Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al., 2020). An alternative host can also be a collateral host belonging to the same plant family as the primary host, helping crop pests to survive when the primary hosts are unavailable (Sileshi et al., 2008). These secondary hosts may offer less adequate nutrition for insects (Capinera, 2005). However, they may provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al., 2021). According to Liu et al. (2017), since hibiscus serves as an overwintering host for cotton-specialized aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during times of food shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin et al., 2010). They maintain a cycle of host alternation, shifting between their primary hosts (typically a woody

plant) and secondary hosts (often herbaceous plants) (Moran, 1992). Weeds pose a continuous threat in both cropped and non-crop areas, providing food, shelter and reproductive sites for various pest organisms (Kumar et al., 2021). This indicates that weeds can serve as alternative hosts for aphids.

A study of aphid species on horticultural plants has been conducted (Maharani et al., 2018). However, information about aphid species on ornamental and wild plants has not received as much attention and remains largely unexplored. In South Sumatra, particularly in the highland areas like Pagaralam, there are numerous ornamental and native plants. The research on the diversity of aphid species in ornamental and wild plants has received little attention. Therefore, this study was conducted in Pagaralam, a highland region of South Sumatra, with the aim of obtaining information on the diversity of aphid species found in ornamental and wild plants. The findings from this study can serve as a valuable resource for aphid management.

Methods

The field research employed a purposive and direct observation approach to inventory cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing fruit, vegetable, and ornamental varieties, as well as wild plants or weeds. The collection and identification of host plants, aphids, and their natural enemies involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. Any plants colonized by aphids were documented as aphid hosts. Aphids, along with their natural enemies within the aphid colonies, were systematically collected. All components of the collected observations were then identified.

Guidelines for finding host plants were written by Blackman & Eastop (1994, 2000; Irsan 1998; Kranz *et al.* 1978). Aphid identification was conducted using identification keys made by Blackman & Eastop (1994, 2000); Heie (1992, 1994, 1995); Irsan (1998); Kranz *et al.* (1978); Martin (1983). Identification of aphid species took place in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on morphological characteristics. The host plants were identified based on identification keys made by van Steenis (1988). The location and size of aphid colonies, morphology of aphids including their shape and color, as well as any symptoms observed in the host plants were recorded, and photographs of the aphid colonies and their host plants were taken.

Results

The results showed that 15 aphid species were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipapis erysimi*. Based on the observation, these aphids were found on various ornamental plants (Table 1). The primary colony locations were generally in flowers, and this study documented these colony locations in ornamental plants (Figure 1).

Table 1: Aphid species found in ornamental plants and their colony locations

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Sitobion luteum</i>	flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	flower
3	<i>Caladium</i> sp.	<i>Pentalonia</i> sp.	flower
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	flower
5	<i>Canna indica</i>	<i>Pentalonia nigronervosa</i>	flower
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	flower
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	flower
9	<i>Cosmos caudatus</i>	<i>Uroleucon</i> sp.	flower
10	<i>Dahlia Kelvin</i>	<i>Aphis gossypii</i>	flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	flower
13	<i>Helianthus</i> sp.	<i>Aphis glycines</i> <i>Hyperomyzus</i> sp.	flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	flower
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	flower
20	<i>Spondiras dulcissoland</i>	<i>Aphis citricola</i> <i>Hysteroneura setariae</i>	flower

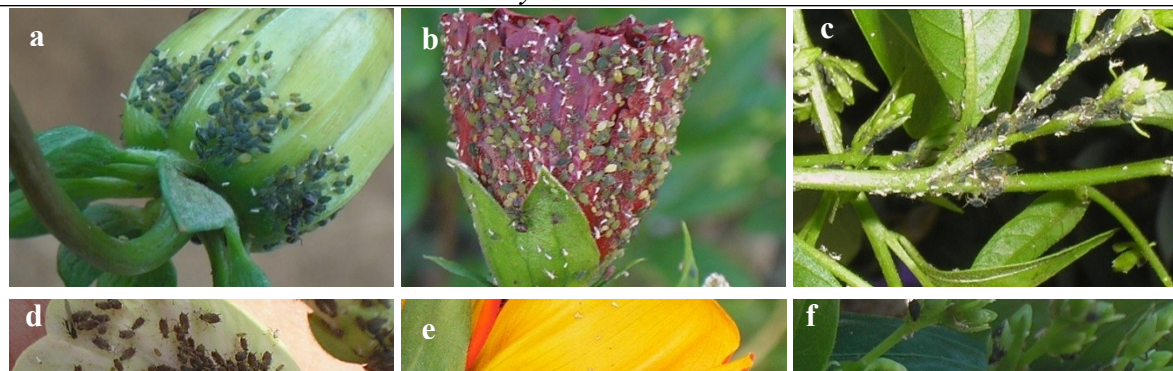


Fig 1. The location of aphid colonization on various plant parts. a) *A. gossypii* in *D. Kelvin* flower b) *A. gossypii* in *H. rosasinensis* flower c) *A. gossypii* in tuberos flower, d) *A. craccivora* in *Clitoria ternatea* flower, e) *A. citricola* in *Helianthus* sp., f) *A. aurantii* on the *M. paniculata* flower, g) *T. odinae* in the *S. dulcissoland*, h) *Uroleucon* sp. in chrysanthemums, i) *Macrosiphum rosae* in *R. indica* flower, j) *Pentalonia nigronervosa* in *C. indica* leaves

In addition, this study documented the presence of weeds, which might serve as alternative hosts for aphids (Table 2). The location of aphid colonies also varied, namely on flowers, stalks, plant tops, young leaves and old leaves of wild plants (Figure 2). The presence of specific plants or host plants within a habitat influenced the types of aphids found. Many aphid species are found on a broad range of plants or host plants, while others are highly specialized and are only found on specific plants or host plants. This is closely related to the polyphagous, oligophagous or monophagous nature of aphids (Blackman & Eastop 2000).

Table 2: Species of aphids found in wild plants and their colony locations.

No	Host Plant	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	<i>Aphis gossypii</i>	Shoots, buds
3	<i>Alternanthera sessilis</i>	<i>Aphis gossypii</i>	Shoots, buds
4	<i>Amaranthus gracilis</i>	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
6	<i>Croton hirtus</i>	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
8	<i>Cyperus rotundus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	<i>Hysteronura setariae</i>	Flower, flower stalks
11	<i>Echinochloa crusgali</i>	<i>Hiperomyzus</i> sp.	Young leaves, old leaves
12	<i>Ecliptica prostrata</i>	<i>Aphis gossypii</i>	Shoots, young leaves
13	<i>Eleusin indica</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	<i>Hysteronura setariae</i>	Flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	<i>Aphis gossypii</i>	Young leaves, old leaves
17	<i>Eupotarium odoratum</i>	<i>Aphis gossypii</i> , <i>Aphis glycine</i>	Young leaves, old leaves, young twigs
18	<i>Hymenochera acutigluma</i>	<i>Hysteronura setariae</i>	Flowers, flower stalks, leaf axils
19	<i>Lagerstromea</i> Sp.	<i>Greenidea</i> sp.	Young leaves
20	<i>Lophatherum gracile</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	<i>Aphis gossypii</i>	Shoots, young leaves

No	Host Plant	Aphid species	Colony location
22	<i>Mikania mikranta</i>	<i>Aphis gossypii</i> <i>Aphis glycine</i>	Shoots, young leaves, old leaves
23	<i>Mimosa invisa</i>	<i>Aphis craccivora</i>	Shoots, pods
24	<i>Mimosa pudica</i>	<i>Aphis craccivora</i>	Shoots, pods, flowers
25	<i>Mimosa vigma</i>	<i>Aphis craccivora</i>	Shoots, pods
26	<i>Oryza rufipogon</i>	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	Old leaves, young leaves (pupus), leaf axils
27	<i>Oxonopus compressus</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, seeds
29	<i>Phyllanthus neruri</i>	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	<i>Aphis craccivora</i>	Shoots, young leaves, flower
31	<i>Physalis angulata</i>	<i>Aphis craccivora</i> , <i>A. gossypii</i>	Shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	<i>Lipapis erysimi</i>	Flower, fruit, shoots, young leaves
33	<i>Sida rhombifolia</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arvensis</i>	<i>Lipapis erysimi</i>	Young leaves, fruit stalks, flower, fruit

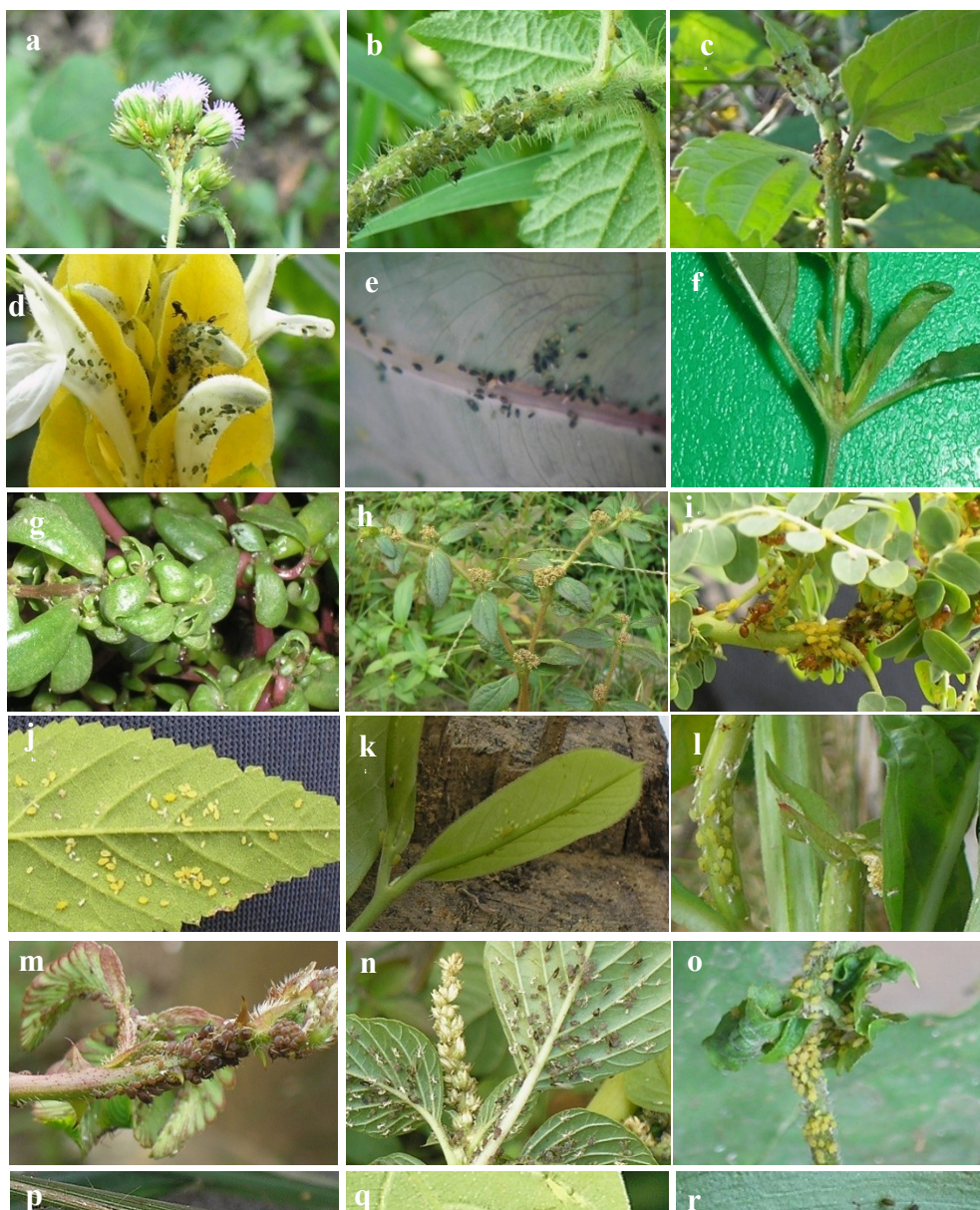


Figure 2. Aphids found on wild plants a) *A. gossypii* on the weed *Ageratum conyzoides*, b) *A. gossypii* on Croton weed *hirtus* c) *A. gossypii* on the weed *Eupatorium odoratum*, d) *A. gossypii* on plants *Pachystochys* sp., e) *A. gossypii* on plants *Caladium* sp., f) *A. gossypii* on the weed *Alternanthera sessilis*, g) *A. gossypii* in *Portulaca oleraceae* weeds, h) *A. gossypii* on the weed *Euphorbia hirta*, i) *A. citricola* on the weed *Phylantus nerruri*, j) *A. citricola* on *Sida rhombifolia* weed, k) *A. citricola* on plants *Annona muricata*, l) *A. citricola* on the weed *Ludwigia peruviana*, m) *A. craccivora* on *Mimosa pudica* weed, n) *A. craccivora* on weeds *Amaranthus gracilis*, o) *A. glycine* in *Mikania micranta* weed, p) *Hysteneura* sp. in *Eleusin* weeds, q) *Greenidae* sp. in kenidai trees (shrubs) *indica*, r) *Hyperomyzus* sp. in *Echinocloa crusgali* Weed, s) *L. erysimi* on weed *sonchus arventris*, t) *Rhopalosiphum rice* on the weed *Oryza rufipogon*, u) *Rhopalosiphum Maidis* on the weed *Oryza rufipogon*.

Discussion

The plant species or host plant influences the distribution of aphids. There are aphid species that can be found on a wide range of host plants, which is closely related to the polyphagous nature of aphids, allowing them to colonize many different species of host plants. Host plants can also affect the distribution of aphids, as evidenced by the presence of aphid species exclusively found on certain host plants (Peccoud et al., 2010). But there are some species of aphids found only on one particular host and are not found on other host plants (Döring, 2014). *A. gossypii*, and *Aphis aurantii* have been found on many host plants because both aphids are classified as polyphagous aphids (Margaritopoulos et al., 2006; Piron et al., 2019).

Aphids can commonly be found infesting a variety of ornamental plants. They are attracted to these plants due to the rich nutrient content in the plant sap (Wäckers & Van Rijn, 2012). In this present study, some aphid species were found on some ornamental plants in Pagaralam. The location of aphid colonization on the plants varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and on newly emerging leaves. The aphids displayed brown and black coloration. The aphid colonies found were small, and the colonized plant parts showed no signs of disease. The identification results showed that the

aphids were *Neotoxoptera* sp., and notably, they were not associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The identification results showed that the aphids were *Uroleucon* sp., and they were associated with ants.

On the *Brugmansia suaveolens* (angel's trumpet), *M. persicae* were found on the undersides of old leaves or leaves that have started to turn yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. (taro) was found one species of aphids: *A. gossypii*. The aphids formed colonies under the surface of young and older leaves. The occupied leaf areas did not display severe symptoms. The aphids were yellow green to dark green. The wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black in color. The colonies of *T. aurantii* were found to be associated with black ants.

Aphids on *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body. The identification results showed that the aphids were *P. nigronervosa*. The colonies of *P. nigronervosa* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and the colonized plant parts did not show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the undersides of young leaves, shoots, and within flower parts, especially between petals or flower stalks that had not fully bloomed. The colonies were quite large. The body color of aphids was green to dark green with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated with ants.

Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems and young leaves. The aphids were brown to black in color. Colonized plant parts, especially shoots and young leaves, showed stunting symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently

associated with ants. On the plant *Cosmos caudatus*, aphids were found on the flower petals. The colonies were not very large. The body color was green and light green. The identification results showed that the aphids were *A. gossypii*, and they were also associated with ants. The aphids on the *Dahlia kelvin plant* formed colonies on unopened flower buds, with a significant population among the blooming petals. The body color was green to dark green. The identification results showed that the aphids were *A. gossypii*. Aphids on *Datura metel* (amethyst) were found to form colonies on the undersides of old leaves. The aphids were medium-sized with a green body color. The colonized plant parts did not show any symptoms of disease. The identification results showed that the aphids were *Myzus ornatus*. The aphid colonies were not associated with ants. Within *Dendrobium* sp., aphid colonies were found on the young leaves. The aphids were yellow, green to dark green. The colonized plants did not show any disease symptoms. The identification results showed that the aphids were *A. gossypii*, and they were associated with ants. On *Duranta* sp. (bonsai), colonies of aphids were located on the undersides of young leaves. The colonized plant parts showed stunting symptoms. The colonies were very large. The aphids were green in color. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants.

On the *Helianthus annuus* (sunflower) plants, aphid colonies were found between the flower petals. The colonized flowers, especially the crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid colonies were not associated with ants. Within the colonies, mummified aphids that were parasitized by Aphidiidae were found.

On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Two types of aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and

slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, similar to sugar. The aphids had yellow, green or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The identification results showed that the aphids were

A. gossypii, and they were almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants.

In *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied the shoots, young leaves and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from yellow and green to a slightly darker green. Sometimes the upper surface of the wingless imago's body appeared white, resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost always associated with ants. Another species of aphids were founded and formed colonies on flower stalks that had not yet bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms of plant disease. The aphids were yellow or yellow-green, with black cauda and siphunculi. Their bodies were very small to small in size. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also frequently found in association with ants.

Two types of aphids were found on *Mussaenda frondosa*, each forming colonies in different locations. The first type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease symptoms. The aphids were yellow, green, and some with dark green. The identification results showed that the aphids were *A. gossypii*. The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could also be found on young leaves, shoots and within flower parts. The plant parts they infested showed no signs of diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had tiny to small bodies. The identification results showed that the aphids were *A. citricola*.

The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This indicated that multiple species of aphids colonized various

host plants. The aphid species colonizing these plants were generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green, yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots, flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves. They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi* aphids. These aphids were bright green, and of medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow-green to dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to red-brown. They were associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies were found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants. The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis rotundiventris* aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or buds. Small colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crussgali* or water hyacinth plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black, and formed large colonies on the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids were bright green to blackish green. The aphid colonies were also consistently associated with ants.

Eleusin indica was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H. setariae* formed colonies in flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body color ranged from red-brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis* formed colonies in the leaf axils and undersides of leaves and on leaf shoots that had not yet opened. The colonies were not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants. The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids were yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves.

Eragrostis tenella was infested by *Hysteroneura setariae* aphids. The aphids were brown to red-brown. Small colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by *Aphis gossypii*. The aphids formed colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupotarium odoratum* was colonized by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young twigs. Young leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this plant showed yellow-green to dark green in body colour. The colonies of *A. citricola* formed on the young twigs near the shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.

Hymenochera acutigluma or hair axis was colonized by *Hysteroneura setariae*, which formed colonies on the flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves, leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids

were brown to red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis* aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two species of aphids on *L. gracile* to mix.

Melastoma affine was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly emerging shoots and on newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The colonized plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony.

Mimosa invisa (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisa* plants formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots, and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were shiny black. The colonized plant parts did not show any disease symptoms.

Oryza rufipogon was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species could be distinguished by their body color. *R. maidis* appeared green with black siphunculi and cauda, while *R. rice* appeared white. The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants. *Oxonopus compressus* or *pait* grass was colonized by *Hysteroneura setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed, and they were also consistently associated with ants.

Paspalum conjugatum was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds and flower stalks. Aphids had brown to dark brown bodies. *Phylanthus niruri* was colonized by *Aphis citricola*. The colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted, and

wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large. *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants formed colonies on the undersides of leaves, especially young leaves, shoots and in flowers. The colonized plant parts became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that appeared glossy black.

Physalis angulata plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant parts did not show any symptoms of disease. *Rorippa indica* or mustard land was colonized by *Lipaphis erysimi*. The colonies formed on the flowers, fruits, flower stalks and the lower surface of leaves. The colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia* or cacabeen was colonized by *Aphis gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks and flower petals. The colonized plant parts, especially the shoots, showed curling. and the leaf edges curled downward. *Sonchus arvensis* plants were colonized by *L. erysimi*. The aphids had green to whitish green body colours, and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves. These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid infestations.

The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to grow, resulting in some parts developing normally while others become stunted (Pettersson et al., 2017). This condition could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or

stunted leaf growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to recognize through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids had colonized the plant (Tegelaar et al., 2012). Therefore, the presence of ants could serve as an indicator of the presence of aphid colonies.

Throughout their life cycle, aphids exhibited host alternation by switching between two distinct host plants (Peccoud et al., 2010). They overwintered on woody plants, reproduced in the spring, and migrated to herbaceous plants during the summer before returning to their primary host in the autumn (Yamamoto et al., 2020). This allowed aphids to maximize resource utilization, avoid congestion and competition, evade predators and parasites, circumvent plant defenses, and colonize new areas. Aphids could distribute their population efficiently, thereby avoiding overcrowding, predators and parasites, and plant defenses developing over time through host switching (Yamamoto et al., 2020). This behavior was essential for the survival and environmental adaptation of aphids.

Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new growth or reproductive parts of plants. Flowers contain nutrient-rich nature (Jakubczyk et al., 2022) and easy access to sap, therefore aphids were attractive to sap the flowers. Some aphid species were drawn to certain colors (Chittka, 2007), while others preferred different types of plants and plant parts (Sorensen, 2009). It's worth noting that different aphid species often had distinct preferences for plant ty(Harrington et al., 2007)pes and parts.

Herbs served as an alternative host for aphids in this present study. Aphids consumed sugar-rich liquid in plants, known as "sap". Aphids considered herbs and other green vegetation as abundant food sources. Aphids utilized needle-like mouthparts to penetrate plant tissues and access this fluid (Brožek et al., 2015). Numerous herbs had structural characteristics, such as folds, crevices, and concealed flowering portions (Harrington et al., 2007), that provided aphids with refuge .

Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson & Mooney, 2022). The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Detrain et al., 2010). Ants were drawn to this nutrient-rich food source and would often

'farm' aphids for it. In exchange for honeydew, ants provided aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and parasitic wasps (Karami-jamour et al., 2018). Certain species of ants would transport aphids to new host plants for improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al., 2021). Honeydew not only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain species) and provided energy for the growth of their own progeny (Biedermann & Vega, 2020).

References

- Biedermann, P. H. W., & Vega, F. E. (2020). Ecology and evolution of insect–fungus mutualisms. *Annual Review of Entomology*, *65*, 431–455.
- Blackman, R. L., & Eastop, V. F. (2000). *Aphids on the world's crops: an identification and information guide*. (Issue Ed. 2). John Wiley & Sons Ltd.
- Blackman, R. L., & Eastop, V. F. (2017). Taxonomic issues. In *Aphids as crop pests* (pp. 1–36). CABI Wallingford UK.
- Boivin, G., Hance, T., & Brodeur, J. (2012). Aphid parasitoids in biological control. *Canadian Journal of Plant Science*, *92*(1), 1–12.
- Brożek, J., Mróz, E., Wyleżek, D., Depa, Ł., & Węgierek, P. (2015). The structure of extremely long mouthparts in the aphid genus *Stomaphis* Walker (Hemiptera: Sternorrhyncha: Aphididae). *Zoomorphology*, *134*, 431–445.
- Capinera, J. L. (2005). Relationships between insect pests and weeds: an evolutionary perspective. *Weed Science*, *53*(6), 892–901.
- Chandel, R. S., Chandla, V. K., Verma, K. S., & Pathania, M. (2022). *Chapter 21 - Insect pests of potato in India: biology and management* (A. Alyokhin, S. I. Rondon, & Y. B. T.-I. P. of P. (Second E. Gao (eds.); pp. 371–400). Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-821237-0.11001-7>
- Chittka, Æ. L. (2007). *Visual ecology of aphids—a critical review on the role of colours in host finding* *Visual ecology of aphids — a critical review on the role of colours in host finding*. June 2014. <https://doi.org/10.1007/s11829-006-9000-1>
- Clarke, R., Kehoe, M. A., Broughton, S., & Jones, R. A. C. (2020). Host plant affiliations of aphid vector species found in a remote tropical environment. *Virus Research*, *281*(December 2019), 197934. <https://doi.org/10.1016/j.virusres.2020.197934>
- Degani, E., Leigh, S. G., Barber, H. M., Jones, H. E., Lukac, M., Sutton, P., & Potts, S. G. (2019). Crop rotations in a climate change scenario: short-term effects of crop diversity on resilience and ecosystem service provision under drought. *Agriculture, Ecosystems & Environment*, *285*, 106625.
- Detrain, C., Verheggen, F. J., Diez, L., Wathelet, B., & Haubruge, E. (2010). Aphid–ant mutualism: how honeydew sugars influence the behaviour of ant scouts. *Physiological Entomology*, *35*(2), 168–174.
- Döring, T. F. (2014). How aphids find their host plants, and how they don't. *Annals of Applied Biology*, *165*(1), 3–26. <https://doi.org/https://doi.org/10.1111/aab.12142>
- Gadhawe, K. R., Gautam, S., Rasmussen, D. A., & Srinivasan, R. (2020). Aphid transmission of Potyvirus: the largest plant-infecting RNA virus genus. *Viruses*, *12*(7), 773.
- Giannetti, D., Mandrioli, M., Schifani, E., Castracani, C., Spotti, F. A., Mori, A., & Grasso, D. A. (2021). First report on the acrobat ant *Crematogaster scutellaris* storing live aphids in its oak-gall nests. *Insects*, *12*(2), 108.

- Guo, H., Gu, L., Liu, F., Chen, F., Ge, F., & Sun, Y. (2019). Aphid-borne Viral Spread Is Enhanced by Virus-induced Accumulation of Plant Reactive Oxygen Species 1. *Plant Physiol*, 179(January), 143–155. <https://doi.org/10.1104/pp.18.00437>
- Harrington, R., Clark, S. J., Welham, S. J., Verrier, P. J., Denholm, C. H., Hulle, M., Maurice, D., Rounsevell, M. D., Cocu, N., & Consortium, E. U. E. (2007). Environmental change and the phenology of European aphids. *Global Change Biology*, 13(8), 1550–1564.
- Hullé, M., Chaubet, B., Turpeau, E., & Simon, J.-C. (2020). Encyclop'Aphid: A website on aphids and their natural enemies. *Entomologia Generalis*, 40(1).
- Ikbal, C., & Pavela, R. (2019). Essential oils as active ingredients of botanical insecticides against aphids. *Journal of Pest Science*, 92, 971–986.
- Jakubczyk, K., Koprowska, K., Gottschling, A., & Janda-Milczarek, K. (2022). Edible Flowers as a Source of Dietary Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement. *Nutrients*, 14(12). <https://doi.org/10.3390/nu14122470>
- Jaouannet, M., Rodriguez, P. A., Thorpe, P., Lenoir, C. J. G., & Macleod, R. (2014). Plant immunity in plant – aphid interactions. *Front Plant Sci.*, 5(December), 1–10. <https://doi.org/10.3389/fpls.2014.00663>
- Jones, R. A. C. (2022). Alteration of plant species mixtures by virus infection: Managed pastures the forgotten dimension. *Plant Pathology*, 71(6), 1255–1281.
- Jousselin, E., Gwenaëlle, G., & Armelle, C. D. A. (2010). Evolutionary lability of a complex life cycle in the aphid genus *Brachycaudus*. *BMC Evolutionary Biology*, 10(1). <https://doi.org/10.1186/1471-2148-10-295>
- Karami-jamour, T., Mirmoayedi, A., Zamani, A., & Khajehzadeh, Y. (2018). The impact of ant attendance on protecting *Aphis gossypii* against two aphidophagous predators and its role on the intraguild predation between them. *Journal of Insect Behavior*, 31, 222–239.
- Kennedy, J. S., & Stroyan, H. L. G. (1959). Biology of aphids. *Annual Review of Entomology*, 4(1), 139–160.
- Kinley, C., Banu, A. N., Raut, A. M., Wahengbam, J., & Jamtsho, T. (2021). A review on past, present and future approaches for Aphids management. *Journal of Entomological Research*, 45(2), 336–346. <https://doi.org/10.5958/0974-4576.2021.00053.0>
- Kumar, Sarwan. (2019). Aphid-Plant Interactions: Implications for Pest Management. In M. T. Oliveira, F. Candan, & A. Fernandes-Silva (Eds.), *Plant Communities and Their Environment* (p. Ch. 7). IntechOpen. <https://doi.org/10.5772/intechopen.84302>
- Kumar, Sushil, Bhowmick, M. K., & Ray, P. (2021). Weeds as alternate and alternative hosts of crop pests. *Indian Journal of Weed Science*, 53(1), 14–29. <https://doi.org/10.5958/0974-8164.2021.00002.2>
- Liu, X. D., Xu, T. T., & Lei, H. X. (2017). Refuges and host shift pathways of host-specialized aphids *Aphis gossypii*. *Scientific Reports*, 7(1), 1–9. <https://doi.org/10.1038/s41598-017-02248-4>
- Maharani, Y., Hidayat, P., Rauf, A., & Maryana, N. (2018). Short communication: New records of aphid species subfamily aphidinae (Hemiptera: Aphididae) in West Java, Indonesia. *Biodiversitas*, 19(2), 460–465. <https://doi.org/10.13057/biodiv/d190219>
- Margaritopoulos, J. T., Tzortzi, M., Zarpas, K. D., Tsitsipis, J. A., & Blackman, R. L. (2006). Morphological discrimination of *Aphis gossypii* (Hemiptera: Aphididae) populations feeding on Compositae. *Bulletin of Entomological Research*, 96(2), 153–165. <https://doi.org/10.1079/ber2005410>
- Moran, N. A. (1992). The Evolution of Aphid Life Cycles. *Annual Review of Entomology*, 37(1), 321–348. <https://doi.org/10.1146/annurev.en.37.010192.001541>
- Müller, C. B., Williams, I. S., & Hardie, J. (2001). The role of nutrition, crowding and

- interspecific interactions in the development of winged aphids. *Ecological Entomology*, 26(3), 330–340.
- Nelson, A. S., & Mooney, K. A. (2022). The evolution and ecology of interactions between ants and honeydew-producing hemipteran insects. *Annual Review of Ecology, Evolution, and Systematics*, 53, 379–402.
- Peccoud, J., Simon, J.-C., von Dohlen, C., Coeur d'acier, A., Plantegenest, M., Vanlerberghe-Masutti, F., & Jousselin, E. (2010). Evolutionary history of aphid-plant associations and their role in aphid diversification. *Comptes Rendus Biologies*, 333(6), 474–487. <https://doi.org/https://doi.org/10.1016/j.crv.2010.03.004>
- Pettersson, J., Tjallingii, W. F., & Hardie, J. (2017). Host-plant selection and feeding. In *Aphids as crop pests* (pp. 173–195). CABI Wallingford UK.
- Piron, P., de Haas, M., & Sonnemans, M. (2019). The presence of *Aphis* (Toxoptera) *aurantii* (Homoptera: Aphididae) in the Netherlands. *Entomologische Berichten*, 79(5), 162–164.
- Sileshi, G., Schroth, G., Rao, M. R., & Girma, H. (2008). Weeds, diseases, insect pests and tri-trophic interactions in tropical agroforestry. *Ecological Basis of Agroforestry*, 73–94.
- Singh, R., & Singh, G. (2021). Aphids. *Polyphagous Pests of Crops*, 105–182.
- Sorensen, J. T. (2009). *Chapter 8 - Aphids* (V. H. Resh & R. T. B. T.-E. of I. (Second E. Cardé (eds.); pp. 27–31). Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-374144-8.00008-4>
- Tegelaar, K., Hagman, M., Glinwood, R., Pettersson, J., & Leimar, O. (2012). Ant-aphid mutualism: the influence of ants on the aphid summer cycle. *Oikos*, 121(1), 61–66. <https://doi.org/https://doi.org/10.1111/j.1600-0706.2011.19387.x>
- Völkl, W., Mackauer, M., Pell, J. K., & Brodeur, J. (2023). Predators, parasitoids and pathogens. In *CABI Books*. CABI Books. <https://doi.org/10.1079/9780851998190.0187>
- Wäckers, F. ., & Van Rijn, P. . (2012). Pick and mix: selecting flowering plants to meet the requirements of target biological control insects. *Biodiversity and Insect Pests: Key Issues for Sustainable Management*, 9(April), 139–165. <https://doi.org/10.1002/9781118231838.ch9>
- Yamamoto, T., Hattori, M., & Itino, T. (2020). *Seasonal Migration in the Aphid Genus Stomaphis (Hemiptera : Aphididae) : Discovery of Host Alternation Between Woody Plants in Subfamily Lachninae*. 20. <https://doi.org/10.1093/jisesa/ieaa103>

16 October 2023

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Biodiversitas

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Thank you so much for the very kind attention and great helps provided by editorial team of Journal of Biodiversitas

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1	The Introduction has more than 700 words	The Introduction has been revised	Line 32-83
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Sincerely
Corresponding author,



Chandra Irsan

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2
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4
5 I herewith enclosed a research article,

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7 The submission has not been previously published, nor is it before another journal for consideration (or an explanation has been provided in Comments to the Editor).
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39 Title:

Species of Aphids Found in Ornamental and Wild Plants in Highland, Pagar Alam, South Sumatra

40

41 Author(s) name:

Chandra Irsan^{a*}, Erise Anggraini^{a,b}, Siti Herlinda^a, Wenny Ramadhani^c, M. Umar Harun^d,

42

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This paper described the alternative host of aphids in high land, South Sumatera. The knowledge regarding the alternative of insect pest could be beneficial resource for basic control of aphids.

56

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62

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65 **Sincerely yours,**

66 (fill in your name, no need scanned autograph)

Dr. Chandra Irsan

67
68 **Species of Aphids Found in Ornamental and Wild Plants in Highland,**
69 **Pagar Alam, South Sumatra**
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82 **Abstract**

83 Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be
84 very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported
85 about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid
86 species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of
87 aphids found in ornamental plants and the wild plants. The field research employed a purposive and direct observation
88 approach to inventory cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included
89 cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host
90 plants, and aphids, involved systematic searches for the selected plants and subsequent examination for the presence of
91 aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that 15
92 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum*
93 *rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis*
94 *glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis erysimi*.

95 **Keywords:** aphids, ornamental plants, wild plants

96 **Running title:** Aphids Found in Ornamental and Wild Plants
97

98 **INTRODUCTION**

99 Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous,
100 and monophagous characteristics (Kennedy & Stroyan, 1959). One species of aphids can host more than 400 species from
101 40 families (Bass et al., 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhavie et al.,
102 2020). Aphids can transmit 275 viruses (Ertunc, 2020). In tropical areas, aphids can always be found throughout the year
103 due to their parthenogenetic nature of reproduction (Blackman & Eastop, 2017). Aphids consume young leaves sap, which
104 can deplete essential nutrients for healthy growth (Cao et al., 2018). Moreover, when aphids transmit viral diseases from
105 one plant to another, this can further weaken and stunt the growth of infected plants (Jones, 2022). According to Kinley et
106 al. (2021), aphids cause yield losses directly (35 - 40%) by sucking the plant sap or indirectly (20 - 80%) through viral
107 transmission. Therefore, aphid infestations can have adverse effects on crop yields and overall plant health (Sarwan
108 Kumar, 2019).

109 Due to their function as vectors, the presence of aphids on a plant can be highly damaging (Jaouannet et al.,
110 2014). They feed by piercing the plant's tissues and consuming its sap, which can reduce the plant's growth and
111 productivity, ultimately leading to weakness and possible death (Chandel et al., 2022). Additionally, as vectors, aphids can
112 transmit a variety of plant diseases. They are as carriers for various plant viruses, and when they move from infected to
113 healthy plants, these viruses can rapidly spread and cause extensive damage (Guo et al., 2019). In addition, the honeydew
114 that aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's

115 leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh & Singh, 2021). Therefore, it is
116 crucial to control aphid populations in gardens and crops.

117 Understanding the species diversity of aphids is fundamental to effective aphid control, as it facilitates the
118 development of measures to keep their populations in check. In addition, understanding the diversity of aphid species can
119 provide valuable insights into potential plant diseases, as different aphid species carry distinct viruses. Methods used to
120 control aphids often encompass various techniques, including the use of natural enemies such as predators (like ladybugs,
121 lacewings, and parasitic wasps) (Singh & Singh, 2021; Völkl et al., 2023), parasitoids (Boivin et al., 2012),
122 entomopathogens (Hullé et al., 2020), the use of essential oils as botanical pesticides to control aphids (Ikbal & Pavela,
123 2019), and crop rotation techniques (Degani et al., 2019). Regular monitoring of aphid populations and diversity can help
124 in detecting when population sizes may be reaching harmful levels, allowing for prompt implementation of the necessary
125 countermeasures.

126 Many aphid species were found on plants that were not their actual hosts (Maharani et al., 2018). Aphids have
127 one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants
128 they feed on most frequently (Clarke et al., 2020). An alternative host can also be a collateral host belonging to the same
129 plant family as the primary host, helping crop pests to survive when the primary hosts are unavailable (Kumar et al.,
130 2021). These secondary hosts may offer less adequate nutrition for insects (Mo & Smilanich, 2023), However, they may
131 provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental
132 conditions (Kumar et al., 2021). According to Liu et al. (2017), since hibiscus serves as an overwintering host for cotton-
133 specialized aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during
134 times of food shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin et al., 2010). They
135 maintain a cycle of host alternation, shifting between their primary hosts (typically a woody plant) and secondary hosts
136 (often herbaceous plants) (Yamamoto et al., 2020). Weeds pose a continuous threat in both cropped and non-crop areas,
137 providing food, shelter and reproductive sites for various pest organisms (Kumar et al., 2021). This indicates that weeds
138 can serve as alternative hosts for aphids.

139 A study of aphid species on horticultural plants has been conducted (Maharani et al., 2018), However,
140 information about aphid species on ornamental and wild plants has not received as much attention and remains largely
141 unexplored. In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and
142 native plants. The research on the diversity of aphid species in ornamental and wild plants has received little attention.
143 Therefore, this study was conducted in Pagar Alam, a highland region of South Sumatra, with the aim of obtaining
144 information on the diversity of aphid species found in ornamental and wild plants. The findings from this study can serve
145 as a valuable resource for aphid management.

146 **MATERIALS AND METHODS**

147 The field research employed a purposive and direct observation approach to inventory cultivated or wild plants
148 hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing ornamental
149 plants, as well as wild plants or weeds. The collection and identification of host plants, and aphids, involved systematic
150 searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all
151 existing plant species to find those colonized by aphids. Any plants colonized by aphids were documented as aphid hosts.
152 Aphids, along with their natural enemies within the aphid colonies, were systematically collected. All components of the
153 collected observations were then identified.

154 Aphid identification was conducted using identification keys (Blackman & Eastop, 2008). Identification of aphid
 155 species took place in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on
 156 morphological characteristics. The host plants were identified using weed identification hand book (Kallas, 2010;
 157 Meuninck, 2023; Naidu, 2012). The location and size of aphid colonies, morphology of aphids including their shape and
 158 color, as well as any symptoms observed in the host plants were recorded, and photographs of the aphid colonies and their
 159 host plants were taken.

160 RESULT AND DISCUSSION

161 Result

162 The results showed that 15 aphid species were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
 163 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*,
 164 *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipapis*
 165 *erysimi*. Based on the observation, these aphids were found on various ornamental plants (Table 1). The primary colony
 166 locations were generally in flowers, and this study documented these colony locations in ornamental plants (Figure 1).

167
 168 Table 1: Aphid species found in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Sitobion luteum</i>	flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	flower
3	<i>Caladium</i> sp.	<i>Pentalonia</i> sp.	flower
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	flower
5	<i>Canna indica</i>	<i>Pentalonia nigronervosa</i>	flower
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	flower
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	flower
9	<i>Cosmos caudatus</i>	<i>Uroleucon</i> sp.	flower
10	<i>Dahlia Kelvin</i>	<i>Aphis gossypii</i>	flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	flower
13	<i>Helianthus</i> sp.	<i>Aphis glycines</i> <i>Hyperomyzus</i> sp.	flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	flower
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	flower
20	<i>Spondiras dulcissoland</i>	<i>Aphis citricola</i> <i>Hysteroneura setariae</i>	flower



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Fig 1. The location of aphid colonization on various plant parts. a) *A. gossypii* in *D. Kelvin* flower b) *A. gossypii* in *H. rosinensis* flower c) *A. gossypii* in tuberose flower, d) *A. craccivora* in *Clitoria ternatea* flower, e) *A. citricola* in *Helianthus* sp., f) *A. aurantii* on the *M. paniculata* flower, g) *T. odinae* in the *S. dulcissoland*, h) *Uroleucon* sp. in chrysanthemums, i) *Macrosiphum rosae* in *R. indica* flower, j) *Pentalonia nigronervosa* in *C. indica* leaves

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In addition, this study documented the presence of weeds, which might serve as alternative hosts for aphids (Table 2). The location of aphid colonies also varied, namely on flowers, stalks, plant tops, young leaves and old leaves of wild plants (Figure 2). The presence of specific plants or host plants within a habitat influenced the types of aphids found. Many aphid species are found on a broad range of plants or host plants, while others are highly specialized and are only found on specific plants or host plants. This is closely related to the polyphagous, oligophagous or monophagous nature of aphids (Blackman & Eastop 2000).

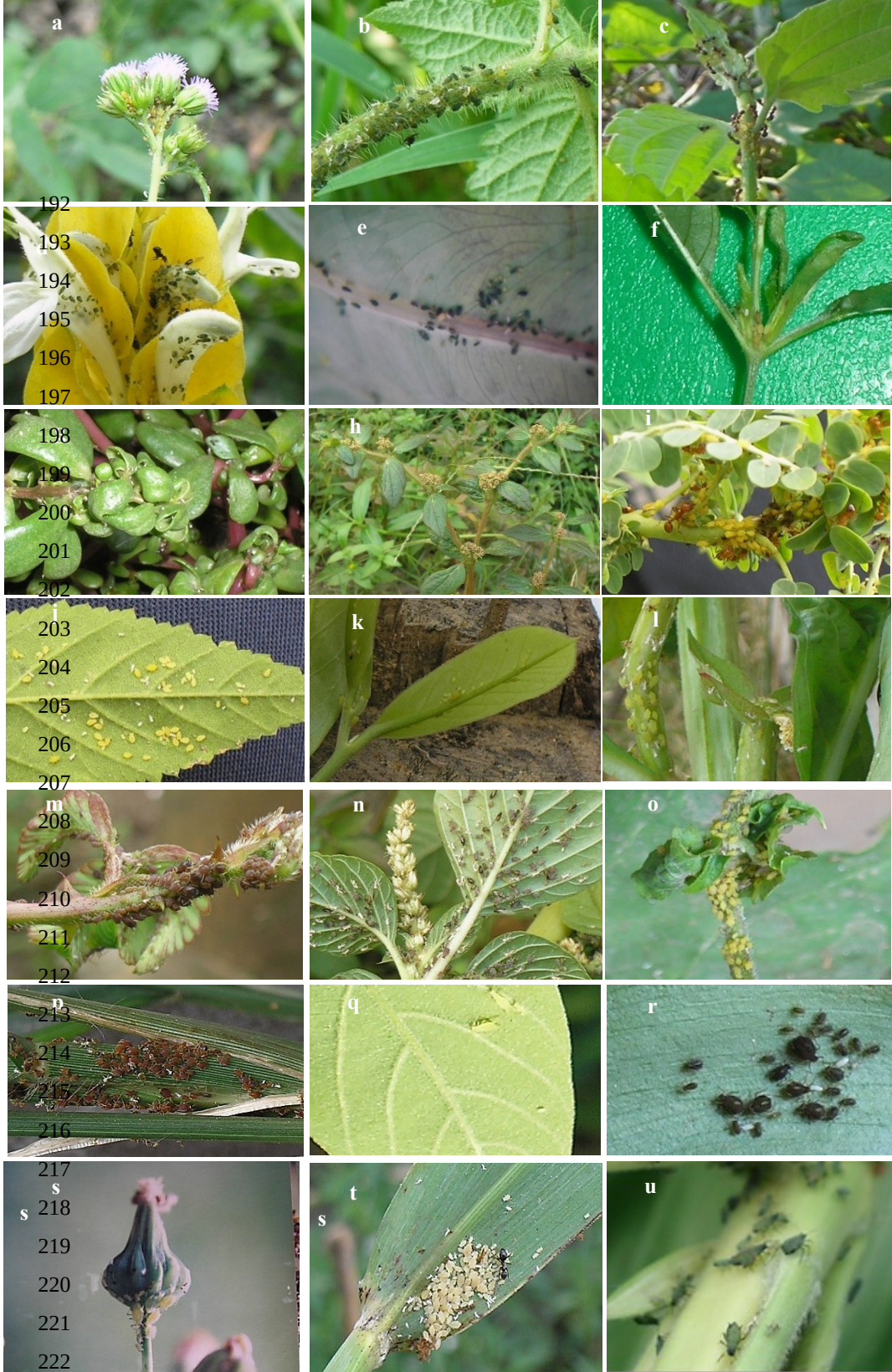
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191 Table 2: Species of aphids found in wild plants and their colony locations.

No	Host Plant	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	<i>Aphis gossypii</i>	Shoots, buds
3	<i>Alternanthera sessilis</i>	<i>Aphis gossypii</i>	Shoots, buds
4	<i>Amaranthus gracilis</i>	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
6	<i>Croton hirtus</i>	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
8	<i>Cyperus rotundus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	<i>Hysteronura setariae</i>	Flower, flower stalks
11	<i>Echinochloa crusgali</i>	<i>Hiperomyzus</i> sp.	Young leaves, old leaves
12	<i>Ecliptica prostrata</i>	<i>Aphis gossypii</i>	Shoots, young leaves
13	<i>Eleusin indica</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	<i>Hysteronura setariae</i>	Flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	<i>Aphis gossypii</i>	Young leaves, old leaves
17	<i>Eupotarium odoratum</i>	<i>Aphis gossypii</i> , <i>Aphis glycine</i>	Young leaves, old leaves, young twigs
18	<i>Hymenochera acutigluma</i>	<i>Hysteronura setariae</i>	Flowers, flower stalks, leaf axils
19	<i>Lagerstromea</i> Sp.	<i>Greenidea</i> sp.	Young leaves
20	<i>Lophatherum gracile</i>	<i>Hysteronura setariae</i> <i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	<i>Aphis gossypii</i>	Shoots, young leaves
22	<i>Mikania mikranta</i>	<i>Aphis gossypii</i> <i>Aphis glycine</i>	Shoots, young leaves, old leaves
23	<i>Mimosa invisa</i>	<i>Aphis craccivora</i>	Shoots, pods
24	<i>Mimosa pudica</i>	<i>Aphis craccivora</i>	Shoots, pods, flowers
25	<i>Mimosa vigra</i>	<i>Aphis craccivora</i>	Shoots, pods
26	<i>Oryza rufipogon</i>	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	Old leaves, young leaves (pupus), leaf axils
27	<i>Oxonopus compressus</i>	<i>Hysteronura setariae</i>	Flower, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	<i>Hysteronura setariae</i>	Flower, flower stalk, seeds
29	<i>Phyllanthus neruri</i>	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	<i>Aphis craccivora</i>	Shoots, young leaves, flower
31	<i>Physalis angulata</i>	<i>Aphis craccivora</i> , <i>A. gossypii</i>	Shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	<i>Lipapis erysimi</i>	Flower, fruit, shoots, young leaves
33	<i>Sida rhombifolia</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arventris</i>	<i>Lipapis erysimi</i>	Young leaves, fruit stalks, flower, fruit



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230 Figure 2. Aphids found on wild plants a) *A. gossypii* on the weed *Ageratum conyzoides*, b) *A. gossypii* on Croton weed *hirtus* c) *A.*
231 *gossypii* on the weed *Eupatorium odoratum*, d) *A.gossypii* on plants *Pachystochys* sp., e) *A.gossypii* on plants *Caladium* sp., f) *A.*
232 *gossypii* on the weed *Alternanthera sessilis*, g) *A.gossypii* in *Portulaca oleraceae* weeds, h) *A.gossypii* on the weed *Euphorbia hirta*, i)
233 *A. citricola* on the weed *Phyllanthus nerruri*, j) *A. citricola* on *Sida rhombifolia* weed, k) *A. citricola* on plants *Annona muricata*, l)

234 *A. citricola* on the weed *Ludwigia peruviana*, m) *A. craccivora* on *Mimosa pudica* weed, n) *A. craccivora* on weeds *Amaranthus gracilis*,
235 o) *A. glycine* in *Mikania micranta* weed, p) *Hysteneura* sp. in *Eleusin* weeds, q) *Greenidae* sp. in kenidai trees (shrubs) *indica*,
236 r) *Hyperomyzus* sp. in *Echinocloa crusgali* Weed, s) *L. erysimi* on weed *sonchus arventris*, t) *Rhopalosiphum* rice on the weed *Oryza*
237 *rufipogon*, u) *Rhopalosiphum* *Maidis* on the weed *Oryza rufipogon*.

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Discussion

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The plant species or host plant influences the distribution of aphids. There are aphid species that can be found on a wide range of host plants, which is closely related to the polyphagous nature of aphids, allowing them to colonize many different species of host plants. Host plants can also affect the distribution of aphids, as evidenced by the presence of aphid species exclusively found on certain host plants (Santiago et al., 2017). But there are some species of aphids found only on one particular host and are not found on other host plants (Döring, 2014). *A. gossypii*, and *Aphis aurantii* have been found on many host plants because both aphids are classified as polyphagous aphids (Alotaibi et al., 2023).

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Aphids can commonly be found infesting a variety of ornamental plants. They are attracted to these plants due to the rich nutrient content in the plant sap (Braham et al., 2023). In this present study, some aphid species were found on some ornamental plants in Pagaralam. The location of aphid colonization on the plants varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and on newly emerging leaves. The aphids displayed brown and black coloration. The aphid colonies found were small, and the colonized plant parts showed no signs of disease. The identification results showed that the aphids were *Neotoxoptera* sp., and notably, they were not associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The identification results showed that the aphids were *Uroleucon* sp., and they were associated with ants.

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On the *Brugmansia suaveolens*, *M. persicae* were found on the undersides of old leaves or leaves that have started to turn yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. (taro) was found one species of aphids: *A. gossypii*. The aphids formed colonies under the surface of young and older leaves. The occupied leaf areas did not display severe symptoms. The aphids were yellow green to dark green. The wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black in color. The colonies of *T. aurantii* were found to be associated with black ants.

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Aphids on *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body. The identification results showed that the aphids were *P. nigronevosa*. The colonies of *P. nigronevosa* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and the colonized plant parts did not show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the undersides of young leaves, shoots, and within flower parts, especially between petals or flower stalks that had not fully bloomed. The colonies were quite large. The body color of aphids was green to dark green with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated with ants.

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Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems and young leaves. The aphids were brown to black in color. Colonized plant parts, especially shoots and young leaves, showed stunting

276 symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently
277 associated with ants. On the plant *Cosmos caudatus*, aphids were found on the flower petals. The colonies were not very
278 large. The body color was green and light green. The identification results showed that the aphids were *A. gossypii*, and
279 they were also associated with ants. The aphids on the *Dahlia kelvin plant* formed colonies on unopened flower buds, with
280 a significant population among the blooming petals. The body color was green to dark green. The identification results
281 showed that the aphids were *A. gossypii*. Aphids on *Datura metel* (amethyst) were found to form colonies on the
282 undersides of old leaves. The aphids were medium sized with a green body color. The colonized plant parts did not show
283 any symptoms of disease. The identification results showed that the aphids were *Myzus ornatus*. The aphid colonies were
284 not associated with ants. Within *Dendrobium* sp., aphid colonies were found on the young leaves. The aphids were yellow,
285 green to dark green. The colonized plants did not show any disease symptoms. The identification results showed that the
286 aphids were *A. gossypii*, and they were associated with ants. On *Duranta* sp. (bonsai), colonies of aphids were located on
287 the undersides of young leaves. The colonized plant parts showed stunting symptoms. The colonies were very large. The
288 aphids were green in color. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were
289 consistently associated with ants.

290 On the *Helianthus annuus* (sunflower) plants, aphid colonies were found between the flower petals. The
291 colonized flowers, especially the crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in
292 color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies
293 were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies
294 were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease
295 symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid colonies were not associated with
296 ants. Within the colonies, mummified aphids that were parasitized by Aphidiidae were found.

297 On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark green were found. The aphids formed
298 colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large.
299 The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with
300 ants. Two types of aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the
301 undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The
302 occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and
303 slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, similar to sugar. The aphids had
304 yellow, green, or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The
305 identification results showed that the aphids were *A. gossypii*, and they were almost always associated with ants. The
306 second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could
307 also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs
308 of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The
309 identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants.

310 In *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied the shoots, young leaves
311 and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from
312 yellow and green to a slightly darker green. Sometimes the upper surface of the wingless imago's body appeared white,
313 resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost
314 always associated with ants. Another species of aphids was founded and formed colonies on flower stalks that had not yet
315 bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms

316 of plant disease. The aphids were yellow or yellow green, with black cauda and siphunculi. Their bodies were very small
317 to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also
318 frequently found in association with ants.

319 Two types of aphids were found on *Mussaenda frondosa*, each forming colonies in different locations. The first
320 type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease
321 symptoms. The aphids were yellow, green, and some with dark green. The identification results showed that the aphids
322 were *A. gossypii*. The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as
323 if piled up. The aphid colonies could also be found on young leaves, shoots and within flower parts. The plant parts they
324 infested showed no signs of diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had
325 tiny to small bodies. The identification results showed that the aphids were *A. citricola*.

326 The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids.
327 This indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
328 generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
329 colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
330 yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized
331 by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging
332 from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots,
333 flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus*
334 *gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves.
335 They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with
336 both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi* aphids. These aphids were bright green, and of
337 medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies
338 were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow-green to
339 dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon*
340 *dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks
341 and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to red-brown. They were
342 associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies were
343 found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants.
344 The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis rotundiventris*
345 aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or buds. Small
346 colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on
347 the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crussgali* or water hyacinth
348 plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large colonies on
349 the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica*
350 *prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids
351 were bright green to blackish green. The aphid colonies were also consistently associated with ants.

352 *Eleusin indica* was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H.*
353 *setariae* formed colonies in flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body
354 color ranged from red brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis*
355 formed colonies in the leaf axils and undersides of leaves and on leaf shoots that had not yet opened. The colonies were

356 not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These
357 aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants.
358 The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids were
359 yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves.

360 *Eragrostis tenella* was infested by *Hysteroneura setariae* aphids. The aphids were brown to red brown. Small
361 colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae*
362 were consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by *Aphis gossypii*. The aphids formed
363 colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in
364 color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupotarium odoratum* was colonied
365 by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young
366 twigs. Young leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this
367 plant showed yellow-green to dark green in body colour. The colonies of *A. citricola* formed on the young twigs near the
368 shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of
369 both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.

370 *Hymenochera acutigluma* or hair axis was colonized by *Hysteroneura setariae*, which formed colonies on the
371 flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or
372 *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with
373 thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not
374 show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of aphids:
375 *hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves,
376 leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were brown to
377 red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis*
378 aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two species
379 of aphids on *L. gracile* to mix.

380 *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly
381 emerging shoots and on newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The
382 colonized plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis*
383 *glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and
384 curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were
385 light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a
386 single colony.

387 *Mimosa invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisa* plants
388 formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa*
389 *pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots,
390 and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the
391 colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of
392 aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were
393 shiny black. The colonized plant parts did not show any disease symptoms.

394 *Oryza rufipogon* was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both
395 aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species

396 could be distinguished by their body color. *R. maidis* appeared green with black sifunculi and cauda, while *R. rice*
397 appeared white. The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants.
398 *Oxonopus compressus* or *pait* grass was colonized by *Hysteronadura setariae* aphids. The colonies occupied flowers, flower
399 stalks, seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed,
400 and they were also consistently associated with ants.

401 *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the
402 seeds and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus niruri* was colonized by *Aphis citricola*. The
403 colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted,
404 and wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large.
405 *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants
406 formed colonies on the undersides of leaves, especially young leaves, shoots and in flowers. The colonized plant parts
407 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
408 appeared glossy black.

409 *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with
410 glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant
411 parts did not show any symptoms of disease. *Rorippa indica* or mustard land was colonized by *Lipaphis erysimi*. The
412 colonies formed on the flowers, fruits, flower stalks and the lower surface of leaves. The colonized plant parts showed
413 symptoms such as curling and stunting. *Sida rhombifolia* or cacabean was colonized by *Aphis gossypii*. The aphids had
414 green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks and flower petals. The
415 colonized plant parts, especially the shoots, showed curling, and the leaf edges curled downward. *Sonchus arvensis* plants
416 were colonized by *L. erysimi*. The aphids had green to whitish green body colours, and the colonies formed on flower
417 stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

418 In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
419 displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants
420 caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves.
421 These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show
422 symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum
423 growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that
424 did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the
425 leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid
426 infestations.

427 The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a
428 cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to
429 grow, resulting in some parts developing normally while others become stunted (Pettersson et al., 2017). This condition
430 could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or stunted leaf
431 growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any
432 distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed
433 from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to recognize
434 through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids

435 had colonized the plant (Tegelaar et al., 2012). Therefore, the presence of ants could serve as an indicator of the presence
436 of aphid colonies.

437 Throughout their life cycle, aphids exhibited host alternation by switching between two distinct host plants
438 (Yamamoto et al., 2020). They overwintered on woody plants, reproduced in the spring, and migrated to herbaceous plants
439 during the summer before returning to their primary host in the autumn (Yamamoto et al., 2020). This allowed aphids to
440 maximize resource utilization, avoid congestion and competition, evade predators and parasites, circumvent plant
441 defenses, and colonize new areas. Aphids could distribute their population efficiently, thereby avoiding overcrowding,
442 predators and parasites, and plant defenses developing over time through host switching (Yamamoto et al., 2020). This
443 behavior was essential for the survival and environmental adaptation of aphids.

444 Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new
445 growth or reproductive parts of plants. Flowers contain a nutrient-rich nature and easy access to sap, therefore aphids were
446 attractive to sap the flowers. Some aphid species were drawn to certain colors (Jakubczyk et al., 2022). Herbs served as an
447 alternative host for aphids in this present study. Aphids consume sugar-rich liquid in plants, known as "sap". Aphids
448 considered herbs and other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate
449 plant tissues and access this fluid (Brožek et al., 2015). Several aphids colonized herbs such as Indian mustards, *Lipaphis*
450 *erysimi*, and *Myzus persicae* are the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al.,
451 2022).

452 Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a
453 delicious substance known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson &
454 Mooney, 2022). The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Zheng et al.,
455 2022). Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for honeydew,
456 ants provided aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and parasitic
457 wasps (Karami-jamour et al., 2018). Certain species of ants would transport aphids to new host plants for improved
458 foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al., 2021). Honeydew not only
459 nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
460 species) and provided energy for the growth of their own progeny (Biedermann & Vega, 2020).

461 CONCLUSION

462 15 species of aphids were found in ornamental and wild plants in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
463 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia*
464 *nigronevosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus*
465 sp. *Lipaphis erysimi*.

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470 REFERENCES

- 471 Alotaibi, N. J., Alsufyani, T., M'sakni, N. H., Almalki, M. A., Alghamdi, E. M., & Spiteller, D. (2023). Rapid
472 Identification of Aphid Species by Headspace GC-MS and Discriminant Analysis. *Insects*, *14*(589).
473 <https://doi.org/https://doi.org/10.3390/insects14070589>
474 Bass, C., Puinean, A. M., Zimmer, C. T., Denholm, I., Field, L. M., Foster, S. P., Gutbrod, O., Nauen, R., Slater, R., &
475 Williamson, M. S. (2014). The evolution of insecticide resistance in the peach potato aphid, *Myzus persicae*. *Insect*
476 *Biochemistry and Molecular Biology*, *51*, 41–51. <https://doi.org/10.1016/j.ibmb.2014.05.003>

- 477 Biedermann, P. H. W., & Vega, F. E. (2020). Ecology and evolution of insect–fungus mutualisms. *Annual Review of*
478 *Entomology*, 65, 431–455. <https://doi.org/https://doi.org/10.1146/annurev-ento-011019-024910>
- 479 Blackman, R. L., & Eastop, V. F. (2008). *Aphids on the world's herbaceous plants and shrubs, 2 volume set*. John Wiley
480 & Sons.
- 481 Blackman, R. L., & Eastop, V. F. (2017). Taxonomic issues. In *Aphids as crop pests* (pp. 1–36). CABI Wallingford UK.
- 482 Boivin, G., Hance, T., & Brodeur, J. (2012). Aphid parasitoids in biological control. *Canadian Journal of Plant Science*,
483 92(1), 1–12. <https://doi.org/DOI: 10.4141/cjps2011-045>
- 484 Braham, M., Boulahia-kheder, S., Kahia, M., & Nourira, S. (2023). Aphids and citrus responses to nitrogen fertilization.
485 *Journal of the Saudi Society of Agricultural Sciences*, 22(6), 374–383. <https://doi.org/10.1016/j.jssas.2023.03.003>
- 486 Brożek, J., Mróz, E., Wylężek, D., Depa, Ł., & Węgierek, P. (2015). The structure of extremely long mouthparts in the
487 aphid genus *Stomaphis* Walker (Hemiptera: Sternorrhyncha: Aphididae). *Zoomorphology*, 134, 431–445.
488 <https://doi.org/https://doi.org/10.1007/s00435-015-0266-7>
- 489 Cao, H., Zhang, Z., Wang, X., & Liu, T. (2018). Nutrition versus defense : Why *Myzus persicae* (green peach aphid)
490 prefers and performs better on young leaves of cabbage. *PloS One*, 13(4), 1–16.
491 <https://doi.org/https://doi.org/10.1371/journal.pone.0196219>
- 492 Chandel, R. S., Chandla, V. K., Verma, K. S., & Pathania, M. (2022). Chapter 21 - Insect pests of potato in India: biology
493 and management (A. Alyokhin, S. I. Rondon, & Y. B. T.-I. P. of P. (Second E. Gao (eds.); pp. 371–400). Academic
494 Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-821237-0.11001-7>
- 495 Clarke, R., Kehoe, M. A., Broughton, S., & Jones, R. A. C. (2020). Host plant a ffi liations of aphid vector species found
496 in a remote tropical environment. *Virus Research*, 281(December 2019), 197934.
497 <https://doi.org/10.1016/j.virusres.2020.197934>
- 498 Degani, E., Leigh, S. G., Barber, H. M., Jones, H. E., Lukac, M., Sutton, P., & Potts, S. G. (2019). Crop rotations in a
499 climate change scenario: short-term effects of crop diversity on resilience and ecosystem service provision under
500 drought. *Agriculture, Ecosystems & Environment*, 285, 106625.
501 <https://doi.org/https://doi.org/10.1016/j.agee.2019.106625>
- 502 Döring, T. F. (2014). How aphids find their host plants, and how they don't. *Annals of Applied Biology*, 165(1), 3–26.
503 <https://doi.org/https://doi.org/10.1111/aab.12142>
- 504 Ertunc, F. (2020). Chapter 46 - Emerging Plant Viruses (M. M. B. T.-E. and R. V. P. Ennaji (ed.); pp. 1041–1062).
505 Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-819400-3.00046-6>
- 506 Gadhve, K. R., Gautam, S., Rasmussen, D. A., & Srinivasan, R. (2020). Aphid transmission of Potyvirus: the largest
507 plant-infecting RNA virus genus. *Viruses*, 12(7), 773. <https://doi.org/doi: 10.3390/v12070773>
- 508 Giannetti, D., Mandrioli, M., Schifani, E., Castracani, C., Spotti, F. A., Mori, A., & Grasso, D. A. (2021). First report on
509 the acrobat ant *Crematogaster scutellaris* storing live aphids in its oak-gall nests. *Insects*, 12(2), 108.
510 <https://doi.org/https://doi.org/10.3390/insects12020108>
- 511 Guo, H., Gu, L., Liu, F., Chen, F., Ge, F., & Sun, Y. (2019). Aphid-borne Viral Spread Is Enhanced by Virus-induced
512 Accumulation of Plant Reactive Oxygen Species 1. *Plant Physiol*, 179(January), 143–155.
513 <https://doi.org/10.1104/pp.18.00437>
- 514 Hullé, M., Chaubet, B., Turpeau, E., & Simon, J.-C. (2020). Encyclop'Aphid: A website on aphids and their natural
515 enemies. *Entomologia Generalis*, 40(1). <https://doi.org/DOI: 10.1127/entomologia/2019/0867>
- 516 Ikbāl, C., & Pavela, R. (2019). Essential oils as active ingredients of botanical insecticides against aphids. *Journal of Pest*
517 *Science*, 92, 971–986. <https://doi.org/DOI: 10.1007/s10340-019-01089-6>
- 518 Jakubczyk, K., Koprowska, K., Gottschling, A., & Janda-Milczarek, K. (2022). Edible Flowers as a Source of Dietary
519 Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement. *Nutrients*, 14(12).
520 <https://doi.org/10.3390/nu14122470>
- 521 Jaouannet, M., Rodriguez, P. A., Thorpe, P., Lenoir, C. J. G., & Macleod, R. (2014). Plant immunity in plant – aphid
522 interactions. *Front Plant Sci.*, 5(December), 1–10. <https://doi.org/10.3389/fpls.2014.00663>
- 523 Jayaswal, D., Mainkar, P., Kumar, K., Agarwal, Y., & Prabha, R. (2022). Pyramiding and evaluation of segregating lines
524 containing lectin and protease inhibitor genes for aphid resistance in Brassica juncea. *Indian Journal of Biochemistry*
525 *& Biophysics*, 59(August), 800–807. <https://doi.org/10.56042/ijbb.v59i8.62319>
- 526 Jones, R. A. C. (2022). Alteration of plant species mixtures by virus infection: Managed pastures the forgotten dimension.
527 *Plant Pathology*, 71(6), 1255–1281. <https://doi.org/DOI: 10.1111/ppa.13571>
- 528 Jousset, E., Gwenaelle, G., & Armelle, C. D. A. (2010). Evolutionary lability of a complex life cycle in the aphid genus
529 *Brachycaudus*. *BMC Evolutionary Biology*, 10(1). <https://doi.org/10.1186/1471-2148-10-295>
- 530 Kallas, J. (2010). *Edible wild plants*. Gibbs Smith.
- 531 Karami-jamour, T., Mirmoayedi, A., Zamani, A., & Khajehzadeh, Y. (2018). The impact of ant attendance on protecting
532 *Aphis gossypii* against two aphidophagous predators and it's role on the intraguild predation between them. *Journal*
533 *of Insect Behavior*, 31, 222–239. <https://doi.org/DOI: 10.1007/s10905-018-9670-4>
- 534 Kennedy, J. S., & Stroyan, H. L. G. (1959). Biology of aphids. *Annual Review of Entomology*, 4(1), 139–160.
- 535 Kinley, C., Banu, A. N., Raut, A. M., Wahengbam, J., & Jamtsho, T. (2021). A review on past, present and future
536 approaches for Aphids management. *Journal of Entomological Research*, 45(2), 336–346.

537 <https://doi.org/10.5958/0974-4576.2021.00053.0>

538 Kumar, Sarwan. (2019). Aphid-Plant Interactions: Implications for Pest Management. In M. T. Oliveira, F. Candan, & A.

539 Fernandes-Silva (Eds.), *Plant Communities and Their Environment* (p. Ch. 7). IntechOpen.

540 <https://doi.org/10.5772/intechopen.84302>

541 Kumar, Sushil, Bhowmick, M. K., & Ray, P. (2021). Weeds as alternate and alternative hosts of crop pests. *Indian Journal*

542 *of Weed Science*, 53(1), 14–29. <https://doi.org/10.5958/0974-8164.2021.00002.2>

543 Liu, X. D., Xu, T. T., & Lei, H. X. (2017). Refuges and host shift pathways of host-specialized aphids *Aphis gossypii*.

544 *Scientific Reports*, 7(1), 1–9. <https://doi.org/10.1038/s41598-017-02248-4>

545 Maharani, Y., Hidayat, P., Rauf, A., & Maryana, N. (2018). Short communication: New records of aphid species

546 subfamily aphidinae (Hemiptera: Aphididae) in West Java, Indonesia. *Biodiversitas*, 19(2), 460–465.

547 <https://doi.org/10.13057/biodiv/d190219>

548 Margaritopoulos, J. T., Tzortzi, M., Zarpas, K. D., Tsitsipis, J. A., & Blackman, R. L. (2006). Morphological

549 discrimination of *Aphis gossypii* (Hemiptera: Aphididae) populations feeding on Compositae. *Bulletin of*

550 *Entomological Research*, 96(2), 153–165. <https://doi.org/10.1079/ber2005410>

551 Meuninck, J. (2023). *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.

552 Mo, C., & Smilanich, A. M. (2023). Feeding on an exotic host plant enhances plasma levels of phenoloxidase by

553 modulating feeding efficiency in a specialist insect herbivore. *Frontiers in Physiology*, 14(February), 1–10.

554 <https://doi.org/10.3389/fphys.2023.1127670>

555 Naidu, V. (2012). *Hand book on weed identification*. Dr. VSGR Naidu.

556 Nelson, A. S., & Mooney, K. A. (2022). The evolution and ecology of interactions between ants and honeydew-producing

557 hemipteran insects. *Annual Review of Ecology, Evolution, and Systematics*, 53, 379–402.

558 <https://doi.org/https://doi.org/10.1146/annurev-ecolsys-102220-014840>

559 Pettersson, J., Tjallingii, W. F., & Hardie, J. (2017). Host-plant selection and feeding. In *Aphids as crop pests* (pp. 173–

560 195). CABI Wallingford UK. <https://doi.org/DOI:10.1079/9780851998190.0087>

561 Piron, P., de Haas, M., & Sonnemans, M. (2019). The presence of *Aphis* (Toxoptera) *aurantii* (Homoptera: Aphididae) in

562 the Netherlands. *Entomologische Berichten*, 79(5), 162–164.

563 Santiago, G. S., Fonseca, L., Canedo-ju, E. O., Ribas, C. R., Pereira, R., & Alves, G. P. (2017). Isolated and Community

564 Contexts Produce Distinct Responses by Host Plants to the Presence of Ant-Aphid Interaction : Plant Productivity

565 and Seed Viability. *Plos One*, 12(1), 1–12. <https://doi.org/10.1371/journal.pone.0170915>

566 Singh, R., & Singh, G. (2021). Aphids. *Polyphagous Pests of Crops*, 105–182. [https://doi.org/DOI:10.1007/978-981-15-](https://doi.org/DOI:10.1007/978-981-15-8075-8_3)

567 [8075-8_3](https://doi.org/DOI:10.1007/978-981-15-8075-8_3)

568 Tegelaar, K., Hagman, M., Glinwood, R., Pettersson, J., & Leimar, O. (2012). Ant-aphid mutualism: the influence of ants

569 on the aphid summer cycle. *Oikos*, 121(1), 61–66. <https://doi.org/https://doi.org/10.1111/j.1600-0706.2011.19387.x>

570 Völkl, W., Mackauer, M., Pell, J. K., & Brodeur, J. (2023). Predators, parasitoids and pathogens. In *CABI Books*. CABI

571 Books. <https://doi.org/10.1079/9780851998190.0187>

572 Yamamoto, T., Hattori, M., & Itino, T. (2020). *Seasonal Migration in the Aphid Genus Stomaphis (Hemiptera : Aphididae*

573 *): Discovery of Host Alternation Between Woody Plants in Subfamily Lachninae*. 20.

574 <https://doi.org/10.1093/jisesa/ieaa103>

575 Zheng, Z., Zhao, M., Zhang, Z., Hu, X., Xu, Y., & Wei, C. (2022). Lactic Acid Bacteria Are Prevalent in the Infrabuccal

576 Pockets and Crops of Ants That Prefer Aphid Honeydew. *Front. Microbiol.*, 12(January), 1–17.

577 <https://doi.org/10.3389/fmicb.2021.785016>

578

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2
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5 I herewith enclosed a research article,

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- 8 The submission file is in OpenOffice, Microsoft Word (DOC, not DOCX), or RTF document file format.
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39 Title:

Species of Aphids Found in Ornamental and Wild Plants in Highland, Pagar Alam, South Sumatra

40

41 Author(s) name:

Chandra Irsan^{a*}, Erise Anggraini^{a,b}, Siti Herlinda^a, Wenny Ramadhani^c, M. Umar Harun^d,

42

43 **Address**

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54 **Novelty:**

55 (state your claimed novelty of the findings versus current knowledge)

This paper described the alternative host of aphids in high land, South Sumatera. The knowledge regarding the alternative of insect pest could be beneficial resource for basic control of aphids.

56

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58

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60 (Fill in names of five potential reviewers **that agree to review your manuscript** and their **email** addresses. He/she should have Scopus ID and come from different institution with the authors; and from at least three different countries)

61

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62

63 **Place and date:**

Palembang, 5 October 2023

64

65 **Sincerely yours,**

66 (fill in your name, no need scanned autograph)

Dr. Chandra Irsan

67
68 **Species of Aphids Found in Ornamental and Wild Plants in Highland,**
69 **Pagar Alam, South Sumatra**
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82 **Abstract**

83 Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be
84 very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported
85 about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid
86 species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of
87 aphids found in ornamental plants and the wild plants. The field research employed a purposive and direct observation
88 approach to inventory cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included
89 cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host
90 plants, and aphids, involved systematic searches for the selected plants and subsequent examination for the presence of
91 aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that 15
92 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum*
93 *rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis*
94 *glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis erysimi*.

95 **Keywords:** aphids, ornamental plants, wild plants

96 **Running title:** Aphids Found in Ornamental and Wild Plants
97

98 **INTRODUCTION**

99 Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous,
100 and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from
101 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhav et al. 2020).
102 Aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can always be found throughout the year due to
103 their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids consume young leaves sap, which can
104 deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, when aphids transmit viral diseases from one
105 plant to another, this can further weaken and stunt the growth of infected plants (Jones 2022). According to Kinley et al.
106 (2021), aphids cause yield losses directly (35 - 40%) by sucking the plant sap or indirectly (20 - 80%) through viral
107 transmission. Therefore, aphid infestations can have adverse effects on crop yields and overall plant health (Kumar
108 2019).

109 Due to their function as vectors, the presence of aphids on a plant can be highly damaging (Jaouannet et al. 2014).
110 They feed by piercing the plant's tissues and consuming its sap, which can reduce the plant's growth and productivity,
111 ultimately leading to weakness and possible death (Chandel et al. 2022). Additionally, as vectors, aphids can transmit a
112 variety of plant diseases. They are as carriers for various plant viruses, and when they move from infected to healthy
113 plants, these viruses can rapidly spread and cause extensive damage (Guo et al. 2019). In addition, the honeydew that
114 aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's

115 leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh and Singh 2021). Therefore, it
116 is crucial to control aphid populations in gardens and crops.

117 Many aphid species were found on plants that were not their actual hosts (Maharani et al. 2018). Aphids have one
118 or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they
119 feed on most frequently (Clarke et al. 2020). An alternative host can also be a collateral host belonging to the same plant
120 family as the primary host, helping crop pests to survive when the primary hosts are unavailable (Kumar et al., 2021).
121 These secondary hosts may offer less adequate nutrition for insects (Mo and Smilanich 2023), However, they may provide
122 a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions
123 (Kumar et al., 2021). According to Liu et al. (2017), since hibiscus serves as an overwintering host for cotton-specialized
124 aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during times of food
125 shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin, Gwenaelle, and Armelle 2010).
126 They maintain a cycle of host alternation, shifting between their primary hosts (typically a woody plant) and secondary
127 hosts (often herbaceous plants) (Yamamoto, Hattori, and Itino 2020). Weeds pose a continuous threat in both cropped and
128 non-crop areas, providing food, shelter and reproductive sites for various pest organisms (Kumar et al., 2021). This
129 indicates that weeds can serve as alternative hosts for aphids.

130 A study of aphid species on horticultural plants has been conducted (Maharani et al. 2018), However, information
131 about aphid species on ornamental and wild plants has not received as much attention and remains largely unexplored. In
132 South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and native plants. The
133 research on the diversity of aphid species in ornamental and wild plants has received little attention. Therefore, this study
134 was conducted in Pagar Alam, a highland region of South Sumatra, with the aim of obtaining information on the diversity
135 of aphid species found in ornamental and wild plants. The findings from this study can serve as a valuable resource for
136 aphid management.

137 MATERIALS AND METHODS

138 The field research employed a purposive and direct observation approach to inventory cultivated or wild plants
139 hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing ornamental
140 plants, as well as wild plants or weeds. The collection and identification of host plants, and aphids, involved systematic
141 searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all
142 existing plant species to find those colonized by aphids. Any plants colonized by aphids were documented as aphid hosts.
143 Aphids, along with their natural enemies within the aphid colonies, were systematically collected. All components of the
144 collected observations were then identified.

145 Aphid identification was conducted using identification keys (Blackman and Eastop 2008). Identification of aphid
146 species took place in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on
147 morphological characteristics. The host plants were identified using weed identification hand book (Kallas, 2010;
148 Meuninck, 2023; Naidu, 2012). The location and size of aphid colonies, morphology of aphids including their shape and
149 color, as well as any symptoms observed in the host plants were recorded, and photographs of the aphid colonies and their
150 host plants were taken.

151 RESULT AND DISCUSSION

152 Result

153 The results showed that 15 aphid species were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
154 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*,

155 *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipapis*
 156 *erysimi*. Based on the observation, these aphids were found on various ornamental plants (Table 1). The primary colony
 157 locations were generally in flowers, and this study documented these colony locations in ornamental plants (Figure 1).

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159 Table 1: Aphid species found in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Sitobion luteum</i>	flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	flower
3	<i>Caladium</i> sp.	<i>Pentalonia</i> sp.	flower
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	flower
5	<i>Canna indica</i>	<i>Pentalonia nigronervosa</i>	flower
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	flower
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	flower
9	<i>Cosmos caudatus</i>	<i>Uroleucon</i> sp.	flower
10	<i>Dahlia Kelvin</i>	<i>Aphis gossypii</i>	flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	flower
13	<i>Helianthus</i> sp.	<i>Aphis glycines</i> <i>Hyperomyzus</i> sp.	flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	flower
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i> <i>Toxoptera aurantii</i>	flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i> <i>Toxoptera citricidus</i>	flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i> <i>Toxoptera odinae</i>	flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	flower
20	<i>Spondiras dulcessoland</i>	<i>Aphis citricola</i> <i>Hysteroneura setariae</i>	flower



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Fig 1. The location of aphid colonization on various plant parts. a) *A. gossypii* in *D. Kelvin* flower b) *A. gossypii* in *H. rosinensis* flower c) *A. gossypii* in tuberose flower, d) *A. craccivora* in *Clitoria ternatea* flower, e) *A. citricola* in *Helianthus* sp., f) *A. aurantii* on the *M. paniculata* flower, g) *T. odinae* in the *S. dulcissoland*, h) *Uroleucon* sp. in chrysanthemums, i) *Macrosiphum rosae* in *R. indica* flower, j) *Pentalonia nigronervosa* in *C. indica* leaves

In addition, this study documented the presence of weeds, which might serve as alternative hosts for aphids (Table 2). The location of aphid colonies also varied, namely on flowers, stalks, plant tops, young leaves and old leaves of wild plants (Figure 2). The presence of specific plants or host plants within a habitat influenced the types of aphids found. Many aphid species are found on a broad range of plants or host plants, while others are highly specialized and are only found on specific plants or host plants. This is closely related to the polyphagous, oligophagous or monophagous nature of aphids (Blackman & Eastop 2000).

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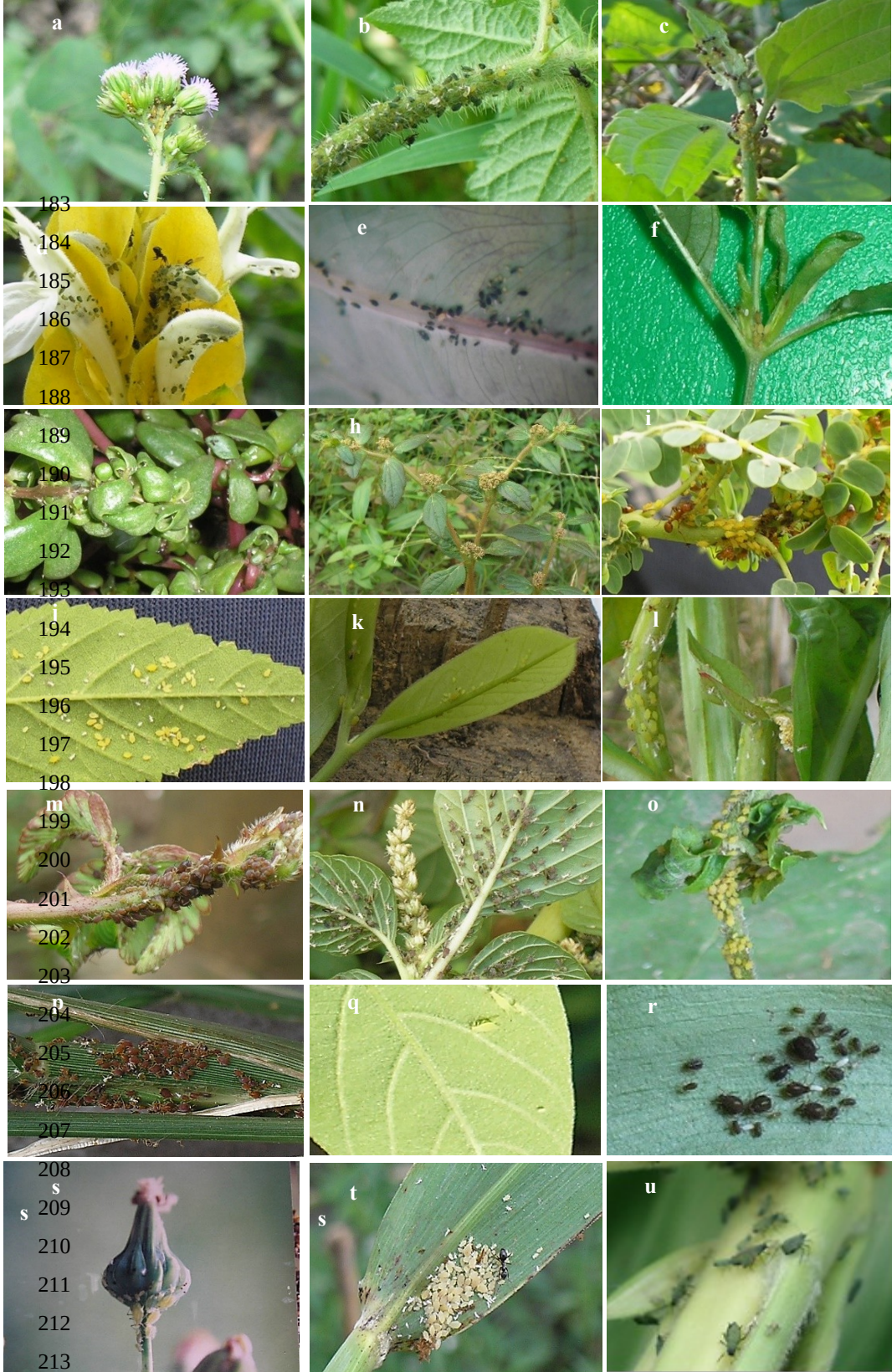
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Table 2: Species of aphids found in wild plants and their colony locations.

No	Host Plant	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	<i>Aphis gossypii</i>	Shoots, buds
3	<i>Alternanthera sessilis</i>	<i>Aphis gossypii</i>	Shoots, buds
4	<i>Amaranthus gracilis</i>	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
6	<i>Croton hirtus</i>	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
8	<i>Cyperus rotundus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	<i>Hystroneura setariae</i>	Flower, flower stalks
11	<i>Echinochloa crusgali</i>	<i>Hiperomyzus</i> sp.	Young leaves, old leaves
12	<i>Ecliptica prostrata</i>	<i>Aphis gossypii</i>	Shoots, young leaves
13	<i>Eleusin indica</i>	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	<i>Hysteroneura setariae</i>	Flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	<i>Aphis gossypii</i>	Young leaves, old leaves
17	<i>Eupotarium odoratum</i>	<i>Aphis gossypii</i> , <i>Aphis glycine</i>	Young leaves, old leaves, young twigs
18	<i>Hymenochera acutigluma</i>	<i>Hysteroneura setariae</i>	Flowers, flower stalks, leaf axils
19	<i>Lagerstromea</i> Sp.	<i>Greenidea</i> sp.	Young leaves
20	<i>Lophatherum gracile</i>	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	<i>Aphis gossypii</i>	Shoots, young leaves
22	<i>Mikania mikranta</i>	<i>Aphis gossypii</i> <i>Aphis glycine</i>	Shoots, young leaves, old leaves
23	<i>Mimosa invisa</i>	<i>Aphis craccivora</i>	Shoots, pods
24	<i>Mimosa pudica</i>	<i>Aphis craccivora</i>	Shoots, pods, flowers
25	<i>Mimosa vigra</i>	<i>Aphis craccivora</i>	Shoots, pods
26	<i>Oryza rufipogon</i>	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	Old leaves, young leaves (pupus), leaf axils
27	<i>Oxonopus compressus</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, seeds
29	<i>Phyllanthus neruri</i>	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	<i>Aphis craccivora</i>	Shoots, young leaves, flower
31	<i>Physalis angulata</i>	<i>Aphis craccivora</i> , <i>A. gossypii</i>	Shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	<i>Lipapis erysimi</i>	Flower, fruit, shoots, young leaves
33	<i>Sida rhombifolia</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arventris</i>	<i>Lipapis erysimi</i>	Young leaves, fruit stalks, flower, fruit



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221 Figure 2. Aphids found on wild plants a) *A. gossypii* on the weed *Ageratum conyzoides*, b) *A. gossypii* on Croton weed *hirtus* c) *A.*
 222 *gossypii* on the weed *Eupatorium odoratum*, d) *A.gossypii* on plants *Pachystochys* sp., e) *A.gossypii* on plants *Caladium* sp., f) *A.*
 223 *gossypii* on the weed *Alternanthera sessilis*, g) *A.gossypii* in *Portulaca oleraceae* weeds, h) *A.gossypii* on the weed *Euphorbia hirta*, i)
 224 *A. citricola* on the weed *Phyllanthus nerruri*, j) *A. citricola* on *Sida rhombifolia* weed, k) *A. citricola* on plants *Annona muricata*, l)

225 *A. citricola* on the weed *Ludwigia peruviana*, m) *A. craccivora* on *Mimosa pudica* weed, n) *A. craccivora* on weeds *Amaranthus gracilis*,
226 o) *A. glycine* in *Mikania micranta* weed, p) *Hysteneura* sp. in *Eleusin* weeds, q) *Greenidae* sp. in kenidai trees (shrubs) *indica*,
227 r) *Hyperomyzus* sp. in *Echinochloa crusgali* Weed, s) *L. erysimi* on weed *sonchus arventris*, t) *Rhopalosiphum* rice on the weed *Oryza*
228 *rufipogon*, u) *Rhopalosiphum* *Maidis* on the weed *Oryza rufipogon*.

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230 Discussion

231 The plant species or host plant influences the distribution of aphids. There are aphid species that can be found on
232 a wide range of host plants, which is closely related to the polyphagous nature of aphids, allowing them to colonize many
233 different species of host plants. Host plants can also affect the distribution of aphids, as evidenced by the presence of aphid
234 species exclusively found on certain host plants (Santiago et al. 2017). But there are some species of aphids found only on
235 one particular host and are not found on other host plants (Döring 2014). *A. gossypii*, and *Aphis aurantii* have been found
236 on many host plants because both aphids are classified as polyphagous aphids (Alotaibi et al., 2023).

237 Aphids can commonly be found infesting a variety of ornamental plants. They are attracted to these plants due to
238 the rich nutrient content in the plant sap (Braham et al. 2023). In this present study, some aphid species were found on
239 some ornamental plants in Pagaram. The location of aphid colonization on the plants varied. On *Adiantum predatum*
240 plants, aphids formed colonies on young leaf stalks and on newly emerging leaves. The aphids displayed brown and black
241 coloration. The aphid colonies found were small, and the colonized plant parts showed no signs of disease. The
242 identification results showed that the aphids were *Neotoxoptera* sp., and notably, they were not associated with ants. On
243 *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively
244 large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The
245 identification results showed that the aphids were *Uroleucon* sp., and they were associated with ants.

246 On the *Brugmansia suaveolens*, *M. persicae* were found on the undersides of old leaves or leaves that have started
247 to turn yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant
248 parts did not show any signs of disease. On *Caladium* sp. (taro) was found one species of aphids: *A. gossypii*. The aphids
249 formed colonies under the surface of young and older leaves. The occupied leaf areas did not display severe symptoms.
250 The aphids were yellow green to dark green. The wingless adult aphids often had a white, flour-like appearance on their
251 bodies. On the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides of the leaves, the
252 shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially
253 shoots, showed signs of stunting. The aphids found were brown to black in color. The colonies of *T. aurantii* were found to
254 be associated with black ants.

255 Aphids on *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the
256 leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a
257 medium-sized body. The identification results showed that the aphids were *P. nigronevosa*. The colonies of *P.*
258 *nigronevosa* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were
259 found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and
260 the colonized plant parts did not show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed
261 colonies on the undersides of young leaves, shoots, and within flower parts, especially between petals or flower stalks that
262 had not fully bloomed. The colonies were quite large. The body color of aphids was green to dark green with small to
263 medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results
264 showed that the aphids were *A. gossypii*. The aphid colonies found were consistently associated with ants.

265 Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems and young leaves.
266 The aphids were brown to black in color. Colonized plant parts, especially shoots and young leaves, showed stunting

267 symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently
268 associated with ants. On the plant *Cosmos caudatus*, aphids were found on the flower petals. The colonies were not very
269 large. The body color was green and light green. The identification results showed that the aphids were *A. gossypii*, and
270 they were also associated with ants. The aphids on the *Dahlia kelvin plant* formed colonies on unopened flower buds, with
271 a significant population among the blooming petals. The body color was green to dark green. The identification results
272 showed that the aphids were *A. gossypii*. Aphids on *Datura metel* (amethyst) were found to form colonies on the
273 undersides of old leaves. The aphids were medium sized with a green body color. The colonized plant parts did not show
274 any symptoms of disease. The identification results showed that the aphids were *Myzus ornatus*. The aphid colonies were
275 not associated with ants. Within *Dendrobium* sp., aphid colonies were found on the young leaves. The aphids were yellow,
276 green to dark green. The colonized plants did not show any disease symptoms. The identification results showed that the
277 aphids were *A. gossypii*, and they were associated with ants. On *Duranta* sp. (bonsai), colonies of aphids were located on
278 the undersides of young leaves. The colonized plant parts showed stunting symptoms. The colonies were very large. The
279 aphids were green in color. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were
280 consistently associated with ants.

281 On the *Helianthus annuus* (sunflower) plants, aphid colonies were found between the flower petals. The
282 colonized flowers, especially the crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in
283 color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies
284 were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies
285 were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease
286 symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid colonies were not associated with
287 ants. Within the colonies, mummified aphids that were parasitized by Aphidiidae were found.

288 On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark green were found. The aphids formed
289 colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large.
290 The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with
291 ants. Two types of aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the
292 undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The
293 occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and
294 slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, similar to sugar. The aphids had
295 yellow, green, or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The
296 identification results showed that the aphids were *A. gossypii*, and they were almost always associated with ants. The
297 second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could
298 also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs
299 of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The
300 identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants.

301 In *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied the shoots, young leaves
302 and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from
303 yellow and green to a slightly darker green. Sometimes the upper surface of the wingless imago's body appeared white,
304 resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost
305 always associated with ants. Another species of aphids was founded and formed colonies on flower stalks that had not yet
306 bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms

307 of plant disease. The aphids were yellow or yellow green, with black cauda and siphunculi. Their bodies were very small
308 to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also
309 frequently found in association with ants.

310 Two types of aphids were found on *Mussaenda frondosa*, each forming colonies in different locations. The first
311 type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease
312 symptoms. The aphids were yellow, green, and some with dark green. The identification results showed that the aphids
313 were *A. gossypii*. The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as
314 if piled up. The aphid colonies could also be found on young leaves, shoots and within flower parts. The plant parts they
315 infested showed no signs of diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had
316 tiny to small bodies. The identification results showed that the aphids were *A. citricola*.

317 The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids.
318 This indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
319 generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
320 colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
321 yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized
322 by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging
323 from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots,
324 flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus*
325 *gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves.
326 They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with
327 both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi* aphids. These aphids were bright green, and of
328 medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies
329 were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow-green to
330 dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon*
331 *dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks
332 and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to red-brown. They were
333 associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies were
334 found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants.
335 The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis rotundiventris*
336 aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or buds. Small
337 colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on
338 the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crussgali* or water hyacinth
339 plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large colonies on
340 the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica*
341 *prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids
342 were bright green to blackish green. The aphid colonies were also consistently associated with ants.

343 *Eleusin indica* was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H.*
344 *setariae* formed colonies in flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body
345 color ranged from red brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis*
346 formed colonies in the leaf axils and undersides of leaves and on leaf shoots that had not yet opened. The colonies were

347 not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These
348 aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants.
349 The plant *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids were
350 yellow to green in colour. The colonies formed near flowers, flower stalks, and shoot leaves.

351 *Eragrostis tenella* was infested by *Hysteroneura setariae* aphids. The aphids were brown to red brown. Small
352 colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae*
353 were consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by *Aphis gossypii*. The aphids formed
354 colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in
355 color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupotarium odoratum* was colonied
356 by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young
357 twigs. Young leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this
358 plant showed yellow-green to dark green in body colour. The colonies of *A. citricola* formed on the young twigs near the
359 shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of
360 both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.

361 *Hymenochera acutigluma* or hair axis was colonized by *Hysteroneura setariae*, which formed colonies on the
362 flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or
363 *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with
364 thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not
365 show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of aphids:
366 *hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves,
367 leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were brown to
368 red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis*
369 aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two species
370 of aphids on *L. gracile* to mix.

371 *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly
372 emerging shoots and on newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The
373 colonized plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis*
374 *glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and
375 curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were
376 light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a
377 single colony.

378 *Mimosa invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisa* plants
379 formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa*
380 *pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots,
381 and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the
382 colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of
383 aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were
384 shiny black. The colonized plant parts did not show any disease symptoms.

385 *Oryza rufipogon* was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both
386 aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species

387 could be distinguished by their body color. *R. maidis* appeared green with black sifunculi and cauda, while *R. rice*
388 appeared white. The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants.
389 *Oxonopus compressus* or *pait* grass was colonized by *Hysteronadura setariae* aphids. The colonies occupied flowers, flower
390 stalks, seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed,
391 and they were also consistently associated with ants.

392 *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the
393 seeds and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus niruri* was colonized by *Aphis citricola*. The
394 colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted,
395 and wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large.
396 *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants
397 formed colonies on the undersides of leaves, especially young leaves, shoots and in flowers. The colonized plant parts
398 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
399 appeared glossy black.

400 *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with
401 glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant
402 parts did not show any symptoms of disease. *Rorippa indica* or mustard land was colonized by *Lipaphis erysimi*. The
403 colonies formed on the flowers, fruits, flower stalks and the lower surface of leaves. The colonized plant parts showed
404 symptoms such as curling and stunting. *Sida rhombifolia* or cacabean was colonized by *Aphis gossypii*. The aphids had
405 green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks and flower petals. The
406 colonized plant parts, especially the shoots, showed curling, and the leaf edges curled downward. *Sonchus arvensis* plants
407 were colonized by *L. erysimi*. The aphids had green to whitish green body colours, and the colonies formed on flower
408 stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

409 In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
410 displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants
411 caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves.
412 These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show
413 symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum
414 growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that
415 did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the
416 leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid
417 infestations.

418 The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a
419 cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to
420 grow, resulting in some parts developing normally while others become stunted (Pettersson, Tjallingii, and Hardie 2017).
421 This condition could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or
422 stunted leaf growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display
423 any distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves
424 differed from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to
425 recognize through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility

426 that aphids had colonized the plant (Tegelaar et al. 2012). Therefore, the presence of ants could serve as an indicator of the
427 presence of aphid colonies.

428 Throughout their life cycle, aphids exhibited host alternation by switching between two distinct host plants
429 (Yamamoto et al. 2020). They overwintered on woody plants, reproduced in the spring, and migrated to herbaceous plants
430 during the summer before returning to their primary host in the autumn (Yamamoto et al. 2020). This allowed aphids to
431 maximize resource utilization, avoid congestion and competition, evade predators and parasites, circumvent plant
432 defenses, and colonize new areas. Aphids could distribute their population efficiently, thereby avoiding overcrowding,
433 predators and parasites, and plant defenses developing over time through host switching (Yamamoto et al. 2020). This
434 behavior was essential for the survival and environmental adaptation of aphids.

435 Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new
436 growth or reproductive parts of plants. Flowers contain a nutrient-rich nature and easy access to sap, therefore aphids were
437 attractive to sap the flowers. Some aphid species were drawn to certain colors (Jakubczyk et al. 2022). Herbs served as an
438 alternative host for aphids in this present study. Aphids consume sugar-rich liquid in plants, known as "sap". Aphids
439 considered herbs and other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate
440 plant tissues and access this fluid (Brožek et al. 2015). Several aphids colonized herbs such as Indian mustards, *Lipaphis*
441 *erysimi*, and *Myzus persicae* are the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al.
442 2022).

443 Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a
444 delicious substance known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson
445 and Mooney 2022). The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Zheng et
446 al. 2022). Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for
447 honeydew, ants provided aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and
448 parasitic wasps (Karami-jamour et al. 2018). Certain species of ants would transport aphids to new host plants for
449 improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not
450 only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
451 species) and provided energy for the growth of their own progeny (Biedermann and Vega 2020).

452 CONCLUSION

453 15 species of aphids were found in ornamental and wild plants in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
454 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia*
455 *nigronevosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus*
456 sp. *Lipaphis erysimi*.

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461 REFERENCES

- 462 Alotaibi, N. J., T. Alsufyani, N. H. M'sakni, M. A. Almalki, E. M. Alghamdi, and D. Spiteller. 2023. "Rapid Identification
463 of Aphid Species by Headspace GC-MS and Discriminant Analysis." *Insects* 14(589). doi: [https://doi.org/10.3390/
464 insects14070589](https://doi.org/10.3390/insects14070589).
- 465 Bass, Chris, Alin M. Puinean, Christoph T. Zimmer, Ian Denholm, Linda M. Field, Stephen P. Foster, Oliver Gutbrod,
466 Ralf Nauen, Russell Slater, and Martin S. Williamson. 2014. "The Evolution of Insecticide Resistance in the Peach
467 Potato Aphid , *Myzus Persicae*." *Insect Biochemistry and Molecular Biology* 51:41–51. doi:

- 468 10.1016/j.ibmb.2014.05.003.
- 469 Biedermann, Peter H. W., and Fernando E. Vega. 2020. "Ecology and Evolution of Insect–Fungus Mutualisms." Annual
470 Review of Entomology 65:431–55. doi: <https://doi.org/10.1146/annurev-ento-011019-024910>.
- 471 Blackman, Roger L., and Victor F. Eastop. 2008. *Aphids on the World's Herbaceous Plants and Shrubs, 2 Volume Set*.
472 John Wiley & Sons.
- 473 Blackman, Roger L., and Victor F. Eastop. 2017. "Taxonomic Issues." Pp. 1–36 in *Aphids as crop pests*. CABI
474 Wallingford UK.
- 475 Braham, Mohamed, Synda Boulahia-kheder, Mouna Kahia, and Siwar Noura. 2023. "Aphids and Citrus Responses to
476 Nitrogen Fertilization." Journal of the Saudi Society of Agricultural Sciences 22(6):374–83. doi:
477 10.1016/j.jssas.2023.03.003.
- 478 Brożek, Jolanta, Ewa Mróz, Dominika Wylęzek, Łukasz Depa, and Piotr Węgierek. 2015. "The Structure of Extremely
479 Long Mouthparts in the Aphid Genus Stomaphis Walker (Hemiptera: Sternorrhyncha: Aphididae)." Zoomorphology
480 134:431–45. doi: <https://doi.org/10.1007/s00435-015-0266-7>.
- 481 Cao, He-he, Zhan-feng Zhang, Xiao-feng Wang, and Tong-xian Liu. 2018. "Nutrition versus Defense: Why Myzus
482 Persicae (Green Peach Aphid) Prefers and Performs Better on Young Leaves of Cabbage." PloS One 13(4):1–16.
483 doi: <https://doi.org/10.1371/journal.pone.0196219>.
- 484 Chandel, R. S., V. K. Chandla, K. S. Verma, and Mandeep Pathania. 2022. "Chapter 21 - Insect Pests of Potato in India:
485 Biology and Management." Pp. 371–400 in, edited by A. Alyokhin, S. I. Rondon, and Y. B. T.-I. P. of P. (Second E.
486 Gao. Academic Press.
- 487 Clarke, Rebecca, Monica A. Kehoe, Sonya Broughton, and Roger A. C. Jones. 2020. "Host Plant Affiliations of Aphid
488 Vector Species Found in a Remote Tropical Environment." Virus Research 281(December 2019):197934. doi:
489 10.1016/j.virusres.2020.197934.
- 490 Döring, Thomas F. 2014. "How Aphids Find Their Host Plants, and How They Don't." Annals of Applied Biology
491 165(1):3–26. doi: <https://doi.org/10.1111/aab.12142>.
- 492 Ertunc, Filiz. 2020. "Chapter 46 - Emerging Plant Viruses." Pp. 1041–62 in, edited by M. M. B. T.-E. and R. V. P. Ennaji.
493 Academic Press.
- 494 Gadhve, Kiran R., Saurabh Gautam, David A. Rasmussen, and Rajagopalbabu Srinivasan. 2020. "Aphid Transmission of
495 Potyvirus: The Largest Plant-Infecting RNA Virus Genus." Viruses 12(7):773. doi: doi: 10.3390/v12070773.
- 496 Giannetti, Daniele, Mauro Mandrioli, Enrico Schifani, Cristina Castracani, Fiorenza A. Spotti, Alessandra Mori, and
497 Donato A. Grasso. 2021. "First Report on the Acrobat Ant Crematogaster Scutellaris Storing Live Aphids in Its Oak-
498 Gall Nests." Insects 12(2):108. doi: <https://doi.org/10.3390/insects12020108>.
- 499 Guo, Huijuan, Liyuan Gu, Fanqi Liu, Fajun Chen, Feng Ge, and Yucheng Sun. 2019. "Aphid-Borne Viral Spread Is
500 Enhanced by Virus-Induced Accumulation of Plant Reactive Oxygen Species 1." Plant Physiol 179(January):143–
501 55. doi: 10.1104/pp.18.00437.
- 502 Jakubczyk, Karolina, Klaudia Koprowska, Aleksandra Gottschling, and Katarzyna Janda-Milczarek. 2022. "Edible
503 Flowers as a Source of Dietary Fibre (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement."
504 Nutrients 14(12). doi: 10.3390/nu14122470.
- 505 Jaouannet, Maëlle, Patricia A. Rodriguez, Peter Thorpe, Camille J. G. Lenoir, and Ruari Macleod. 2014. "Plant Immunity
506 in Plant – Aphid Interactions." Front Plant Sci. 5(December):1–10. doi: 10.3389/fpls.2014.00663.
- 507 Jayaswal, Deepanshu, Pawan Mainkar, Kuldeep Kumar, Yamini Agarwal, and Ratna Prabha. 2022. "Pyramiding and
508 Evaluation of Segregating Lines Containing Lectin and Protease Inhibitor Genes for Aphid Resistance in Brassica
509 Juncea." Indian Journal of Biochemistry & Biophysics 59(August):800–807. doi: 10.56042/ijbb.v59i8.62319.
- 510 Jones, Roger A. C. 2022. "Alteration of Plant Species Mixtures by Virus Infection: Managed Pastures the Forgotten
511 Dimension." Plant Pathology 71(6):1255–81. doi: DOI: 10.1111/ppa.13571.
- 512 Joussetin, Emmanuelle, Genson Gwenaelle, and Coeur D. Acie. Armelle. 2010. "Evolutionary Lability of a Complex Life
513 Cycle in the Aphid Genus Brachycaudus." BMC Evolutionary Biology 10(1). doi: 10.1186/1471-2148-10-295.
- 514 Kallas, John. 2010. *Edible Wild Plants*. Gibbs Smith.
- 515 Karami-jamour, Tahereh, Alinaghi Mirmoayedi, Abbasali Zamani, and Yadolah Khajehzadeh. 2018. "The Impact of Ant
516 Attendance on Protecting Aphis Gossypii against Two Aphidophagous Predators and It's Role on the Intraguild
517 Predation between Them." Journal of Insect Behavior 31:222–39. doi: DOI: 10.1007/s10905-018-9670-4.
- 518 Kennedy, J. S., and H. L. G. Stroyan. 1959. "Biology of Aphids." Annual Review of Entomology 4(1):139–60.
- 519 Kinley, Chimi, A. Najitha Banu, A. M. Raut, Johnson Wahengbam, and Thinley Jamtsho. 2021. "A Review on Past,
520 Present and Future Approaches for Aphids Management." Journal of Entomological Research 45(2):336–46. doi:
521 10.5958/0974-4576.2021.00053.0.
- 522 Kumar, Sarwan. 2019. "Aphid-Plant Interactions: Implications for Pest Management." P. Ch. 7 in *Plant Communities and
523 Their Environment*, edited by M. T. Oliveira, F. Candan, and A. Fernandes-Silva. Rijeka: IntechOpen.
- 524 Kumar, Sushil, Malay K. Bhowmick, and Puja Ray. 2021. "Weeds as Alternate and Alternative Hosts of Crop Pests."
525 Indian Journal of Weed Science 53(1):14–29. doi: 10.5958/0974-8164.2021.00002.2.
- 526 Liu, Xiang Dong, Ting Ting Xu, and Hai Xia Lei. 2017. "Refuges and Host Shift Pathways of Host-Specialized Aphids
527 Aphis Gossypii." Scientific Reports 7(1):1–9. doi: 10.1038/s41598-017-02248-4.

- 528 Maharani, Yani, Purnama Hidayat, Aunu Rauf, and Nina Maryana. 2018. "Short Communication: New Records of Aphid
529 Species Subfamily Aphidinae (Hemiptera: Aphididae) in West Java, Indonesia." *Biodiversitas* 19(2):460–65. doi:
530 10.13057/biodiv/d190219.
- 531 Margaritopoulos, J. T., M. Tzortzi, K. D. Zarpas, J. A. Tsitsipis, and R. L. Blackman. 2006. "Morphological
532 Discrimination of *Aphis Gossypii* (Hemiptera: Aphididae) Populations Feeding on Compositae." *Bulletin of*
533 *Entomological Research* 96(2):153–65. doi: 10.1079/ber2005410.
- 534 Meuninck, Jim. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.
- 535 Mo, Carmen, and Angela M. Smilanich. 2023. "Feeding on an Exotic Host Plant Enhances Plasma Levels of
536 Phenoloxidase by Modulating Feeding Efficiency in a Specialist Insect Herbivore." *Frontiers in Physiology*
537 14(February):1–10. doi: 10.3389/fphys.2023.1127670.
- 538 Naidu, VSGR. 2012. "Hand Book on Weed Identification."
- 539 Nelson, Annika S., and Kailen A. Mooney. 2022. "The Evolution and Ecology of Interactions between Ants and
540 Honeydew-Producing Hemipteran Insects." *Annual Review of Ecology, Evolution, and Systematics* 53:379–402.
541 doi: <https://doi.org/10.1146/annurev-ecolsys-102220-014840>.
- 542 Pettersson, Jan, W. Fred Tjallingii, and Jim Hardie. 2017. "Host-Plant Selection and Feeding." Pp. 173–95 in *Aphids as*
543 *crop pests*. CABI Wallingford UK.
- 544 Piron, PGM, MC de Haas, and MAHM Sonnemans. 2019. "The Presence of *Aphis (Toxoptera) Aurantii* (Homoptera:
545 Aphididae) in the Netherlands." *Entomologische Berichten* 79(5):162–64.
- 546 Santiago, Grazielle Silva, Luana Fonseca, Ernesto Oliveira Canedo-ju, Carla Rodrigues Ribas, Rafaela Pereira, and
547 Guilherme Pereira Alves. 2017. "Isolated and Community Contexts Produce Distinct Responses by Host Plants to
548 the Presence of Ant-Aphid Interaction: Plant Productivity and Seed Viability." *Plos One* 12(1):1–12. doi:
549 10.1371/journal.pone.0170915.
- 550 Singh, Rajendra, and Garima Singh. 2021. "Aphids." Pp. 105–82 in *Polyphagous Pests of Crops*. Springer.
- 551 Tegelaar, Karolina, Mattias Hagman, Robert Glinwood, Jan Pettersson, and Olof Leimar. 2012. "Ant-Aphid Mutualism:
552 The Influence of Ants on the Aphid Summer Cycle." *Oikos* 121(1):61–66. doi: [https://doi.org/10.1111/j.1600-](https://doi.org/10.1111/j.1600-0706.2011.19387.x)
553 [0706.2011.19387.x](https://doi.org/10.1111/j.1600-0706.2011.19387.x).
- 554 Yamamoto, Tetsuya, Mitsuru Hattori, and Takao Itino. 2020. "Seasonal Migration in the Aphid Genus *Stomaphis*
555 (Hemiptera : Aphididae): Discovery of Host Alternation Between Woody Plants in Subfamily Lachninae." *Journal of*
556 *Insect Science* 20(5):1–10. doi: 10.1093/jisesa/ieaa103.
- 557 Zheng, Zhou, Mengqin Zhao, Zhijun Zhang, Xin Hu, Yang Xu, and Cong Wei. 2022. "Lactic Acid Bacteria Are Prevalent
558 in the Infrabuccal Pockets and Crops of Ants That Prefer Aphid Honeydew." *Front. Microbiol.* 12(January):1–17.
559 doi: 10.3389/fmicb.2021.785016.
- 560

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Species of aphids found in ornamental and wild Plants in Highland, Pagar Alam, South Sumatra

Abstract. Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of aphids found in ornamental plants and the wild plants. The field research employed a purposive and direct observation approach to inventory cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host plants, and aphids, involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that 15 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis erysimi*.

Keywords: Aphids, ornamental plants, wild plants

Running title: Aphids found in ornamental and wild plants

INTRODUCTION

Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhane et al. 2020). Aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can ~~always~~ be found throughout the year due to their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids ~~suck phloem sap of tender plant parts~~ ~~consume young leaves sap~~, which can deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, ~~vector species when aphids transmit viral diseases from one plant to another, this~~ can further weaken and stunt the growth of infected plants (Jones 2022). ~~According to Kinley et al. (2021), aphids cause yield losses directly (35–40%) by sucking the plant sap or indirectly (20–80%) through viral transmission. Therefore, aphid infestations can have adverse effects on crop yields and overall plant health (Kumar 2019).~~

~~Due to their function as vectors, the presence of aphids on a plant can be highly damaging (Jaouannet et al. 2014). They feed by piercing the plant's tissues and consuming its sap, which can reduce the plant's growth and productivity, ultimately leading to weakness and possible death (Chandel et al. 2022). Additionally, as vectors, aphids can transmit a variety of plant diseases. They are as carriers for various plant viruses, and when they move from infected to healthy plants, these viruses can rapidly spread and cause extensive damage (Guo et al. 2019). In addition, the honeydew that aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh and Singh 2021). Therefore, it is crucial to control aphid populations in gardens and crops.~~

Many aphid species ~~are~~ found on plants that ~~are~~ not their actual hosts (Maharani et al. 2018). Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al. 2020). ~~Alternative plants An alternative host can also be a collateral host belonging to the same plant family as the primary host, helping crop pests to survive when the primary hosts are unavailable (Kumar et al., 2021). These secondary hosts may offer less adequate nutrition for insects (Mo and Smilanich 2023). However, they may provide a means of survival when primary hosts are unavailable, during certain seasons, or~~

under certain environmental conditions (Kumar et al., 2021). According to Liu et al. (2017), since hibiscus serves as an overwintering host for cotton-specialized aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during times of food shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin, Gwenaëlle, and Armelle 2010). They maintain a cycle of host alternation, shifting between their primary hosts (typically a woody plant) and secondary hosts (often herbaceous plants) (Yamamoto, Hattori, and Itino 2020). Weeds pose a continuous threat in both cropped and non-crop areas, providing food, shelter and reproductive sites for various pest organisms (Kumar et al., 2021). This indicates that weeds can serve as alternative hosts for aphids.

A study of aphid species on horticultural plants has been conducted (Maharani et al. 2018). However, information about aphid species on ornamental and wild plants has not received as much attention and remains largely unexplored. In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and native plants. The research on the diversity of aphid species in ornamental and wild plants has received little attention. Therefore, this study reports was conducted in Pagar Alam, a highland region of South Sumatra, with the aim of obtaining information on the diversity of aphid species found in ornamental and wild plants found in this area. The findings from this study can serve as a valuable resource for aphid management.

MATERIALS AND METHODS

The field research employed a purposive and direct observation approach to inventory of cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host plants, and aphids, and natural enemies where available, involved systematic searches of for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. Any plants colonized by aphids were documented as aphid hosts. Aphids, along with their natural enemies within the aphid colonies, were systematically collected. All components of the collected observations were then identified.

Aphid identification was done using identification keys (Blackman and Eastop 2008): Identification of aphid species took place in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on morphological characteristics. The host plants were identified using weed identification hand book (Kallas, 2010; Meuninck, 2023; Naidu, 2012). The location and size of aphid colonies, morphology of aphids including their life shape and color, as well as any symptoms observed in the host plants were recorded, and photographs of the aphid colonies and their host plants were recorded.

RESULTS AND DISCUSSION

Result

The results showed that 15 aphid species were found in Pagar Alam, namely (Tables 1, 2). *Aphis gossypii*, *Uroleucon* sp., *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*, *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp., *Lipapis erysimi*. Based on the observation, these aphids mostly colonised flowers of were found on various ornamental plants (Table 1, Figure 1). The primary colony locations were generally in flowers, and this study documented these colony locations in ornamental plants (Figure 1).

Table 1. Aphid species recorded found in ornamental plants and their colony locations

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Sitobion luteum</i>	flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i> <i>Neomyzus circumflexus</i> <i>Myzus persicae</i>	flower
3	<i>Caladium</i> sp.	<i>Pentalonia</i> sp.	flower
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	flower
5	<i>Canna indica</i>	<i>Pentalonia nigronervosa</i>	flower
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i> <i>Neomyzus circumflexus</i>	flower
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	flower
9	<i>Cosmos caudatus</i>	<i>Uroleucon</i> sp.	flower
10	<i>Dahlia 'Kelvin'</i>	<i>Aphis gossypii</i>	flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	flower

13	<i>Helianthus</i> sp.	<i>Aphis glycines</i> <i>Hyperomyzus</i> sp.	flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> , <i>Toxoptera aurantii</i>	flower
16	<i>Ixora</i> sp.	<i>Aphis citricola</i> <i>Aphis gossypii</i>	flower
17	<i>Murraya paniculata</i>	<i>Toxoptera aurantii</i> <i>Aphis craccivora</i>	flower
18	<i>Mussaenda frondosa</i>	<i>Toxoptera citricidus</i> <i>Aphis citricola</i>	flower
19	<i>Rosa indica</i>	<i>Toxoptera odinae</i> <i>Macrosiphum rosae</i>	flower
20	<i>Spondiras dulcissoland</i>	<i>Aphis citricola</i> <i>Hysteroneura setariae</i>	flower

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94 | **Fig 1. Photos showing colonies of different aphid species in ornamental plants: The location of aphid colonization on various plant**
95 | **parts-** a) *A. gossypii* in *D. kelvin* flower b) *A. gossypii* in *H. rosasinensis* flower c) *A. gossypii* in tuberose flower, d) *A. craccivora* in
96 | *Clitoria ternatea* flower, e) *A. citricola* in *Helianthus* sp., f) *A. aurantii* on the *M. paniculata* flower, g) *T. odinae* in the *S. dulcissoland*,
97 | h) *Uroleucon* sp. in chrysanthemums, i) *Macrosiphum rosae* in *R. indica* flower, j) *Pentalonia nigronevosa* in *C. indica* leaves

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99 In addition, this study documented the presence of weeds, which might serve as alternative hosts for aphids (Table 2).
 100 The location of aphid colonies also varied, namely on flowers, stalks, plant tops, young leaves and old leaves of wild
 101 plants (Table 2, Figure 2). The presence of specific plants or host plants within a habitat influenced the types of aphids
 102 found. Many aphid species are found on a broad range of plants or host plants, while others are highly specialized and are
 103 only found on specific plants or host plants. This is closely related to the polyphagous, oligophagous or monophagous
 104 nature of aphids (Blackman & Eastop 2000).
 105

106 **Table 2.** Species of aphids found in wild or weed plants and their colony locations
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No	Host Plant	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	<i>Aphis gossypii</i>	Shoots, buds
3	<i>Alternanthera sessilis</i>	<i>Aphis gossypii</i>	Shoots, buds
4	<i>Amaranthus gracilis</i>	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
6	<i>Croton hirtus</i>	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
8	<i>Cyperus rotundus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	<i>Hysteroneura setariae</i>	Flower, flower stalks
11	<i>Echinocloa crusgali</i>	<i>Hiperomyzus</i> sp.	Young leaves, old leaves
12	<i>Ecliptica prostrata</i>	<i>Aphis gossypii</i>	Shoots, young leaves
13	<i>Eleusin indica</i>	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	<i>Hysteroneura setariae</i>	Flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	<i>Aphis gossypii</i>	Young leaves, old leaves
17	<i>Eupotarium odoratum</i>	<i>Aphis gossypii</i> ; <i>Aphis glycine</i>	Young leaves, old leaves, young twigs
18	<i>Hymenochera acutigluma</i>	<i>Hysteroneura setariae</i>	Flowers, flower stalks, leaf axils
19	<i>Lagerstromea</i> Sp.	<i>Greenidea</i> sp.	Young leaves
20	<i>Lophatherum gracile</i>	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	<i>Aphis gossypii</i>	Shoots, young leaves
22	<i>Mikania mikranta</i>	<i>Aphis gossypii</i> <i>Aphis glycine</i>	Shoots, young leaves, old leaves
23	<i>Mimosa invisa</i>	<i>Aphis craccivora</i>	Shoots, pods
24	<i>Mimosa pudica</i>	<i>Aphis craccivora</i>	Shoots, pods, flowers
25	<i>Mimosa vigra</i>	<i>Aphis craccivora</i>	Shoots, pods
26	<i>Oryza rufipogon</i>	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	Old leaves, young leaves (pupus), leaf axils
27	<i>Oxonopus compressus</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	<i>Hysteroneura setariae</i>	Flower, flower stalk, seeds
29	<i>Phylanthus neruri</i>	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	<i>Aphis craccivora</i>	Shoots, young leaves, flower
31	<i>Physalis angulata</i>	<i>Aphis craccivora</i> ; <i>A. gossypii</i>	Shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	<i>Lipapis erysimi</i>	Flower, fruit, shoots, young leaves
33	<i>Sida rhombifolia</i>	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arvensis</i>	<i>Lipapis erysimi</i>	Young leaves, fruit stalks, flower, fruit

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113 | **Figure 2.** Aphids found infesting wild plants a) *A. gossypii* ~~inon the weed~~ *Ageratum conyzoides*, b) *A. gossypii* ~~inon~~ *Croton weed*
 114 | *hirtus* c) *A. gossypii* ~~inon the weed~~ *Eupatorium odoratum*, d) *A.gossypii* ~~ion plants~~ *Pachystochys* sp., e) *A.gossypii* ~~inon plants~~ *Caladium*
 115 | sp., f) *A. gossypii* ~~inon the weed~~ *Alternanthera sessilis*, g) *A.gossypii* in *Portulaca oleraceae* ~~weeds~~, h) *A.gossypii* ~~inon the weed~~
 116 | *Euphorbia hirta*, i) *A. citricola* ~~ion the weed~~ *Phyllanthus nerruri*, j) *A. citricola* ~~inon~~ *Sida rhombifolia* ~~weed~~, k) *A. citricola* ~~inon plants~~
 117 | *Annona muricata*, l) *A.citricola* ~~ion the weed~~ *Ludwigia peruviana*, m) *A. craccivora* ~~inon~~ *Mimosa pudica* ~~weed~~, n) *A.craccivora* ~~inon~~

118 | weeds *Amaranthus gracilis*, o) *A. glycine* in *Mikania micranta* weed, p) *Hysteneura* sp. in *Eleusine* weeds, q) *Greenidae* sp. in kenidai
119 | trees (shrubs) *indica*, r) *Hyperomyzus* sp. in *Echinochloa crusgali* Weed, s) *L. erysimi* on weed-sonchus arventris, t) *Rhopalosiphum rice*
120 | in on the weed-*Oryza rufipogon*, u) *Rhopalosiphum Maidis* in on the weed-*Oryza rufipogon*.
121

122 | Discussion

123
124 | The plant species or host plant influences the distribution of aphids. There are aphid species that can be found on a
125 | wide range of host plants, which is closely related to the polyphagous nature of aphids, allowing them to colonize many
126 | different species of host plants. Host plants can also affect the distribution of aphids, as evidenced by the presence of aphid
127 | species exclusively found on certain host plants (Santiago et al. 2017). But there are some species of aphids found only on
128 | one particular host and are not found on other host plants (Döring 2014). *A. gossypii*, and *Aphis aurantii* have been found
129 | on many host plants because both aphids are classified as polyphagous aphids (Alotaibi et al., 2023).

130 | Many aphid species can commonly be found infesting a variety of ornamental plants because these insects are
131 | attracted to such plants due to the rich nutrient content in the plant sap (Braham et al. 2023). In their present study,
132 | some aphid species were found on some ornamental plants in Pagaram. The location of aphid colonization on the plants
133 | varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and on newly emerging leaves. The
134 | aphids displayed brown and black coloration. The aphid colonies found were small, and the colonized plant parts showed
135 | no signs of disease. The identification results showed that the aphids were *Neotoxoptera* sp., and notably, they were not
136 | associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots, and the
137 | colonies were relatively large. The color of the aphids was dark brown to black. The colonized plant parts showed
138 | symptoms of stunting. The identification results showed that the aphids were *Uroleucon* sp., and they were associated with
139 | ants.

140 | On the *Brugmansia suaveolens*, *M. persicae* were found on the undersides of old leaves or leaves that have started to
141 | turn yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant parts
142 | did not show any signs of disease. On *Caladium* sp. (taro) was found one species of aphids: *A. gossypii*. The aphids formed
143 | colonies under the surface of young and older leaves. The occupied leaf areas did not display severe symptoms. The aphids
144 | were yellow green to dark green. The wingless adult aphids often had a white, flour-like appearance on their bodies. On
145 | the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds,
146 | and unopened flower petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially shoots,
147 | showed signs of stunting. The aphids found were brown to black in color. The colonies of *T. aurantii* were found to be
148 | associated with black ants.

149 | Aphids on *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf
150 | surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-
151 | sized body. The identification results showed that the aphids were *P. nigronervosa*. The colonies of *P. nigronervosa* were
152 | found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were found. The aphids were
153 | yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and the colonized plant parts
154 | did not show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the undersides of
155 | young leaves, shoots, and within flower parts, especially between petals or flower stalks that had not fully bloomed. The
156 | colonies were quite large. The body color of aphids was green to dark green with small to medium-sized bodies. The
157 | colonized plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were
158 | *A. gossypii*. The aphid colonies found were consistently associated with ants.

159 | Aphids on *Clitoria ternatea* were found to form colonies on flower parts, flower crowns, stems and young leaves. The
160 | aphids were brown to black in color. Colonized plant parts, especially shoots and young leaves, showed stunting
161 | symptoms. The identification results showed that the aphids were *A. craccivora*. These colonies were consistently
162 | associated with ants. On the plant *Cosmos caudatus*, aphids were found on the flower petals. The colonies were not very
163 | large. The body color was green and light green. The identification results showed that the aphids were *A. gossypii*, and
164 | they were also associated with ants. The aphids on the *Dahlia kelvin plant* formed colonies on unopened flower buds, with
165 | a significant population among the blooming petals. The body color was green to dark green. The identification results
166 | showed that the aphids were *A. gossypii*. Aphids on *Datura metel* (amethyst) were found to form colonies on the
167 | undersides of old leaves. The aphids were medium sized with a green body color. The colonized plant parts did not show
168 | any symptoms of disease. The identification results showed that the aphids were *Myzus ornatus*. The aphid colonies were
169 | not associated with ants. Within *Dendrobium* sp., aphid colonies were found on the young leaves. The aphids were yellow,
170 | green to dark green. The colonized plants did not show any disease symptoms. The identification results showed that the
171 | aphids were *A. gossypii*, and they were associated with ants. On *Duranta* sp. (bonsai), colonies of aphids were located on
172 | the undersides of young leaves. The colonized plant parts showed stunting symptoms. The colonies were very large. The
173 | aphids were green in color. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were
174 | consistently associated with ants.

175 | On the *Helianthus annuus* (sunflower) plants, aphid colonies were found between the flower petals. The colonized
176 | flowers, especially the crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in color. The

177 colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies were
178 associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies were
179 small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease
180 symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid colonies were not associated with
181 ants. Within the colonies, mummified aphids that were parasitized by Aphidiidae were found.

182 On the *Hibiscus rosa-sinensis*, aphids ranging in color from yellow to dark green were found. The aphids formed
183 colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large.
184 The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with
185 ants. Two types of aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the
186 undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The
187 occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and
188 slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, similar to sugar. The aphids had
189 yellow, green, or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The
190 identification results showed that the aphids were *A. gossypii*, and they were almost always associated with ants. The
191 second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could
192 also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs
193 of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The
194 identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants.

195 In *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied the shoots, young leaves
196 and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from
197 yellow and green to a slightly darker green. Sometimes the upper surface of the wingless imago's body appeared white,
198 resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost
199 always associated with ants. Another species of aphids was founded and formed colonies on flower stalks that had not yet
200 bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce any symptoms
201 of plant disease. The aphids were yellow or yellow green, with black cauda and siphunculi. Their bodies were very small
202 to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also
203 frequently found in association with ants.

204 Two types of aphids were found on *Mussaenda frondos*, each forming colonies in different locations. The first
205 type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease
206 symptoms. The aphids were yellow, green, and some with dark green. The identification results showed that the aphids
207 were *A. gossypii*. The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as
208 if piled up. The aphid colonies could also be found on young leaves, shoots and within flower parts. The plant parts they
209 infested showed no signs of diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had
210 tiny to small bodies. The identification results showed that the aphids were *A. citricola*.

211 The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This
212 indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
213 generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
214 colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
215 yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized
216 by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging
217 from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots,
218 flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus*
219 *gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves.
220 They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with
221 both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi* aphids. These aphids were bright green, and of
222 medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies
223 were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow-green to
224 dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon*
225 *dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks
226 and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to red-brown. They were
227 associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies were
228 found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants.
229 The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis rotundiventris*
230 aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or buds. Small
231 colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on
232 the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crussgali* or water hyacinth
233 plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large colonies on
234 the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica*
235 *prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids
236 were bright green to blackish green. The aphid colonies were also consistently associated with ants.

237 *Eleusin indica* was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H. setariae*
238 formed colonies in flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body color ranged
239 from red brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis* formed
240 colonies in the leaf axils and undersides of leaves and on leaf shoots that had not yet opened. The colonies were not
241 densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These aphids
242 had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants. The plant
243 *Emilia sonchifolia*, characterized by its purple flowers, was colonized by *Aphis gossypii*. The aphids were yellow to green
244 in colour. The colonies formed near flowers, flower stalks, and shoot leaves.

245 *Eragrostis tenella* was infested by *Hysteroneura setariae* aphids. The aphids were brown to red brown. Small colonies
246 formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were
247 consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by *Aphis gossypii*. The aphids formed
248 colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in
249 color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupotarium odoratum* was colonied
250 by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young
251 twigs. Young leaves that were colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this
252 plant showed yellow-green to dark green in body colour. The colonies of *A. citricola* formed on the young twigs near the
253 shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of
254 both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.

255 *Hymenochera acutigluma* or hair axis was colonized by *Hysteroneura setariae*, which formed colonies on the flower
256 stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea sp.* or
257 *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with
258 thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not
259 show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of aphids:
260 *hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves,
261 leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were brown to
262 red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis*
263 aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two species
264 of aphids on *L. gracile* to mix.

265 *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots, particularly near newly emerging
266 shoots and on newly emerging fruits and flowers. The body colour of aphids ranged from yellow to green. The colonized
267 plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis gossypii* and *Aphis glycine*. *A.*
268 *gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A.*
269 *glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine* aphids were light green to green
270 in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony.

271 *Mimosa invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on *M. invisa* plants
272 formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa*
273 *pubica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots, especially young shoots,
274 and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the
275 colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis craccivora*. The colonies of
276 aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were
277 shiny black. The colonized plant parts did not show any disease symptoms.

278 *Oryza rufipogon* was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both aphids
279 colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species could
280 be distinguished by their body color. *R. maidis* appeared green with black siphunculi and cauda, while *R. rice*
281 appeared white. The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants.
282 *Oxonopus compressus* or pait grass was colonized by *Hysteroneura setariae* aphids. The colonies occupied flowers, flower
283 stalks, seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed,
284 and they were also consistently associated with ants.

285 *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds
286 and flower stalks. Aphids had brown to dark brown bodies. *Phylanthus niruri* was colonized by *Aphis citricola*. The
287 colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted,
288 and wrinkled. The aphids had yellow bodies with black sifunculi and cauda, and the colonies formed were quite large.
289 *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants
290 formed colonies on the undersides of leaves, especially young leaves, shoots and in flowers. The colonized plant parts
291 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
292 appeared glossy black.

293 *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with glossy
294 black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant parts did
295 not show any symptoms of disease. *Rorippa indica* or mustard land was colonized by *Lipaphis erysimi*. The colonies
296 formed on the flowers, fruits, flower stalks and the lower surface of leaves. The colonized plant parts showed symptoms

297 such as curling and stunting. *Sida rhombifolia* or cacabean was colonized by *Aphis gossypii*. The aphids had green-yellow
298 to green body colors. The colonies formed on the surface of lower leaves, stalks and flower petals. The colonized plant
299 parts, especially the shoots, showed curling. and the leaf edges curled downward. *Sonchus arventris* plants were colonized
300 by *L. erysimi*. The aphids had green to whitish green body colours, and the colonies formed on flower stalks, under petals,
301 and on young shoots or leaves. The colonized plant parts became stunted over time.

302 In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
303 displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants
304 caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves.
305 These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show
306 symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum
307 growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that
308 did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the
309 leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid
310 infestations.

311 The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a cessation
312 in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to grow,
313 resulting in some parts developing normally while others become stunted (Pettersson, Tjallingii, and Hardie 2017). This
314 condition could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or stunted
315 leaf growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any
316 distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed
317 from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to recognize
318 through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids
319 had colonized the plant (Tegelaar et al. 2012). Therefore, the presence of ants could serve as an indicator of the presence
320 of aphid colonies.

321 ~~Throughout their life cycle, aphids exhibited host alternation by switching between two distinct host plants (Yamamoto
322 et al. 2020). They overwintered on woody plants, reproduced in the spring, and migrated to herbaceous plants during the
323 summer before returning to their primary host in the autumn (Yamamoto et al. 2020). This allowed aphids to maximize
324 resource utilization, avoid congestion and competition, evade predators and parasites, circumvent plant defenses, and
325 colonize new areas. Aphids could distribute their population efficiently, thereby avoiding overcrowding, predators and
326 parasites, and plant defenses developing over time through host switching (Yamamoto et al. 2020). This behavior was
327 essential for the survival and environmental adaptation of aphids.~~

328 Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new
329 growth or reproductive parts of plants. Flowers contain a nutrient-rich nature and easy access to sap, therefore aphids were
330 attractive to sap the flowers. Some aphid species were drawn to certain colors (Jakubczyk et al. 2022). Herbs served as an
331 alternative host for aphids in this present study. Aphids consume sugar-rich liquid in plants, known as "sap". Aphids
332 considered herbs and other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate
333 plant tissues and access this fluid (Brożek et al. 2015). Several aphids colonized herbs such as Indian mustards, *Lipaphis*
334 *erysimi*, and *Myzus persicae* are the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al.
335 2022).

336 Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a
337 delicious substance known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson
338 and Mooney 2022). The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Zheng et
339 al. 2022). Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for
340 honeydew, ants provided aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and
341 parasitic wasps (Karami-jamour et al. 2018). Certain species of ants would transport aphids to new host plants for
342 improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not
343 only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
344 species) and provided energy for the growth of their own progeny (Biedermann and Vega 2020).

345 CONCLUSION

346 15 species of aphids were found in ornamental and wild plants in Pagaralam, namely *Aphis gossypii*, *Uroleucon* sp.,
347 *Toxoptera odinae*, *Macrosiphum rosae*, *Aphis citricola*, *Aphis craccivora*, *Toxoptera aurantii*, *Pentalonia nigronervosa*,
348 *Hystenura* sp., *Aphis glycine*, *Greenidae* sp., *Rhopalosiphum padi*, *Rhopalosiphum maidis*, *Hyperomyzus* sp. *Lipaphis*
349 *erysimi*.

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REFERENCES

- 353 Alotaibi, N. J., T. Alsufyani, N. H. M'sakni, M. A. Almalki, E. M. Alghamdi, and D. Spiteller. 2023. "Rapid Identification of Aphid Species by
354 Headspace GC-MS and Discriminant Analysis." *Insects* 14(589). doi: <https://doi.org/10.3390/insects14070589>.
- 355 Bass, Chris, Alin M. Puinean, Christoph T. Zimmer, Ian Denholm, Linda M. Field, Stephen P. Foster, Oliver Gutbrod, Ralf Nauen, Russell Slater, and
356 Martin S. Williamson. 2014. "The Evolution of Insecticide Resistance in the Peach Potato Aphid, *Myzus persicae*." *Insect Biochemistry and*
357 *Molecular Biology* 51:41–51. doi: 10.1016/j.ibmb.2014.05.003.
- 358 Biedermann, Peter H. W., and Fernando E. Vega. 2020. "Ecology and Evolution of Insect–Fungus Mutualisms." *Annual Review of Entomology* 65:431–
359 55. doi: <https://doi.org/10.1146/annurev-ento-011019-024910>.
- 360 Blackman, Roger L., and Victor F. Eastop. 2008. *Aphids on the World's Herbaceous Plants and Shrubs, 2 Volume Set*. John Wiley & Sons.
- 361 Blackman, Roger L., and Victor F. Eastop. 2017. "Taxonomic Issues." Pp. 1–36 in *Aphids as crop pests*. CABI Wallingford UK.
- 362 Braham, Mohamed, Synda Boulahia-kheder, Mouna Kahia, and Siwar Nouria. 2023. "Aphids and Citrus Responses to Nitrogen Fertilization." *Journal of*
363 *the Saudi Society of Agricultural Sciences* 22(6):374–83. doi: 10.1016/j.jssas.2023.03.003.
- 364 Brożek, Jolanta, Ewa Mróz, Dominika Wylężek, Łukasz Depa, and Piotr Węgierek. 2015. "The Structure of Extremely Long Mouthparts in the Aphid
365 Genus *Stomaphis* Walker (Hemiptera: Sternorrhyncha: Aphididae)." *Zoomorphology* 134:431–45. doi: <https://doi.org/10.1007/s00435-015-0266-7>.
- 366 Cao, He-he, Zhan-feng Zhang, Xiao-feng Wang, and Tong-xian Liu. 2018. "Nutrition versus Defense: Why *Myzus persicae* (Green Peach Aphid)
367 Prefers and Performs Better on Young Leaves of Cabbage." *PLoS One* 13(4):1–16. doi: <https://doi.org/10.1371/journal.pone.0196219>.
- 368 Chandel, R. S., V. K. Chandla, K. S. Verma, and Mandeep Pathania. 2022. "Chapter 21 - Insect Pests of Potato in India: Biology and Management." Pp.
369 371–400 in, edited by A. Alyokhin, S. I. Rondon, and Y. B. T.-I. P. of P. (Second E. Gao. Academic Press.
- 370 Clarke, Rebecca, Monica A. Kehoe, Sonya Broughton, and Roger A. C. Jones. 2020. "Host Plant Affiliations of Aphid Vector Species Found in a
371 Remote Tropical Environment." *Virus Research* 281(December 2019):197934. doi: 10.1016/j.virusres.2020.197934.
- 372 Döring, Thomas F. 2014. "How Aphids Find Their Host Plants, and How They Don't." *Annals of Applied Biology* 165(1):3–26. doi:
373 <https://doi.org/10.1111/aab.12142>.
- 374 Ertunc, Filiz. 2020. "Chapter 46 - Emerging Plant Viruses." Pp. 1041–62 in, edited by M. M. B. T.-E. and R. V. P. Ennaji. Academic Press.
- 375 Gadhave, Kiran R., Saurabh Gautam, David A. Rasmussen, and Rajagopalbabu Srinivasan. 2020. "Aphid Transmission of Potyvirus: The Largest Plant-
376 Infecting RNA Virus Genus." *Viruses* 12(7):773. doi: 10.3390/v12070773.
- 377 Giannetti, Daniele, Mauro Mandrioli, Enrico Schifani, Cristina Castracani, Fiorenza A. Spotti, Alessandra Mori, and Donato A. Grasso. 2021. "First
378 Report on the Acrobat Ant *Crematogaster scutellaris* Storing Live Aphids in Its Oak-Gall Nests." *Insects* 12(2):108. doi:
379 <https://doi.org/10.3390/insects12020108>.
- 380 Guo, Huijuan, Liyuan Gu, Fanqi Liu, Fajun Chen, Feng Ge, and Yucheng Sun. 2019. "Aphid-Borne Viral Spread Is Enhanced by Virus-Induced
381 Accumulation of Plant Reactive Oxygen Species 1." *Plant Physiology* 179(January):143–55. doi: 10.1104/pp.18.00437.
- 382 Jakubczyk, Karolina, Klaudia Koprowska, Aleksandra Gottschling, and Katarzyna Janda-Milczarek. 2022. "Edible Flowers as a Source of Dietary Fibre
383 (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement." *Nutrients* 14(12). doi: 10.3390/nu14122470.
- 384 Jaouannet, Maëlle, Patricia A. Rodriguez, Peter Thorpe, Camille J. G. Lenoir, and Ruari Macleod. 2014. "Plant Immunity in Plant – Aphid Interactions." *Front Plant Sci.* 5(December):1–10. doi: 10.3389/fpls.2014.00663.
- 385 Jayaswal, Deepanshu, Pawan Mainkar, Kuldeep Kumar, Yamini Agarwal, and Ratna Prabha. 2022. "Pyramiding and Evaluation of Segregating Lines
386 Containing Lectin and Protease Inhibitor Genes for Aphid Resistance in Brassica Juncea." *Indian Journal of Biochemistry & Biophysics*
387 59(August):800–807. doi: 10.56042/ijbb.v59i8.62319.
- 388 Jones, Roger A. C. 2022. "Alteration of Plant Species Mixtures by Virus Infection: Managed Pastures the Forgotten Dimension." *Plant Pathology*
389 71(6):1255–81. doi: DOI: 10.1111/ppa.13571.
- 390 Jousset, Emmanuelle, Genson Gwenaëlle, and Coeur D. Armelle. 2010. "Evolutionary Lability of a Complex Life Cycle in the Aphid Genus
391 *Brachycaudus*." *BMC Evolutionary Biology* 10(1). doi: 10.1186/1471-2148-10-295.
- 392 Kallas, John. 2010. *Edible Wild Plants*. Gibbs Smith.
- 393 Karami-jamou, Tahereh, Alinaghi Mirmoayedi, Abbasali Zamani, and Yadolah Khajehzadeh. 2018. "The Impact of Ant Attendance on Protecting Aphis
394 *Gossypii* against Two Aphidophagous Predators and Its Role on the Intraguild Predation between Them." *Journal of Insect Behavior* 31:222–39.
395 doi: DOI: 10.1007/s10905-018-9670-4.
- 396 Kennedy, J. S., and H. L. G. Stroyan. 1959. "Biology of Aphids." *Annual Review of Entomology* 4(1):139–60.
- 397 Kinley, Chimi, A. Najitha Banu, A. M. Raut, Johnson Wahengbam, and Thinley Jamtsho. 2021. "A Review on Past, Present and Future Approaches for
398 Aphids Management." *Journal of Entomological Research* 45(2):336–46. doi: 10.5958/0974-4576.2021.00053.0.
- 399 Kumar, Sarwan. 2019. "Aphid-Plant Interactions: Implications for Pest Management." P. Ch. 7 in *Plant Communities and Their Environment*, edited by
400 M. T. Oliveira, F. Candan, and A. Fernandes-Silva. Rijeka: IntechOpen.
- 401 Kumar, Sushil, Malay K. Bhowmick, and Puja Ray. 2021. "Weeds as Alternate and Alternative Hosts of Crop Pests." *Indian Journal of Weed Science*
402 53(1):14–29. doi: 10.5958/0974-8164.2021.00002.2.
- 403 Liu, Xiang Dong, Ting Ting Xu, and Hai Xia Lei. 2017. "Refuges and Host Shift Pathways of Host-Specialized Aphids *Aphis Gossypii*." *Scientific*
404 *Reports* 7(1):1–9. doi: 10.1038/s41598-017-02248-4.
- 405 Maharani, Yani, Purnama Hidayat, Aunu Rauf, and Nina Maryana. 2018. "Short Communication: New Records of Aphid Species Subfamily Aphidinae
406 (Hemiptera: Aphididae) in West Java, Indonesia." *Biodiversitas* 19(2):460–65. doi: 10.13057/biodiv/d190219.
- 407 Margaritopoulos, J. T., M. Tzortzi, K. D. Zarpas, J. A. Tsitsipis, and R. L. Blackman. 2006. "Morphological Discrimination of *Aphis Gossypii*
408 (Hemiptera: Aphididae) Populations Feeding on Compositae." *Bulletin of Entomological Research* 96(2):153–65. doi: 10.1079/ber2005410.
- 409 Meuninck, Jim. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.
- 410 Mo, Carmen, and Angela M. Smilanich. 2023. "Feeding on an Exotic Host Plant Enhances Plasma Levels of Phenoloxidase by Modulating Feeding Efficiency
411 in a Specialist Insect Herbivore." *Frontiers in Physiology* 14(February):1–10. doi: 10.3389/fphys.2023.1127670.
- 412 Naidu, VSGR. 2012. "Hand Book on Weed Identification."
- 413 Nelson, Annika S., and Kailen A. Mooney. 2022. "The Evolution and Ecology of Interactions between Ants and Honeydew-Producing Hemipteran
414 Insects." *Annual Review of Ecology, Evolution, and Systematics* 53:379–402. doi: <https://doi.org/10.1146/annurev-eolsys-102220-014840>.
- 415 Pettersson, Jan, W. Fred Tjallingii, and Jim Hardie. 2017. "Host-Plant Selection and Feeding." Pp. 173–95 in *Aphids as crop pests*. CABI Wallingford
416 UK.
- 417 Piron, PGM, MC de Haas, and MAHM Sonnemans. 2019. "The Presence of Aphis (Toxoptera) *Aurantii* (Homoptera: Aphididae) in the Netherlands." *Entomologische Berichten* 79(5):162–64.

420 Santiago, Grazielle Silva, Luana Fonseca, Ernesto Oliveira Canedo-ju, Carla Rodrigues Ribas, Rafaela Pereira, and Guilherme Pereira Alves. 2017.
421 "Isolated and Community Contexts Produce Distinct Responses by Host Plants to the Presence of Ant-Aphid Interaction : Plant Productivity and
422 Seed Viability." Plos One 12(1):1–12. doi: 10.1371/journal.pone.0170915.
423 Singh, Rajendra, and Garima Singh. 2021. "Aphids." Pp. 105–82 in *Polyphagous Pests of Crops*. Springer.
424 Tegelaar, Karolina, Mattias Hagman, Robert Glinwood, Jan Pettersson, and Olof Leimar. 2012. "Ant–Aphid Mutualism: The Influence of Ants on the
425 Aphid Summer Cycle." *Oikos* 121(1):61–66. doi: <https://doi.org/10.1111/j.1600-0706.2011.19387.x>.
426 Yamamoto, Tetsuya, Mitsuru Hattori, and Takao Itino. 2020. "Seasonal Migration in the Aphid Genus *Stomaphis* (Hemiptera : Aphididae): Discovery of
427 Host Alternation Between Woody Plants in Subfamily Lachninae." *Journal of Insect Science* 20(5):1–10. doi: 10.1093/jisesa/ieaa103.
428 Zheng, Zhou, Mengqin Zhao, Zhijun Zhang, Xin Hu, Yang Xu, and Cong Wei. 2022. "Lactic Acid Bacteria Are Prevalent in the Infrabuccal Pockets and
429 Crops of Ants That Prefer Aphid Honeydew." *Front. Microbiol.* 12(January):1–17. doi: 10.3389/fmicb.2021.785016.
430

Species of aphids found in ornamental and wild Plants in Highland, Pagar Alam, South Sumatra

Abstract. Aphids are one of the crucial pests in the tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species were found on plants that were not actually hosts such as wild plants. Therefore, this study reported the species of aphids found in ornamental plants and the wild plants. The field research employed a purposive and direct observation approach to inventory cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host plants, and aphids, involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that 21 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Aphis citricola*, *Aphis craccivora*, *Aphis glycines*, *Aulacorthum solani*, *Greenidae* sp., *Hyperomyzus* sp., *Hysteroneura setariae*, *Lipaphis erysimi*, *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*, *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Rhopalosiphum padi*, *Sinemogoura citricola*, *Toxoptera aurantii*, *Toxoptera citricidus*, *Toxoptera odinae*, and *Schizaphis rotundiventris*.

Keywords: Aphids, ornamental plants, wild plants

Running title: Aphids found in ornamental and wild plants.

INTRODUCTION

Aphids are one of the crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhve et al. 2020). Aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can be found throughout the year due to their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids suck phloem sap of tender plant parts, which can deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, vector species can further weaken and stunt the growth of infected plants (Jones 2022). Therefore, it is crucial to control aphid populations in gardens and crops.

Many aphid species are found on plants that are not their actual hosts (Maharani et al. 2018). Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al. 2020). Alternative plants provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al., 2021). In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and native plants. Research on the diversity of aphid species in ornamental and wild plants has received little attention. This study reports diversity of aphid species found in ornamental and wild plants found in this area. The findings from this study can serve as a valuable resource for aphid management.

MATERIALS AND METHODS

The field research employed a purposive and direct observation approach to inventory of cultivated or wild plants hosting aphids and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. The collection and identification of host plants, and aphids, and natural enemies where available, involved systematic searches of all existing plant species to find those colonized by aphids. Any plants

50 colonized by aphids are documented as aphid hosts. Aphid identification was done using identification keys (Blackman and
 51 Eastop 2008) in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on
 52 morphological characteristics. The host plants were identified using weed identification hand book (Kallas, 2010;
 53 Meuninck, 2023; Naidu, 2012). The location and size of aphid colonies, including their life color, and photographs of the
 54 aphid colonies and their host plants were recorded.

55 RESULTS AND DISCUSSION

56 Result

57 Aphids infesting in ornamental plants

58 The results showed that 15 aphid species were found in Pagar Alam (Tables 1, 2).. These aphids mostly colonised
 59 flowers of various ornamental plants (Table 1, Figure 1).
 60

61 **Table 1.** Aphid species recorded in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Macrosiphoniella sanborni</i>	Leaves, young twig, flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i>	Leaves, flower
		<i>Neomyzus circumflexus</i>	Leaves
		<i>Myzus persicae</i>	Leaves, flower
3	<i>Caladium sp.</i>	<i>Pentalonia caladii</i>	Leaves,
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	Leaves, flower
5	<i>Canna indica</i>	<i>Rhopalosiphum nymphaeae</i>	Leaf
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	Shoot, young leaves, flower
7	<i>Cestrum sp.</i>	<i>Aphis gossypii</i>	Shoot, flower
		<i>Neomyzus circumflexus</i>	Young leaves
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	Flower
9	<i>Chrysanthemum sp.</i>	<i>Macrosiphoniella sanborni</i>	Shoot, twig
10	<i>Dahlia sp.</i>	<i>Aphis gossypii</i>	Flower
11	<i>Dendrobium sp.</i>	<i>Sinemogoura citricola</i>	Flower
12	<i>Duranta sp.</i>	<i>Aphis gossypii</i>	Shoot, flower
13	<i>Helianthus giganteus.</i>	<i>Aphis glycines</i>	Flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	Flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii,</i>	Flower
		<i>Toxoptera aurantii</i>	Shoot, young leaves
16	<i>Ixora sp.</i>	<i>Aphis citricola</i>	Flower
		<i>Aphis gossypii</i>	Flower
		<i>Toxoptera aurantii</i>	Shoot, flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i>	Young Twig
		<i>Toxoptera citricidus</i>	Shoot, flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i>	Shoot, flower
		<i>Toxoptera odinae</i>	Shoot, flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	Flower
20	<i>Spondias dulcis</i>	<i>Aphis citricola</i>	Flower

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69 **Fig 1.** Photos showing colonies of different aphid species in ornamental plants: a) *Aphis gossypii* in *Dahlia* sp. flower b) *Aphis gossypii*
 70 in *Hibiscus rosasinensis* flower c) *Aphis gossypii* in *Cestrum* twig and flower, d) *Aphis craccivora* in *Clitoria ternatea* flower, e) *Aphis*
 71 *glycines* in *Helianthus giganteus* flower, f) *Aphis craccivora* on the *Murayya paniculata* flower, g) *Toxoptera odinae* in the *Mussaenda*
 72 *frondosa*, h) *Macrosiphoniella sanborni*. in *Chrysanthemum* sp. leaves i) *Macrosiphum rosae* in *Rosa indica* flower, j) *Rhopalosiphum*
 73 *nymphaeae* in *Canna indica* leaves. All the photos were captured by Chandra Irsan.

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76 The relationship between aphids and ants was also recorded. Aphids produce a sweet, sticky substance called
 77 honeydew. Ants are attracted to this honey because it serves as a food source for them. When aphids are present, they
 78 secrete honeydew, which attracts ants. This research recorded the presence of ants on plant parts colonized by aphids
 79 (Table 2).

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83 **Table 2.** Aphid species recorded in ornamental plants and the presence of the ants in the plant parts colonized

No	Aphid Species	Ornamental plants	Aphids life colour	Plant parts colonized	Ant attendance
1	<i>Aphis craccivora</i>	<i>Clitoria ternatea</i>	black	flowers	+
		<i>Murraya paniculata</i>	black	flowers	+
2	<i>Aphis citricola</i>	<i>Catharanthus roseus</i>	greenish yellow	flowers	+
		<i>Ixora</i> sp.	greenish yellow	flowers	+
		<i>Mussaenda frondosa</i>	greenish yellow	shoots, flowers	+
		<i>Spondias dulcis</i>	greenish yellow	flowers	+
3	<i>Aphis glycines</i>	<i>Helianthus giganteus</i>	greenish yellow	flowers	+
4	<i>Aphis gossypii</i>	<i>Cestrum</i> sp.	green	shoots, flowers	+
		<i>Cananga odoratum</i>	light green	shoots, flowers	+
		<i>Dahlia</i> sp.	green dark	flowers	+
		<i>Duranta</i> sp.	light green	shoots, flowers	+
		<i>Hibiscus rosasinensis</i>	dark green	flowers	+
		<i>Ixora paludosa</i>	light green	flowers	+
		<i>Ixora</i> sp.	light green	flowers	+
5	<i>Aulacorthum solani</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-
6	<i>Macrosiphoniella sanborni</i>	<i>Aster alpinus</i>	brown black	leaves, twigs, flowers	+
		<i>Chrysanthemum</i> sp.	reddish brown	leaves, twigs	+
7	<i>Macrosiphum rosae</i>	<i>Rosa indica</i>	green	flowers	-
8	<i>Myzus persicae</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-
9	<i>Neomyzus circumflexus</i>	<i>Cestrum</i> sp.	light green	young leaves,	-
		<i>Brugmansia suaveolens</i>	light green	flowers	-
				flowers	
10	<i>Pentalonia caladii</i>	<i>Caladium</i> sp.	brown-black	leaves	+
11	<i>Rhopalosiphum nymphaeae</i>	<i>Canna indica</i>	green black	leaves	+
12	<i>Sinemegoura citricola</i>	<i>Dendrobium</i> sp.	brown	flowers	-
13	<i>Toxoptera aurantii</i>	<i>Ixora paludosa</i>	brown black	flowers	+
		<i>Ixora</i> sp.	brown black	flowers	+
14	<i>Toxoptera citricidus</i>	<i>Murraya paniculata</i>	black	stems	+
15	<i>Toxoptera odinae</i>	<i>Mussaenda frondosa</i>	reddish-brown	flowers	+

84 (+): present, (-): absent

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86 **Aphids infesting in wild plants (weed or non-weed plants)**

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88 In addition, this study documented aphid colonies on flowers, stalks, plant tops, young leaves and old leaves of wild
89 plants (Table 3, Figure 2).

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91 **Table 3.** Species of aphids found in wild (weed or non-weed) plants and their colony locations.

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	weed	<i>Aphis gossypii</i>	shoots, buds
3	<i>Alternanthera sessilis</i>	weed	<i>Aphis gossypii</i>	shoots, buds
4	<i>Amaranthus gracilis</i>	weed	<i>Aphis craccivora</i>	flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	weed	<i>Lipaphis erysimi</i>	flowers, shoots, and buds
6	<i>Croton hirtus</i>	weed	<i>Aphis gossypii</i>	flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks
8	<i>Cyperus rotundus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	weed	<i>Hysteroneura setariae</i>	flower, flower stalks
11	<i>Echinocloa crussgali</i>	weed	<i>Hiperomyzus</i> sp.	young leaves, old leaves
12	<i>Ecliptica prostrata</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves
13	<i>Eleusine indica</i>	weed	<i>Hysteroneura setariae</i>	flower, flower stalks, leaf axils
			<i>Rhopalosiphum maidis</i>	flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	weed	<i>Aphis gossypii</i>	flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	weed	<i>Hysteroneura setariae</i>	flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves
17	<i>Eupotarium odoratum</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves,
			<i>Aphis glycines</i>	shoot, young twigs
18	<i>Hymenochera acutigluma</i>	Weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, leaf axils
19	<i>Bridelia tomentosa</i>	Non-weed	<i>Greenidea</i> sp.	young leaves

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
20	<i>Lophatherum gracile</i>	Weed	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	young leaves, old leaves, leaf axils young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	Non-weed	<i>Aphis gossypii</i>	shoots, young leaves
22	<i>Mikania mikranta</i>	Weed - liana	<i>Aphis gossypii</i> <i>Aphis glycines</i>	shoots, young leaves, old leaves shoot, young twig
23	<i>Mimosa invisa</i>	weed	<i>Aphis craccivora</i>	shoots, pods
24	<i>Mimosa pudica</i>	weed	<i>Aphis craccivora</i>	shoots, pods, flowers
25	<i>Mimosa vigra</i>	Non-weed	<i>Aphis craccivora</i>	shoots, pods
26	<i>Oryza rufipogon</i>	weed	<i>Rhopalosiphum padi</i> , <i>Rhopalosiphum maidis</i>	old leaves, young leaves (shoot), leaf axils old leaves, young leaves (shoot), leaf axils
27	<i>Oxonopus compressus</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalk, seeds
29	<i>Phyllanthus neruri</i>	weed	<i>Aphis citricola</i>	shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	weed	<i>Aphis craccivora</i>	shoots, young leaves, flowers
31	<i>Physalis angulata</i>	weed	<i>Aphis craccivora</i> <i>Aphis gossypii</i>	shoots, young leaves, old leaves shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	weed	<i>Lipapis erysimi</i>	flowers, fruits, shoots, young leaves
33	<i>Sida rhombifolia</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arventris</i>	weed	<i>Lipapis erysimi</i>	young leaves, fruit stalks, flowers, fruits

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93 The presence of ants in aphid colonization symbolizes a mutually beneficial relationship where the ants receive food
94 from the aphids while providing protection to the aphids. This study recorded the ant attendance in aphids colonization
95 (Table 4).

96 **Table 4.** Aphid species recorded in ornamental plants and the presence of the ants in the plant parts colonized.

No	Aphid Species	Wild plants	Aphids life colour	Plant parts colonized	Ant attendance	
1	<i>Aphis gossypii</i>	<i>Ageratum conyzoides</i>	Light green	shoots, young leaves, old leaves, flowers	+	
		<i>Alternanthera philoxeroides</i>	Light green	shoots, buds	+	
		<i>Alternanthera sessilis</i>	Light green	shoots, buds	-	
		<i>Croton hirtus</i>	Dark green	flowers, shoots, young leaves, old leaves, young twigs	+	
		<i>Ecliptica prostrata</i>	green	twigs	+	
		<i>Emilia sonchifolia</i>	green	shoots, young leaves	+	
		<i>Euphorbia hirta</i>	light green	flower, flower stalks, shoots	+	
		<i>Eupotarium odoratum</i>	light green	young leaves, old leaves	+	
		<i>Melastoma affine</i>	light green	young leaves, old leaves, young twigs	+	
		<i>Mikania mikranta</i>	light green	shoots, young leaves	+	
		<i>Physalis angulata</i>	yellowish green	shoots, young leaves, old leaves	+	
		<i>Sida rhombifolia</i>	yellowish green	shoots, young leaves, old leaves, fruit/seeds	-	
2	<i>Aphis craccivora</i>	<i>Amaranthus gracilis</i>	black	flowers, shoots, young leaves, old leaves	+	
		<i>Mimosa invisa</i>	black	shoots, pods	+	
		<i>Mimosa pudica</i>	black	shoots, pods, flowers	+	
		<i>Mimosa vigra</i>	black	shoots, pods	+	
		<i>Portulaca oleraceae</i>	black	shoots, young leaves, flowers	+	
		<i>Physalis angulata</i>	black	shoots, young leaves, old leaves	+	
3	<i>Aphis glycines</i>	<i>Eupotarium odoratum</i>	Greenish yellow	young leaves, old leaves, young twigs	+	
		<i>Mikania mikranta</i>	Light green	shoots, young leaves, old leaves	+	
4	<i>Aphis citricola</i>	<i>Phyllanthus neruri</i>	Greenish Yellow	shoot, young leaves, young twigs, petioles	+	
5	<i>Greenidea</i> sp.	<i>Bridelia Tomentosa</i>	Greenish Yellow	young leaves	-	
6	<i>Hysteronura setariae</i>	<i>Digitaria ciliaris</i>	reddish-brown	flower, flower stalks	+	
		<i>Eleusin indica</i>	reddish-brown	flower, flower stalks, leaf axils	+	
		<i>Eragrostis tenella</i>	reddish-brown	flower, flower stalks, seeds	+	
		<i>Hymenochera acutigluma</i>	reddish-brown	flowers, flower stalks, leaf axils	+	
		<i>Lophatherum gracile</i>	reddish-brown	young leaves, old leaves, leaf axils	+	
		<i>Oxonopus compressus</i>	reddish-brown	flower, flower stalk, leaf axils	+	
		<i>Paspalum conjugatum</i>	reddish-brown	flower, flower stalk, seeds	+	
7		<i>Hiperomyzus</i> sp.	<i>Echinochloa crusgali</i>	Black	young leaves, old leaves	-
8		<i>Lipapis erysimi</i>	<i>Blumea lacera</i>	Whitish green	flowers, shoots, and buds	+
			<i>Rorippa indica</i>	Whitish green	flower, fruit, shoots, young leaves	+
	<i>Sonchus arventris</i>		Whitish green	young leaves, fruit stalks, flower, fruit	+	
9	<i>Rhopalosiphum maidis</i>	<i>Eleusin indica</i>	green	flower, flower stalks, leaf axils	+	
		<i>Lophatherum gracile</i>	green	young leaves, old leaves, leaf axils	+	
		<i>Oryza rufipogon</i>	green	old leaves, young leaves (shoot), leaf axils	-	
10	<i>Rhopalosiphum padi</i>	<i>Oryza rufipogon</i>	Whitish green	old leaves, young leaves (shoot), leaf axils	+	
11	<i>Schizaphis rotundiventris</i>	<i>Cynodon dactylon</i>	Green	flowers, flower stalks	+	
		<i>Cyperus rotundus</i>	green	flowers, flower stalks, leaf axils	+	
		<i>Cyperus compressus</i>	green	flowers, flower stalks, leaf axils	+	

97 (+): present, (-): absent

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Figure 2. Aphids found infesting wild plants a) *Aphis gossypii* in *Ageratum conyzoides*, b) *Aphis gossypii* in *Croton hirtus* c) *A. gossypii* in *Eupatorium odoratum*, d) *Aphis gossypii* in *Pachystochys* sp., e) *Pentalonia caladii* in *Caladium* sp., f) *Aphis gossypii* in *Alternanthera sessilis*, g) *Aphis gossypii* in *Portulaca oleraceae* h) *Aphis gossypii* in *Euphorbia hirta*, i) *Aphis citricola* in *Phyllanthus nerruri*, j) *Aphis citricola* in *Sida rhombifolia*, k) *Aphis citricola* in *Annona muricata*, l) *Aphis citricola* in *Ludwigia peruviana*, m) *A. craccivora* in *Mimosa pudica*, n) *Aphis craccivora* in *Amaranthus gracilis*, o) *Aphis glycine* in *Mikania micranta*, p) *Hysteneura* sp. in *Eleusin*, q) *Greenidae* sp. in *Bridelia tomentosa* young leaves., r) *Hyperomyzus* sp. in *Echinochloa crusgali*, s) *Lipaphis erysimi* in *sonchus arventris*, t) *Rhopalosiphum padi* in *Oryza rufipogon*, u) *Rhopalosiphum Maidis* in *Oryza rufipogon*. All the photos were captured by Chandra Irsan.

124 Discussion

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126 In the present study, some aphid species were found on some ornamental plants in Pagaram. The location of aphid
127 colonization on the plants varied. On *Adiantum predatum* plants, aphids formed colonies on young leaf stalks and on
128 newly emerging leaves. The aphids displayed brown and black coloration. The aphid colonies found were small, and the
129 colonized plant parts showed no signs of disease. The identification results showed that the aphids were *Neotoxoptera* sp.,
130 and notably, they were not associated with ants. On *Aster alpinus*, aphids were found to form colonies on the stems or
131 young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized
132 plant parts showed symptoms of stunting. The identification results showed that the aphids were *Macrosiphoniella*
133 *sanborni*, and they were associated with ants. On the *Brugmansia suaveolens*, *M. persicae* were found on the undersides of
134 old leaves or leaves that have started to turn yellow. The colonies were relatively small. The aphids found were green and
135 large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. was found one species of
136 aphids: *P. caladii*. *P. caladii* was known and found in taro plants, the aphids formed colonies under the surface of young
137 and older leaves (Bhadra and Agarwala 2014). According to this present study, the occupied leaf areas did not display
138 severe symptoms. The aphids were yellow green to dark green. The wingless adult aphids often had a white, flour-like
139 appearance on their bodies. On the *Cananga odoratum* (ylang-ylang), colonies of *T. aurantii* were found on the undersides
140 of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large.
141 Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black in color. The colonies
142 of *T. aurantii* were found to be associated with black ants. Aphids on *C. indica* (Indian shot, African arrowroot) were
143 found to form colonies in the leaf axils and under the leaf surface near the leaf base. The colonies were quite large. The
144 aphids were dark brown to dark red coloring with a medium-sized body and the identification results showed that the
145 aphids were *Rhopalosiphum nymphaeae* (Acharya and Singh 2004). The colonies of *R. nymphaeae* were found to be
146 associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were found. The aphids were yellow-
147 green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and the colonized plant parts did not
148 show any symptoms of disease. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the undersides of young
149 leaves, shoots, and within flower parts, especially between petals or flower stalks that had not fully bloomed. The colonies
150 were quite large. The body color of aphids was green to dark green with small to medium-sized bodies. The colonized
151 plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were *A.*
152 *gossypii*. The aphid colonies found were consistently associated with ants. Aphids on *Clitoria ternatea* were found to form
153 colonies on flower parts, flower crowns, stems and young leaves. The aphids were brown to black in color. Colonized
154 plant parts, especially shoots and young leaves, showed stunting symptoms. The identification results showed that the
155 aphids were *A. craccivora*. These colonies were consistently associated with ants. The aphids on the *Dahlia* sp. formed
156 colonies on unopened flower buds, with a significant population among the blooming petals. The body color was green to
157 dark green. The identification results showed that the aphids were *A. gossypii*. According to this present study,
158 *Sinemegoura citricola* colonies were found on the young leaves of *Dendrobium* sp., with the color body of the *S. citricola*
159 aphids were yellow, green to dark green, and the colonized plants did not show any disease symptoms, and they were
160 associated with ants. On *Duranta* sp., colonies of aphids were located on the undersides of young leaves and the colonized
161 plant parts showed stunting symptoms. The colonies were very large. The aphids were green in color. The identification
162 results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Furthermore,
163 on the *Helianthus annuus*, aphid colonies were found between the flower petals. The colonized flowers, especially the
164 crowns, exhibited a tendency to fall off easily. The aphids were green and yellow in color. The colonies were small. The
165 identification results showed that the aphids were *A. gossypii*. These aphid colonies were associated with ants. Aphid

166 colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies were small in size. The aphids were
167 green with a medium body size. The colonized plant parts did not show any disease symptoms. The identification results
168 showed that the aphids were *M. ornatus*. The aphid colonies were not associated with ants. Within the colonies,
169 mummified aphids that were parasitized by Aphidiidae were found. On the *Hibiscus rosa-sinensis*, aphids ranging in color
170 from yellow to dark green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the
171 undersides of aging leaves. The colonies grew to be very large. The identification results showed that the aphids were *A.*
172 *gossypii*. The aphid colonies were consistently associated with ants. Two types of aphids were found on the flowering
173 plant *Ixora paludosa*. First, the aphids formed colonies on the undersides of young leaves that were still red or light green
174 and sometimes on flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf
175 growth, leaf shrinkage, necrotic spots on the leaf surface, and slightly downward-curved leaf edges. The upper leaf surface
176 looked wet and sticky, like sugar. The aphids had yellow, green, or slightly dark green bodies, with some wingless adults
177 having a powdery white upper surface. The identification results showed that the aphids were *A. gossypii*, and they were
178 almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface of
179 young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts occupied
180 by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched stigma and
181 venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids were also
182 associated with ants. Moreover, in *Ixora* sp. flower plants, two forms of aphids were discovered. These aphids occupied
183 the shoots, young leaves and unopened flowers. The affected plant parts did not show obvious symptoms. The aphids
184 exhibited colors ranging from yellow and green to a slightly darker green. Sometimes the upper surface of the wingless
185 imago's body appeared white, resembling flour. The identification results showed that these aphids were *A. gossypii*. These
186 aphid colonies were almost always associated with ants. Another species of aphids was founded and formed colonies on
187 flower stalks that had not yet bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant
188 did not induce any symptoms of plant disease. The aphids were yellow or yellowish green, with black cauda and
189 siphunculi. Their bodies were very small to small. The identification results showed that the aphids were *A. citricola*. The
190 colonies of *A. citricola* were also frequently found in association with ants. Two types of aphids were found on *Mussaenda*
191 *frondos*, each forming colonies in different locations. The first type formed colonies on young leaves, shoots, and flowers.
192 The plant parts they occupied showed no obvious disease symptoms. The identification results showed that the aphids
193 were *Toxoptera odinae*. The aphids were yellow, green, and some with dark green (Blackman et al. 2011). The second
194 type of aphids formed colonies on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies
195 could also be found on young leaves, shoots and within flower parts. The plant parts they infested showed no signs of
196 diseases. The aphids were yellow or yellow green, with black cauda and siphunculi. They had tiny to small bodies. The
197 identification results showed that the aphids were *A. citricola*. Many aphid species infest a variety of ornamental plants
198 because these insects are attracted to such plants due to the rich nutrient content in the plant sap (Braham et al. 2023).

199 The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This
200 indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
201 generally consistent within the same taxon. *Ageratum conyzoides* was infested by *Aphis gossypii*. These aphids formed
202 colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
203 yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* or alligator grass was also colonized
204 by *Aphis gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging
205 from yellow-green to dark green. *Alternanthera sessilis* was colonized by *Aphis gossypii*, forming colonies on shoots,
206 flowers, and fruit. The colonies were typically large, and they were often associated with tiny brown ants. *Amaranthus*
207 *gracilis* was infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers and young and old leaves.
208 They were dark brown to black in color, with shiny black wingless imagoes. Colonies of these aphids were associated with
209 both black and red ants. *Blumea lacera* was colonized by *Lipaphis erysimi*. These aphids were bright green, and of
210 medium size. The colonies formed on flowers, flower stalks and the undersides of the leaves at the top. The aphid colonies
211 were not associated with ants. *Croton hirtus* or fire grass was infested by *Aphis gossypii*. The aphids were yellow green to
212 dark green. The colonies were found on the stems, leaves, buds and flowers, often forming large colonies. *Cynodon*
213 *dactylon* or Bermuda grass was colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks
214 and sometimes in the leaf axils of the plant. Small colonies were formed. The aphids were brown to reddish brown. They
215 were associated with ants. *Cyperus rotundus* or nut grass was infested by *Schizaphis rotundiventris* aphids. The colonies
216 were found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red
217 ants. The aphids were dark brown in color. *Cyperus compressus* or grass puzzle was colonized by *Schizaphis*
218 *rotundiventris* aphids, forming colonies in the flowers, flower stalks and sometimes in the axils and leaves of the shoots or
219 buds. Small colonies were observed. *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies
220 scattered on the flowers and flower stalks. These aphids were light brown to brown in color. *Echinocloa crussgali* or water
221 hyacinth plants were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large
222 colonies on the undersides of both young and old leaves. The aphid colonies were never found in association with ants.
223 *Ecliptica prostrata* or urang aring was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The
224 aphids were bright green to blackish green. The aphid colonies were also consistently associated with ants. *Eleusin indica*
225 was colonized by two species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H. setariae* formed colonies in

226 flower parts, flower stalks and leaf axils resulting in quite large colonies. *H. setariae* body color ranged from red brown to
227 dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis* formed colonies in the leaf axils
228 and undersides of leaves and on leaf shoots that had not yet opened. The colonies were not densely packed. The leaf aphids
229 of *R. maidis* were green in color, with distinct black siphunculi and cauda. These aphids had relatively large bodies with a
230 slightly elongated shape. *R. maidis* colonies were always associated with ants. The plant *Emilia sonchifolia*, characterized
231 by its purple flowers, was colonized by *Aphis gossypii*. The aphids were yellow to green in colour. The colonies formed
232 near flowers, flower stalks, and shoot leaves. *Eragrostis tenella* was infested by *Hysteroneura setariae* aphids. The aphids
233 were brown to red brown. Small colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's
234 seeds. The aphids of *H. setariae* were consistently associated with ants. *Euphorbia hirta* or wart grass was colonized by
235 *Aphis gossypii*. The aphids formed colonies on the undersides of leaves, resulting in stunted growth of the leaves. The
236 aphids were yellow to dark green in color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants.
237 *Eupotarium odoratum* was colonized by both *Aphis gossypii* and *Aphis citricola*. *A. gossypii* formed colonies in the buds,
238 young leaves, old leaves, and young twigs. Young leaves that were colonized by *A. gossypii* became stunted with an
239 irregular shape. *A. gossypii* found in this plant showed yellow-green to dark green in body colour. The colonies of *A.*
240 *citricola* formed on the young twigs near the shoots, with these aphids displaying yellow-green coloration and having
241 black siphunculi and cauda. Aphid colonies of both *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated
242 with either black or red ants. *Hymenochera acutigluma* or hair axis was colonized by *Hysteroneura setariae*, which formed
243 colonies on the flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms.
244 *Lagerstromea sp.* or *kenidai*, was infested by *Greenidae sp.* These aphids had bright green bodies and distinctive elongated
245 siphunculi with thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized
246 leaves did not show any disease symptoms. *Lophatherum gracile* or bamboo grass plants were colonized by two species of
247 aphids: *hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of
248 leaves, leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were
249 brown to red brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R.*
250 *maidis* aphids were green to bright green in color, with black siphunculi and cauda. It was possible for colonies of the two
251 species of aphids on *L. gracile* to mix. In addition, *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed
252 on shoots, particularly near newly emerging shoots and on newly emerging fruits and flowers. The body colour of aphids
253 ranged from yellow to green. The colonized plant parts did not show any disease symptoms. *Mikania miranta* was
254 colonized by *Aphis gossypii* and *Aphis glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of
255 the leaves, resulting in stunted and curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely
256 populated. *A. Glycine* aphids were light green to green in color. The colonized plant parts became distorted. The two
257 species of aphids could mix to form a single colony. *Mimosa invisa* (cater-grass) was colonized by *Aphis craccivora*. The
258 aphids of *A. craccivora* on *M. invisa* plants formed colonies only on the shoots with small colonies. The aphids appeared
259 dark black with wingless imagoes. *Mimosa pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed
260 colonies on shoots, especially young shoots, and occasionally on flowers and pods. The aphids were black and of medium
261 size, resulting in stunted growth of the colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized
262 by *Aphis craccivora*. The colonies of aphids occupied the pods and shoots with small colonies. The nymphs of aphids were
263 black, and wingless adults were shiny black. The colonized plant parts did not show any disease symptoms. *Oryza*
264 *rufipogon* was colonized by two species of aphids: *Rhopalosiphum rice* and *Rhopalosiphum maidis*. Both aphids colonized
265 the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species could be
266 distinguished by their body color. *R. maidis* appeared green with black siphunculi and cauda, while *R. rice* appeared white.
267 The colonies of *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants. *Oxonopus*
268 *compressus* or *pait* grass was colonized by *Hysteroneura setariae* aphids. The colonies occupied flowers, flower stalks,
269 seeds, and sometimes in the leaf axils. The aphids were brown to dark brown in color. Small colonies were formed, and
270 they were also consistently associated with ants. *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies
271 occupied flower parts, especially the seeds and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus niruri*
272 was colonized by *Aphis citricola*. The colonies formed on the shoots and the undersides of leaves and petioles. The
273 colonized parts became distorted, stunted, and wrinkled. The aphids had yellow bodies with black siphunculi and cauda, and
274 the colonies formed were quite large. *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A.*
275 *craccivora* in *P. oleraceae* plants formed colonies on the undersides of leaves, especially young leaves, shoots and in
276 flowers. The colonized plant parts became stunted, and leaf edges curled downward. The aphids had dark brown to black
277 bodies, with wingless imagoes that appeared glossy black. *Physalis angulata* plants were colonized by *Aphis craccivora*.
278 The aphids had dark green to black bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the
279 shoots or near the leaf buds. The colonized plant parts did not show any symptoms of disease. *Rorippa indica* or mustard
280 land was colonized by *Lipaphis erysimi*. The colonies formed on the flowers, fruits, flower stalks and the lower surface of
281 leaves. The colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia* or cacabean was
282 colonized by *Aphis gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of
283 lower leaves, stalks and flower petals. The colonized plant parts, especially the shoots, showed curling, and the leaf edges
284 curled downward. *Sonchus arvensis* plants were colonized by *L. erysimi*. The aphids had green to whitish green body

285 colours, and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts
286 became stunted over time.

287 In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
288 displayed typical symptoms of damage, but some did not show any symptoms. Generally, the symptoms of the plants
289 caused by aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves.
290 These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show
291 symptoms when colonized by aphids. This condition happened because the colonized parts had reached their maximum
292 growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that
293 did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the
294 leaves and plant parts were old. The old leaves or twigs might not show the typical symptoms associated with aphid
295 infestations. The part of the plant exhibiting characteristic symptoms when colonized by aphids also often experienced a
296 cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued to
297 grow, resulting in some parts developing normally while others become stunted (Pettersson, Tjallingii, and Hardie 2017).
298 This condition could lead to the bending of shoots or young stems, curling of leaves, downward curling of leaf edges, or
299 stunted leaf growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display
300 any distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves
301 differed from that of dicot plants. Therefore, the presence of aphids in monocot plants or plants was often easier to
302 recognize through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility
303 that aphids had colonized the plant (Tegelaar et al. 2012). Therefore, the presence of ants could serve as an indicator of the
304 presence of aphid colonies. According to this present study, ants were present in some aphids colonies from the subfamily
305 aphidini, while the ants were absent in some aphids colonies from the macrocypini subfamily. The absent of ants in aphids
306 colonies could be the colonies have just formed, or the population is still low (Kummel, Brown, and Bruder 2013). Aphids
307 colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new growth or
308 reproductive parts of plants. Flowers contain a nutrient-rich nature and easy access to sap, therefore aphids were attractive
309 to sap the flowers. Some aphid species were drawn to certain colors (Jakubczyk et al. 2022). Herbs served as an alternative
310 host for aphids in this present study. Aphids consume sugar-rich liquid in plants, known as "sap". Aphids considered herbs
311 and other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate plant tissues and
312 access this fluid (Brožek et al. 2015). Several aphids colonized herbs such as Indian mustards, *Lipaphis erysimi*, and
313 *Myzus persicae* are the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al. 2022). Due to a
314 symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance
315 known as honeydew as a waste product, which ants found highly attractive as a food source (Nelson and Mooney 2022).
316 The honeydew contained an abundance of sugars, extracted by aphids from the plant juice (Zheng et al. 2022). Ants were
317 drawn to this nutrient-rich food source and would often 'farm' aphids for it. In exchange for honeydew, ants provided
318 aphids with protection from other insects and predators, such as ladybugs, lacewing larvae, and parasitic wasps (Karami-
319 jamour et al. 2018). Certain species of ants would transport aphids to new host plants for improved foraging opportunities,
320 ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not only nourished the ant colony,
321 but its high sugar content also supported the development of their fungus farms (in certain species) and provided energy
322 for the growth of their own progeny (Biedermann and Vega 2020).

323

CONCLUSION

324 21 species of aphids were found in Pagaralam, namely *Aphis gossypii*, *Aphis citricola*, *Aphis craccivora*, *Aphis*
325 *glycines*, *Aulacorthum solani*, *Greenidae* sp., *Hyperomyzus* sp., *Hysteroneura setariae*, *Lipaphis erysimi*,
326 *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*,
327 *Rhopalosiphum maidis*, *Rhopalosiphum nymphaeae*, *Rhopalosiphum padi*, *Sinemogoura citricola*, *Toxoptera aurantii*,
328 *Toxoptera citricidus*, *Toxoptera odinae*, and *Schizaphis rotundiventris*.

329

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REFERENCES

- 333 Acharya, Shelley, and Rajendra Singh. 2004. "Aphids on Medicinal Plants in North East India (Insecta : Homoptera : Aphididae)." *Rec. Zool. Surv.*
334 *India* 102(June 2004). doi: 10.26515/rzsi/v103/i1-2/2004/159495.
- 335 Bass, Chris, Alin M. Puinean, Christoph T. Zimmer, Ian Denholm, Linda M. Field, Stephen P. Foster, Oliver Gutbrod, Ralf Nauen, Russell Slater, and
336 Martin S. Williamson. 2014. "The Evolution of Insecticide Resistance in the Peach Potato Aphid , *Myzus Persicae*." *Insect Biochemistry and*

337 *Molecular Biology* 51:41–51. doi: 10.1016/j.ibmb.2014.05.003.

338 Bhadra, Parna, and Basant Kumar Agarwala. 2014. “On the Morphological and Genotypic Variations of Two Congeneric Species of Banana Aphid
339 Pentalonia (Homoptera : Aphididae) from India.” (March). doi: 10.5932/j.als.20120203.06.

340 Biedermann, Peter H. W., and Fernando E. Vega. 2020. “Ecology and Evolution of Insect–Fungus Mutualisms.” *Annual Review of Entomology* 65:431–
341 55. doi: <https://doi.org/10.1146/annurev-ento-011019-024910>.

342 Blackman, Roger L., and Victor F. Eastop. 2008. *Aphids on the World’s Herbaceous Plants and Shrubs, 2 Volume Set*. John Wiley & Sons.

343 Blackman, Roger L., and Victor F. Eastop. 2017. “Taxonomic Issues.” Pp. 1–36 in *Aphids as crop pests*. CABI Wallingford UK.

344 Blackman, Roger Laurence, Masato Sorin, and Masahisa Miyazaki. 2011. “Sexual Morphs and Colour Variants of Aphis (Formerly Toxoptera) Odinae
345 (Hemiptera, Aphididae) in Japan.” *Zootaxa* (November 2011):53–60. doi: 10.11646/zootaxa.3110.1.5.

346 Braham, Mohamed, Synda Boulahia-kheder, Mouna Kahia, and Siwar Nouira. 2023. “Aphids and Citrus Responses to Nitrogen Fertilization.” *Journal of
347 the Saudi Society of Agricultural Sciences* 22(6):374–83. doi: 10.1016/j.jssas.2023.03.003.

348 Brożek, Jolanta, Ewa Mróz, Dominika Wylęzek, Łukasz Depa, and Piotr Węgierek. 2015. “The Structure of Extremely Long Mouthparts in the Aphid
349 Genus Stomaphis Walker (Hemiptera: Sternorrhyncha: Aphididae).” *Zoomorphology* 134:431–45. doi: <https://doi.org/10.1007/s00435-015-0266-7>.

350

351 Cao, He-he, Zhan-feng Zhang, Xiao-feng Wang, and Tong-xian Liu. 2018. “Nutrition versus Defense : Why Myzus Persicae (Green Peach Aphid)
352 Prefers and Performs Better on Young Leaves of Cabbage.” *PLoS One* 13(4):1–16. doi: <https://doi.org/10.1371/journal.pone.0196219>.

353 Clarke, Rebecca, Monica A. Kehoe, Sonya Broughton, and Roger A. C. Jones. 2020. “Host Plant a Ffi Liations of Aphid Vector Species Found in a
354 Remote Tropical Environment.” *Virus Research* 281(December 2019):197934. doi: 10.1016/j.virusres.2020.197934.

355 Ertunc, Filiz. 2020. “Chapter 46 - Emerging Plant Viruses.” Pp. 1041–62 in, edited by M. M. B. T.-E. and R. V. P. Ennaji. Academic Press.

356 Gadhave, Kiran R., Saurabh Gautam, David A. Rasmussen, and Rajagopalbabu Srinivasan. 2020. “Aphid Transmission of Potyvirus: The Largest Plant-
357 Infecting RNA Virus Genus.” *Viruses* 12(7):773. doi: 10.3390/v12070773.

358 Giannetti, Daniele, Mauro Mandrioli, Enrico Schifani, Cristina Castracani, Fiorenza A. Spotti, Alessandra Mori, and Donato A. Grasso. 2021. “First
359 Report on the Acrobat Ant Crematogaster Scutellaris Storing Live Aphids in Its Oak-Gall Nests.” *Insects* 12(2):108. doi:
360 <https://doi.org/10.3390/insects12020108>.

361 Jakubczyk, Karolina, Klaudia Koprowska, Aleksandra Gottschling, and Katarzyna Janda-Milczarek. 2022. “Edible Flowers as a Source of Dietary Fibre
362 (Total, Insoluble and Soluble) as a Potential Athlete’s Dietary Supplement.” *Nutrients* 14(12). doi: 10.3390/nu14122470.

363 Jayaswal, Deepanshu, Pawan Mainkar, Kuldeep Kumar, Yamini Agarwal, and Ratna Prabha. 2022. “Pyramiding and Evaluation of Segregating Lines
364 Containing Lectin and Protease Inhibitor Genes for Aphid Resistance in Brassica Juncea.” *Indian Journal of Biochemistry & Biophysics*
365 59(August):800–807. doi: 10.56042/ijbb.v59i8.62319.

366 Jones, Roger A. C. 2022. “Alteration of Plant Species Mixtures by Virus Infection: Managed Pastures the Forgotten Dimension.” *Plant Pathology*
367 71(6):1255–81. doi: DOI: 10.1111/ppa.13571.

368 Kallas, John. 2010. *Edible Wild Plants*. Gibbs Smith.

369 Karami-jamour, Tahereh, Alinaghi Mirmoayedi, Abbasali Zamani, and Yadolah Khajehzadeh. 2018. “The Impact of Ant Attendance on Protecting Aphis
370 Gossypii against Two Aphidophagous Predators and It’s Role on the Intraguild Predation between Them.” *Journal of Insect Behavior* 31:222–39.
371 doi: DOI: 10.1007/s10905-018-9670-4.

372 Kennedy, J. S., and H. L. G. Stroyan. 1959. “Biology of Aphids.” *Annual Review of Entomology* 4(1):139–60.

373 Kumar, Sushil, Malay K. Bhowmick, and Puja Ray. 2021. “Weeds as Alternate and Alternative Hosts of Crop Pests.” *Indian Journal of Weed Science*
374 53(1):14–29. doi: 10.5958/0974-8164.2021.00002.2.

375 Kummel, Miroslav, David Brown, and Andrea Bruder. 2013. “How the Aphids Got Their Spots: Predation Drives Self-Organization of Aphid Colonies
376 in a Patchy Habitat.” *Oikos* 122(6):896–906. doi: <https://doi.org/10.1111/j.1600-0706.2012.20805.x>.

377 Maharani, Yani, Purnama Hidayat, Aunu Rauf, and Nina Maryana. 2018. “Short Communication: New Records of Aphid Species Subfamily Aphidinae
378 (Hemiptera: Aphididae) in West Java, Indonesia.” *Biodiversitas* 19(2):460–65. doi: 10.13057/biodiv/d190219.

379 Meuninck, Jim. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.

380 Naidu, VSGR. 2012. “Hand Book on Weed Identification.”

381 Nelson, Annika S., and Kailen A. Mooney. 2022. “The Evolution and Ecology of Interactions between Ants and Honeydew-Producing Hemipteran
382 Insects.” *Annual Review of Ecology, Evolution, and Systematics* 53:379–402. doi: <https://doi.org/10.1146/annurev-ecolsys-102220-014840>.

383 Pettersson, Jan, W. Fred Tjallingii, and Jim Hardie. 2017. “Host-Plant Selection and Feeding.” Pp. 173–95 in *Aphids as crop pests*. CABI Wallingford
384 UK.

385 Tegelaar, Karolina, Mattias Hagman, Robert Glinwood, Jan Pettersson, and Olof Leimar. 2012. “Ant–Aphid Mutualism: The Influence of Ants on the
386 Aphid Summer Cycle.” *Oikos* 121(1):61–66. doi: <https://doi.org/10.1111/j.1600-0706.2011.19387.x>.

387 Zheng, Zhou, Mengqin Zhao, Zhijun Zhang, Xin Hu, Yang Xu, and Cong Wei. 2022. “Lactic Acid Bacteria Are Prevalent in the Infrabuccal Pockets and
388 Crops of Ants That Prefer Aphid Honeydew.” *Front. Microbiol.* 12(January):1–17. doi: 10.3389/fmicb.2021.785016.

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11 December 2023

Dear Editors,
BIODIVERSITAS Journal of Biological Diversity

As requested, this is our response to reviewers' comments and suggestions.

Thank you so much for the very kind attention and great help provided by editorial team of BIODIVERSITAS Journal of Biological Diversity.

"Letter on responses to reviewers' comments and suggestions"

No .	Location in manuscript	Reviewers' suggestion	Our response
1	Introduction section	<p>This is a simple survey study undertaken in an area to record presence of aphid species in ornamental and herbaceous or shrub weed plants. However, the 'Introduction' section attempts to distinguish primary and alternate host plants of aphids, terming weeds as the 'alternate' host plants. This point is widely recorded, and it does not require an explanation. It should be restricted to a few sentences as matter of reference only. Accordingly, I have suggested trimming of this section.</p>	<p>The Introduction has been rewritten as recommended</p>
2	Materials and method section	<ol style="list-style-type: none">1. I wonder that so few ornamental plant species are present in the study area in this study. This section must include the number of aphid samples collected, the area in square kilometre surveyed, frequency of sampling done from the sampling area, any seasonal survey done, and a schematic diagram of the study area be provided showing scale in sq. km and geo-coordinates.2. Names of some plant species and aphid species mentioned in tables 1 and 2 do not match with that mentioned in the figure legends and more so in the 'Discussion' section (see below).	<ol style="list-style-type: none">1. We collected samples by direct observation and did not take the location sampling sites. Therefore, we do apologize can't revise as the suggestion.2. We already made the corrections as suggested by reviewer

3	Results	<ol style="list-style-type: none"> 1. This section should be divided into two sub-heading: 2. Aphids infesting ornamental plants. 3. Aphids infesting wild and weed plants. 4. Each sub-heading should have a table providing following information: <p>Sr No. Aphid species* Ornamental plants Aphid Plant parts Antlife color colonized attendance Present (+) or absent (-)</p>	The recommended tables had been added
4	Results	<p>*Aphid species names should accompany by mention of author names in the first mention only.</p> <ol style="list-style-type: none"> 1. Table 1. Following discrepancies require correction/clarification: 2. Record of <i>Sitobion luteum</i> from <i>Aster alpinus</i> is unusual; this aphid normally infest crops and weed plants of Cyperaceae family; <i>Aster alpinus</i> is a plant of Asteraceae family; authors may re-check the identification of this aphid sample! 3. Record of <i>Pentalonia</i> from <i>Caladium</i> sp. require a re-check! I suggest the authors to read the paper by Bhadra P, Agarwala BK. 2010. A comparison of fitness characters of two host plant-based congeneric species of the banana aphid, <i>Pentalonia nigronervosa</i> and <i>P. caladii</i>. <i>Journal of Insect Science</i> 10:140 available online: insectscience.org/10.140 and P. Bhadra and B.K. Agarwala, 2012. On the Morphological and Genotypic Variations of Two Congeneric species of Banana Aphid <i>Pentalonia</i> (Homoptera: Aphididae) from India, <i>Advances in Life Sciences</i>, 2(3): 75-81, DOI: 10.5932/j.als.20120203.06, DOI: 10.5932/j.als.20120203.06. Authors can identify the aphid species based on the identification key based on morphological characters and host plant association. 	<ol style="list-style-type: none"> 1. We already checked and clarified. 2. We revised the species aphid; the aphid species is <i>Macrosiphoniella sanborni</i> 3. The species and the sentences have been revised
5	Results	1. Identification of <i>Pentalonia nigronervosa</i> from <i>Canna indica</i> require checking following the identification key provided in the above-said reference.	1. <i>Pentalonia nigronervosa</i> was revised to be <i>Rhopalosiphum nymphaeae</i>

		<p>2. Identification of <i>Uroleucon</i> sp. from <i>Cosmos caudatus</i> mentioned in the table does not match with the figure legend “<i>Uroleucon</i> sp. in <i>Chrysanthemum</i>”. These are entirely different.</p> <p>3. Similarly, <i>Aphis craccivora</i> from <i>Murraya paniculata</i> stated in the table does not match with the “<i>aurantii</i> in the <i>M. paniculata</i> flower”</p>	<p>2. The corrected sentences have been revised, the species of <i>Uroleucon</i> sp. In <i>Chrysanthemum</i></p> <p>3. The species has been corrected</p>
6	Results	<p>1. All the figures in the plate should be denoted by alphabets in serial order corresponding to those in the fused in the figure legend, and each of these figures should be credited to the photographer by name on the photographs.</p> <p>2. Table 2. Table contents be provided with similar information as suggested for the table 1. In addition, a column should include ‘Plant type’ to denote herb or shrub and weed or non-weed wild plant.</p> <p>3. Serial no. 19 in the table 2 mentions <i>Lagerstroemia</i> sp. infested by <i>Greenidea</i> sp. but the figure legend mentions (q) <i>Greenidae</i> in kenidai trees (shrubs) <i>indica</i>; these do not match!</p> <p>4. ‘t) <i>Rhopalosiphum rice</i> in <i>Oryza rufipogon</i>,’ mentioned in the figure legend does not match with the sr. no. 26 of the table, please check and correct.</p> <p>5. Other suggestions regarding improvements in the figures and figure legend made for figure 1 are to be followed for figure 2 as well.</p>	<p>1. The figures have been corrected</p> <p>2. The table 2 has been corrected</p> <p>3. The species has been corrected</p> <p>4. The species has been corrected</p> <p>5. The figures have been improved</p>
7	Discussions	<p>This section should be brief and to the point. Presently, it is written ad nauseous, without proper context and too elaborate. This section can divided in to three paragraphs as under:</p> <p>1. First paragraph should briefly recount the results of this study.</p> <p>2. Second paragraph should highlight the major features of aphid colonization of important ornamental and weed plants with respect to association of one or more aphid species association and pattern of colonization; for example, <i>Aphis gossypii</i> is found on many different plant species but their life color and colonization pattern</p>	<p>The discussions section has been changed</p>

		differ in different plants; 3. Third and final paragraph should be devoted to comparison of this study findings to those reported from neighboring or other parts of Indonesia or Southeast Asia.	
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Sincerely,
Corresponding author,

Chandra Irsan

15738 / IRSAN et al. / Species of aphids found in ornament

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Dear Editors,
BIODIVERSITAS Journal of Biological Diversity

As requested, this is our response to reviewers' comments and suggestions.

Thank you so much for a very kind attention and great helps provided by editorial team of BIODIVERSITAS Journal of Biological Diversity.

"Letter on responses to reviewers' comments and suggestions"

No	Location in manuscript	Reviewers' suggestion	Our response
1	Line 129	<i>Adiantum raddianum</i> is not available in the table	We already made the corrections. We delete it from the discussion
2	Line 260	<i>Rhopalosiphum padi</i> not <i>Rhopalosiphum rice</i>	We have already corrected it
3	Line 302	macrosiphini not macrocypini	The word had been corrected
4	Line 321	This conclusion could be more deeply investigated by presenting (in brief) the diversity of aphid species found in ornamental and wild plants (this study's purposes), what kind of aphid species are preferred by ants, why aphids prefer the weed species, why <i>aphis gossypii</i> species could colonize 12 plants while <i>aphis citricola</i> only one, etc.	The conclusion has been corrected. We highlighted the total species of aphids in ornamental and weeds because we would like to answer our title. For the presence and absence of the ants, we add some sentences to explain it in discussion part.

Best regards,
Corresponding author,

Chandra Irsan

Table 1. Aphid species recorded in ornamental plants and their colony locations

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Macrosiphoniella sanborni</i>	Leaves, young twig, flower
		<i>Aulacorthum solani</i>	Leaves, flower
2	<i>Brugmansia suaveolens</i>	<i>Neomyzus circumflexus</i>	Leaves
		<i>Myzus persicae</i>	Leaves, flower
3	<i>Caladium</i> sp.	<i>Pentalonia caladii</i>	Leaves,
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	Leaves, flower
5	<i>Canna indica</i>	<i>Rhopalosiphum nymphaeae</i>	Leaf
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	Shoot, young leaves, flower
		<i>Aphis gossypii</i>	Shoot, flower
7	<i>Cestrum</i> sp.	<i>Neomyzus circumflexus</i>	Young leaves
8	<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	Flower
9	<i>Chrysanthemum</i> sp.	<i>Macrosiphoniella sanborni</i>	Shoot, twig
10	<i>Dahlia</i> sp.	<i>Aphis gossypii</i>	Flower
11	<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	Flower
12	<i>Duranta</i> sp.	<i>Aphis gossypii</i>	Shoot, flower
13	<i>Helianthus giganteus</i> .	<i>Aphis glycines</i>	Flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	Flower
15	<i>Ixora paludosa</i>	<i>Aphis gossypii</i> ,	Flower
		<i>Toxoptera aurantii</i>	Shoot, young leaves
		<i>Aphis citricola</i>	Flower
16	<i>Ixora</i> sp.	<i>Aphis gossypii</i>	Flower
		<i>Toxoptera aurantii</i>	Shoot, flower
17	<i>Murraya paniculata</i>	<i>Aphis craccivora</i>	Young Twig
		<i>Toxoptera citricidus</i>	Shoot, flower
18	<i>Mussaenda frondosa</i>	<i>Aphis citricola</i>	Shoot, flower
		<i>Toxoptera odinae</i>	Shoot, flower
19	<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	Flower
20	<i>Spondias dulcis</i>	<i>Aphis citricola</i>	Flower

Table 2. Aphid species recorded in ornamental plants and the presence of the

No	Aphid Species	Ornamental plants	Aphids life colour	Plant parts colonized	Ant attendance	count
1	<i>Aphis craccivora</i>	<i>Clitoria ternatea</i>	black	flowers	+	1
		<i>Murraya paniculata</i>	black	flowers	+	1
		<i>Catharanthus roseus</i>	greenish yellow	flowers	+	1
2	<i>Aphis citricola</i>	<i>Ixora</i> sp.	greenish yellow	flowers	+	1
		<i>Mussaenda frondosa</i>	greenish yellow	shoots, flowers	+	1
		<i>Spondias dulcis</i>	greenish yellow	flowers	+	1
3	<i>Aphis glycines</i>	<i>Helianthus giganteus</i>	greenish yellow	flowers	+	1
		<i>Cestrum</i> sp.	green	shoots, flowers	+	1
		<i>Cananga odoratum</i>	light green	shoots, flowers	+	1
4	<i>Aphis gossypii</i>	<i>Dahlia</i> sp.	green dark	flowers	+	1
		<i>Duranta</i> sp.	light green	shoots, flowers	+	1
		<i>Hibiscus rosasinensis</i>	dark green	flowers	+	1
		<i>Ixora paludosa</i>	light green	flowers	+	1
		<i>Ixora</i> sp.	light green	flowers	+	1
5	<i>Aulacorthu m solani</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-	0
6	<i>Macrosiphonia niella sanborni</i>	<i>Aster alpinus</i>	brown black	leaves, twigs, flowers	+	1
		<i>Chrysantemum</i> sp.	reddish brown	leaves, twigs	+	1
7	<i>Macrosiphu m rosae</i>	<i>Rosa indica</i>	green	flowers	-	0
8	<i>Myzus persicae</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-	0
		<i>Cestrum</i> sp.	light green	young leaves, flowers	-	0
9	<i>Neomyzus circumflexus</i>	<i>Brugmansia suaveolens</i>	light green	flowers	-	0
		<i>Caladium</i> sp.	brown-black	leaves	+	1
10	<i>Pentalonia caladii</i>	<i>Caladium</i> sp.	brown-black	leaves	+	1
11	<i>Rhopalosiphum nymphaeae</i>	<i>Canna indica</i>	green black	leaves	+	1
		<i>Dendrobium</i> sp.	brown	flowers	-	0
12	<i>Sinemegoura citricola</i>	<i>Ixora paludosa</i>	brown black	flowers	+	1
		<i>Ixora</i> sp.	brown black	flowers	+	1
13	<i>Toxoptera aurantii</i>	<i>Murraya paniculata</i>	black	stems	+	1
14	<i>Toxoptera citricidus</i>	<i>Mussaenda frondosa</i>	reddish-brown	flowers	+	1
15	<i>Toxoptera odinae</i>	<i>Mussaenda frondosa</i>	reddish-brown	flowers	+	1

(+): present, (-): absent

e 3. Species of aphids found in wild (weed or non-weed) plants and their colony locat

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	weed	<i>Aphis gossypii</i>	shoots, buds
3	<i>Alternanthera sessilis</i>	weed	<i>Aphis gossypii</i>	shoots, buds
4	<i>Amaranthus gracilis</i>	weed	<i>Aphis craccivora</i>	flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	weed	<i>Lipaphis erysimi</i>	flowers, shoots, and buds
6	<i>Croton hirtus</i>	weed	<i>Aphis gossypii</i>	flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks
8	<i>Cyperus rotundus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	weed	<i>Hysteronera setariae</i>	flower, flower stalks
11	<i>Echinochloa crusgali</i>	weed	<i>Hiperomyzus</i> sp.	young leaves, old leaves
12	<i>Ecliptica prostrata</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves
13	<i>Eleusin indica</i>	weed	<i>Hysteronera setariae</i>	flower, flower stalks, leaf axils
			<i>Rhopalosiphum maidis</i>	flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	weed	<i>Aphis gossypii</i>	flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	weed	<i>Hysteronera setariae</i>	flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves
17	<i>Eupotarium odoratum</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves,
			<i>Aphis glycines</i>	shoot, young twigs
18	<i>Hymenochera acutigluma</i>	Weed	<i>Hysteronera setariae</i>	flowers, flower stalks, leaf axils
19	<i>Bridelia tomentosa</i>	Non-weed	<i>Greenidea</i> sp.	young leaves
			<i>Hysteronera setariae</i>	young leaves, old leaves, leaf axils
20	<i>Lophatherum gracile</i>	Weed	<i>Rhopalosiphum maidis</i>	young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	Non-weed	<i>Aphis gossypii</i>	shoots, young leaves
22	<i>Mikania mikranta</i>	Weed - liana	<i>Aphis gossypii</i>	shoots, young leaves, old leaves
			<i>Aphis glycines</i>	shoot, young twig
23	<i>Mimosa invisa</i>	weed	<i>Aphis craccivora</i>	shoots, pods
24	<i>Mimosa pudica</i>	weed	<i>Aphis craccivora</i>	shoots, pods, flowers

25	<i>Mimosa vigra</i>	Non-weed	<i>Aphis craccivora</i>	shoots, pods
		weed	<i>Rhopalosiphum padi,</i>	old leaves, young leaves (shoot), leaf axils
26	<i>Oryza rufipogon</i>	weed	<i>Rhopalosiphum maidis</i>	old leaves, young leaves (shoot), leaf axils
27	<i>Oxonopus compressus</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalk, leaf axils
28	<i>Paspalum conjugatum</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalk, seeds
29	<i>Phylanthus neruri</i>	weed	<i>Aphis citricola</i>	shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	weed	<i>Aphis craccivora</i>	shoots, young leaves, flowers
		weed	<i>Aphis craccivora</i>	shoots, young leaves, old leaves
31	<i>Physalis angulata</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	weed	<i>Lipapis erysimi</i>	flowers, fruits, shoots, young leaves
33	<i>Sida rhombifolia</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arventris</i>	weed	<i>Lipapis erysimi</i>	young leaves, fruit stalks, flowers, fruits

Table 4. Aphid species recorded in ornamental plants and the presence of the ants in the

No	Aphid Species	Wild plants	Aphids life colour	Plant parts colonized	Ant attendance	count	number
1	<i>Aphis gossypii</i>	<i>Ageratum conyzoides</i>	Light green	shoots, young leaves, old leaves, flowers	+	1	1
		<i>Alternanthera philoxeroides</i>	Light green	shoots, buds	+	1	2
		<i>Alternanthera sessilis</i>	Light green	shoots, buds	-	0	3
		<i>Croton hirtus</i>	Dark green	flowers, shoots, young leaves, old leaves, young twigs	+	1	4
		<i>Ecliptica prostrata</i>	green	shoots, young leaves	+	1	5
		<i>Emilia sonchifolia</i>	green	flower, flower stalks, shoots	+	1	6
		<i>Euphorbia hirta</i>	light green	young leaves, old leaves	+	1	7
		<i>Eupotarium odoratum</i>	light green	young leaves, old leaves, young twigs	+	1	8
		<i>Melastoma affine</i>	light green	shoots, young leaves	+	1	9
		<i>Mikania mikranta</i>	light green	shoots, young leaves, old leaves	+	1	10
		<i>Physalis angulata</i>	yellowish green	shoots, young leaves, old leaves, fruit/seeds	+	1	11
2	<i>Aphis craccivora</i>	<i>Sida rhombifolia</i>	yellowish green		-	0	12
		<i>Amaranthus gracilis</i>	black	flowers, shoots, young leaves, old leaves	+	1	1
		<i>Mimosa invisa</i>	black	shoots, pods	+	1	2
		<i>Mimosa pudica</i>	black	shoots, pods, flowers	+	1	3
		<i>Mimosa vigra</i>	black	shoots, pods	+	1	4
		<i>Portulaca oleraceae</i>	black	shoots, young leaves, flowers	+	1	5
		<i>Physalis angulata</i>	black	shoots, young leaves, old leaves	+	1	6
3	<i>Aphis glycines</i>	<i>Eupotarium odoratum</i>	Greenish yellow	young leaves, old leaves, young twigs	+	1	1
		<i>Mikania mikranta</i>	Light green	shoots, young leaves, old leaves	+	1	2
4	<i>Aphis citricola</i>	<i>Phyllanthus neruri</i>	Greenish Yellow	shoot, young leaves, young twigs, petioles	+	1	1
5	<i>Greenidea</i> sp.	<i>Bridelia Tomentosa</i>	Greenish Yellow	young leaves	-	0	1
		<i>Digitaria ciliaris</i>	reddish-brown	flower, flower stalks	+	1	1
		<i>Eleusin indica</i>	reddish-brown	flower, flower stalks, leaf axils	+	1	2
		<i>Eragrostis tenella</i>	reddish-brown	flower, flower stalks, seeds	+	1	3
6	<i>Hystro-neura setariae</i>	<i>Hymenochera acutigluma</i>	reddish-brown	flowers, flower stalks, leaf axils	+	1	4
		<i>Lophatherum gracile</i>	reddish-brown	young leaves, old leaves, leaf axils	+	1	5
		<i>Oxonopus compressus</i>	reddish-brown	flower, flower stalk, leaf axils	+	1	6
		<i>Paspalum conjugatum</i>	reddish-brown	flower, flower stalk, seeds	+	1	7
7	<i>Hiperomyzus</i> sp.	<i>Echinocloa crussgali</i>	Black	young leaves, old leaves	-	0	1

		<i>Blumea lacera</i>	Whitish green	flowers, shoots, and buds	+	1	1
8	<i>Lipaphis erysimi</i>	<i>Rorippa indica</i>	Whitish green	flower, fruit, shoots, young leaves	+	1	2
		<i>Sonchus arvensis</i>	Whitish green	young leaves, fruit stalks, flower, fruit	+	1	3
		<i>Eleusin indica</i>	green	flower, flower stalks, leaf axils	+	1	1
9	<i>Rhopalosiphum maidis</i>	<i>Lophatherum gracile</i>	green	young leaves, old leaves, leaf axils	+	1	2
		<i>Oryza rufipogon</i>	green	old leaves, young leaves (shoot), leaf axils	-	0	3
10	<i>Rhopalosiphum padi</i>	<i>Oryza rufipogon</i>	Whitish green	old leaves, young leaves (shoot), leaf axils	+	1	1
		<i>Cynodon dactylon</i>	Green	flowers, flower stalks	+	1	1
11	<i>Schizaphis rotundiventris</i>	<i>Cyperus rotundus</i>	green	flowers, flower stalks, leaf axils	+	1	2
		<i>Cyperus compressus</i>	green	flowers, flower stalks, leaf axils	+	1	3

35

(+): present, (-): absent

Species of aphids found in ornamental and wild plants in Highland, Pagar Alam District, South Sumatra, Indonesia

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Abstract. Irsan C, Anggraini E, Ramadhani W. 2023. Species of aphids found in ornamental and wild plants in Highland, Pagar Alam District, South Sumatra, Indonesia. Biodiversitas 24: xxx-xxx. Aphids are one of the crucial pests in tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species, such as wild plants, were found on plants that were not hosts. Therefore, this study reported the species of aphids found in ornamental and wild plants. The field research employed purposive and direct observation to inventory cultivated or wild plants hosting and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants and wild plants or weeds. The collection and identification of host plants and aphids involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that the total of 15 species aphids found in Ornamental plants, *Aphis craccivora* Koch, 1854, *Aphis citricola* van der Goot, 1912, *Aphis glycines* Matsumura, 1917, *Aphis gossypii* Glover, 1877, *Aulacorthum solani* Kaltenbach, 1843, *Macrosiphoniella sanborni* Gillette, 1908, *Macrosiphum rosae* Linnaeus, 1758, *Myzus persicae* Sulzer, 1776, *Neomyzus circumflexus* Buckton, 1876, *Pentalonia caladii* van der Goot, 1917, *Rhopalosiphum nymphaeae* Linnaeus, 1761, *Sinemegoura citricola* van der Goot, 1917, *Toxoptera aurantii* Boyer de Fonscolombe, 1841, *Toxoptera citricidus* Kirkaldy, 1907, *Toxoptera odinae* van der Goot, 1917 and the total of 11 species aphids found in weeds, *A. gossypii*, *A. craccivora*, *A. glycines*, *A. citricola*, *Greenidea* sp., *Hysteronura setariae* Thomas, 1878, *Hiperomyzus* sp., *Lipaphis erysimi* Kaltenbach, 1843, *Rhopalosiphum maidis* Fitch, 1856, *Rhopalosiphum padi* Linnaeus, 1758, *Schizaphis rotundiventris* Signoret, 1860.

Keywords: Aphids, ornamental plants, wild plants

INTRODUCTION

Aphids are crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhav et al. 2020); aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can be found throughout the year due to their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids suck phloem sap of tender plant parts, which can deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, vector species can further weaken and stunt the growth of infected plants (Jones 2022). Therefore, it is crucial to control aphid populations in gardens and crops.

Many aphid species are found on plants that are not their actual hosts (Maharani et al. 2018). Aphids have one or more secondary, or alternative, host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al. 2020). Alternative plants provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain

environmental conditions (Kumar et al. 2021). In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and native plants. Research on the diversity of aphid species in ornamental and wild plants has less noticed. This study reports the diversity of aphid species found in ornamental and wild plants found in this area. The findings from this study can serve as a valuable resource for aphid management.

MATERIALS AND METHODS

The field research employed a purposive and direct observation to inventory cultivated or wild plants hosting and collecting aphids. The plant selection included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. Where available, collecting and identifying host plants, aphids, and natural enemies involved systematic searches of all existing plant species to find those colonized by aphids. Any plants colonized by aphids are documented as aphid hosts. Aphid identification was done using identification keys (Blackman and Eastop 2008) in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on

morphological characteristics. The host plants were identified using the weed identification handbook (Kallas 2010; Naidu 2012; Meuninck 2023). The location and aphid colony sizes, including their life color, and photographs of the aphid colonies and their host plants were recorded.

RESULTS AND DISCUSSION

Result

Aphids infesting in ornamental plants

The results showed that 15 aphid species were found in Pagar Alam (Tables 1 and 2). These aphids mostly colonized flowers of various ornamental plants (Table 1, Figure 1).

The relationship between aphids and ants was also recorded. Aphids produce a sweet, sticky substance called honeydew; ants are attracted to this honey because it serves as a food source. When aphids are present, they secrete honeydew, which attracts ants. This research recorded the presence of ants on plant parts colonized by aphids (Table 2).

Aphids infesting in wild plants (weed or non-weed plants)

In addition, this study documented aphid colonies on flowers, stalks, plant tops, young leaves, and old leaves of wild plants (Table 3, Figure 2).

The presence of ants in aphid colonization symbolizes a mutually beneficial relationship where the ants receive food from the aphids while protecting them. This study recorded the ant attendance in aphids colonization (Table 4).

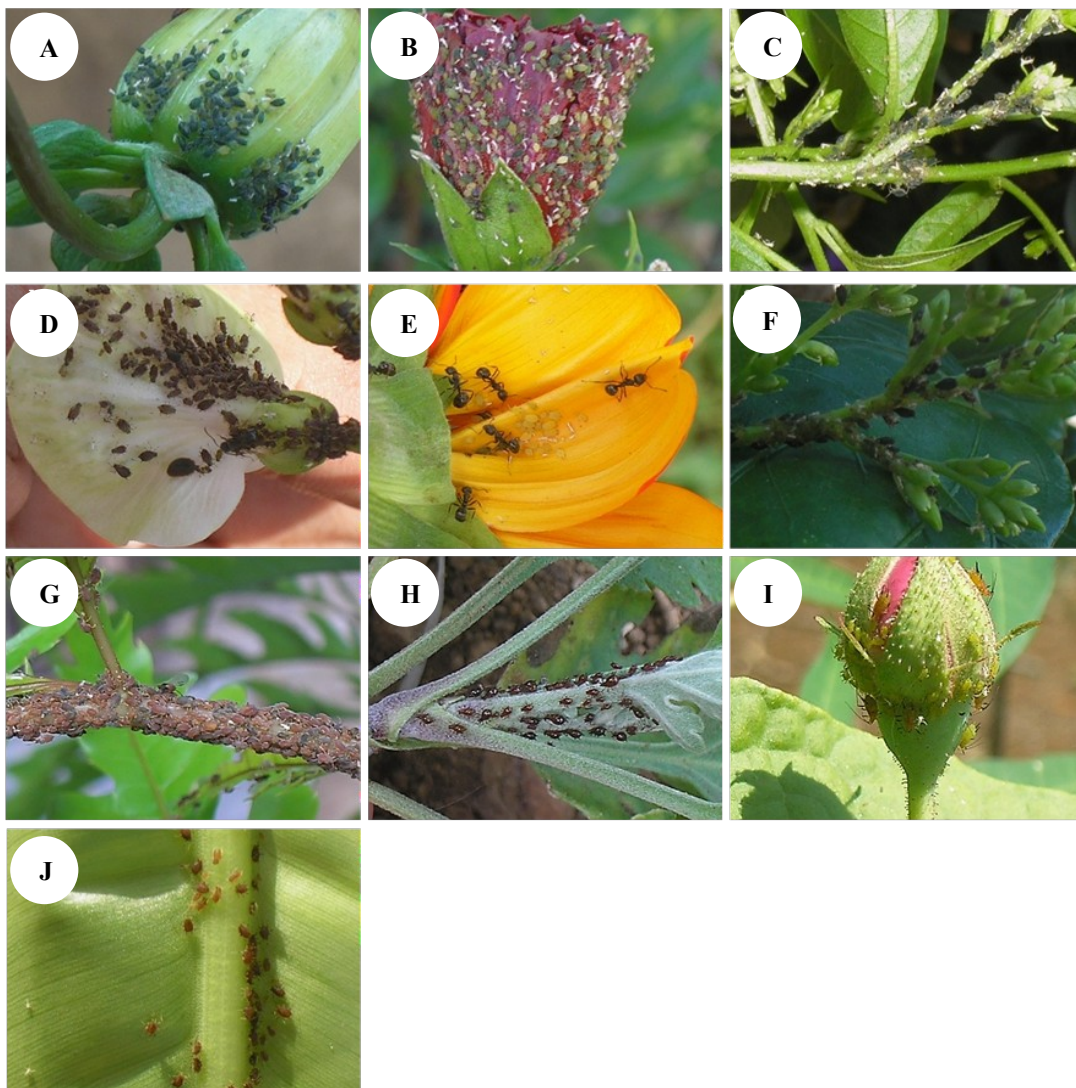


Figure 1. Photos showing colonies of different aphid species in ornamental plants: A. *Aphis gossypii* in *Dahlia* sp. flower; B. *Aphis gossypii* in *Hibiscus rosasinensis* flower; C. *Aphis gossypii* in *Cestrum* twig and flower; D. *Aphis craccivora* in *Clitoria ternatea* flower; E. *Aphis glycines* in *Helianthus giganteus* flower; F. *Aphis craccivora* on the *Murayya paniculata* flower; G. *Toxoptera odinae* in the *Mussaenda frondose*; H. *Macrosiphoniella sanborni*. in *Chrysanthemum* sp. Leaves; I. *Macrosiphum rosae* in *Rosa indica* flower; J. *Rhopalosiphum nymphaeae* in *Canna indica* leaves. Chandra Irsan captured all the photos

Table 1. Aphid species recorded in ornamental plants and their colony locations

Host plant	Aphid species	Colony location
<i>Aster alpinus</i>	<i>Macrosiphoniella sanborni</i>	Leaves, young twig, flower
<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i>	Leaves, flower
	<i>Neomyzus circumflexus</i>	Leaves
	<i>Myzus persicae</i>	Leaves, flower
<i>Caladium sp.</i>	<i>Pentalonia caladii</i>	Leaves,
<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	Leaves, flower
<i>Canna indica</i>	<i>Rhopalosiphum nymphaeae</i>	Leaf
<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	Shoot, young leaves, flower
<i>Cestrum sp.</i>	<i>Aphis gossypii</i>	Shoot, flower
	<i>Neomyzus circumflexus</i>	Young leaves
<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	Flower
<i>Chrysanthemum sp.</i>	<i>Macrosiphoniella sanborni</i>	Shoot, twig
<i>Dahlia sp.</i>	<i>Aphis gossypii</i>	Flower
<i>Dendrobium sp.</i>	<i>Sinemogoura citricola</i>	Flower
<i>Duranta sp.</i>	<i>Aphis gossypii</i>	Shoot, flower
<i>Helianthus giganteus.</i>	<i>Aphis glycines</i>	Flower
<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	Flower
<i>Ixora paludosa</i>	<i>Aphis gossypii,</i>	Flower
	<i>Toxoptera aurantii</i>	Shoot, young leaves
<i>Ixora sp.</i>	<i>Aphis citricola</i>	Flower
	<i>Aphis gossypii</i>	Flower
	<i>Toxoptera aurantii</i>	Shoot, flower
<i>Murraya paniculata</i>	<i>Aphis craccivora</i>	Young Twig
	<i>Toxoptera citricidus</i>	Shoot, flower
<i>Mussaenda frondosa</i>	<i>Aphis citricola</i>	Shoot, flower
	<i>Toxoptera odinae</i>	Shoot, flower
<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	Flower
<i>Spondias dulcis</i>	<i>Aphis citricola</i>	Flower

Table 2. Aphid species recorded in ornamental plants and the presence of the ants in the plant parts colonized

Aphid species	Ornamental plants	Aphids life color	Plant parts colonized	Ant attendance	Total individual of ant
<i>Aphis craccivora</i>	<i>Clitoria ternatea</i>	Black	Flowers	+	3
	<i>Murraya paniculata</i>	Black	Flowers	+	2
<i>Aphis citricola</i>	<i>Catharanthus roseus</i>	Greenish yellow	Flowers	+	2
	<i>Ixora sp.</i>	greenish yellow	Flowers	+	3
	<i>Mussaenda frondosa</i>	greenish yellow	Shoots, flowers	+	7
	<i>Spondias dulcis</i>	greenish yellow	Flowers	+	8
<i>Aphis glycines</i>	<i>Helianthus giganteus</i>	Greenish yellow	Flowers	+	3
<i>Aphis gossypii</i>	<i>Cestrum sp.</i>	Green	Shoots, flowers	+	4
	<i>Cananga odoratum</i>	Light green	Shoots, flowers	+	1
	<i>Dahlia sp.</i>	Green dark	Flowers	+	2
	<i>Duranta sp.</i>	Light green	Shoots, flowers	+	5
	<i>Hibiscus rosasinensis</i>	Dark green	Flowers	+	6
	<i>Ixora paludosa</i>	Light green	Flowers	+	2
	<i>Ixora sp.</i>	Light green	Flowers	+	7
<i>Aulacorthum solani</i>	<i>Brugmansia suaveolens</i>	Greenish yellow	Leaves, flowers	-	0
<i>Macrosiphoniella sanborni</i>	<i>Aster alpinus</i>	Brown black	Leaves, twigs, flowers	+	5
	<i>Chrysanthemum sp.</i>	Reddish brown	Leaves, twigs	+	5
<i>Macrosiphum rosae</i>	<i>Rosa indica</i>	Green	Flowers	-	0
<i>Myzus persicae</i>	<i>Brugmansia suaveolens</i>	Greenish yellow	Leaves, flowers	-	0
<i>Neomyzus circumflexus</i>	<i>Cestrum sp.</i>	Light green	Young leaves,	-	0
	<i>Brugmansia suaveolens</i>	Light green	flowers	-	0
			Flowers		
<i>Pentalonia caladii</i>	<i>Caladium sp.</i>	Brown-black	Leaves	+	7
<i>Rhopalosiphum nymphaeae</i>	<i>Canna indica</i>	Green black	Leaves	+	1
<i>Sinemogoura citricola</i>	<i>Dendrobium sp.</i>	Brown	Flowers	-	0
<i>Toxoptera aurantii</i>	<i>Ixora paludosa</i>	Brown black	Flowers	+	5
	<i>Ixora sp.</i>	Brown black	Flowers	+	4
<i>Toxoptera citricidus</i>	<i>Murraya paniculata</i>	Black	Stems	+	6
<i>Toxoptera odinae</i>	<i>Mussaenda frondosa</i>	Reddish-brown	Flowers	+	4

Notes: (+) = present; (-) = absent

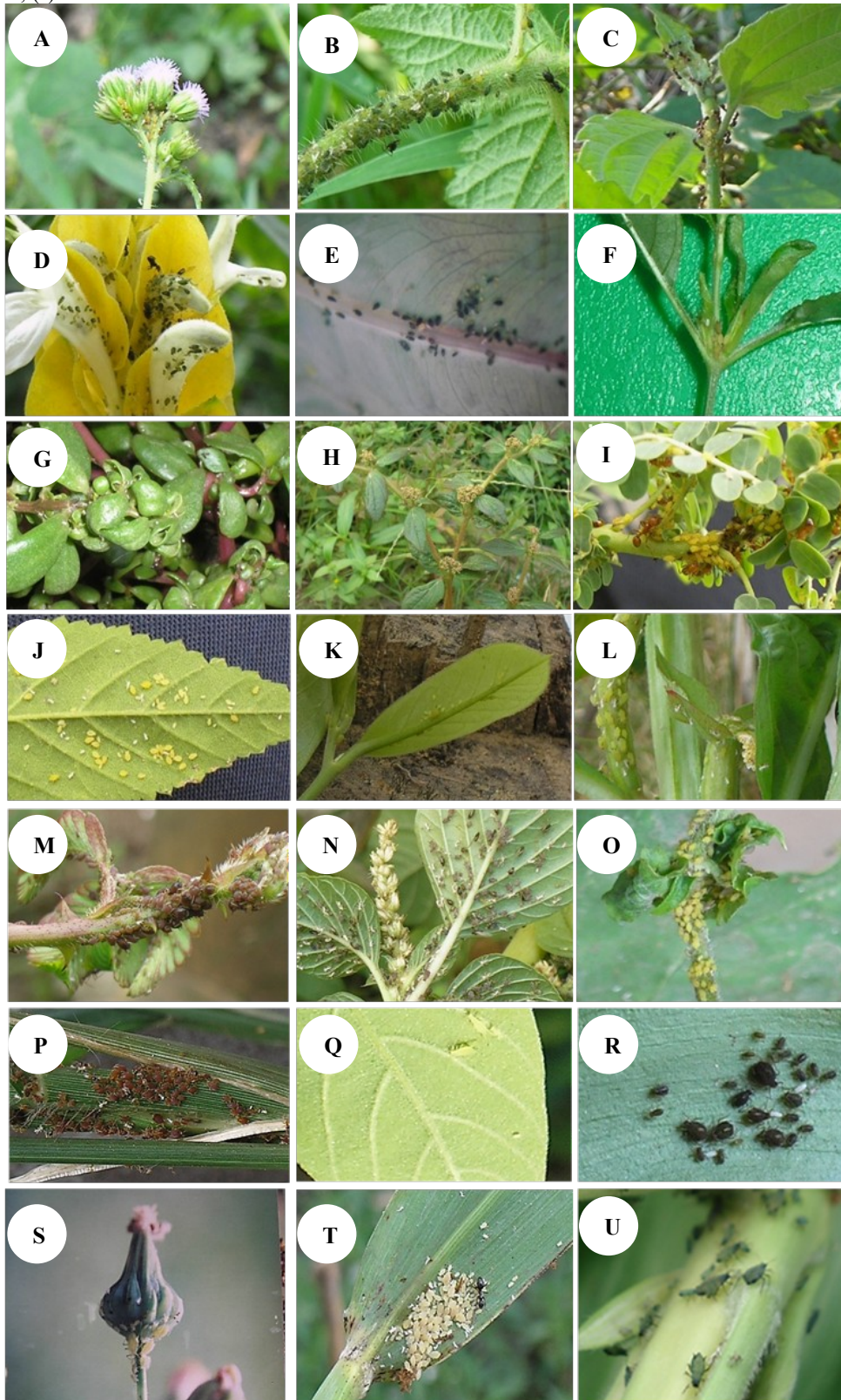


Figure 2. Aphids found infesting wild plants A. *Aphis gossypii* in *Ageratum conyzoides*; B. *Aphis gossypii* in *Croton hirtus*; C. *Aphis gossypii* in *Eupatorium odoratum*; D. *Aphis gossypii* in *Pachystochys* sp.; E. *Pentalonia caladii* in *Caladium* sp.; F. *Aphis gossypii* in *Alternanthera sessilis*; G. *Aphis gossypii* in *Portulaca oleraceae*; H. *Aphis gossypii* in *Euphorbia hirta*; I. *Aphis citricola* in *Phyllanthus nerruri*; J. *Aphis citricola* in *Sida rhombifolia*; K. *Aphis citricola* in *Annona muricata*; L. *Aphis citricola* in *Ludwigia peruviana*; M. *A. craccivora* in *Mimosa pudica*; N. *Aphis craccivora* in *Amaranthus gracilis*; O. *Aphis glycine* in *Mikania micrantha*; P. *Hysteneura* sp. in *Eleusin* sp.; Q. *Greenidae* sp. in *Bridelia tomentosa* young leaves.; R. *Hyperomyzus* sp. in *Echinocloa crusgali*; S. *Lipaphis erysimi* in

sonchus arventris; T. *Rhopalosiphum padi* in *Oryza rufipogon*; U. *Rhopalosiphum maidis* in *Oryza rufipogon*. All the photos were captured by Chandra Irsan

Table 3. Species of aphids found in wild (weed or non-weed) plants and their colony locations

Host plant	Weeds or non-weed plants	Aphid species	Colony location
<i>Ageratum conyzoides</i>	Weed	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
<i>Alternanthera philoxeroides</i>	Weed	<i>Aphis gossypii</i>	Shoots, buds
<i>Alternanthera sessilis</i>	Weed	<i>Aphis gossypii</i>	Shoots, buds
<i>Amaranthus gracilis</i>	Weed	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
<i>Blumea lacera</i>	Weed	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
<i>Croton hirtus</i>	Weed	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
<i>Cynodon dactylon</i>	Weed	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
<i>Cyperus rotundus</i>	Weed	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
<i>Cyperus compressus</i>	Weed	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
<i>Digitaria ciliaris</i>	Weed	<i>Hysteroneura setariae</i>	Flower, flower stalks
<i>Echinochloa crusgali</i>	Weed	<i>Hyperomyzus</i> sp.	Young leaves, old leaves
<i>Ecliptica prostrata</i>	Weed	<i>Aphis gossypii</i>	Shoots, young leaves
<i>Eleusine indica</i>	Weed	<i>Hysteroneura setariae</i>	Flower, flower stalks, leaf axils
		<i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
<i>Emilia sonchifolia</i>	Weed	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
<i>Eragrostis tenella</i>	Weed	<i>Hysteroneura setariae</i>	Flower, flower stalks, seeds
<i>Euphorbia hirta</i>	Weed	<i>Aphis gossypii</i>	Young leaves, old leaves
<i>Eupatorium odoratum</i>	Weed	<i>Aphis gossypii</i>	Young leaves, old leaves,
		<i>Aphis glycines</i>	Shoot, young twigs
<i>Hymenochera acutigluma</i>	Weed	<i>Hysteroneura setariae</i>	Flowers, flower stalks, leaf axils
<i>Bridelia tomentosa</i>	Non-weed	<i>Greenidea</i> sp.	Young leaves
<i>Lophatherum gracile</i>	Weed	<i>Hysteroneura setariae</i>	Young leaves, old leaves, leaf axils
		<i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
<i>Melastoma affine</i>	Non-weed	<i>Aphis gossypii</i>	Shoots, young leaves
<i>Mikania micrantha</i>	Weed	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves
		<i>Aphis glycines</i>	Shoot, young twig
<i>Mimosa invisa</i>	Weed	<i>Aphis craccivora</i>	Shoots, pods
<i>Mimosa pudica</i>	Weed	<i>Aphis craccivora</i>	Shoots, pods, flowers
<i>Mimosa vigra</i>	Non-weed	<i>Aphis craccivora</i>	Shoots, pods
<i>Oryza rufipogon</i>	Weed	<i>Rhopalosiphum padi</i> ,	Old leaves, young leaves (shoot), leaf axils
		<i>Rhopalosiphum maidis</i>	Old leaves, young leaves (shoot), leaf axils
<i>Oxonopus compressus</i>	Weed	<i>Hysteroneura setariae</i>	Flowers, flower stalks, leaf axils
<i>Paspalum conjugatum</i>	Weed	<i>Hysteroneura setariae</i>	Flowers, flower stalks, seeds
<i>Phyllanthus neruri</i>	Weed	<i>Aphis citricola</i>	Shoot, young leaves, old leaves, young twigs, petioles
<i>Portulaca oleraceae</i>	Weed	<i>Aphis craccivora</i>	Shoots, young leaves, flowers
<i>Physalis angulata</i>	Weed	<i>Aphis craccivora</i>	Shoots, young leaves, old leaves
		<i>Aphis gossypii</i>	Shoots, young leaves, old leaves
<i>Rorippa indica</i>	Weed	<i>Lipaphis erysimi</i>	Flowers, fruits, shoots, young leaves
<i>Sida rhombifolia</i>	Weed	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
<i>Sonchus arventris</i>	Weed	<i>Lipaphis erysimi</i>	Young leaves, fruit stalks, flowers, fruits

Table 4. Aphid species were recorded in wild plants, and the presence of ants in the plant parts colonized

Aphid species	Wild plants	Aphids life color	Plant parts colonized	Ant attendance	Total individual of ant
<i>Aphis gossypii</i>	<i>Ageratum conyzoides</i>	Light green	Shoots, young leaves, old leaves, flowers	+	5
	<i>Alternanthera philoxeroides</i>	Light green	Shoots, buds	+	3
	<i>Alternanthera sessilis</i>	Light green	Shoots, buds	-	0
	<i>Croton hirtus</i>	Dark green	Shoots, buds	+	7
	<i>Ecliptica prostrata</i>	Green	Flowers, shoots, young leaves, old leaves, young twigs	+	5
	<i>Emilia sonchifolia</i>	Green	Flowers, shoots, young leaves, old leaves, young twigs	+	6
	<i>Euphorbia hirta</i>	Light green	Shoots, young leaves	+	7
	<i>Eupatorium odoratum</i>	Light green	Flower, flower stalks, shoots	+	8
	<i>Melastoma affine</i>	Light green	Young leaves, old leaves	+	8
	<i>Mikania micrantha</i>	Light green	Young leaves, old leaves, young twigs	+	9
	<i>Physalis angulata</i>	Yellowish	twigs	+	10
	<i>Sida rhombifolia</i>	green	Shoots, young leaves	-	0
	<i>Sonchus arventris</i>	Yellowish	Shoots, young leaves, old leaves		
	<i>Sonchus arventris</i>	green	Shoots, young leaves, old leaves, fruit/seeds		
<i>Aphis craccivora</i>	<i>Amaranthus gracilis</i>	Black	Flowers, shoots, young leaves,	+	3

	<i>Mimosa invisa</i>	Black	old leaves	+	2
	<i>Mimosa pudica</i>	Black	Shoots, pods	+	3
	<i>Mimosa vigra</i>	Black	Shoots, pods, flowers	+	4
	<i>Portulaca oleraceae</i>	Black	Shoots, pods	+	7
	<i>Physalis angulata</i>	Black	Shoots, young leaves, flowers	+	4
			Shoots, young leaves, old leaves		
<i>Aphis glycines</i>	<i>Eupatorium odoratum</i>	Greenish yellow	Young leaves, old leaves, young twigs	+	6
				+	4
	<i>Mikania micrantha</i>	Light green	Shoots, young leaves, old leaves		
<i>Aphis citricola</i>	<i>Phyllanthus neruri</i>	Greenish yellow	Shoot, young leaves, young twigs, petioles	+	5
<i>Greenidea</i> sp.	<i>Bridelia Tomentosa</i>	Greenish yellow	Young leaves	-	0
<i>Hystroneura setariae</i>	<i>Digitaria ciliaris</i>	Reddish-brown	Flower, flower stalks	+	3
	<i>Eleusin indica</i>	Reddish-brown	Flower, flower stalks, leaf axils	+	4
	<i>Eragrostis tenella</i>	Reddish-brown	Flower, flower stalks, seeds	+	4
	<i>Hymenochera acutigluma</i>	Reddish-brown	Flowers, flower stalks, leaf axils	+	3
	<i>Lophatherum gracile</i>	Reddish-brown	Young leaves, old leaves, leaf axils	+	6
	<i>Oxonopus compressus</i>	Reddish-brown	Flower, flower stalk, leaf axils	+	3
	<i>Paspalum conjugatum</i>		Flower, flower stalk, seeds	+	6
<i>Hyperomyzus</i> sp.	<i>Echinocloa crussgali</i>	Black	Young leaves, old leaves	-	0
<i>Lipaphis erysimi</i>	<i>Blumea lacera</i>	Whitish green	Flowers, shoots, and buds	+	4
	<i>Rorippa indica</i>	Whitish green	Flower, fruit, shoots, young leaves	+	4
	<i>Sonchus arvensis</i>	Whitish green	Young leaves, fruit stalks, flowers, fruit	+	5
<i>Rhopalosiphum maidis</i>	<i>Eleusin indica</i>	Green	Flower, flower stalks, leaf axils	+	3
	<i>Lophatherum gracile</i>	Green	Young leaves, old leaves, leaf axils	+	4
	<i>Oryza rufipogon</i>	Green	Old leaves, young leaves (shoot), leaf axils	-	0
<i>Rhopalosiphum padi</i>	<i>Oryza rufipogon</i>	Whitish green	Old leaves, young leaves (shoot), leaf axils	+	4
<i>Schizaphis rotundiventris</i>	<i>Cynodon dactylon</i>	Green	Flowers, flower stalks	+	6
	<i>Cyperus rotundus</i>	Green	Flowers, flower stalks, leaf axils	+	4
	<i>Cyperus compressus</i>	Green	Flowers, flower stalks, leaf axils	+	4

Notes: (+): present, (-): absent

Discussion

In the present study, some aphid species were found on several ornamental plants in Pagar Alam, the location of aphid colonization on the plants varied. On *Aster alpinus* L., aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The identification results showed that the aphids were *Macrosiphoniella sanborni* Gillette, 1908 associated with ants. On the *Brugmansia suaveolens* (Humb. & Bonpl. ex Willd.) Bercht. & J.Presl, *Myzus persicae* Sulzer, 1776 were found on the undersides of old leaves or leaves that have turned yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. was found one species of aphids: *Pentalonia caladii* van der Goot, 1917. *P. caladii* was known and found in taro plants; the aphids formed colonies under the surface of young and older leaves (Bhadra and Agarwala 2014). This study found that the occupied leaf areas did not display severe symptoms; the aphids were yellow-green to dark green. The wingless adult aphids often had a white,

flour-like appearance on their bodies. On the *Cananga odorata* (Lam.) Hook.f. & Thomson (ylang-ylang), colonies of *Toxoptera aurantii* Boyer de Fonscolombe, 1841 were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black. The colonies of *T. aurantii* were found to be associated with black ants. Aphids on *Canna indica* L. (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body and the identification results showed that the aphids were *Rhopalosiphum nymphaeae* Linnaeus, 1761 (Ghosh and Singh 2004). The colonies of *R. nymphaeae* were found to be associated with ants. In the *Catharanthus roseus* (L.) G.Don (periwinkle), *Aphis citricola* van der Goot, 1912 aphids were found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and the colonized plant parts showed no disease symptoms. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the

undersides of young leaves, shoots, and within flower parts, especially between petals or stalks that had not fully bloomed; the colonies were quite large. The body color of aphids was green to dark green, with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were *Aphis gossypii* Glover, 1877. The aphid colonies found were consistently associated with ants. Aphids on *Clitoria ternatea* L. were found to form colonies on flower parts, flower crowns, stems, and young leaves. The aphids were brown to black. Colonized plant parts, especially shoots and young leaves, showed stunting symptoms. The identification results showed that the aphids were *Aphis craccivora* Koch, 1854. These colonies were consistently associated with ants. The aphids on the *Dahlia* sp. formed colonies on unopened flower buds, with a significant population among the blooming petals. The body color was green to dark green. The identification results showed that the aphids were *A. gossypii*. According to this present study, *Sinemegoura citricola* van der Goot, 1917 colonies were found on the young leaves of *Dendrobium* sp., with the color body of the *S. citricola* aphids were yellow, green to dark green, and the colonized plants showing no disease symptoms, and were associated with ants. On *Duranta* sp., colonies of aphids on the undersides of young leaves, and the colonized plant parts showed stunting symptoms. The colonies were very large. The aphids were green. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Furthermore, on the *Helianthus annuus* L., aphid colonies were found between the flower petals. The colonized flowers, especially the crowns, tended to fall off easily. The aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease symptoms. The identification results showed that the aphids were *Myzus ornatus* Laing, 1932. The aphid colonies were not associated with ants. Within the colonies, mummified aphids that Aphidiidae parasitized were found. On the *Hibiscus rosa-sinensis* L., aphids ranging from yellow to dark green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Two types of aphids were found on the flowering plant *Ixora paludosa* (Blume) Kurz. First, the aphids formed colonies on the undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, like sugar. The aphids had yellow, green, or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The

identification results showed that the aphids were *A. gossypii* almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants. Moreover, two forms of aphids were discovered in *Ixora* sp. flower plants. These aphids occupied the shoots, young leaves, and unopened flowers; the affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from yellow and green to a slightly darker green. Sometimes, the upper surface of the wingless imago's body appeared white, resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost always associated with ants. Another species of aphids formed colonies on flower stalks that had not yet bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce plant disease symptoms. The aphids were yellow or yellowish green, with black cauda and siphunculi. Their bodies were very small to small. The identification results showed that the aphids were *A. citricola*. The colonies of *A. citricola* were also frequently found in association with ants. Two types of aphids were found on *Mussaenda frondosa* L., each forming colonies in different locations. The first type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease symptoms. The identification results showed that the aphids were *Toxoptera odinae* van der Goot, 1917. The aphids were yellow, green, and dark green (Blackman et al. 2011). The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could also be found on young leaves, shoots, and within flower parts. The plant parts they infested showed no signs of diseases. The aphids were yellow or yellow-green, with black cauda and siphunculi. They had tiny to small bodies. The identification results showed that the aphids were *A. citricola*. Many aphid species infest various ornamental plants because these insects are attracted to such plants due to the rich nutrient content in the plant sap (Braham et al. 2023).

The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were generally consistent within the same taxon. *Ageratum conyzoides* L. was infested by *A. gossypii*. These aphids formed colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green, yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* (Mart.) Griseb., or alligator grass, was also colonized by *A. gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging from yellow-green to dark green. *Alternanthera sessilis* (L.) R.Br. ex DC. was colonized by *A. gossypii*, forming

colonies on shoots, flowers, and fruit. The colonies were typically large, and often associated with tiny brown ants. *Amaranthus gracilis* Desf. was infested by *A. craccivora*. These aphids established colonies on shoots, flowers, and young and old leaves. They were dark brown to black, with shiny black wingless imagoes. Colonies of these aphids were associated with both black and red ants. *Blumea lacera* (Burm.fil.) DC. was colonized by *Lipaphis erysimi* Kaltentbach, 1843. These aphids were bright green and of medium size. The colonies formed on flowers, flower stalks, and the undersides of the leaves at the top. The aphid colonies were not associated with ants. *Croton hirtus* L'Hér., or fire grass, was infested by *A. gossypii*; the aphids were yellow-green to dark green. The colonies were found on the stems, leaves, buds, and flowers, often forming large colonies. *Cynodon dactylon* (L.) Pers. or Bermuda grass was colonized by *Schizaphis rotundiventris* Signoret, 1860. The aphids colonized the flowers, flower stalks, and sometimes the plant leaf axils. Small colonies were formed. The aphids were brown to reddish brown. They were associated with ants. *Cyperus rotundus* L., or nut grass, was infested by *S. rotundiventris* aphids. The colonies were found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants. The aphids were dark brown in color. *Cyperus compressus* L., or grass puzzle, was colonized by *S. rotundiventris* aphids, forming colonies in the flowers, flower stalks, and sometimes in the axils and leaves of the shoots or buds. Small colonies were observed. *Digitaria ciliaris* (Retz.) Koeler was infested by *Hysteroneura setariae* Thomas 1878 aphids, with small colonies scattered on the flowers and flower stalks. These aphids were light brown to brown in color. *Echinochloa crus-galli* (L.) P.Beauv., or water hyacinth plants, were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large colonies on the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Eclipta prostrata* (L.) L., or urang-aring, was colonized by *A. gossypii*, forming small colonies on the shoots and flowers. The aphids were bright green to blackish green. The aphid colonies were also consistently associated with ants. *Eleusin indica* (L.) Gaertn. was colonized by two species of aphids: *Hysteroneura setariae* Thomas, 1878 and *Rhopalosiphum maidis* Fitch, 1856. *H. setariae* formed colonies in flower parts, flower stalks, and leaf axils, resulting in large colonies. *H. setariae*'s body color ranged from red-brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis* formed colonies in the leaf axils and undersides of leaves and leaf shoots that had not yet opened. The colonies were not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants. The plant *Emilia sonchifolia* (L.) DC. ex Wight, characterized by its purple flowers, was colonized by *A. gossypii*; the aphids were yellow to green in color. The colonies formed near flowers, flower stalks, and shoot leaves. *Eragrostis tenella* was infested by *H. setariae* aphids. The aphids were brown to red-brown. Small

colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were consistently associated with ants. *Euphorbia hirta* L., or wart grass, was colonized by *A. gossypii*. The aphids formed colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupatorium odoratum* L. was colonized by *A. gossypii* and *A. citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young twigs. Young leaves colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this plant showed yellow-green to dark-green body color. The colonies of *A. citricola* formed on the young twigs near the shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants. *Hymenachne acutigluma* (Steud.) Gilliland, or hair axis, was colonized by *H. setariae*, which formed colonies on the flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromea* sp., or *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not show any disease symptoms. *Lophatherum gracile* Brongn. or bamboo grass plants, were colonized by two species of aphids: *H. setariae* and *R. maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves, leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were brown to red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis* aphids were green to bright green, with black siphunculi and cauda. It was possible for colonies of the two species of aphids on *L. gracile* to mix. In addition, *Melastoma affine* D.Don was colonized by *A. gossypii*. The colonies formed on shoots, particularly near newly emerging shoots and newly emerging fruits and flowers. The body color of aphids ranged from yellow to green. The colonized plant parts did not show any disease symptoms. *Mikania micrantha* Kunth was colonized by *A. gossypii* and *Aphis glycines* Matsumura, 1917. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. glycines* aphids were light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony. *Mimosa invisa* Mart. ex Colla (cater-grass) was colonized by *A. craccivora*. The aphids of *A. craccivora* on *M. invisa* plants formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa pudica* L. was observed to be colonized by *A. craccivora*. The aphids formed colonies on shoots, especially young shoots, and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the colonized plant parts. The colonies

were quite large. *Mimosa pigra* L. was colonized by *A. craccivora*. The colonies of aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were shiny black. The colonized plant parts did not show any disease symptoms. *Oryza rufipogon* Griff. was colonized by two species of aphids: *Rhopalosiphum macr* and *R. maidis*. Both aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species could be distinguished by their body color. *R. maidis* appeared green with black siphunculi and cauda, while *Rhopalosiphum padi* Linnaeus, 1758 appeared white. The colonies of *R. maidis* and *R. padi* in *O. rufipogon* plants were associated with the presence of red ants. *Axonopus compressus* (Sw.) P.Beauv., or *pait* grass, was colonized by *H. setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes the leaf axils. The aphids were brown to dark brown. Small colonies were formed, and they were also consistently associated with ants. *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus neruri* L. was colonized by *A. citricola*. The colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became distorted, stunted, and wrinkled. The aphids had yellow bodies with black siphunculi and cauda; the colonies formed were large. *Portulaca oleracea* L. plants were colonized by *A. craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants formed colonies on the undersides of leaves, especially young leaves, shoots, and flowers. The colonized plant parts became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that appeared glossy black. *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant parts did not show disease symptoms. *Rorippa indica* (L.) Hiern, or mustard land, was colonized by *L. erysimi*. The colonies formed on the flowers, fruits, flower stalks, and the lower leaf's surface. The colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia* L., or cacabean, was colonized by *A. gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks, and flower petals. The colonized plant parts, especially the shoots, showed curling, and the leaf edges curled downward. *Sonchus arvensis* L. plants were colonized by *L. erysimi*. The aphids had green to whitish green body colors, and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically displayed typical damage symptoms, but some did not show any symptoms at all. Generally, the plants' symptoms due to aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves. These characteristic symptoms serve as indicators

of aphid infestations. However, some plants or plant parts did not show symptoms when colonized by aphids. This condition occurred because the colonized parts had reached maximum growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the leaves and plant parts were old. Furthermore, the old leaves or twigs might not show the typical symptoms associated with aphid infestations. The plant parts exhibiting characteristic symptoms when colonized by aphids also often experienced a cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued growing, resulting in some parts developing ordinary while others became stunted (Pettersson et al. 2017). This condition could lead to bending shoots or young stems, curling leaves, downward curling of leaf edges, or stunted leaf growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed from that of dicot plants. Therefore, the presence of aphids in monocot plants was often easier to recognize through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids had colonized the plant (Tegelaar et al. 2012). Therefore, the presence of ants could serve as an indicator of the aphid colonies. According to this study, ants were present in some aphid colonies from the subfamily Aphidinae, while the ants were absent in some aphid colonies from the macrosiphini subfamily. The bodies of aphids from the subfamily Aphidinae are relatively small and have short siphunculi. On the other hand, aphids, which have large bodies and relatively long siphunculi, are never visited by ants. This happens because long siphunculi are reported to disturb ants, so the ants don't like to come close. Additionally, large aphids and long siphunculi generally do not produce honeydew, so ants do not want to come close.

The absence of ants in aphid colonies could be because the colonies have just formed or the population is still low (Kummel et al. 2013). Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new growth or reproductive plant parts. Flowers contain a nutrient-rich nature and easy access to sap; therefore, aphids were attracted to flower saps. In addition, some aphid species were drawn to certain colors (Jakubczyk et al. 2022). Herbs served as an alternative host for aphids in this present study. Aphids consume sugar-rich liquid in plants, known as sap. Aphids considered herbs and other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate plant tissues and access this fluid (Brožek et al. 2015). Several aphids colonized herbs such as Indian mustards, *L. erysimi*, and *M. persicae*, the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al. 2022). Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance known as honeydew as a waste product, which ants found highly attractive food sources (Nelson and

Mooney 2022). The honeydew contained abundant sugars extracted by aphids from the plant juice (Zheng et al. 2022). Ants were drawn to this nutrient-rich food source and would often farm aphids for it. In exchange for honeydew, ants protected aphids from other insects and predators, such as ladybugs, lacewing larvae, and parasitic wasps (Karami-Jamour et al. 2018). Certain ant species would transport aphids to new host plants for improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain species) and provided energy for the growth of their progeny (Biedermann and Vega 2020). Ornamental plants, and also weeds are generally grown with simple maintenance and usually free pesticides. The ecological habitat of ornamental plants and weeds is assumed to be the same. Therefore, many species of aphids found on ornamental plants were also found on weeds.

In conclusion total of 15 species aphids found in ornamental plants, *A. craccivora*, *A. citricola*, *A. glycines*, *A. gossypii*, *A. solani*, *M. sanborni*, *M. rosae*, *M. persicae*, *N. circumflexus*, *P. caladii*, *R. nymphaeae*, *S. citricola*, *T. aurantii*, *T. citricidus*, *T. odinae*. The total of 11 species aphids found in weeds, *A. gossypii*, *A. craccivora*, *A. glycines*, *A. citricola*, *Greenidea* sp., *H. setariae*, *Hiperomyzus* sp., *L. erysimi*, *R. maidis*, *R. padi*, *S. rotundiventris*.

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REFERENCES

- Ghosh S, Singh R. 2004. Aphids on medicinal plants in North East India (Insecta : Homoptera : Aphididae). *Rec Zool Surv India* 102 (1-2): 169-186. DOI: 10.26515/rzsi/v103/i1-2/2004/159495.
- Bass C, Puinean AM, Zimmer CT, Denholm I, Field LM, Foster SP, Gutbrod O, Nauen R, Slater R, Williamson MS. 2014. The evolution of insecticide resistance in the peach potato aphid, *Myzus persicae*. *Insect Biochem Mol Biol* 51: 41-51. DOI: 10.1016/j.ibmb.2014.05.003.
- Bhadra P, Agarwala BK. 2014. On the morphological and genotypic variations of two congeneric species of banana aphid *Pentalonia* (Homoptera : Aphididae) from India. *Aadv Life Sci* 2 (3): 75-81. DOI: 10.5932/j.als.20120203.06.
- Biedermann PHW, Vega FE. 2020. Ecology and evolution of insect-fungus mutualisms. *Ann Rev Entomol* 65: 431-55. DOI: 10.1146/annurev-ento-011019-024910.
- Blackman RL, Eastop VF. 2008. *Aphids On The World's Herbaceous Plants And Shrubs 2 Volume Set*. John Wiley & Sons, Hoboken, New Jersey.
- Blackman RL, Eastop VF. 2017. *Taxonomic Issues*. CABI, Wallingford, UK. DOI: 10.1079/9781780647098.0001.
- Blackman RL, Sorin M, Miyazaki M. 2011. Sexual morphs and colour variants of *Aphis* (Formerly Toxoptera) Odinae (Homoptera, Aphididae) in Japan. *Zootaxa* 3110 (1): 53-60. DOI: 10.11646/zootaxa.3110.1.5.
- Braham M, Boulahia-kheder S, Kahia M, Nouira. S 2023. Aphids and Citrus responses to nitrogen fertilization. *J Saudi Soc Agric Sci* 22 (6):374-83. DOI: 10.1016/j.jssas.2023.03.003.
- Brożek J, Mróz E, Wylęzek D, Depa Ł, Węgierek P. 2015. The structure of extremely long mouthparts in the aphid genus *Stomaphis* Walker (Homoptera: Sternorrhyncha: Aphididae). *Zoomorphology* 134:431-45. DOI: 10.1007/s00435-015-0266-7.
- Cao HH, Zhang ZF, Wang XF, Liu TX. 2018. Nutrition versus defense : Why *Myzus persicae* (Green peach aphid) prefers and performs better on young leaves of cabbage *PloS One* 13 (4):1-16. DOI: 10.1371/journal.pone.0196219.
- Clarke R, Kehoe MA, Broughton S, Jones RAC. 2020. Host plant affiliations of aphid vector species found in a remote tropical environment. *Virus Res* 281: 197934. DOI: 10.1016/j.virusres.2020.197934.
- Ertunc F. 2020. Emerging plant viruses. In: *Emerging and Reemerging Viral Pathogens*. Academic Press, Cambridge, Massachusetts.
- Gadhve KR, Gautam S, Rasmussen DA, Srinivasan R. 2020. Aphid transmission of potyvirus: The largest plant-infecting RNA virus genus. *Viruses* 12 (7): 773. DOI: 10.3390/v12070773.
- Giannetti D, Mandrioli M, Schifani E, Castracani C, Spotti FA, Mori A, Grasso DA. 2021. First report on the acrobat ant *crematogaster scutellaris* storing live aphids in its oak-gall nests. *Insects* 12 (2): 108. DOI: 10.3390/insects12020108.
- Jakubczyk K, Koprowska K, Gottschling A, Janda-Milczarek K. 2022. Edible flowers as a source of dietary fibre (Total, Insoluble and Soluble) as a potential athlete's dietary supplement. *Nutrients* 14 (12): 2470. DOI: 10.3390/nu14122470.
- Jayaswal D, Mainkar P, Kumar K, Agarwal Y, Prabha R. 2022. Pyramiding and evaluation of segregating lines containing lectin and protease inhibitor genes for aphid resistance in *Brassica juncea*. *Indian J Biochem Biophys* 59 (8): 800-807. DOI: 10.56042/ijbb.v59i8.62319.
- Jones RAC. 2022. Alteration of plant species mixtures by virus infection: Managed pastures the forgotten dimension. *Plant Pathol* 71 (6): 1255-81. DOI: DOI: 10.1111/ppa.13571.
- Kallas J. 2010. *Edible Wild Plants*. Gibbs Smith, Layton, Utah.
- Karami-Jamour T, Mirmoayed A, Zamani A, Khajehzadeh Y. 2018. The impact of ant attendance on protecting *Aphis gossypii* against two aphidophagous predators and it's role on the intraguild predation between them. *J Insect Behav* 31: 222-39. DOI: 10.1007/s10905-018-9670-4.
- Kennedy JS, Stroyan HLG. 1959. Biology of aphids. *Ann Rev Entomol* 4 (1): 139-60. DOI: 10.1146/annurev.en.04.010159.001035.
- Kumar S, Bhowmick MK, Ray P. 2021. Weeds as alternate and alternative hosts of crop pests. *Indian J Weed Sci* 53 (1): 14-29. DOI: 10.5958/0974-8164.2021.00002.2.
- Kummel M, Brown D, Bruder A. 2013. How the aphids got their spots: predation drives self-organization of aphid colonies in a patchy habitat. *Oikos* 122 (6): 896-906. DOI: 10.1111/j.1600-0706.2012.20805.x.
- Maharani Y, Hidayat P, Rauf A, Maryana N. 2018. Short Communication: New records of aphid species subfamily Aphidinae (Homoptera: Aphididae) in West Java, Indonesia. *Biodiversitas* 19 (2):460-65. DOI: 10.13057/biodiv/d190219.
- Meuninck J. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield, Lanham, Maryland, US.
- Naidu VSGR. 2012. *Hand Book on Weed Identification*. Directorate of Weed Science Research, Jabalpur, India.
- Nelson AS, Mooney KA. 2022. The evolution and ecology of interactions between ants and honeydew-producing hemipteran insects. *Ann Rev Ecol Evol Syst* 53: 379-402. DOI: 10.1146/annurev-ecolsys-102220-014840.
- Pettersson J, Tjallingii WF, Hardie J. 2017. Host-plant selection and feeding. In: *Aphids As Crop Pests*. CABI, Wallingford, UK. DOI: 10.1079/9781780647098.0173.
- Tegelaar K, Hagman M, Glinwood R, Pettersson J, Leimar O. 2012. Ant-aphid mutualism: The influence of ants on the aphid summer cycle." *Oikos* 121 (1): 61-66. DOI: 10.1111/j.1600-0706.2011.19387.x.
- Zheng Z, Zhao M, Zhang Z, Hu X, Xu Y, Wei C. 2022. Lactic acid bacteria are prevalent in the infrabuccal pockets and crops of ants that prefer aphid honeydew. *Front Microbiol* 12 (1): 1-17. DOI: 10.3389/fmicb.2021.785016.

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2	Abstract and table	<i>Aphis ctiricola</i> is not accepted	We have already corrected it; we change to <i>Aphis Spiraecola</i>

Best regards,

Corresponding author,

Chandra Irsan

Species of aphids found in ornamental and wild plants in Pagar Alam District, South Sumatra, Indonesia

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Abstract. Irsan C, Anggraini E, Ramadhani W. 2023. *Species of aphids found in ornamental and wild plants in Pagar Alam District, South Sumatra, Indonesia. Biodiversitas 24: xxx-xxx.* Aphids are one of the crucial pests in tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species, such as wild plants, were found on plants that were not hosts. Therefore, this study reported the species of aphids found in ornamental and wild plants. The field research employed purposive and direct observation to inventory cultivated or wild plants hosting and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants and wild plants or weeds. The collection and identification of host plants and aphids involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that the total of 15 species aphids found in Ornamental plants, *Aphis craccivora* Koch, 1854, *Aphis spiraeicola* Patch, 1914, *Aphis glycines* Matsumura, 1917, *Aphis gossypii* Glover, 1877, *Aulacorthum solani* Kaltentbach, 1843, *Macrosiphoniella sanborni* Gillette, 1908, *Macrosiphum rosae* Linnaeus, 1758, *Myzus persicae* Sulzer, 1776, *Neomyzus circumflexus* Buckton, 1876, *Pentalonia caladii* van der Goot, 1917, *Rhopalosiphum nymphaeae* Linnaeus, 1761, *Sinemegoura citricola* van der Goot, 1917, *Toxoptera aurantii* Boyer de Fonscolombe, 1841, *Toxoptera citricidus* Kirkaldy, 1907, *Toxoptera odinae* van der Goot, 1917 and the total of 11 species aphids found in weeds, *A. gossypii*, *A. craccivora*, *A. glycines*, *A. citricola*, *Greenidea* sp., *Hystroneura setariae* Thomas, 1878, *Hiperomyzus* sp., *Lipaphis erysimi* Kaltentbach, 1843, *Rhopalosiphum maidis* Fitch, 1856, *Rhopalosiphum padi* Linnaeus, 1758, *Schizaphis rotundiventris* Signoret, 1860.

Keywords: Aphids, ornamental plants, wild plants

INTRODUCTION

Aphids are crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhav et al. 2020); aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can be found throughout the year due to their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids suck phloem sap of tender plant parts, which can deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, vector species can further weaken and stunt the growth of infected plants (Jones 2022). In addition, the honeydew that aphids secrete can lead to the growth of sooty mold, a black fungus that can prevent sunlight from reaching the plant's leaves, thereby impairing photosynthesis, the process by which plants produce food (Singh and Singh 2021). Therefore, it is crucial to control aphid populations in gardens and crops.

Many aphid species are found on plants that are not their actual hosts (Maharani et al. 2018). Aphids have one or more secondary, or alternative, host plants in addition to

their primary host plants, which are the types of plants they feed on most frequently (Clarke et al. 2020). Alternative plants provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al. 2021). These secondary hosts may offer less adequate nutrition for insects (Mo and Smilanich 2023). However, they may provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al., 2021). According to Liu et al. (2017), hibiscus serves as an overwintering host for cotton-specialized aphids but not for cucurbit-specialized aphids, it is evident that host-specialized aphids have refuges during times of food shortage. The life cycles of numerous aphid species exhibit such complexity (Jousselin et al. 2010). They maintain a cycle of host alternation, shifting between their primary hosts (typically woody plants) and secondary hosts (often herbaceous plants) (Yamamoto et al. 2020). Weeds pose a continuous threat in both cropped and non-crop areas, providing food, shelter, and reproductive sites for various pest organisms (Kumar et al., 2021). This indicates that weeds can serve as alternative hosts for aphids.

In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and wild plants. Research on the inventory of aphid species in ornamental and wild plants has less noticed. This study reports the diversity of aphid species found in ornamental and wild plants found in this area. The findings from this study can serve as a valuable resource for aphid management.

MATERIALS AND METHODS

The field research employed a purposive and direct observation to inventory cultivated or wild plants hosting and collecting aphids. The plant selection included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. Where available, collecting and identifying host plants, aphids, and natural enemies involved systematic searches of all existing plant species to find those colonized by aphids. Any plants colonized by aphids are documented as aphid hosts. Aphid identification was done using identification keys (Blackman and Eastop 2008) in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on morphological characteristics. The host plants were identified using the weed identification handbook (Kallas 2010; Naidu 2012; Meuninck 2023). The location and aphid colony sizes, including their life color, and

photographs of the aphid colonies and their host plants were recorded.

RESULTS AND DISCUSSION

Result

Aphids infesting in ornamental plants

The results showed that 15 aphid species were found in Pagar Alam (Tables 1 and 2). These aphids mostly colonized flowers of various ornamental plants (Table 1, Figure 1).

The relationship between aphids and ants was also recorded. Aphids produce a sweet, sticky substance called honeydew; ants are attracted to this honey because it serves as a food source. When aphids are present, they secrete honeydew, which attracts ants. This research recorded the presence of ants on plant parts colonized by aphids (Table 2).

Aphids infesting in wild plants (weed or non-weed plants)

In addition, this study documented aphid colonies on flowers, stalks, plant tops, young leaves, and old leaves of wild plants (Table 3, Figure 2).

The presence of ants in aphid colonization symbolizes a mutually beneficial relationship where the ants receive food from the aphids while protecting them. This study recorded the ant attendance in aphids colonization (Table 4).

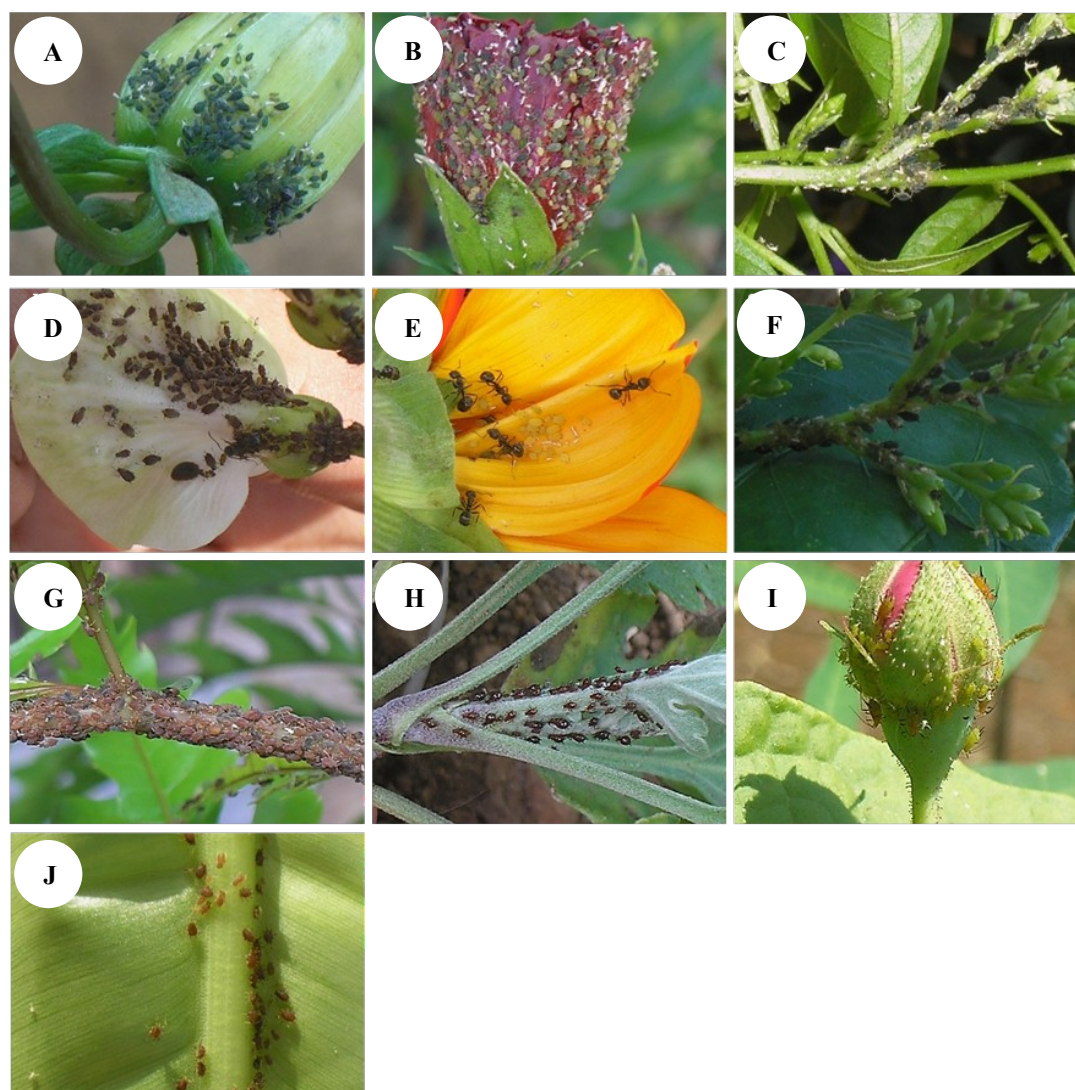


Figure 1. Photos showing colonies of different aphid species in ornamental plants: A. *Aphis gossypii* in *Dahlia* sp. flower; B. *Aphis gossypii* in *Hibiscus rosasinensis* flower; C. *Aphis gossypii* in *Cestrum* twig and flower; D. *Aphis craccivora* in *Clitoria ternatea* flower; E. *Aphis glycines* in *Helianthus giganteus* flower; F. *Aphis craccivora* on the *Murayya paniculata* flower; G. *Toxoptera odinae* in the *Mussaenda frondose*; H. *Macrosiphoniella sanborni*. in *Chrysanthemum* sp. Leaves; I. *Macrosiphum rosae* in *Rosa indica* flower; J. *Rhopalosiphum nymphaeae* in *Canna indica* leaves. Chandra Irsan captured all the photos.

Table 1. Aphid species recorded in ornamental plants and their colony locations

Host plant	Aphid species	Colony location
<i>Aster alpinus</i>	<i>Macrosiphoniella sanborni</i>	Leaves, young twig, flower
<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i>	Leaves, flower
	<i>Neomyzus circumflexus</i>	Leaves
	<i>Myzus persicae</i>	Leaves, flower
<i>Caladium</i> sp.	<i>Pentalonia caladii</i>	Leaves,
<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	Leaves, flower
<i>Canna indica</i>	<i>Rhopalosiphum nymphaeae</i>	Leaf
<i>Catharanthus roseus</i>	<i>Aphis spiraeicola</i>	Shoot, young leaves, flower
<i>Cestrum</i> sp.	<i>Aphis gossypii</i>	Shoot, flower
	<i>Neomyzus circumflexus</i>	Young leaves
<i>Clitoria ternatea</i>	<i>Aphis craccivora</i>	Flower
<i>Chrysanthemum</i> sp.	<i>Macrosiphoniella sanborni</i>	Shoot, twig
<i>Dahlia</i> sp.	<i>Aphis gossypii</i>	Flower
<i>Dendrobium</i> sp.	<i>Sinemogoura citricola</i>	Flower
<i>Duranta</i> sp.	<i>Aphis gossypii</i>	Shoot, flower
<i>Helianthus giganteus</i> .	<i>Aphis glycines</i>	Flower
<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i>	Flower
<i>Ixora paludosa</i>	<i>Aphis gossypii</i> ,	Flower
	<i>Toxoptera aurantii</i>	Shoot, young leaves

<i>Ixora</i> sp.	<i>Aphis spiraeicola</i>	Flower
	<i>Aphis gossypii</i>	Flower
	<i>Toxoptera aurantii</i>	Shoot, flower
<i>Murraya paniculata</i>	<i>Aphis craccivora</i>	Young Twig
	<i>Toxoptera citricidus</i>	Shoot, flower
<i>Mussaenda frondosa</i>	<i>Aphis spiraeicola</i>	Shoot, flower
	<i>Toxoptera odinae</i>	Shoot, flower
<i>Rosa indica</i>	<i>Macrosiphum rosae</i>	Flower
<i>Spondias dulcis</i>	<i>Aphis spiraeicola</i>	Flower

Table 2. Aphid species recorded in ornamental plants and the presence of the ants in the plant parts colonized

Aphid species	Ornamental plants	Aphids life color	Plant parts colonized	Ant attendance	Total individual of ant
<i>Aphis craccivora</i>	<i>Clitoria ternatea</i>	Black	Flowers	+	3
	<i>Murraya paniculata</i>	Black	Flowers	+	2
<i>Aphis spiraeicola</i>	<i>Catharanthus roseus</i>	Greenish yellow	Flowers	+	2
	<i>Ixora</i> sp.	greenish yellow	Flowers	+	3
	<i>Mussaenda frondosa</i>	greenish yellow	Shoots, flowers	+	7
	<i>Spondias dulcis</i>	greenish yellow	Flowers	+	8
<i>Aphis glycines</i>	<i>Helianthus giganteus</i>	Greenish yellow	Flowers	+	3
<i>Aphis gossypii</i>	<i>Cestrum</i> sp.	Green	Shoots, flowers	+	4
	<i>Cananga odoratum</i>	Light green	Shoots, flowers	+	1
	<i>Dahlia</i> sp.	Green dark	Flowers	+	2
	<i>Duranta</i> sp.	Light green	Shoots, flowers	+	5
	<i>Hibiscus rosasinensis</i>	Dark green	Flowers	+	6
	<i>Ixora paludosa</i>	Light green	Flowers	+	2
	<i>Ixora</i> sp.	Light green	Flowers	+	7
<i>Aulacorthum solani</i>	<i>Brugmansia suaveolens</i>	Greenish yellow	Leaves, flowers	-	0
<i>Macrosiphoniella sanborni</i>	<i>Aster alpinus</i>	Brown black	Leaves, twigs, flowers	+	5
	<i>Chrysanthemum</i> sp.	Reddish brown	Leaves, twigs	+	5
<i>Macrosiphum rosae</i>	<i>Rosa indica</i>	Green	Flowers	-	0
<i>Myzus persicae</i>	<i>Brugmansia suaveolens</i>	Greenish yellow	Leaves, flowers	-	0
<i>Neomyzus circumflexus</i>	<i>Cestrum</i> sp.	Light green	Young leaves,	-	0
	<i>Brugmansia suaveolens</i>	Light green	flowers	-	0
			Flowers		
<i>Pentalonia caladii</i>	<i>Caladium</i> sp.	Brown-black	Leaves	+	7
<i>Rhopalosiphum nymphaeae</i>	<i>Canna indica</i>	Green black	Leaves	+	1
<i>Sinemegoura citricola</i>	<i>Dendrobium</i> sp.	Brown	Flowers	-	0
<i>Toxoptera aurantii</i>	<i>Ixora paludosa</i>	Brown black	Flowers	+	5
	<i>Ixora</i> sp.	Brown black	Flowers	+	4
<i>Toxoptera citricidus</i>	<i>Murraya paniculata</i>	Black	Stems	+	6
<i>Toxoptera odinae</i>	<i>Mussaenda frondosa</i>	Reddish-brown	Flowers	+	4

Notes: (+) = present; (-) = absent

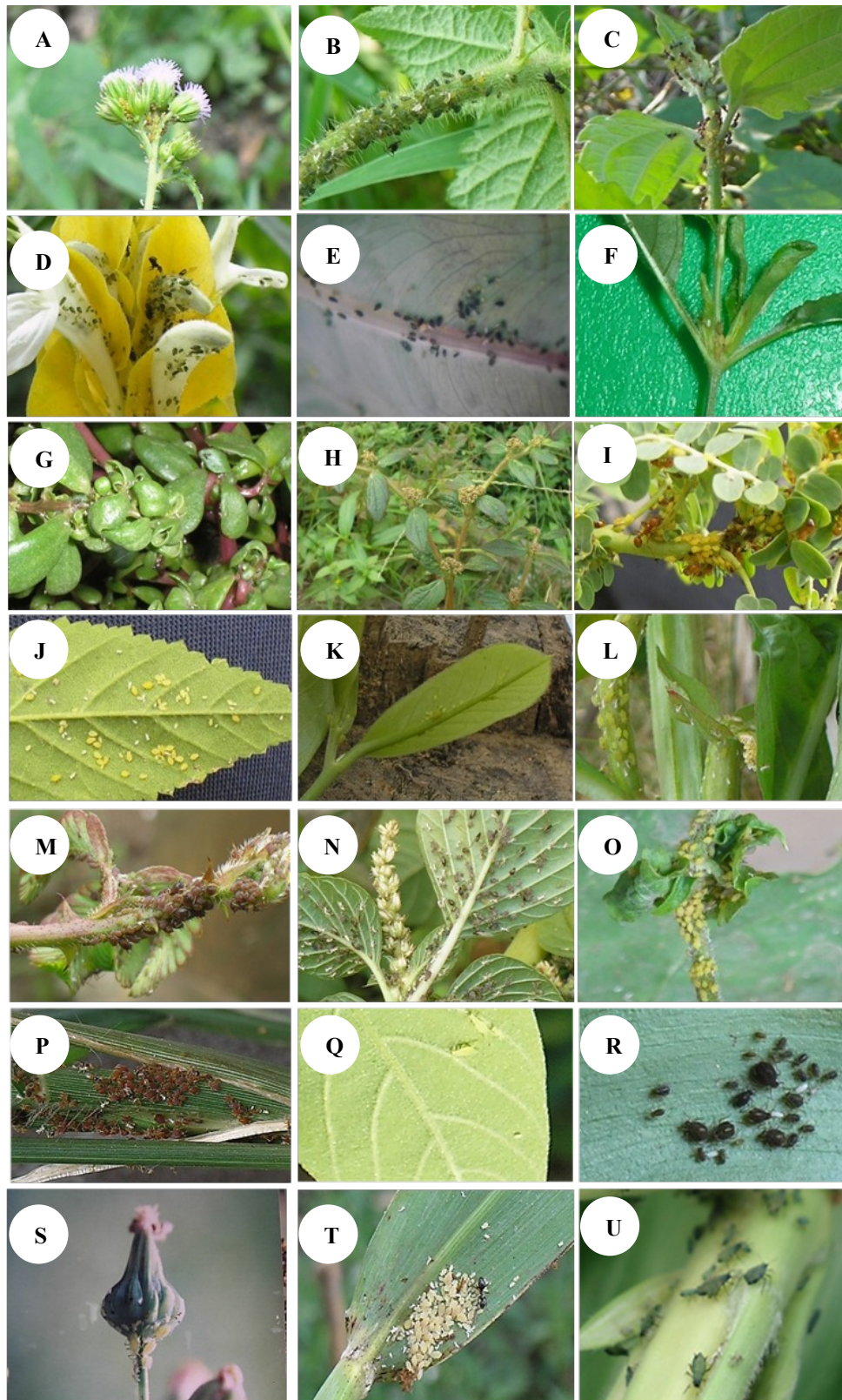


Figure 2. Aphids found infesting wild plants A. *Aphis gossypii* in *Ageratum conyzoides*; B. *Aphis gossypii* in *Croton hirtus*; C. *Aphis gossypii* in *Eupatorium odoratum*; D. *Aphis gossypii* in *Pachystochys* sp.; E. *Pentalonia caladii* in *Caladium* sp.; F. *Aphis gossypii* in *Alternanthera sessilis*; G. *Aphis gossypii* in *Portulaca oleraceae*; H. *Aphis gossypii* in *Euphorbia hirta*; I. *Aphis spiraeicola* in *Phyllanthus nerruri*; J. *Aphis spiraeicola* in *Sida rhombifolia*; K. *Aphis spiraeicola* in *Bridelia tomentosa*; L. *Aphis spiraeicola* in *Ludwigia peruviana*; M. *A. craccivora* in *Mimosa pudica*; N. *Aphis craccivora* in *Amaranthus viridis*; O. *Aphis glycine* in *Mikania micrantha*; P. *Hysteneura* sp. in *Eleusin* sp.; Q. *Greenidae* sp. in *Bridelia tomentosa*; R. *Hyperomyzus* sp. in *Echinochloa crusgali*; S. *Lipaphis erysimi* in *sonchus arventris*; T. *Rhopalosiphum padi* in *Oryza rufipogon*; U. *Rhopalosiphum maidis* in *Oryza rufipogon*. All the photos were captured by Chandra Irsan.

Table 3. Species of aphids found in wild (weed or non-weed) plants and their colony locations

Host plant	Weeds or non-weed plants	Aphid species	Colony location
<i>Ageratum conyzoides</i>	Weed	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, flowers
<i>Alternanthera philoxeroides</i>	Weed	<i>Aphis gossypii</i>	Shoots, buds
<i>Alternanthera sessilis</i>	Weed	<i>Aphis gossypii</i>	Shoots, buds
<i>Amaranthus viridis</i>	Weed	<i>Aphis craccivora</i>	Flowers, shoots, young leaves, old leaves
<i>Blumea lacera</i>	Weed	<i>Lipaphis erysimi</i>	Flowers, shoots, and buds
<i>Bridelia tomentosa</i>	Non-weed	<i>Greenidea</i> sp.	Young leaves
		<i>Aphis spiraeicola</i>	Shoot, young leaves
<i>Croton hirtus</i>	Weed	<i>Aphis gossypii</i>	Flowers, shoots, young leaves, old leaves, young twigs
<i>Cynodon dactylon</i>	Weed	<i>Schizaphis rotundiventris</i>	Flower, flower stalks
<i>Cyperus rotundus</i>	Weed	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
<i>Cyperus compressus</i>	Weed	<i>Schizaphis rotundiventris</i>	Flower, flower stalks, leaf axils
<i>Digitaria ciliaris</i>	Weed	<i>Hysteronura setariae</i>	Flower, flower stalks
<i>Echinochloa crusgali</i>	Weed	<i>Hyperomyzus</i> sp.	Young leaves, old leaves
<i>Ecliptica prostrata</i>	Weed	<i>Aphis gossypii</i>	Shoots, young leaves
<i>Eleusine indica</i>	Weed	<i>Hysteronura setariae</i>	Flower, flower stalks, leaf axils
		<i>Rhopalosiphum maidis</i>	Flower, flower stalks, leaf axils
<i>Emilia sonchifolia</i>	Weed	<i>Aphis gossypii</i>	Flower, flower stalks, shoots
<i>Eragrostis tenella</i>	Weed	<i>Hysteronura setariae</i>	Flower, flower stalks, seeds
<i>Euphorbia hirta</i>	Weed	<i>Aphis gossypii</i>	Young leaves, old leaves
<i>Eupatorium odoratum</i>	Weed	<i>Aphis gossypii</i>	Young leaves, old leaves,
		<i>Aphis glycines</i>	Shoot, young twigs
<i>Hymenochera acutigluma</i>	Weed	<i>Hysteronura setariae</i>	Flowers, flower stalks, leaf axils
<i>Lophatherum gracile</i>	Weed	<i>Hysteronura setariae</i>	Young leaves, old leaves, leaf axils
		<i>Rhopalosiphum maidis</i>	Young leaves, old leaves, leaf axils
<i>Melastoma affine</i>	Non-weed	<i>Aphis gossypii</i>	Shoots, young leaves
<i>Mikania micrantha</i>	Weed	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves
		<i>Aphis glycines</i>	Shoot, young twig
<i>Mimosa invisa</i>	Weed	<i>Aphis craccivora</i>	Shoots, pods
<i>Mimosa pudica</i>	Weed	<i>Aphis craccivora</i>	Shoots, pods, flowers
<i>Mimosa vigra</i>	Non-weed	<i>Aphis craccivora</i>	Shoots, pods
<i>Oryza rufipogon</i>	Weed	<i>Rhopalosiphum padi</i> ,	Old leaves, young leaves (shoot), leaf axils
		<i>Rhopalosiphum maidis</i>	Old leaves, young leaves (shoot), leaf axils
<i>Oxonopus compressus</i>	Weed	<i>Hysteronura setariae</i>	Flowers, flower stalks, leaf axils
<i>Paspalum conjugatum</i>	Weed	<i>Hysteronura setariae</i>	Flowers, flower stalks, seeds
<i>Phyllanthus neruri</i>	Weed	<i>Aphis spiraeicola</i>	Shoot, young leaves, old leaves, young twigs, petioles
<i>Portulaca oleraceae</i>	Weed	<i>Aphis craccivora</i>	Shoots, young leaves, flowers
<i>Physalis angulata</i>	Weed	<i>Aphis craccivora</i>	Shoots, young leaves, old leaves
		<i>Aphis gossypii</i>	Shoots, young leaves, old leaves
<i>Rorippa indica</i>	Weed	<i>Lipaphis erysimi</i>	Flowers, fruits, shoots, young leaves
<i>Sida rhombifolia</i>	Weed	<i>Aphis gossypii</i>	Shoots, young leaves, old leaves, fruit/seeds
<i>Sonchus arvensis</i>	Weed	<i>Lipaphis erysimi</i>	Young leaves, fruit stalks, flowers, fruits

Table 4. Aphid species were recorded in wild plants, and the presence of ants in the plant parts colonized

Aphid species	Wild plants	Aphids life color	Plant parts colonized	Ant attendance	Total individual of ant
<i>Aphis gossypii</i>	<i>Ageratum conyzoides</i>	Light green	Shoots, young leaves, old leaves, flowers	+	5
	<i>Alternanthera philoxeroides</i>	Light green	Shoots, buds	+	3
	<i>Alternanthera sessilis</i>	Light green	Shoots, buds	-	0
	<i>Croton hirtus</i>	Dark green	Flowers, shoots, young leaves, old leaves,	+	7
	<i>Ecliptica prostrata</i>	Green	young twigs	+	5
	<i>Emilia sonchifolia</i>	Green	Shoots, young leaves	+	6
	<i>Euphorbia hirta</i>	Light green	Flower, flower stalks, shoots	+	7
	<i>Eupatorium odoratum</i>	Light green	Young leaves, old leaves	+	8
	<i>Melastoma affine</i>	Light green	Young leaves, old leaves, young twigs	+	8
	<i>Mikania micrantha</i>	Light green	Shoots, young leaves	+	9
	<i>Physalis angulata</i>	Yellowish green	Shoots, young leaves, old leaves	+	10
	<i>Sida rhombifolia</i>	Yellowish green	Shoots, young leaves, old leaves,	-	0
			fruit/seeds		
<i>Aphis craccivora</i>	<i>Amaranthus viridis</i>	Black	Flowers, shoots, young leaves, old leaves	+	3
	<i>Mimosa invisa</i>	Black	Shoots, pods	+	2
	<i>Mimosa pudica</i>	Black	Shoots, pods, flowers	+	3
	<i>Mimosa vigra</i>	Black	Shoots, pods	+	4

	<i>Portulaca oleraceae</i>	Black	Shoots, young leaves, flowers	+	7
	<i>Physalis angulata</i>	Black	Shoots, young leaves, old leaves	+	4
<i>Aphis glycines</i>	<i>Eupatorium odoratum</i>	Greenish yellow	Young leaves, old leaves, young twigs	+	6
	<i>Mikania micrantha</i>	Light green	Shoots, young leaves, old leaves	+	4
<i>Aphis spiraeicola</i>	<i>Phyllanthus neruri</i>	Greenish yellow	Shoot, young leaves, young twigs, petioles	+	5
	<i>Bridelia Tomentosa</i>	Greenish yellow	Shoot, young leaves	+	2
<i>Greenidea</i> sp.	<i>Bridelia Tomentosa</i>	Greenish yellow	Young leaves	-	0
<i>Hystroneura setariae</i>	<i>Digitaria ciliaris</i>	Reddish-brown	Flower, flower stalks	+	3
	<i>Eleusin indica</i>	Reddish-brown	Flower, flower stalks, leaf axils	+	4
	<i>Eragrostis tenella</i>	Reddish-brown	Flower, flower stalks, seeds	+	4
	<i>Hymenochera acutigluma</i>	Reddish-brown	Flowers, flower stalks, leaf axils	+	3
	<i>Lophatherum gracile</i>	Reddish-brown	Young leaves, old leaves, leaf axils	+	6
	<i>Oxonopus compressus</i>	Reddish-brown	Flower, flower stalk, leaf axils	+	3
	<i>Paspalum conjugatum</i>	Reddish-brown	Flower, flower stalk, seeds	+	6
<i>Hyperomyzus</i> sp.	<i>Echinochloa crussgali</i>	Black	Young leaves, old leaves	-	0
<i>Lipaphis erysimi</i>	<i>Blumea lacera</i>	Whitish green	Flowers, shoots, and buds	+	4
	<i>Rorippa indica</i>	Whitish green	Flower, shoots, young leaves	+	4
	<i>Sonchus arvensis</i>	Whitish green	Young leaves, fruit stalks, flowers, fruit	+	5
<i>Rhopalosiphum maidis</i>	<i>Eleusin indica</i>	Green	Flower, flower stalks, leaf axils	+	3
	<i>Lophatherum gracile</i>	Green	Young leaves, old leaves, leaf axils	+	4
	<i>Oryza rufipogon</i>	Green	Old leaves, young leaves (shoot), leaf axils	-	0
<i>Rhopalosiphum padi</i>	<i>Oryza rufipogon</i>	Whitish green	Old leaves, young leaves (shoot), leaf axils	+	4
<i>Schizaphis</i>	<i>Cynodon dactylon</i>	Green	Flowers, flower stalks	+	6
<i>rotundiventris</i>	<i>Cyperus compressus</i>	Green	Flowers, flower stalks, leaf axils	+	4
	<i>Cyperus rotundus</i>	Green	Flowers, flower stalks, leaf axils	+	4

Notes: (+): present, (-): absent

Discussion

In the present study, some aphid species were found on several ornamental plants in Pagar Alam, the location of aphid colonization on the plants varied. On *Aster alpinus* L., aphids were found to form colonies on the stems or young leaf shoots, and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized plant parts showed symptoms of stunting. The identification results showed that the aphids were *Macrosiphoniella sanborni* Gillette, 1908 associated with ants. On the *Brugmansia suaveolens* (Humb. & Bonpl. ex Willd.) Bercht. & J.Presl, *Myzus persicae* Sulzer, 1776 were found on the undersides of old leaves or leaves that have turned yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant parts did not show any signs of disease. On *Caladium* sp. was found one species of aphids: *Pentalonia caladii* van der Goot, 1917. *P. caladii* was known and found in taro plants; the aphids formed colonies under the surface of young and older leaves (Bhadra and Agarwala 2014). This study found that the occupied leaf areas did not display severe symptoms; the aphids were yellow-green to dark green. The wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odorata* (Lam.) Hook.f. & Thomson (ylang-ylang), colonies of *Toxoptera aurantii* Boyer de Fonscolombe, 1841 were found on the undersides of the leaves, the shoots, buds, and unopened flower petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting. The aphids found were brown to black. The colonies of *T. aurantii* were found to be associated with black ants. Aphids on *Canna indica* L. (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a

medium-sized body and the identification results showed that the aphids were *Rhopalosiphum nymphaeae* Linnaeus, 1761 (Ghosh and Singh 2004). The colonies of *R. nymphaeae* were found to be associated with ants. In the *Catharanthus roseus* (L.) G.Don (periwinkle), *Aphis spiraeicola* Patch, 1914 aphids were found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and the colonized plant parts showed no disease symptoms. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the undersides of young leaves, shoots, and within flower parts, especially between petals or stalks that had not fully bloomed; the colonies were quite large. The body color of aphids was green to dark green, with small to medium-sized bodies. The colonized plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were *Aphis gossypii* Glover, 1877. The aphid colonies found were consistently associated with ants. Aphids on *Clitoria ternatea* L. were found to form colonies on flower parts, flower crowns, stems, and young leaves. The aphids were brown to black. Colonized plant parts, especially shoots and young leaves, showed stunting symptoms. The identification results showed that the aphids were *Aphis craccivora* Koch, 1854. These colonies were consistently associated with ants. The aphids on the *Dahlia* sp. formed colonies on unopened flower buds, with a significant population among the blooming petals. The body color was green to dark green. The identification results showed that the aphids were *A. gossypii*. According to this present study, *Sinemegoura citricola* van der Goot, 1917 colonies were found on the young leaves of *Dendrobium* sp., with the color body of the *S. citricola* aphids were yellow, green to dark green, and the colonized plants showing no disease symptoms, and were associated with ants. On *Duranta* sp., colonies of aphids on the undersides of young leaves, and the colonized plant parts

showed stunting symptoms. The colonies were very large. The aphids were green. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Furthermore, on the *Helianthus annuus* L., aphid colonies were found between the flower petals. The colonized flowers, especially the crowns, tended to fall off easily. The aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A. gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant parts did not show any disease symptoms. The identification results showed that the aphids were *Aphis glycines* Matsumura, 1917. The aphid colonies were not associated with ants. Within the colonies, mummified aphids that Aphidiidae parasitized were found. On the *Hibiscus rosa-sinensis* L., aphids ranging from yellow to dark green were found. The aphids formed colonies on flower buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large. The identification results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Two types of aphids were found on the flowering plant *Ixora paludosa* (Blume) Kurz. First, the aphids formed colonies on the undersides of young leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The occupied plant parts showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and slightly downward-curved leaf edges. The upper leaf surface looked wet and sticky, like sugar. The aphids had yellow, green, or slightly dark green bodies, with some wingless adults having a powdery white upper surface. The identification results showed that the aphids were *A. gossypii* almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies under the surface of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The plant parts occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-branched stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*. These aphids were also associated with ants. Moreover, two forms of aphids were discovered in *Ixora* sp. flower plants. These aphids occupied the shoots, young leaves, and unopened flowers; the affected plant parts did not show obvious symptoms. The aphids exhibited colors ranging from yellow and green to a slightly darker green. Sometimes, the upper surface of the wingless imago's body appeared white, resembling flour. The identification results showed that these aphids were *A. gossypii*. These aphid colonies were almost always associated with ants. Another species of aphids formed colonies on flower stalks that had not yet bloomed and on newly emerging shoots or leaves. The presence of these aphids on the plant did not induce plant disease symptoms. The aphids were yellow or yellowish green, with black cauda and siphunculi. Their bodies were very small to small. The identification results showed that the aphids

were *A. citricola*. The colonies of *A. citricola* were also frequently found in association with ants. Two types of aphids were found on *Mussaenda frondosa* L., each forming colonies in different locations. The first type formed colonies on young leaves, shoots, and flowers. The plant parts they occupied showed no obvious disease symptoms. The identification results showed that the aphids were *Toxoptera odinae* van der Goot, 1917. The aphids were yellow, green, and dark green (Blackman et al. 2011). The second type of aphids formed colonies on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could also be found on young leaves, shoots, and within flower parts. The plant parts they infested showed no signs of diseases. The aphids were yellow or yellow-green, with black cauda and siphunculi. They had tiny to small bodies. The identification results showed that the aphids were *A. citricola*. Many aphid species infest various ornamental plants because these insects are attracted to such plants due to the rich nutrient content in the plant sap (Braham et al. 2023).

The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were generally consistent within the same taxon. *Ageratum conyzoides* L. was infested by *A. gossypii*. These aphids formed colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green, yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides* (Mart.) Griseb., or alligator grass, was also colonized by *A. gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green, ranging from yellow-green to dark green. *Alternanthera sessilis* (L.) R.Br. ex DC. was colonized by *A. gossypii*, forming colonies on shoots, flowers, and fruit. The colonies were typically large, and often associated with tiny brown ants. *Amaranthus viridis* Linnaeus was infested by *A. craccivora*. These aphids established colonies on shoots, flowers, and young and old leaves. They were dark brown to black, with shiny black wingless imagoes. Colonies of these aphids were associated with both black and red ants. *Blumea lacera* (Burm.fil.) DC. was colonized by *Lipaphis erysimi* Kaltenbach, 1843. These aphids were bright green and of medium size. The colonies formed on flowers, flower stalks, and the undersides of the leaves at the top. The aphid colonies were not associated with ants. *Croton hirtus* L'Hér., or fire grass, was infested by *A. gossypii*; the aphids were yellow-green to dark green. The colonies were found on the stems, leaves, buds, and flowers, often forming large colonies. *Cynodon dactylon* (L.) Pers. or Bermuda grass was colonized by *Schizaphis rotundiventris* Signoret, 1860. The aphids colonized the flowers, flower stalks, and sometimes the plant leaf axils. Small colonies were formed. The aphids were brown to reddish brown. They were associated with ants. *Cyperus rotundus* L., or nut grass, was infested by *S. rotundiventris* aphids. The colonies were found on flower stalks, flowers, and leaf axils. The colonies were quite large and associated with both black and red ants. The aphids were dark brown in

color. *Cyperus compressus* L., or grass puzzle, was colonized by *S. rotundiventris* aphids, forming colonies in the flowers, flower stalks, and sometimes in the axils and leaves of the shoots or buds. Small colonies were observed. *Digitaria ciliaris* (Retz.) Koeler was infested by *Hysteroneura setariae* Thomas 1878 aphids, with small colonies scattered on the flowers and flower stalks. These aphids were light brown to brown in color. *Echinochloa crus-galli* (L.) P.Beauv., or water hyacinth plants, were colonized by *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large colonies on the undersides of both young and old leaves. The aphid colonies were never found in association with ants. *Eclipta prostrata* (L.) L., or urang-aring, was colonized by *A. gossypii*, forming small colonies on the shoots and flowers. The aphids were bright green to blackish green. The aphid colonies were also consistently associated with ants. *Eleusin indica* (L.) Gaertn. was colonized by two species of aphids: *Hysteroneura setariae* Thomas, 1878 and *Rhopalosiphum maidis* Fitch, 1856. *H. setariae* formed colonies in flower parts, flower stalks, and leaf axils, resulting in large colonies. *H. setariae*'s body color ranged from red-brown to dark brown. The colonies were consistently associated with ants. The aphids of *R. maidis* formed colonies in the leaf axils and undersides of leaves and leaf shoots that had not yet opened. The colonies were not densely packed. The leaf aphids of *R. maidis* were green in color, with distinct black siphunculi and cauda. These aphids had relatively large bodies with a slightly elongated shape. *R. maidis* colonies were always associated with ants. The plant *Emilia sonchifolia* (L.) DC. ex Wight, characterized by its purple flowers, was colonized by *A. gossypii*; the aphids were yellow to green in color. The colonies formed near flowers, flower stalks, and shoot leaves. *Eragrostis tenella* was infested by *H. setariae* aphids. The aphids were brown to red-brown. Small colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The aphids of *H. setariae* were consistently associated with ants. *Euphorbia hirta* L., or wart grass, was colonized by *A. gossypii*. The aphids formed colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids were yellow to dark green in color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants. *Eupatorium odoratum* L. was colonized by *A. gossypii* and *A. citricola*. *A. gossypii* formed colonies in the buds, young leaves, old leaves, and young twigs. Young leaves colonized by *A. gossypii* became stunted with an irregular shape. *A. gossypii* found in this plant showed yellow-green to dark-green body color. The colonies of *A. citricola* formed on the young twigs near the shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda. Aphid colonies of *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants. *Hymenachne acutigluma* (Steud.) Gilliland, or hair axis, was colonized by *H. setariae*, which formed colonies on the flower stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromia* sp., or kenidai, was infested by *Greenidae* sp. These aphids had bright green bodies and

distinctive elongated siphunculi with thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not show any disease symptoms. *Lophatherum gracile* Brongn. or bamboo grass plants, were colonized by two species of aphids: *H. setariae* and *R. maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves, leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were brown to red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis* aphids were green to bright green, with black siphunculi and cauda. It was possible for colonies of the two species of aphids on *L. gracile* to mix. In addition, *Melastoma affine* D.Don was colonized by *A. gossypii*. The colonies formed on shoots, particularly near newly emerging shoots and newly emerging fruits and flowers. The body color of aphids ranged from yellow to green. The colonized plant parts did not show any disease symptoms. *Mikania micrantha* Kunth was colonized by *A. gossypii* and *Aphis glycines* Matsumura, 1917. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting in stunted and curled leaves. *A. glycines* formed colonies on the branches. The colonies were densely populated. *A. glycines* aphids were light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix to form a single colony. *Mimosa invisa* Mart. ex Colla (cater-grass) was colonized by *A. craccivora*. The aphids of *A. craccivora* on *M. invisa* plants formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless imagoes. *Mimosa pudica* L. was observed to be colonized by *A. craccivora*. The aphids formed colonies on shoots, especially young shoots, and occasionally on flowers and pods. The aphids were black and of medium size, resulting in stunted growth of the colonized plant parts. The colonies were quite large. *Mimosa pigra* L. was colonized by *A. craccivora*. The colonies of aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black, and wingless adults were shiny black. The colonized plant parts did not show any disease symptoms. *Oryza rufipogon* Griff. was colonized by two species of aphids: *Rhopalosiphum padi* and *R. maidis*. Both aphids colonized the same plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species could be distinguished by their body color. *R. maidis* appeared green with black siphunculi and cauda, while *Rhopalosiphum padi* Linnaeus, 1758 appeared white. The colonies of *R. maidis* and *R. padi* in *O. rufipogon* plants were associated with the presence of red ants. *Axonopus compressus* (Sw.) P.Beauv., or *pait* grass, was colonized by *H. setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes the leaf axils. The aphids were brown to dark brown. Small colonies were formed, and they were also consistently associated with ants. *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts, especially the seeds and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus neruri* L. was colonized by *A. citricola*. The colonies formed on the shoots and the undersides of leaves

and petioles. The colonized parts became distorted, stunted, and wrinkled. The aphids had yellow bodies with black sifunculi and cauda; the colonies formed were large. *Portulaca oleracea* L. plants were colonized by *A. craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants formed colonies on the undersides of leaves, especially young leaves, shoots, and flowers. The colonized plant parts became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that appeared glossy black. *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The colonized plant parts did not show disease symptoms. *Rorippa indica* (L.) Hiern, or mustard land, was colonized by *L. erysimi*. The colonies formed on the flowers, fruits, flower stalks, and the lower leaf's surface. The colonized plant parts showed symptoms such as curling and stunting. *Sida rhombifolia* L., or cacabean, was colonized by *A. gossypii*. The aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks, and flower petals. The colonized plant parts, especially the shoots, showed curling, and the leaf edges curled downward. *Sonchus arvensis* L. plants were colonized by *L. erysimi*. The aphids had green to whitish green body colors, and the colonies formed on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.

In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically displayed typical damage symptoms, but some did not show any symptoms at all. Generally, the plants' symptoms due to aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves. These characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show symptoms when colonized by aphids. This condition occurred because the colonized parts had reached maximum growth or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that did not induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the leaves and plant parts were old. Furthermore, the old leaves or twigs might not show the typical symptoms associated with aphid infestations. The plant parts exhibiting characteristic symptoms when colonized by aphids also often experienced a cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued growing, resulting in some parts developing ordinary while others became stunted (Pettersson et al. 2017). This condition could lead to bending shoots or young stems, curling leaves, downward curling of leaf edges, or stunted leaf growth. In this observation, monocot plants or groups of grasses with narrow leaves generally did not display any distinctive symptoms when colonized by aphids. This might be because the growth or development of their leaves differed from that of dicot plants. Therefore, the presence of aphids in monocot plants was often easier to recognize

through the presence of ants. If a plant was found to have a significant number of ants, there was a possibility that aphids had colonized the plant (Tegelaar et al. 2012). Therefore, the presence of ants could serve as an indicator of the aphid colonies. According to this study, ants were present in some aphid colonies from the subfamily Aphidinae, while the ants were absent in some aphid colonies from the macrosiphini subfamily. The bodies of aphids from the subfamily Aphidinae are relatively small and have short sifunculi. On the other hand, aphids, which have large bodies and relatively long sifunculi, are never visited by ants. This happens because long sifunculi are reported to disturb ants, so the ants don't like to come close. Additionally, large aphids and long sifunculi generally do not produce honeydew, so ants do not want to come close.

The absence of ants in aphid colonies could be because the colonies have just formed or the population is still low (Kummel et al. 2013). Aphids colonized flowers because they may offer an accessible and rich food source, sugary plant sap found in new growth or reproductive plant parts. Flowers contain a nutrient-rich nature and easy access to sap; therefore, aphids were attracted to flower saps. In addition, some aphid species were drawn to certain colors (Jakubczyk et al. 2022). Herbs served as an alternative host for aphids in this present study. Aphids consume sugar-rich liquid in plants, known as sap. Aphids considered herbs and other green vegetation as abundant food sources. Aphids utilize needle-like mouthparts to penetrate plant tissues and access this fluid (Brožek et al. 2015). Several aphids colonized herbs such as Indian mustards, *L. erysimi*, and *M. persicae*, the most devastating insects, infesting leaves, stems, and floral parts (Jayaswal et al. 2022). Due to a symbiotic relationship, the prevalence of aphids and ants was frequently correlated. Aphids produced a delicious substance known as honeydew as a waste product, which ants found highly attractive food sources (Nelson and Mooney 2022). The honeydew contained abundant sugars extracted by aphids from the plant juice (Zheng et al. 2022). Ants were drawn to this nutrient-rich food source and would often farm aphids for it. In exchange for honeydew, ants protected aphids from other insects and predators, such as ladybugs, lacewing larvae, and parasitic wasps (Karami-Jamour et al. 2018). Certain ant species would transport aphids to new host plants for improved foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not only nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain species) and provided energy for the growth of their progeny (Biedermann and Vega 2020). Ornamental plants, and also weeds are generally grown with simple maintenance and usually free pesticides. The ecological habitat of ornamental plants and weeds is assumed to be the same. Therefore, many species of aphids found on ornamental plants were also found on weeds.

In conclusion total of 15 species aphids found in ornamental plants, *A. craccivora*, *A. citricola*, *A. glycines*, *A. gossypii*, *A. solani*, *M. sanborni*, *M. rosae*, *M. persicae*, *N. circumflexus*, *P. caladii*, *R. nymphaeae*, *S. citricola*, *T. aurantii*, *T. citricidus*, *T. odinae*. The total of 11 species

aphids found in weeds, *A. gossypii*, *A. craccivora*, *A. glycines*, *A. citricola*, *Greenidea* sp., *H. setariae*, *Hiperomyzus* sp., *L. erysimi*, *R. maidis*, *R. padi*, *S. rotundiventris*.

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REFERENCES

- Ghosh S, Singh R. 2004. Aphids on medicinal plants in North East India (Insecta : Homoptera : Aphididae). *Rec Zool Surv India* 102 (1-2): 169-186. DOI: 10.26515/rzsi/v103/i1-2/2004/159495.
- Bass C, Puinean AM, Zimmer CT, Denholm I, Field LM, Foster SP, Gutbrod O, Nauen R, Slater R, Williamson MS. 2014. The evolution of insecticide resistance in the peach potato aphid, *Myzus persicae*. *Insect Biochem Mol Biol* 51: 41-51. DOI: 10.1016/j.ibmb.2014.05.003.
- Bhadra P, Agarwala BK. 2014. On the morphological and genotypic variations of two congeneric species of banana aphid *Pentalonia* (Homoptera : Aphididae) from India. *Aadv Life Sci* 2 (3): 75-81. DOI: 10.5932/j.als.20120203.06.
- Biedermann PHW, Vega FE. 2020. Ecology and evolution of insect-fungus mutualisms. *Ann Rev Entomol* 65: 431-55. DOI: 10.1146/annurev-ento-011019-024910.
- Blackman RL, Eastop VF. 2008. Aphids On The World's Herbaceous Plants And Shrubs 2 Volume Set. John Wiley & Sons, Hoboken, New Jersey.
- Blackman RL, Eastop VF. 2017. Taxonomic Issues. CABI, Wallingford, UK. DOI: 10.1079/9781780647098.0001.
- Blackman RL, Sorin M, Miyazaki M. 2011. Sexual morphs and colour variants of *Aphis* (Formerly Toxoptera) Odinae (Homoptera, Aphididae) in Japan. *Zootaxa* 3110 (1): 53-60. DOI: 10.11646/zootaxa.3110.1.5.
- Braham M, Boulahia-kheder S, Kahia M, Noura. S 2023. Aphids and Citrus responses to nitrogen fertilization. *J Saudi Soc Agric Sci* 22 (6):374-83. DOI: 10.1016/j.jssas.2023.03.003.
- Brożek J, Mróz E, Wylężek D, Depa Ł, Węgierek P. 2015. The structure of extremely long mouthparts in the aphid genus *Stomaphis* Walker (Homoptera: Sternorrhyncha: Aphididae). *Zoomorphology* 134:431-45. DOI: 10.1007/s00435-015-0266-7.
- Cao HH, Zhang ZF, Wang XF, Liu TX. 2018. Nutrition versus defense : Why *Myzus persicae* (Green peach aphid) prefers and performs better on young leaves of cabbage *PloS One* 13 (4):1-16. DOI: 10.1371/journal.pone.0196219.
- Clarke R, Kehoe MA, Broughton S, Jones RAC. 2020. Host plant affiliations of aphid vector species found in a remote tropical environment. *Virus Res* 281: 197934. DOI: 10.1016/j.virusres.2020.197934.
- Ertunc F. 2020. Emerging plant viruses. In: *Emerging and Reemerging Viral Pathogens*. Academic Press, Cambridge, Massachusetts.
- Gadhve KR, Gautam S, Rasmussen DA, Srinivasan R. 2020. Aphid transmission of potyvirus: The largest plant-infecting RNA virus genus. *Viruses* 12 (7): 773. DOI: 10.3390/v12070773.
- Giannetti D, Mandrioli M, Schifani E, Castracani C, Spotti FA, Mori A, Grasso DA. 2021. First report on the acrobat ant *crematogaster scutellaris* storing live aphids in its oak-gall nests. *Insects* 12 (2): 108. DOI: 10.3390/insects12020108.
- Jakubczyk K, Koprowska K, Gottschling A, Janda-Milczarek K. 2022. Edible flowers as a source of dietary fibre (Total, Insoluble and Soluble) as a potential athlete's dietary supplement. *Nutrients* 14 (12): 2470. DOI: 10.3390/nu14122470.
- Jayaswal D, Mainkar P, Kumar K, Agarwal Y, Prabha R. 2022. Pyramiding and evaluation of segregating lines containing lectin and protease inhibitor genes for aphid resistance in *Brassica juncea*. *Indian J Biochem Biophys* 59 (8): 800-807. DOI: 10.56042/ijbb.v59i8.62319.
- Jones RAC. 2022. Alteration of plant species mixtures by virus infection: Managed pastures the forgotten dimension. *Plant Pathol* 71 (6): 1255-81. DOI: 10.1111/ppa.13571.
- Jousselin, Emmanuelle, Genson Gwenaëlle, and Coeur D. Acie. Armelle. 2010. "Evolutionary Lability of a Complex Life Cycle in the Aphid Genus *Brachycaudus*." *BMC Evolutionary Biology* 10(1). doi: 10.1186/1471-2148-10-295.
- Kallas J. 2010. *Edible Wild Plants*. Gibbs Smith, Layton, Utah.
- Karami-Jamour T, Mirmoayedi A, Zamani A, Khajehzadeh Y. 2018. The impact of ant attendance on protecting *Aphis gossypii* against two aphidophagous predators and it's role on the intraguild predation between them. *J Insect Behav* 31: 222-39. DOI: 10.1007/s10905-018-9670-4.
- Kennedy JS, Stroyan HLG. 1959. Biology of aphids. *Ann Rev Entomol* 4 (1): 139-60. DOI: 10.1146/annurev.en.04.010159.001035.
- Kumar S, Bhowmick MK, Ray P. 2021. Weeds as alternate and alternative hosts of crop pests. *Indian J Weed Sci* 53 (1): 14-29. DOI: 10.5958/0974-8164.2021.00002.2.
- Kummel M, Brown D, Bruder A. 2013. How the aphids got their spots: predation drives self-organization of aphid colonies in a patchy habitat. *Oikos* 122 (6): 896-906. DOI: 10.1111/j.1600-0706.2012.20805.x.
- Liu, Xiang Dong, Ting Ting Xu, and Hai Xia Lei. 2017. "Refuges and Host Shift Pathways of Host-Specialized Aphids *Aphis Gossypii*." *Scientific Reports* 7(1):1-9. doi: 10.1038/s41598-017-02248-4.
- Maharani Y, Hidayat P, Rauf A, Maryana N. 2018. Short Communication: New records of aphid species subfamily Aphidinae (Homoptera: Aphididae) in West Java, Indonesia. *Biodiversitas* 19 (2):460-65. DOI: 10.13057/biodiv/d190219.
- Meuninck J. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield, Lanham, Maryland, US.
- Mo, Carmen, and Angela M. Smilanich. 2023. "Feeding on an Exotic Host Plant Enhances Plasma Levels of Phenoloxidase by Modulating Feeding Efficiency in a Specialist Insect Herbivore." *Frontiers in Physiology* 14(February):1-10. doi: 10.3389/fphys.2023.1127670.
- Naidu VSGR. 2012. *Hand Book on Weed Identification*. Directorate of Weed Science Research, Jabalpur, India.
- Nelson AS, Mooney KA. 2022. The evolution and ecology of interactions between ants and honeydew-producing hemipteran insects. *Ann Rev Ecol Evol Syst* 53: 379-402. DOI: 10.1146/annurev-ecolsys-102220-014840.
- Pettersson J, Tjallingii WF, Hardie J. 2017. Host-plant selection and feeding. In: *Aphids As Crop Pests*. CABI, Wallingford, UK. DOI: 10.1079/9781780647098.0173.
- Singh, Rajendra, and Garima Singh. 2021. "Aphids." Pp. 105-82 in *Polyphagous Pests of Crops*. Springer. Singapore. https://doi.org/10.1007/978-981-15-8075-8_3.
- Tegelhaar K, Hagman M, Glinwood R, Pettersson J, Leimar O. 2012. Ant-aphid mutualism: The influence of ants on the aphid summer cycle." *Oikos* 121 (1): 61-66. DOI: 10.1111/j.1600-0706.2011.19387.x.
- Yamamoto, Tetsuya, Mitsuru Hattori, and Takao Itino. 2020. "Seasonal Migration in the Aphid Genus *Stomaphis* (Homoptera : Aphididae): Discovery of Host Alternation Between Woody Plants in Subfamily Lachninae." *Journal of Insect Science* 20(5):1-10. doi: 10.1093/jisesa/ieaa103.
- Zheng Z, Zhao M, Zhang Z, Hu X, Xu Y, Wei C. 2022. Lactic acid bacteria are prevalent in the infrabuccal pockets and crops of ants that prefer aphid honeydew. *Front Microbiol* 12 (1): 1-17. DOI: 10.3389/fmicb.2021.785016.

Species of aphids found in ornamental and wild Plants in Highland, Pagar Alam Regency, South Sumatra, Indonesia

Abstract. Aphids are one of the crucial pests in tropical and sub-tropical regions. The presence of aphids in a plant can be very detrimental due to their role as vectors. Aphids exhibit species diversity, but not much information has been reported about the species diversity of aphids associated with essential crops such as ornamental plants. Furthermore, many aphid species, such as wild plants, were found on plants that were not hosts. Therefore, this study reported the species of aphids found in ornamental and wild plants. The field research employed purposive and direct observation to inventory cultivated or wild plants hosting and collecting aphids. The plant selection process included cultivated plants encompassing ornamental plants and wild plants or weeds. The collection and identification of host plants and aphids involved systematic searches for the selected plants and subsequent examination for the presence of aphids. Observations were made to all existing plant species to find those colonized by aphids. This study revealed that the total of 15 species aphids found in Ornamental plants, *Aphis craccivora*, *Aphis citricola*, *Aphis glycines*, *Aphis gossypii*, *Aulacorthum solani*, *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*, *Pentalonia caladii*, *Rhopalosiphum nymphaeae*, *Sinemegoura citricola*, *Toxoptera aurantii*, *Toxoptera citricidus*, *Toxoptera odinae* and the total of 11 species aphids found in weeds, *Aphis gossypii*, *Aphis craccivora*, *Aphis glycines*, *Aphis citricola*, *Greenidea* sp., *Hystroeneura setariae*, *Hiperomyzus* sp., *Lipaphis erysimi*, *Rhopalosiphum maidis*, *Rhopalosiphum padi*, *Schizaphis rotundiventris*.

Keywords: Aphids, ornamental plants, wild plants

Running title: Aphids found in ornamental and wild plants.

INTRODUCTION

Aphids are crucial pests in the tropics and sub-tropics, exhibiting various polyphagous, oligophagous, and monophagous characteristics (Kennedy and Stroyan 1959). One species of aphids can host more than 400 species from 40 families (Bass et al. 2014). In addition to pests, aphids can also be vectors of plant viral diseases (Gadhane et al. 2020); aphids can transmit 275 viruses (Ertunc 2020). In tropical areas, aphids can be found throughout the year due to their parthenogenetic nature of reproduction (Blackman and Eastop 2017). Aphids suck phloem sap of tender plant parts, which can deplete essential nutrients for healthy growth (Cao et al. 2018). Moreover, vector species can further weaken and stunt the growth of infected plants (Jones 2022). Therefore, it is crucial to control aphid populations in gardens and crops.

Many aphid species are found on plants that are not their actual hosts (Maharani et al. 2018). Aphids have one or more secondary, or "alternative," host plants in addition to their primary host plants, which are the types of plants they feed on most frequently (Clarke et al. 2020). Alternative plants provide a means of survival when primary hosts are unavailable, during certain seasons, or under certain environmental conditions (Kumar et al. 2021). In South Sumatra, particularly in the highland areas like Pagar Alam, there are numerous ornamental and native plants. Research on the diversity of aphid species in ornamental and wild plants has less noticed. This study reports the diversity of aphid species found in ornamental and wild plants found in this area. The findings from this study can serve as a valuable resource for aphid management.

MATERIALS AND METHODS

The field research employed a purposive and direct observation to inventory cultivated or wild plants hosting and collecting aphids. The plant selection included cultivated plants encompassing ornamental plants, as well as wild plants or weeds. Where available, collecting and identifying host plants, aphids, and natural enemies involved systematic searches of all existing plant species to find those colonized by aphids. Any plants colonized by aphids are documented as aphid hosts. Aphid identification was done using identification keys (Blackman and Eastop 2008) in the Laboratory of Entomology, Faculty of Agriculture, Universitas Sriwijaya. Identification relied on morphological characteristics. The host plants were identified using the weed identification handbook (Kallas 2010; Meuninck 2023; Naidu 2012). The location and aphid colony sizes, including their life color, and photographs of the aphid colonies and their host plants were recorded.

RESULTS AND DISCUSSION

Result

Aphids infesting in ornamental plants

The results showed that 15 aphid species were found in Pagar Alam (Tables 1 and 2). These aphids mostly colonized flowers of various ornamental plants (Table 1, Figure 1).

Table 1. Aphid species recorded in ornamental plants and their colony locations.

No	Host Plant	Aphid Species	Colony location
1	<i>Aster alpinus</i>	<i>Macrosiphoniella sanborni</i>	Leaves, young twig, flower
2	<i>Brugmansia suaveolens</i>	<i>Aulacorthum solani</i>	Leaves, flower
		<i>Neomyzus circumflexus</i>	Leaves
		<i>Myzus persicae</i>	Leaves, flower
3	<i>Caladium</i> sp.	<i>Pentalonia caladii</i>	Leaves,
4	<i>Cananga odoratum</i>	<i>Aphis gossypii</i>	Leaves, flower
5	<i>Canna indica</i>	<i>Rhopalosiphum nymphaeae</i>	Leaf
6	<i>Catharanthus roseus</i>	<i>Aphis citricola</i>	Shoot, young leaves, flower
7	<i>Cestrum</i> sp.	<i>Aphis gossypii</i>	Shoot, flower
		<i>Neomyzus circumflexus</i>	Young leaves
		<i>Aphis craccivora</i>	Flower
8	<i>Clitoria ternatea</i>	<i>Macrosiphoniella sanborni</i>	Shoot, twig
9	<i>Chrysanthemum</i> sp.	<i>Aphis gossypii</i>	Flower
10	<i>Dahlia</i> sp.	<i>Sinemogoura citricola</i>	Flower
11	<i>Dendrobium</i> sp.	<i>Aphis gossypii</i>	Shoot, flower
12	<i>Duranta</i> sp.	<i>Aphis glycines</i>	Flower
13	<i>Helianthus giganteus</i> .	<i>Aphis gossypii</i>	Flower
14	<i>Hibiscus rosasinensis</i>	<i>Aphis gossypii</i> ,	Flower
15	<i>Ixora paludosa</i>	<i>Toxoptera aurantii</i>	Shoot, young leaves
		<i>Aphis citricola</i>	Flower
		<i>Aphis gossypii</i>	Flower
16	<i>Ixora</i> sp.	<i>Toxoptera aurantii</i>	Shoot, flower
		<i>Aphis craccivora</i>	Young Twig
		<i>Toxoptera citricidus</i>	Shoot, flower
17	<i>Murraya paniculata</i>	<i>Aphis citricola</i>	Shoot, flower
		<i>Toxoptera odinae</i>	Shoot, flower
18	<i>Mussaenda frondosa</i>	<i>Macrosiphum rosae</i>	Flower
		<i>Aphis citricola</i>	Flower
19	<i>Rosa indica</i>	<i>Aphis citricola</i>	Flower
20	<i>Spondias dulcis</i>	<i>Aphis citricola</i>	Flower



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72 **Fig 1.** Photos showing colonies of different aphid species in ornamental plants: a) *Aphis gossypii* in *Dahlia* sp. flower, b) *Aphis gossypii*
 73 in *Hibiscus rosasinensis* flower, c) *Aphis gossypii* in *Cestrum* twig and flower, d) *Aphis craccivora* in *Clitoria ternatea* flower, e) *Aphis*
 74 *glycines* in *Helianthus giganteus* flower, f) *Aphis craccivora* on the *Murayya paniculata* flower, g) *Toxoptera odinae* in the *Mussaenda*
 75 *frondosa*, h) *Macrosiphoniella sanborni*. in *Chrysanthemum* sp. leaves i) *Macrosiphum rosae* in *Rosa indica* flower, j) *Rhopalosiphum*
 76 *nymphaeae* in *Canna indica* leaves. Chandra Irsan captured all the photos.
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79 The relationship between aphids and ants was also recorded. Aphids produce a sweet, sticky substance called
 80 honeydew; ants are attracted to this honey because it serves as a food source. When aphids are present, they secrete
 81 honeydew, which attracts ants. This research recorded the presence of ants on plant parts colonized by aphids (Table 2).
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86 **Table 2.** Aphid species recorded in ornamental plants and the presence of the ants in the plant parts colonized

No	Aphid Species	Ornamental plants	Aphids life color	Plant parts colonized	Ant attendance	Total Individual of ant
1	<i>Aphis craccivora</i>	<i>Clitoria ternatea</i>	black	flowers	+	3
		<i>Murraya paniculata</i>	black	flowers	+	2
2	<i>Aphis citricola</i>	<i>Catharanthus roseus</i>	greenish yellow	flowers	+	2
		<i>Ixora</i> sp.	greenish yellow	flowers	+	3
		<i>Mussaenda frondosa</i>	greenish yellow	shoots, flowers	+	7
		<i>Spondias dulcis</i>	greenish yellow	flowers	+	8
3	<i>Aphis glycines</i>	<i>Helianthus giganteus</i>	greenish yellow	flowers	+	3
4	<i>Aphis gossypii</i>	<i>Cestrum</i> sp.	green	shoots, flowers	+	4
		<i>Cananga odoratum</i>	light green	shoots, flowers	+	1
		<i>Dahlia</i> sp.	green dark	flowers	+	2
		<i>Duranta</i> sp.	light green	shoots, flowers	+	5
		<i>Hibiscus rosasinensis</i>	dark green	flowers	+	6
		<i>Ixora paludosa</i>	light green	flowers	+	2
		<i>Ixora</i> sp.	light green	flowers	+	7
5	<i>Aulacorthum solani</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-	0
6	<i>Macrosiphoniella sanborni</i>	<i>Aster alpinus</i>	brown black	leaves, twigs, flowers	+	5
		<i>Chrysanthemum</i> sp.	reddish brown	leaves, twigs	+	5
7	<i>Macrosiphum rosae</i>	<i>Rosa indica</i>	green	flowers	-	0
8	<i>Myzus persicae</i>	<i>Brugmansia suaveolens</i>	greenish yellow	leaves, flowers	-	0
9	<i>Neomyzus circumflexus</i>	<i>Cestrum</i> sp.	light green	young leaves, flowers	-	0
		<i>Brugmansia suaveolens</i>	light green	flowers	-	0
10	<i>Pentalonia caladii</i>	<i>Caladium</i> sp.	brown-black	leaves	+	7
11	<i>Rhopalosiphum nymphaeae</i>	<i>Canna indica</i>	green black	leaves	+	1
12	<i>Sinemegoura citricola</i>	<i>Dendrobium</i> sp.	brown	flowers	-	0
13	<i>Toxoptera aurantii</i>	<i>Ixora paludosa</i>	brown black	flowers	+	5
		<i>Ixora</i> sp.	brown black	flowers	+	4
14	<i>Toxoptera citricidus</i>	<i>Murraya paniculata</i>	black	stems	+	6
15	<i>Toxoptera odinae</i>	<i>Mussaenda frondosa</i>	reddish-brown	flowers	+	4

87 (+): present, (-): absent

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89 **Aphids infesting in wild plants (weed or non-weed plants)**

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91 In addition, this study documented aphid colonies on flowers, stalks, plant tops, young leaves, and old leaves of wild
92 plants (Table 3, Figure 2).

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94 **Table 3.** Species of aphids found in wild (weed or non-weed) plants and their colony locations.

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
1	<i>Ageratum conyzoides</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, flowers
2	<i>Alternanthera philoxeroides</i>	weed	<i>Aphis gossypii</i>	shoots, buds
3	<i>Alternanthera sessilis</i>	weed	<i>Aphis gossypii</i>	shoots, buds
4	<i>Amaranthus gracilis</i>	weed	<i>Aphis craccivora</i>	flowers, shoots, young leaves, old leaves
5	<i>Blumea lacera</i>	weed	<i>Lipaphis erysimi</i>	flowers, shoots, and buds
6	<i>Croton hirtus</i>	weed	<i>Aphis gossypii</i>	flowers, shoots, young leaves, old leaves, young twigs
7	<i>Cynodon dactylon</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks
8	<i>Cyperus rotundus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
9	<i>Cyperus compressus</i>	weed	<i>Schizaphis rotundiventris</i>	flower, flower stalks, leaf axils
10	<i>Digitaria ciliaris</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks
11	<i>Echinochloa crusgali</i>	weed	<i>Hiperomyzus</i> sp.	young leaves, old leaves
12	<i>Ecliptica prostrata</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves
13	<i>Eleusin indica</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks, leaf axils
			<i>Rhopalosiphum maidis</i>	flower, flower stalks, leaf axils
14	<i>Emilia sonchifolia</i>	weed	<i>Aphis gossypii</i>	flower, flower stalks, shoots
15	<i>Eragrostis tenella</i>	weed	<i>Hysteronura setariae</i>	flower, flower stalks, seeds
16	<i>Euphorbia hirta</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves
17	<i>Eupotarium odoratum</i>	weed	<i>Aphis gossypii</i>	young leaves, old leaves,
			<i>Aphis glycines</i>	shoot, young twigs
18	<i>Hymenochera acutigluma</i>	Weed	<i>Hysteronura setariae</i>	flowers, flower stalks, leaf axils
19	<i>Bridelia tomentosa</i>	Non-weed	<i>Greenidea</i> sp.	young leaves

No	Host Plant	Weeds or non-weed plants	Aphid species	Colony location
20	<i>Lophatherum gracile</i>	Weed	<i>Hysteroneura setariae</i> <i>Rhopalosiphum maidis</i>	young leaves, old leaves, leaf axils young leaves, old leaves, leaf axils
21	<i>Melastoma affine</i>	Non-weed	<i>Aphis gossypii</i>	shoots, young leaves
22	<i>Mikania micrantha</i>	Weed	<i>Aphis gossypii</i> <i>Aphis glycines</i>	shoots, young leaves, old leaves shoot, young twig
23	<i>Mimosa invisa</i>	weed	<i>Aphis craccivora</i>	shoots, pods
24	<i>Mimosa pudica</i>	weed	<i>Aphis craccivora</i>	shoots, pods, flowers
25	<i>Mimosa vigra</i>	Non-weed	<i>Aphis craccivora</i>	shoots, pods
26	<i>Oryza rufipogon</i>	weed	<i>Rhopalosiphum padi</i> <i>Rhopalosiphum maidis</i>	old leaves, young leaves (shoot), leaf axils old leaves, young leaves (shoot), leaf axils
27	<i>Oxonopus compressus</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, leaf axils
28	<i>Paspalum conjugatum</i>	weed	<i>Hysteroneura setariae</i>	flowers, flower stalks, seeds
29	<i>Phylanthus neruri</i>	weed	<i>Aphis citricola</i>	shoot, young leaves, old leaves, young twigs, petioles
30	<i>Portulaca oleraceae</i>	weed	<i>Aphis craccivora</i>	shoots, young leaves, flowers
31	<i>Physalis angulata</i>	weed	<i>Aphis craccivora</i> <i>Aphis gossypii</i>	shoots, young leaves, old leaves shoots, young leaves, old leaves
32	<i>Rorippa indica</i>	weed	<i>Lipapis erysimi</i>	flowers, fruits, shoots, young leaves
33	<i>Sida rhombifolia</i>	weed	<i>Aphis gossypii</i>	shoots, young leaves, old leaves, fruit/seeds
34	<i>Sonchus arventris</i>	weed	<i>Lipapis erysimi</i>	young leaves, fruit stalks, flowers, fruits

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96 The presence of ants in aphid colonization symbolizes a mutually beneficial relationship where the ants receive food
97 from the aphids while protecting them. This study recorded the ant attendance in aphids colonization (Table 4).

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Table 4. Aphid species were recorded in wild plants, and the presence of ants in the plant parts colonized.

No	Aphid Species	Wild plants	Aphids life color	Plant parts colonized	Ant attendance	Total Individual of ant		
1	<i>Aphis gossypii</i>	<i>Ageratum conyzoides</i>	Light green	shoots, young leaves, old leaves, flowers	+	5		
		<i>Alternanthera philoxeroides</i>	Light green	shoots, buds	+	3		
		<i>Alternanthera sessilis</i>	Light green	shoots, buds	-	0		
		<i>Croton hirtus</i>	Dark green	flowers, shoots, young leaves, old leaves, young twigs	+	7		
		<i>Ecliptica prostrata</i>	green	shoots, young leaves	+	5		
		<i>Emilia sonchifolia</i>	green	flower, flower stalks, shoots	+	6		
		<i>Euphorbia hirta</i>	light green	young leaves, old leaves	+	7		
		<i>Eupatorium odoratum</i>	light green	young leaves, old leaves, young twigs	+	8		
		<i>Melastoma affine</i>	light green	shoots, young leaves	+	8		
		<i>Mikania micrantha</i>	light green	shoots, young leaves, old leaves	+	9		
		<i>Physalis angulata</i>	yellowish green	shoots, young leaves, old leaves, fruit/seeds	+	10		
		<i>Sida rhombifolia</i>	yellowish green		-	0		
		2	<i>Aphis craccivora</i>	<i>Amaranthus gracilis</i>	black	flowers, shoots, young leaves, old leaves	+	3
				<i>Mimosa invisa</i>	black	shoots, pods	+	2
<i>Mimosa pudica</i>	black			shoots, pods, flowers	+	3		
<i>Mimosa vigra</i>	black			shoots, pods	+	4		
<i>Portulaca oleraceae</i>	black			shoots, young leaves, flowers	+	7		
<i>Physalis angulata</i>	black			shoots, young leaves, old leaves	+	4		
<i>Eupatorium odoratum</i>	Greenish yellow			young leaves, old leaves, young twigs	+	6		
3	<i>Aphis glycines</i>	<i>Mikania micrantha</i>	Light green	shoots, young leaves, old leaves	+	4		
		<i>Phylanthus neruri</i>	Greenish Yellow	shoot, young leaves, young twigs, petioles	+	5		
4	<i>Aphis citricola</i>	<i>Bridelia Tomentosa</i>	Greenish Yellow	young leaves	-	0		
6	<i>Hysteroneura setariae</i>	<i>Digitaria ciliaris</i>	reddish-brown	flower, flower stalks	+	3		
		<i>Eleusin indica</i>	reddish-brown	flower, flower stalks, leaf axils	+	4		
		<i>Eragrostis tenella</i>	reddish-brown	flower, flower stalks, seeds	+	4		
		<i>Hymenochera acutigluma</i>	reddish-brown	flowers, flower stalks, leaf axils	+	3		
		<i>Lophatherum gracile</i>	reddish-brown	young leaves, old leaves, leaf axils	+	6		
		<i>Oxonopus compressus</i>	reddish-brown	flower, flower stalk, leaf axils	+	3		
		<i>Paspalum conjugatum</i>	reddish-brown	flower, flower stalk, seeds	+	6		
		7	<i>Hiperomyzus</i> sp.	<i>Echinocloa crussgali</i>	Black	young leaves, old leaves	-	0
				<i>Blumea lacera</i>	Whitish green	flowers, shoots, and buds	+	4
		8	<i>Lipaphis erysimi</i>	<i>Rorippa indica</i>	Whitish green	flower, fruit, shoots, young leaves	+	4
				<i>Sonchus arventris</i>	Whitish green	young leaves, fruit stalks, flowers, fruit	+	5
				<i>Eleusin indica</i>	green	flower, flower stalks, leaf axils	+	3
9	<i>Rhopalosiphum maidis</i>	<i>Lophatherum gracile</i>	green	young leaves, old leaves, leaf axils	+	4		
		<i>Oryza rufipogon</i>	green	old leaves, young leaves (shoot), leaf axils	-	0		
		<i>Oryza rufipogon</i>	Whitish green	old leaves, young leaves (shoot), leaf axils	+	4		
11	<i>Schizaphis rotundiventris</i>	<i>Cynodon dactylon</i>	Green	flowers, flower stalks	+	6		
		<i>Cyperus rotundus</i>	green	flowers, flower stalks, leaf axils	+	4		
		<i>Cyperus compressus</i>	green	flowers, flower stalks, leaf axils	+	4		

(+): present, (-): absent

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119 **Figure 2.** Aphids found infesting wild plants a) *Aphis gossypii* in *Ageratum conyzoides*, b) *Aphis gossypii* in *Croton hirtus* c) *A. gossypii*
120 in *Eupatorium odoratum*, d) *Aphis gossypii* in *Pachystochys* sp., e) *Pentalonia caladii* in *Caladium* sp., f) *Aphis gossypii* in
121 *Alternanthera sessilis*, g) *Aphis gossypii* in *Portulaca oleraceae* h) *Aphis gossypii* in *Euphorbia hirta*, i) *Aphis citricola* in *Phyllanthus*
122 *nerruri*, j) *Aphis citricola* in *Sida rhombifolia*, k) *Aphis citricola* in *Annona muricata*, l) *Aphis citricola* in *Ludwigia peruviana*, m) *A.*
123 *craccivora* in *Mimosa pudica*, n) *Aphis craccivora* in *Amaranthus gracilis*, o) *Aphis glycine* in *Mikania micranta*, p) *Hysteneura* sp. in
124 *Eleusin*, q) *Greenidae* sp. in *Bridelia tomentosa* young leaves., r) *Hyperomyzus* sp. in *Echinocloa crusgali*, s) *Lipaphis erysimi* in
125 *sonchus arvensis*, t) *Rhopalosiphum padi* in *Oryza rufipogon*, u) *Rhopalosiphum Maidis* in *Oryza rufipogon*. All the photos were
126 captured by Chandra Irsan.

127 Discussion

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129 In the present study, some aphid species were found on several ornamental plants in Pagar Alam; the location of aphid
130 colonization on the plants varied. On *Aster alpinus*, aphids were found to form colonies on the stems or young leaf shoots,
131 and the colonies were relatively large. The color of the aphids was dark brown to black. The colonized plant parts showed
132 symptoms of stunting. The identification results showed that the aphids were *Macrosiphoniella sanborni* associated with
133 ants. On the *Brugmansia suaveolens*, *M. persicae* were found on the undersides of old leaves or leaves that have turned
134 yellow. The colonies were relatively small. The aphids found were green and large bodies. The colonized plant parts did
135 not show any signs of disease. On *Caladium* sp. was found one species of aphids: *P. caladii*. *P. caladii* was known and
136 found in taro plants; the aphids formed colonies under the surface of young and older leaves (Bhadra and Agarwala 2014).
137 This study found that the occupied leaf areas did not display severe symptoms; the aphids were yellow-green to dark
138 green. The wingless adult aphids often had a white, flour-like appearance on their bodies. On the *Cananga odoratum*
139 (ylang-ylang), colonies of *T. aurantii* were found on the undersides of the leaves, the shoots, buds, and unopened flower
140 petals. The *T. aurantii* colonies found were relatively large. Colonized parts, especially shoots, showed signs of stunting.
141 The aphids found were brown to black. The colonies of *T. aurantii* were found to be associated with black ants. Aphids on
142 *C. indica* (Indian shot, African arrowroot) were found to form colonies in the leaf axils and under the leaf surface near the
143 leaf base. The colonies were quite large. The aphids were dark brown to dark red coloring with a medium-sized body and
144 the identification results showed that the aphids were *Rhopalosiphum nymphaeae* (Acharya and Singh 2004). The colonies
145 of *R. nymphaeae* were found to be associated with ants. In the *Catharanthus roseus* (periwinkle), *A. citricola* aphids were
146 found. The aphids were yellow-green, sifunculi, and black cauda. The aphids formed colonies on flowers and shoots, and
147 the colonized plant parts showed no disease symptoms. On *Cestrum* sp. (Bastard jasmine), aphids formed colonies on the
148 undersides of young leaves, shoots, and within flower parts, especially between petals or stalks that had not fully bloomed;
149 the colonies were quite large. The body color of aphids was green to dark green, with small to medium-sized bodies. The
150 colonized plant parts, especially leaves, showed stunting symptoms. The identification results showed that the aphids were
151 *A. gossypii*. The aphid colonies found were consistently associated with ants. Aphids on *Clitoria ternatea* were found to
152 form colonies on flower parts, flower crowns, stems, and young leaves. The aphids were brown to black. Colonized plant
153 parts, especially shoots and young leaves, showed stunting symptoms. The identification results showed that the aphids
154 were *A. craccivora*. These colonies were consistently associated with ants. The aphids on the *Dahlia* sp. formed colonies
155 on unopened flower buds, with a significant population among the blooming petals. The body color was green to dark
156 green. The identification results showed that the aphids were *A. gossypii*. According to this present study, *Sinemegoura*
157 *citricola* colonies were found on the young leaves of *Dendrobium* sp., with the color body of the *S. citricola* aphids were
158 yellow, green to dark green, and the colonized plants showing no disease symptoms, and were associated with ants. On
159 *Duranta* sp., colonies of aphids on the undersides of young leaves, and the colonized plant parts showed stunting
160 symptoms. The colonies were very large. The aphids were green. The identification results showed that the aphids were *A.*
161 *gossypii*. The aphid colonies were consistently associated with ants. Furthermore, on the *Helianthus annuus*, aphid
162 colonies were found between the flower petals. The colonized flowers, especially the crowns, tended to fall off easily. The
163 aphids were green and yellow in color. The colonies were small. The identification results showed that the aphids were *A.*
164 *gossypii*. These aphid colonies were associated with ants. Aphid colonies on *Helianthus* sp. were found on the undersides
165 of old leaves. These colonies were small in size. The aphids were green with a medium body size. The colonized plant
166 parts did not show any disease symptoms. The identification results showed that the aphids were *M. ornatus*. The aphid
167 colonies were not associated with ants. Within the colonies, mummified aphids that Aphidiidae parasitized were found. On
168 the *Hibiscus rosa-sinensis*, aphids ranging from yellow to dark green were found. The aphids formed colonies on flower
169 buds, unopened flower crowns, and the undersides of aging leaves. The colonies grew to be very large. The identification
170 results showed that the aphids were *A. gossypii*. The aphid colonies were consistently associated with ants. Two types of

171 aphids were found on the flowering plant *Ixora paludosa*. First, the aphids formed colonies on the undersides of young
172 leaves that were still red or light green and sometimes on flower stalks that had not yet bloomed. The occupied plant parts
173 showed symptoms such as stunted leaf growth, leaf shrinkage, necrotic spots on the leaf surface, and slightly downward-
174 curved leaf edges. The upper leaf surface looked wet and sticky, like sugar. The aphids had yellow, green, or slightly dark
175 green bodies, with some wingless adults having a powdery white upper surface. The identification results showed that the
176 aphids were *A. gossypii* almost always associated with ants. The second type of aphids on *Ixora paludosa* formed colonies
177 under the surface of young and older leaves. The colonies could also be found on newly emerging flowers and leaves. The
178 plant parts occupied by these aphids did not show obvious signs of illness. These aphids were dark red to black, with once-
179 branched stigma and venation in their black wings. The identification results showed that the aphids were *T. aurantii*.
180 These aphids were also associated with ants. Moreover, two forms of aphids were discovered in *Ixora* sp. flower plants.
181 These aphids occupied the shoots, young leaves, and unopened flowers; the affected plant parts did not show obvious
182 symptoms. The aphids exhibited colors ranging from yellow and green to a slightly darker green. Sometimes, the upper
183 surface of the wingless imago's body appeared white, resembling flour. The identification results showed that these aphids
184 were *A. gossypii*. These aphid colonies were almost always associated with ants. Another species of aphids formed
185 colonies on flower stalks that had not yet bloomed and on newly emerging shoots or leaves. The presence of these aphids
186 on the plant did not induce plant disease symptoms. The aphids were yellow or yellowish green, with black cauda and
187 siphunculi. Their bodies were very small to small. The identification results showed that the aphids were *A. citricola*. The
188 colonies of *A. citricola* were also frequently found in association with ants. Two types of aphids were found on *Mussaenda*
189 *frondosa*, each forming colonies in different locations. The first type formed colonies on young leaves, shoots, and
190 flowers. The plant parts they occupied showed no obvious disease symptoms. The identification results showed that the
191 aphids were *Toxoptera odinae*. The aphids were yellow, green, and dark green (Blackman et al. 2011). The second type of
192 aphids formed colonies on the stems or young twigs, appearing densely clustered as if piled up. The aphid colonies could
193 also be found on young leaves, shoots, and within flower parts. The plant parts they infested showed no signs of diseases.
194 The aphids were yellow or yellow-green, with black cauda and siphunculi. They had tiny to small bodies. The
195 identification results showed that the aphids were *A. citricola*. Many aphid species infest various ornamental plants
196 because these insects are attracted to such plants due to the rich nutrient content in the plant sap (Braham et al. 2023).

197 The results showed that 34 species of wild plants, including weeds, were growing in the yard colonized by aphids. This
198 indicated that multiple species of aphids colonized various host plants. The aphid species colonizing these plants were
199 generally consistent within the same taxon. *Ageratum conyzoides* was infested by *A. gossypii*. These aphids formed
200 colonies on the flower sections, shoots, lower surfaces of young leaves, or leaves turning yellow. The aphids were green,
201 yellow-green to dark green, often forming large colonies. *Alternanthera philoxeroides*, or alligator grass, was also
202 colonized by *A. gossypii*. Small colonies were found on shoots or stems. These aphids had small bodies and were green,
203 ranging from yellow-green to dark green. *Alternanthera sessilis* was colonized by *A. gossypii*, forming colonies on shoots,
204 flowers, and fruit. The colonies were typically large, and often associated with tiny brown ants. *Amaranthus gracilis* was
205 infested by *Aphis craccivora*. These aphids established colonies on shoots, flowers, and young and old leaves. They were
206 dark brown to black, with shiny black wingless imagoes. Colonies of these aphids were associated with both black and red
207 ants. *Blumea lacera* was colonized by *Lipaphis erysimi*. These aphids were bright green and of medium size. The colonies
208 formed on flowers, flower stalks, and the undersides of the leaves at the top. The aphid colonies were not associated with
209 ants. *Croton hirtus*, or fire grass, was infested by *A. gossypii*; the aphids were yellow-green to dark green. The colonies
210 were found on the stems, leaves, buds, and flowers, often forming large colonies. *Cynodon dactylon* or Bermuda grass was
211 colonized by *Schizaphis rotundiventris*. The aphids colonized the flowers, flower stalks, and sometimes the plant leaf
212 axils. Small colonies were formed. The aphids were brown to reddish brown. They were associated with ants. *Cyperus*
213 *rotundus*, or nut grass, was infested by *Schizaphis rotundiventris* aphids. The colonies were found on flower stalks,
214 flowers, and leaf axils. The colonies were quite large and associated with both black and red ants. The aphids were dark
215 brown in color. *Cyperus compressus*, or grass puzzle, was colonized by *Schizaphis rotundiventris* aphids, forming colonies
216 in the flowers, flower stalks, and sometimes in the axils and leaves of the shoots or buds. Small colonies were observed.
217 *Digitaria ciliaris* was infested by *Hysteroneura setariae* aphids, with small colonies scattered on the flowers and flower
218 stalks. These aphids were light brown to brown in color. *Echinocloa crussgali*, or water hyacinth plants, were colonized by
219 *Hiperomyzus* sp. aphids. These aphids were dark brown to black and formed large colonies on the undersides of both
220 young and old leaves. The aphid colonies were never found in association with ants. *Ecliptica prostrata*, or urang-aring,
221 was colonized by *Aphis gossypii*, forming small colonies on the shoots and flowers. The aphids were bright green to
222 blackish green. The aphid colonies were also consistently associated with ants. *Eleusin indica* was colonized by two
223 species of aphids: *Hysteroneura setariae* and *Rhopalosiphum maidis*. *H. setariae* formed colonies in flower parts, flower
224 stalks, and leaf axils, resulting in large colonies. *H. setariae*'s body color ranged from red-brown to dark brown. The
225 colonies were consistently associated with ants. The aphids of *R. maidis* formed colonies in the leaf axils and undersides of
226 leaves and leaf shoots that had not yet opened. The colonies were not densely packed. The leaf aphids of *R. maidis* were
227 green in color, with distinct black siphunculi and cauda. These aphids had relatively large bodies with a slightly elongated
228 shape. *R. maidis* colonies were always associated with ants. The plant *Emilia sonchifolia*, characterized by its purple
229 flowers, was colonized by *Aphis gossypii*; the aphids were yellow to green in color. The colonies formed near flowers,
230 flower stalks, and shoot leaves. *Eragrostis tenella* was infested by *Hysteroneura setariae* aphids. The aphids were brown

231 to red-brown. Small colonies formed on flowers near the seeds, with groups of aphids surrounding the plant's seeds. The
232 aphids of *H. setariae* were consistently associated with ants. *Euphorbia hirta*, or wart grass, was colonized by *Aphis*
233 *gossypii*. The aphids formed colonies on the undersides of leaves, resulting in stunted growth of the leaves. The aphids
234 were yellow to dark green in color. *A. gossypii* colonies on *E. hirta* plants were consistently associated with ants.
235 *Eupatorium odoratum* was colonized by *A. gossypii* and *A. citricola*. *A. gossypii* formed colonies in the buds, young
236 leaves, old leaves, and young twigs. Young leaves colonized by *A. gossypii* became stunted with an irregular shape. *A.*
237 *gossypii* found in this plant showed yellow-green to dark-green body color. The colonies of *A. citricola* formed on the
238 young twigs near the shoots, with these aphids displaying yellow-green coloration and having black siphunculi and cauda.
239 Aphid colonies of *A. gossypii* and *A. citricola* on *E. odoratum* plants were associated with either black or red ants.
240 *Hymenochera acutigluma*, or hair axis, was colonized by *Hysteroneura setariae*, which formed colonies on the flower
241 stalks and flowers. The colonized parts of the plants did not display any noticeable symptoms. *Lagerstromia sp.*, or
242 *kenidai*, was infested by *Greenidae* sp. These aphids had bright green bodies and distinctive elongated siphunculi with
243 thorns. The aphids formed colonies on the undersides of leaves, especially on young leaves. The colonized leaves did not
244 show any disease symptoms. *Lophatherum gracile* or bamboo grass plants, were colonized by two species of aphids:
245 *hysteroneura setariae* and *Rhopalosiphum maidis*. The aphids of *H. setariae* formed colonies on the undersides of leaves,
246 leaf shoots, and leaf axils. The colonized leaves did not show any disease symptoms. *H. setariae* aphids were brown to
247 red-brown. *R. maidis* aphids also formed colonies on the undersides of leaves, but the colonies were small. *R. maidis*
248 aphids were green to bright green, with black siphunculi and cauda. It was possible for colonies of the two species of
249 aphids on *L. gracile* to mix. In addition, *Melastoma affine* was colonized by *Aphis gossypii*. The colonies formed on shoots,
250 particularly near newly emerging shoots and newly emerging fruits and flowers. The body color of aphids ranged from
251 yellow to green. The colonized plant parts did not show any disease symptoms. *Mikania miranta* was colonized by *Aphis*
252 *gossypii* and *Aphis glycine*. *A. gossypii* formed colonies on the shoots, especially on the undersides of the leaves, resulting
253 in stunted and curled leaves. *A. glycine* formed colonies on the branches. The colonies were densely populated. *A. Glycine*
254 aphids were light green to green in color. The colonized plant parts became distorted. The two species of aphids could mix
255 to form a single colony. *Mimosa invisa* (cater-grass) was colonized by *Aphis craccivora*. The aphids of *A. craccivora* on
256 *M. invisa* plants formed colonies only on the shoots with small colonies. The aphids appeared dark black with wingless
257 imagoes. *Mimosa pudica* was observed to be colonized by *Aphis craccivora*. The aphids formed colonies on shoots,
258 especially young shoots, and occasionally on flowers and pods. The aphids were black and of medium size, resulting in
259 stunted growth of the colonized plant parts. The colonies were quite large. *Mimosa vigra* was colonized by *Aphis*
260 *craccivora*. The colonies of aphids occupied the pods and shoots with small colonies. The nymphs of aphids were black,
261 and wingless adults were shiny black. The colonized plant parts did not show any disease symptoms. *Oryza rufipogon* was
262 colonized by two species of aphids: *Rhopalosiphum macr* and *Rhopalosiphum maidis*. Both aphids colonized the same
263 plant parts, namely the unopened leaves and the leaf axils with large colonies. The two species could be distinguished by
264 their body color. *R. maidis* appeared green with black siphunculi and cauda, while *R. rice* appeared white. The colonies of
265 *R. maidis* and *R. rice* in *O. rufipogon* plants were associated with the presence of red ants. *Oxonopus compressus*, or *pait*
266 grass, was colonized by *Hysteroneura setariae* aphids. The colonies occupied flowers, flower stalks, seeds, and sometimes
267 the leaf axils. The aphids were brown to dark brown. Small colonies were formed, and they were also consistently
268 associated with ants. *Paspalum conjugatum* was colonized by *H. setariae* aphids. The colonies occupied flower parts,
269 especially the seeds and flower stalks. Aphids had brown to dark brown bodies. *Phyllanthus neruri* was colonized by *Aphis*
270 *citricola*. The colonies formed on the shoots and the undersides of leaves and petioles. The colonized parts became
271 distorted, stunted, and wrinkled. The aphids had yellow bodies with black siphunculi and cauda; the colonies formed were
272 large. *Portulaca oleraceae* plants were colonized by *Aphis craccivora*. The aphids of *A. craccivora* in *P. oleraceae* plants
273 formed colonies on the undersides of leaves, especially young leaves, shoots, and flowers. The colonized plant parts
274 became stunted, and leaf edges curled downward. The aphids had dark brown to black bodies, with wingless imagoes that
275 appeared glossy black. *Physalis angulata* plants were colonized by *Aphis craccivora*. The aphids had dark green to black
276 bodies, with glossy black wingless imagoes. *A. craccivora* formed colonies on the shoots or near the leaf buds. The
277 colonized plant parts did not show any disease symptoms. *Rorippa indica*, or mustard land, was colonized by *Lipaphis*
278 *erysimi*. The colonies formed on the flowers, fruits, flower stalks, and the lower leaf's surface. The colonized plant parts
279 showed symptoms such as curling and stunting. *Sida rhombifolia*, or cacabean, was colonized by *Aphis gossypii*. The
280 aphids had green-yellow to green body colors. The colonies formed on the surface of lower leaves, stalks, and flower
281 petals. The colonized plant parts, especially the shoots, showed curling, and the leaf edges curled downward. *Sonchus*
282 *arvensis* plants were colonized by *L. erysimi*. The aphids had green to whitish green body colors, and the colonies formed
283 on flower stalks, under petals, and on young shoots or leaves. The colonized plant parts became stunted over time.
284 In general, aphids observed on ornamental and wild plants formed colonies. The colonized plant parts typically
285 displayed typical damage symptoms, but some did not show any symptoms at all. Generally, the plants' symptoms due to
286 aphid colonies were relatively the same, such as stunted growth, abnormal shape, and stunted or curly leaves. These
287 characteristic symptoms serve as indicators of aphid infestations. However, some plants or plant parts did not show
288 symptoms when colonized by aphids. This condition occurred because the colonized parts had reached maximum growth
289 or development. It indicated that the colonized part was not currently undergoing a growth phase. The colonies that did not
290 induce symptoms typically occurred when the colonized leaves had reached their maximum growth or when the leaves and

291 plant parts were old. Furthermore, the old leaves or twigs might not show the typical symptoms associated with aphid
292 infestations. The plant parts exhibiting characteristic symptoms when colonized by aphids also often experienced a
293 cessation in growth due to the piercing by the aphids. In contrast, the areas surrounding the puncture site continued
294 growing, resulting in some parts developing ordinary while others became stunted (Pettersson et al. 2017). This condition
295 could lead to bending shoots or young stems, curling leaves, downward curling of leaf edges, or stunted leaf growth. In
296 this observation, monocot plants or groups of grasses with narrow leaves generally did not display any distinctive
297 symptoms when colonized by aphids. This might be because the growth or development of their leaves differed from that
298 of dicot plants. Therefore, the presence of aphids in monocot plants was often easier to recognize through the presence of
299 ants. If a plant was found to have a significant number of ants, there was a possibility that aphids had colonized the plant
300 (Tegelaar et al. 2012). Therefore, the presence of ants could serve as an indicator of the aphid colonies. According to this
301 study, ants were present in some aphid colonies from the subfamily Aphidinae, while the ants were absent in some aphid
302 colonies from the macrosiphini subfamily. The bodies of aphids from the subfamily Aphidinae are relatively small and
303 have short sifunculi. On the other hand, aphids, which have large bodies and relatively long sifunculi, are never visited by
304 ants. This happens because long sifunculi are reported to disturb ants, so the ants don't like to come close. Additionally,
305 large aphids and long sifunculi generally do not produce honeydew, so ants do not want to come close.

306 The absence of ants in aphid colonies could be because the colonies have just formed or the population is still low
307 (Kummel, Brown, and Bruder 2013). Aphids colonized flowers because they may offer an accessible and rich food source,
308 sugary plant sap found in new growth or reproductive plant parts. Flowers contain a nutrient-rich nature and easy access to
309 sap; therefore, aphids were attracted to flower saps. In addition, some aphid species were drawn to certain colors
310 (Jakubczyk et al. 2022). Herbs served as an alternative host for aphids in this present study. Aphids consume sugar-rich
311 liquid in plants, known as "sap." Aphids considered herbs and other green vegetation as abundant food sources. Aphids
312 utilize needle-like mouthparts to penetrate plant tissues and access this fluid (Brožek et al. 2015). Several aphids colonized
313 herbs such as Indian mustards, *Lipaphis erysimi*, and *Myzus persicae*, the most devastating insects, infesting leaves, stems,
314 and floral parts (Jayaswal et al. 2022). Due to a symbiotic relationship, the prevalence of aphids and ants was frequently
315 correlated. Aphids produced a delicious substance known as honeydew as a waste product, which ants found highly
316 attractive food sources (Nelson and Mooney 2022). The honeydew contained abundant sugars extracted by aphids from the
317 plant juice (Zheng et al. 2022). Ants were drawn to this nutrient-rich food source and would often 'farm' aphids for it. In
318 exchange for honeydew, ants protected aphids from other insects and predators, such as ladybugs, lacewing larvae, and
319 parasitic wasps (Karami-jamour et al. 2018). Certain ant species would transport aphids to new host plants for improved
320 foraging opportunities, ensuring that aphids had a continuous food source (Giannetti et al. 2021). Honeydew not only
321 nourished the ant colony, but its high sugar content also supported the development of their fungus farms (in certain
322 species) and provided energy for the growth of their progeny (Biedermann and Vega 2020). Ornamental plants, and also
323 weeds are generally grown with simple maintenance and usually free pesticides. The ecological habitat of ornamental
324 plants and weeds is assumed to be the same. Therefore, many species of aphids found on ornamental plants were also
325 found on weeds.

326

CONCLUSION

327 The total of 15 species aphids found in Ornamental plants, *Aphis craccivora*, *Aphis citricola*, *Aphis glycines*, *Aphis*
328 *gossypii*, *Aulacorthum solani*, *Macrosiphoniella sanborni*, *Macrosiphum rosae*, *Myzus persicae*, *Neomyzus circumflexus*,
329 *Pentalonia caladii*, *Rhopalosiphum nymphaeae*, *Sinemegoura citricola*, *Toxoptera aurantii*, *Toxoptera citricidus*,
330 *Toxoptera odinae*. The total of 11 species aphids found in weeds, *Aphis gossypii*, *Aphis craccivora*, *Aphis glycines*, *Aphis*
331 *citricola*, *Greenidea* sp., *Hystroneura setariae*, *Hiperomyzus* sp., *Lipaphis erysimi*, *Rhopalosiphum maidis*,
332 *Rhopalosiphum padi*, *Schizaphis rotundiventris*.
333

334

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REFERENCES

- 338 Acharya, Shelley, and Rajendra Singh. 2004. "Aphids on Medicinal Plants in North East India (Insecta : Homoptera : Aphididae)." *Rec. Zool. Surv. India*
339 102(June 2004). doi: 10.26515/rzsi/v103/i1-2/2004/159495.
- 340 Bass, Chris, Alin M. Puinean, Christoph T. Zimmer, Ian Denholm, Linda M. Field, Stephen P. Foster, Oliver Gutbrod, Ralf Nauen, Russell Slater, and
341 Martin S. Williamson. 2014. "The Evolution of Insecticide Resistance in the Peach Potato Aphid , *Myzus Persicae*." *Insect Biochemistry and*
342 *Molecular Biology* 51:41–51. doi: 10.1016/j.ibmb.2014.05.003.

343 Bhadra, Parna, and Basant Kumar Agarwala. 2014. "On the Morphological and Genotypic Variations of Two Congeneric Species of Banana Aphid
344 Pentalonia (Homoptera : Aphididae) from India." (March). doi: 10.5932/j.als.20120203.06.

345 Biedermann, Peter H. W., and Fernando E. Vega. 2020. "Ecology and Evolution of Insect–Fungus Mutualisms." *Annual Review of Entomology* 65:431–
346 55. doi: <https://doi.org/10.1146/annurev-ento-011019-024910>.

347 Blackman, Roger L., and Victor F. Eastop. 2008. *Aphids on the World's Herbaceous Plants and Shrubs, 2 Volume Set*. John Wiley & Sons.

348 Blackman, Roger L., and Victor F. Eastop. 2017. "Taxonomic Issues." Pp. 1–36 in *Aphids as crop pests*. CABI Wallingford UK.

349 Blackman, Roger Laurence, Masato Sorin, and Masahisa Miyazaki. 2011. "Sexual Morphs and Colour Variants of Aphis (Formerly Toxoptera) Odinae
350 (Hemiptera, Aphididae) in Japan." *Zootaxa* (November 2011):53–60. doi: 10.11646/zootaxa.3110.1.5.

351 Braham, Mohamed, Synda Boulahia-kheder, Mouna Kahia, and Siwar Nouria. 2023. "Aphids and Citrus Responses to Nitrogen Fertilization." *Journal of
352 the Saudi Society of Agricultural Sciences* 22(6):374–83. doi: 10.1016/j.jssas.2023.03.003.

353 Brożek, Jolanta, Ewa Mróz, Dominika Wylężek, Łukasz Depa, and Piotr Węgierek. 2015. "The Structure of Extremely Long Mouthparts in the Aphid
354 Genus Stomaphis Walker (Hemiptera: Sternorrhyncha: Aphididae)." *Zoomorphology* 134:431–45. doi: <https://doi.org/10.1007/s00435-015-0266-7>.
355 7.

356 Cao, He-he, Zhan-feng Zhang, Xiao-feng Wang, and Tong-xian Liu. 2018. "Nutrition versus Defense : Why Myzus Persicae (Green Peach Aphid)
357 Prefers and Performs Better on Young Leaves of Cabbage." *PLoS One* 13(4):1–16. doi: <https://doi.org/10.1371/journal.pone.0196219>.

358 Clarke, Rebecca, Monica A. Kehoe, Sonya Broughton, and Roger A. C. Jones. 2020. "Host Plant Affiliations of Aphid Vector Species Found in a
359 Remote Tropical Environment." *Virus Research* 281(December 2019):197934. doi: 10.1016/j.virusres.2020.197934.

360 Ertunc, Filiz. 2020. "Chapter 46 - Emerging Plant Viruses." Pp. 1041–62 in, edited by M. M. B. T.-E. and R. V. P. Ennaji. Academic Press.

361 Gadhave, Kiran R., Saurabh Gautam, David A. Rasmussen, and Rajagopalbabu Srinivasan. 2020. "Aphid Transmission of Potyvirus: The Largest Plant-
362 Infecting RNA Virus Genus." *Viruses* 12(7):773. doi: 10.3390/v12070773.

363 Giannetti, Daniele, Mauro Mandrioli, Enrico Schifani, Cristina Castracani, Fiorenza A. Spotti, Alessandra Mori, and Donato A. Grasso. 2021. "First
364 Report on the Acrobat Ant Crematogaster Scutellaris Storing Live Aphids in Its Oak-Gall Nests." *Insects* 12(2):108. doi:
365 <https://doi.org/10.3390/insects12020108>.

366 Jakubczyk, Karolina, Klaudia Koprowska, Aleksandra Gottschling, and Katarzyna Janda-Milczarek. 2022. "Edible Flowers as a Source of Dietary Fibre
367 (Total, Insoluble and Soluble) as a Potential Athlete's Dietary Supplement." *Nutrients* 14(12). doi: 10.3390/nu14122470.

368 Jayaswal, Deepanshu, Pawan Mainkar, Kuldeep Kumar, Yamini Agarwal, and Ratna Prabha. 2022. "Pyramiding and Evaluation of Segregating Lines
369 Containing Lectin and Protease Inhibitor Genes for Aphid Resistance in Brassica Juncea." *Indian Journal of Biochemistry & Biophysics*
370 59(August):800–807. doi: 10.56042/ijbb.v59i8.62319.

371 Jones, Roger A. C. 2022. "Alteration of Plant Species Mixtures by Virus Infection: Managed Pastures the Forgotten Dimension." *Plant Pathology*
372 71(6):1255–81. doi: DOI: 10.1111/ppa.13571.

373 Kallas, John. 2010. *Edible Wild Plants*. Gibbs Smith.

374 Karami-jamour, Tahereh, Alinaghi Mirmoayedi, Abbasali Zamani, and Yadolah Khajehzadeh. 2018. "The Impact of Ant Attendance on Protecting Aphis
375 Gossypii against Two Aphidophagous Predators and It's Role on the Intraguild Predation between Them." *Journal of Insect Behavior* 31:222–39.
376 doi: DOI: 10.1007/s10905-018-9670-4.

377 Kennedy, J. S., and H. L. G. Stroyan. 1959. "Biology of Aphids." *Annual Review of Entomology* 4(1):139–60.

378 Kumar, Sushil, Malay K. Bhowmick, and Puja Ray. 2021. "Weeds as Alternate and Alternative Hosts of Crop Pests." *Indian Journal of Weed Science*
379 53(1):14–29. doi: 10.5958/0974-8164.2021.00002.2.

380 Kummel, Miroslav, David Brown, and Andrea Bruder. 2013. "How the Aphids Got Their Spots: Predation Drives Self-Organization of Aphid Colonies
381 in a Patchy Habitat." *Oikos* 122(6):896–906. doi: <https://doi.org/10.1111/j.1600-0706.2012.20805.x>.

382 Maharani, Yani, Purnama Hidayat, Aunu Rauf, and Nina Maryana. 2018. "Short Communication: New Records of Aphid Species Subfamily Aphidinae
383 (Hemiptera: Aphididae) in West Java, Indonesia." *Biodiversitas* 19(2):460–65. doi: 10.13057/biodiv/d190219.

384 Meuninck, Jim. 2023. *Basic Illustrated Edible Wild Plants and Useful Herbs*. Rowman & Littlefield.

385 Naidu, VSGR. 2012. "Hand Book on Weed Identification."

386 Nelson, Annika S., and Kailen A. Mooney. 2022. "The Evolution and Ecology of Interactions between Ants and Honeydew-Producing Hemipteran
387 Insects." *Annual Review of Ecology, Evolution, and Systematics* 53:379–402. doi: <https://doi.org/10.1146/annurev-ecolsys-102220-014840>.

388 Pettersson, Jan, W. Fred Tjallingii, and Jim Hardie. 2017. "Host-Plant Selection and Feeding." Pp. 173–95 in *Aphids as crop pests*. CABI Wallingford
389 UK.

390 Tegelaar, Karolina, Mattias Hagman, Robert Glinwood, Jan Pettersson, and Olof Leimar. 2012. "Ant–Aphid Mutualism: The Influence of Ants on the
391 Aphid Summer Cycle." *Oikos* 121(1):61–66. doi: <https://doi.org/10.1111/j.1600-0706.2011.19387.x>.

392 Zheng, Zhou, Mengqin Zhao, Zhijun Zhang, Xin Hu, Yang Xu, and Cong Wei. 2022. "Lactic Acid Bacteria Are Prevalent in the Infrabuccal Pockets and
393 Crops of Ants That Prefer Aphid Honeydew." *Front. Microbiol.* 12(January):1–17. doi: 10.3389/fmicb.2021.785016.

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