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From foreigner to naturalization, a recent distribution records of Tawny coster *Acraea terpsicore* (Lepidoptera: Nymphalidae) in Sumatra

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Abstract *:*
The Tawny coster Acraea terpsicore (Lepidoptera: Nymphalidae) is a non-native species of butterfly that has been recorded in Sumatra since 2009. Summarize recent review confirmed 40 spatial distribution records of A. terpsicore between 2009 to 2020. These records suggest A. terpsicore have widely distributed and colonialized in Sumatra.
Keywords: Status, butterfly, Acraea terpsicore, Rhopalocera, distribution, South Sumatra.

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1. Introduction

The dividing of the world into 'natural' biodiversity regions, defined as localities with a consistency and distinctiveness of the flora and fauna, has attracted the attention of scientists since the early 19th century [1]. The great islands of western Indonesia (Sumatra, Indonesian Borneo and Java) lie close to the southeastern corner of Asia [2]. Biogeographically, these islands are falls in a distinct faunal subregion known as the Greater Sundas, which is within one of the world's most interesting zoogeographical regions stretching from the Malay Archipelago to the continent of Australia [3].

Tawny Coster *Acraea terpsicore* (Lepidoptera: Nymphalidae) or previously known as *Acraea violae* is naturally range from Sri Langka, India, Myanmar, Vietnam; spread to Thailand and more recently into Peninsular Malaysia and Singapore [4, 5, 6]. This species reach northern Peninsular Malaysia in 1992, following Singapore in 2006 and Indonesia in 2012 [7, 8, 9, 10]. In most recent years, it has been extend to the southern reach Australia and many islands in Indonesia [11, 12].

The island of Sumatra (which measures 400 kilometers wide and 1.800 kilometers long) is second largest island in Indonesia, and one of the richest island of Indonesia for animals [13]. Sumatra is an home for 756 species of butterflies [14], but this number is out of date and must be increase. Many of Sumatran butterflies are endemic, and their distribution range have extended [15]. *Acraea terpsicore* is one new listed butterfly in Sumatra that just has added in recent years from a collected specimen from Padang by Museum Zoologicum Bogoriense and a specimen collected with labelled 'Mouth Kerinci' in 2009 [11], although this species arrived earlier in 2008 [16]. In this paper, we summarize more recent records of *A. terpsicore* in Sumatra, providing new insights about its recent distibutional status.

2. Materials and Methods

Records of present details of *A. terpsicore* were compiled from published and unpublished informations, particularly from local researchers and butterfly enthusiasts. Many records were also obtained from local social media (mainly Facebook group of butterflies in Indonesia) and internet supported with photographs or other evidence (e. g. location, habitat type, morphology and descriptions). All records included herein were verified; and doubtfull or unconfirmed records were rejected.

3. Results and Discussion

There are 40 confirmed spatial records *A. terpsicore* between 2008 to 2020 in Sumatra (Table 1). These records add 36 new records of *A. terpsicore* after reported first time in Sumatra [11]. The *A. terpsicore* has been recorded in all provinces in Indonesia, including Aceh, Sumatera Utara (North Sumatra), Riau, Kepulauan Riau (Riau Islands), Sumatera Barat (West Sumatra), Bengkulu, Jambi, Bangka Belitung, Sumatera Selatan (South Sumatra) and Lampung (Figure 1). *Acraea terpsicore* is a relative easily determine species due to its reddish orenge with black markings (male), or orange yellow (female). It is nearly a distinct species, and no other similar butterfly s species in Sumatra. The wing span is about 45-65 mm. Forewing slightly darker, hindwing with a series of orange submarginal spots outlined by black along the border (Figure 2). These characters are fitted well of *A. terpsicore* in field guides [4, 5, 6].

Table 1. Locations and numbers of *A. terpsicore* in Sumatra between 2009 to 2020. Acronym MI refer to Muhammad Iqbal (first author) and IA refer to Ina Aprilia (second author).

No	Location	Number	Dates	Coordinates	Sources
1	Gue Gajah, Aceh Besar, Aceh	1	13 January 2013	05°30' 48"N, 95°18'05"E	[17]
2	Resort Cinta Raja (Leuser), Besitang, Sumatera Utara	1	December 2018	03°56'18"N, 98°04'35"E	[18]
3	Langkat, Sumatera Utara	1	1 May 2019	03° 28'10"N, 98°8'04'' E	[19]
4	Pulau Samosir, Danau Toba, Sumatera Utara	1	May 2019	02°43'05"N, 98°46'59"E	[19]
5	Pasir Pengairan, Rokan Hulu, Riau	14	August-December 2014, December 2014-January 2015	00°51'14"N, 100°15'88"E	[20, 21]
6	Kampus Bina Widya, Pekanbaru, Riau	1	May 2012	00°30'29"N, 101°26' 41"E	[22]
7	Teluk Binjai, Pelalawan, Riau	1	7 February 201	00° 13' 30"N, 102° 18'54"E	[19]
8	Bangkinang. Kampar, Riau		15 January 201	00° 20'11"N, 101°1'02"E	[19]
9	Pangkalan Kerinci, Pelalawan, Riau	1	3 February 2019	00°21'35"N, 101°51'34"E	[19]
10	Kijang Kota, Bintan, Kepulauan Riau	1	December 2012	00°50'58"N, 104°36'20"E	Farid Muzaki *pers.com*
11	Tanjung Balai Karimun, Karimun island, Kepulauan Riau	6	Between December 2011 and April 2012	00°59'29"N, 103°26'19"E	[23]
12	Cagar Alam Gunung Sago, Tanah Datar, Sumatera Barat	7	September to November 2013	00°18'76"S, 100°45'56"E	[24]
13	Kota Padang, Padang, Sumatera Barat	1	26 February 2020	00°55'32"S, 100°21'43"E	[19]
14	Kota Padang, Padang, Sumatera Barat	1	21 March 2009	00°55'32"S, 100°21'43"E	[11]
15	Kampus Univ. Andalas, Padang, Sumatera Barat		21 September 2019	00°54'33"S, 100°30' 52"E	IA *pers. obs*
16	Air Terjun Lubuk Hitam, Padang, Sumatera Barat	1	Maret-April 2018	01°03'92"S, 100°25'20"E	[25]
17	Pemayungan, Tebo, Jambi	3	17 January 2020	01°04' 60'S, 102°25'30"E	MI *pers.obs*
18	Gunung Kerinci, Kerinci, Jambi	1	21 March 2009	01°42'14"S, 101°16'15"E	[11]
19	Pematang Kabau, Surolangun, Jambi	1	dry season, 2017	01°58'11"S, 102°36'32"E	[26]
20	Kampus Pinang Masak, Kota Jambi, Jambi	19	c. January-June 2019	01°34'44"S, 103°32'55"E	[27]
21	Hutan Kota M. Sabki, Jambi, Jambi	1	January-February 2012	01°39'21"S, 103°35'18"E	[28]
22	Singkawang, Muara Bulian, Jambi	1	dry season 2017	01°51'13"S, 103°18'34"E	[26]
23	Hutan Harapan, Muara Bulian, Jambi	1	August 2008, dry season 2017	01°41'37"S, 103°16'43"E	[25]
24	Kampus Universitas Bengkulu, Bengkulu	1	Agustus-Oktober 2015	03°45'31"S, 102°16'16"E	[29]
25	Banjar Sari, Enggano, Bengkulu	>5	28 February 2020	05°17'41"S, 102°09'35"E	MI *pers.obs*
26	Belinyu, Bangka, Bangka Belitung	1	1 January 2020	01° 36'48"S, 105°45'27'E	[19]
27	Sungailiat, Bangka, Bangka Belitung	1	25 December 2019	01°51' 19"S, 106°07'44"E	[30]
28	Bakam, Bangka, Kepulauan Bangka Belitung	3	2 October 2014	01°54'35"S, 105°53'37"E	MI *pers.obs*
29	SM Dangku, Musi Banyuasin, Sumatera Selatan	>30	4 January 2020	02°35'30"S, 103°40'57"E	[31]
30	Merang Kepayang (PT GAL), Musi Banyuasin, Sumatera Selatan	5	5 March 2019	02°12'25"S, 104°25'47"E	[31]

31	Sungai Bungin (PT Raja Palma), Banyuasin, Sumatera Selatan	>10	2 September 2019	02°11'13"S, 104°43'34"E	MI *pers.obs*
32	Tugu Mulyo, Musi Rawas, Sumatera Selatan	45	July 2018	03°55'57"S, 102°57'26"E	[32]
33	Talang Kelapa, Palembang, Sumatera Selatan	1	1 October 2015	02°56'46"S, 104°41'57"E	MI *pers.obs*
34	Talang Pangeran, Indralaya, Sumatera Selatan	1	20 February 2020	03°12' 16"S, 104°43'29"E	[19]
35	Kampus UNSRI Indralaya, Indralaya, Sumatera Selatan	>10	17 March 2020	03°14'29"S, 104°39'54"E	MI *pers.obs*
36	Lebong Hitam (KPPN), OKI, Sumatera Selatan	1	5 May 2016	03°19'37"S, 105°24'50"E	[31]
37	SM Gunung Raya, Sumatera Selatan	1	1 February 2017	04°53'18"S, 104°04'50"E	[31]
38	Sukadana, Lampung Timur, Lampung	1	19 July 2019	05°06'16" S, 105°40'17"E	[19]
39	Taman Kupu-kupu Gita Persada, Pesawaran, Lampung	1	2019	05°24' 22"S, 105°14'54"E	[33]
40	Belitung island, Bangka Belitung province	>10	2014	Unspecified location, not include in map	Ady Septianto Hermawan *pers.com*

Coming as 'foreigner' in 2009, summarize recent records of *A. terpsicore* in Sumatra suggest that *A. terpsicore* has wide spread to and colonialized. Species present in a region but not native have been termed *allien*, *exotic*, *non-indigenous* and *non-native*, but the various nonbiological uses, sometimes pejorative, of the terms *allien* and *exotic* have lead biologists to use nonindigenous and especially nonnative for species not native to a region [34]. When species move into new regions, they become exotics; over time, this species 'naturalise' and become native [35]. As people in that many natives are immigrants that have been in a country long enough become members and citizens of a community [36]. The presence of *A. terpsicore* in Sumatra and other islands in Indonesia have been meet this phenomenon.

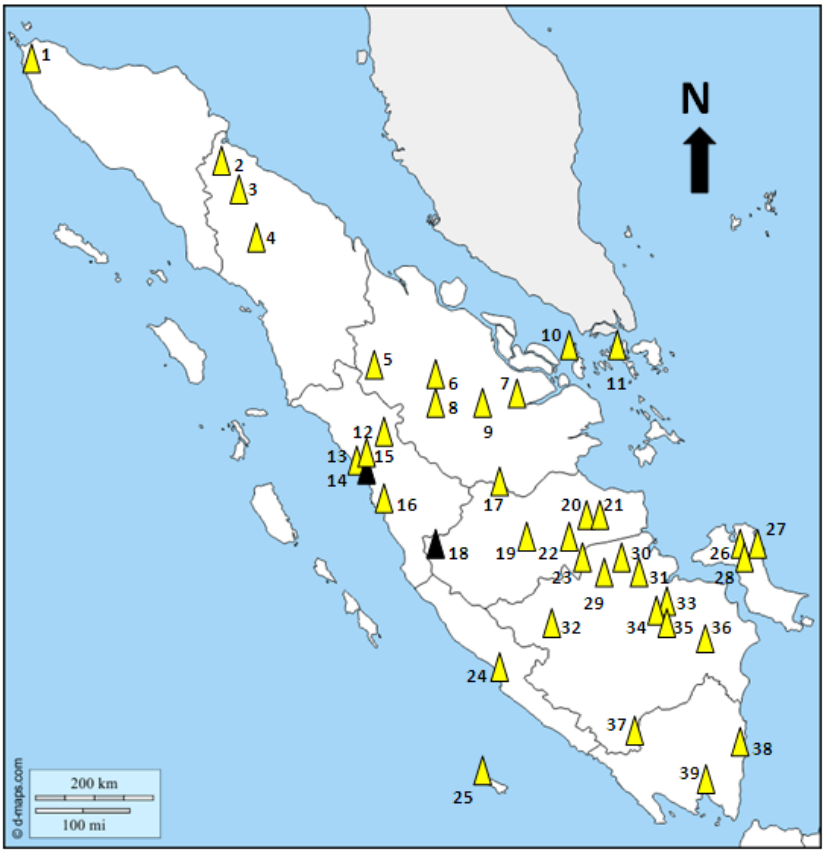

Figure 1. Records of *A. terpsicore* in Sumatra. Black triangles show records in Braby et al. (2014) and yellow triangles are recent reords.

Figure 2. Tawny coster *A. terpsicore* in Sumatra: **A.** Female from Enggano island, Bengkulu province, 28 February 2020; **B.** Male from Enggano island, Bengkulu province, 28 February 2020; **C.** Young male from Pemayungan, Jambi province, 17 January 2020; **D.** Male from Bangka city, Bangka Belitung povince, 2 October 2014 (©Muhammad Iqbal).

The *A. terpsicore* occurs in highly modified open areas, cultivated lands, disturbed grassland, degraded forest, including suburban roadsides [12, 37]. In the recent years, number of forested areas to be converted for various purposes have been increased, providing many open habitats and grass land areas, which support potential and suitable habitat for *A.terpsicore.* This species unlikely to become an economic pest of tropical agriculture [37], but it may pose a biodiversity threat to native *Acraea* sp (eg. *Acraea issoria*) in Sumatra because the larvae competion for food plants. For this reason, further monitoring is needed to looking at trend of *A. terpsicore* and its impact to native butterflies population in the future.

4. Conclusion

A total of 40 confirmed records of *A. terpsicore* suggest this species has been wide spread and established in Sumatra. As a non-native species in Sumatra, *A. terpsicore* has been came as foreigner to be a naturalization species recently.

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Abstract *:*
The Tawny coster Acraea terpsicore (Lepidoptera: Nymphalidae) is a non-native species of butterfly that has been recorded in Sumatra since 2009. Summarize recent review confirmed 40 spatial distribution records of A. terpsicore between 2009 to 2020. These records suggest A. terpsicore have widely distributed and colonialized in Sumatra.
Keywords: Status, butterfly, Acraea terpsicore, Rhopalocera, distribution, South Sumatra.

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1. Introduction

The dividing of the world into 'natural' biodiversity regions, defined as localities with a consistency and distinctiveness of the flora and fauna, has attracted the attention of scientists since the early 19th century [1]. The great islands of western Indonesia (Sumatra, Indonesian Borneo and Java) lie close to the southeastern corner of Asia [2]. Biogeographically, these islands are falls in a distinct faunal subregion known as the Greater Sundas, which is within one of the world's most interesting zoogeographical regions stretching from the Malay Archipelago to the continent of Australia [3].

Tawny Coster *Acraea terpsicore* (Lepidoptera: Nymphalidae) or previously known as *Acraea violae* is naturally range from Sri Langka, India, Myanmar, Vietnam; spread to Thailand and more recently into Peninsular Malaysia and Singapore [4, 5, 6]. This species reach northern Peninsular Malaysia in 1992, following Singapore in 2006 and Indonesia in 2012 [7, 8, 9, 10]. In most recent years, it has been extend to the southern reach Australia and many islands in Indonesia [11, 12].

The island of Sumatra (which measures 400 kilometers wide and 1.800 kilometers long) is second largest island in Indonesia, and one of the richest island of Indonesia for animals [13]. Sumatra is an home for 756 species of butterflies [14], but this number is out of date and must be increase. Many of Sumatran butterflies are endemic, and their distribution range have extended [15]. *Acraea terpsicore* is one new listed butterfly in Sumatra that just has added in recent years from a collected specimen from Padang by Museum Zoologicum Bogoriense and a specimen collected with labelled 'Mouth Kerinci' in 2009 [11], although this species arrived earlier in 2008 [16]. In this paper, we summarize more recent records of *A. terpsicore* in Sumatra, providing new insights about its recent distibutional status.

2. Materials and Methods

Records of present details of *A. terpsicore* were compiled from published and unpublished informations, particularly from local researchers and butterfly enthusiasts. Many records were also obtained from local social media (mainly Facebook group of butterflies in Indonesia) and internet supported with photographs or other evidence (e. g. location, habitat type, morphology and descriptions). All records included herein were verified; and doubtfull or unconfirmed records were rejected.

3. Results and Discussion

There are 40 confirmed spatial records *A. terpsicore* between 2008 to 2020 in Sumatra (Table 1). These records add 36 new records of *A. terpsicore* after reported first time in Sumatra [11]. The *A. terpsicore* has been recorded in all provinces in Indonesia, including Aceh, Sumatera Utara (North Sumatra), Riau, Kepulauan Riau (Riau Islands), Sumatera Barat (West Sumatra), Bengkulu, Jambi, Bangka Belitung, Sumatera Selatan (South Sumatra) and Lampung (Figure 1). *Acraea terpsicore* is a relative easily determine species due to its reddish orenge with black markings (male), or orange yellow (female). It is nearly a distinct species, and no other similar butterfly s species in Sumatra. The wing span is about 45-65 mm. Forewing slightly darker, hindwing with a series of orange submarginal spots outlined by black along the border (Figure 2). These characters are fitted well of *A. terpsicore* in field guides [4, 5, 6].

Table 1. Locations and numbers of *A. terpsicore* in Sumatra between 2009 to 2020. Acronym MI refer to Muhammad Iqbal (first author) and IA refer to Ina Aprilia (second author).

No	Location	Number	Dates	Coordinates	Sources
1	Gue Gajah, Aceh Besar, Aceh	1	13 January 2013	05°30' 48"N, 95°18'05"E	[17]
2	Resort Cinta Raja (Leuser), Besitang, Sumatera Utara	1	December 2018	03°56'18"N, 98°04'35"E	[18]
3	Langkat, Sumatera Utara	1	1 May 2019	03° 28'10"N, 98°8'04'' E	[19]
4	Pulau Samosir, Danau Toba, Sumatera Utara	1	May 2019	02°43'05"N, 98°46'59"E	[19]
5	Pasir Pengairan, Rokan Hulu, Riau	14	August-December 2014, December 2014-January 2015	00°51'14"N, 100°15'88"E	[20, 21]
6	Kampus Bina Widya, Pekanbaru, Riau	1	May 2012	00°30'29"N, 101°26' 41"E	[22]
7	Teluk Binjai, Pelalawan, Riau	1	7 February 201	00° 13' 30"N, 102° 18'54"E	[19]
8	Bangkinang. Kampar, Riau		15 January 201	00° 20'11"N, 101°1'02"E	[19]
9	Pangkalan Kerinci, Pelalawan, Riau	1	3 February 2019	00°21'35"N, 101°51'34"E	[19]
10	Kijang Kota, Bintan, Kepulauan Riau	1	December 2012	00°50'58"N, 104°36'20"E	Farid Muzaki *pers.com*
11	Tanjung Balai Karimun, Karimun island, Kepulauan Riau	6	Between December 2011 and April 2012	00°59'29"N, 103°26'19"E	[23]
12	Cagar Alam Gunung Sago, Tanah Datar, Sumatera Barat	7	September to November 2013	00°18'76"S, 100°45'56"E	[24]
13	Kota Padang, Padang, Sumatera Barat	1	26 February 2020	00°55'32"S, 100°21'43"E	[19]
14	Kota Padang, Padang, Sumatera Barat	1	21 March 2009	00°55'32"S, 100°21'43"E	[11]
15	Kampus Univ. Andalas, Padang, Sumatera Barat		21 September 2019	00°54'33"S, 100°30' 52"E	IA *pers. obs*
16	Air Terjun Lubuk Hitam, Padang, Sumatera Barat	1	Maret-April 2018	01°03'92"S, 100°25'20"E	[25]
17	Pemayungan, Tebo, Jambi	3	17 January 2020	01°04' 60'S, 102°25'30"E	MI *pers.obs*
18	Gunung Kerinci, Kerinci, Jambi	1	21 March 2009	01°42'14"S, 101°16'15"E	[11]
19	Pematang Kabau, Surolangun, Jambi	1	dry season, 2017	01°58'11"S, 102°36'32"E	[26]
20	Kampus Pinang Masak, Kota Jambi, Jambi	19	c. January-June 2019	01°34'44"S, 103°32'55"E	[27]
21	Hutan Kota M. Sabki, Jambi, Jambi	1	January-February 2012	01°39'21"S, 103°35'18"E	[28]
22	Singkawang, Muara Bulian, Jambi	1	dry season 2017	01°51'13"S, 103°18'34"E	[26]
23	Hutan Harapan, Muara Bulian, Jambi	1	August 2008, dry season 2017	01°41'37"S, 103°16'43"E	[25]
24	Kampus Universitas Bengkulu, Bengkulu	1	Agustus-Oktober 2015	03°45'31"S, 102°16'16"E	[29]
25	Banjar Sari, Enggano, Bengkulu	>5	28 February 2020	05°17'41"S, 102°09'35"E	MI *pers.obs*
26	Belinyu, Bangka, Bangka Belitung	1	1 January 2020	01° 36'48"S, 105°45'27'E	[19]
27	Sungailiat, Bangka, Bangka Belitung	1	25 December 2019	01°51' 19"S, 106°07'44"E	[30]
28	Bakam, Bangka, Kepulauan Bangka Belitung	3	2 October 2014	01°54'35"S, 105°53'37"E	MI *pers.obs*
29	SM Dangku, Musi Banyuasin, Sumatera Selatan	>30	4 January 2020	02°35'30"S, 103°40'57"E	[31]
30	Merang Kepayang (PT GAL), Musi Banyuasin, Sumatera Selatan	5	5 March 2019	02°12'25"S, 104°25'47"E	[31]

31	Sungai Bungin (PT Raja Palma), Banyuasin, Sumatera Selatan	>10	2 September 2019	02°11'13"S, 104°43'34"E	MI *pers.obs*
32	Tugu Mulyo, Musi Rawas, Sumatera Selatan	45	July 2018	03°55'57"S, 102°57'26"E	[32]
33	Talang Kelapa, Palembang, Sumatera Selatan	1	1 October 2015	02°56'46"S, 104°41'57"E	MI *pers.obs*
34	Talang Pangeran, Indralaya, Sumatera Selatan	1	20 February 2020	03°12' 16"S, 104°43'29"E	[19]
35	Kampus UNSRI Indralaya, Indralaya, Sumatera Selatan	>10	17 March 2020	03°14'29"S, 104°39'54"E	MI *pers.obs*
36	Lebong Hitam (KPPN), OKI, Sumatera Selatan	1	5 May 2016	03°19'37"S, 105°24'50"E	[31]
37	SM Gunung Raya, Sumatera Selatan	1	1 February 2017	04°53'18"S, 104°04'50"E	[31]
38	Sukadana, Lampung Timur, Lampung	1	19 July 2019	05°06'16" S, 105°40'17"E	[19]
39	Taman Kupu-kupu Gita Persada, Pesawaran, Lampung	1	2019	05°24' 22"S, 105°14'54"E	[33]
40	Belitung island, Bangka Belitung province	>10	2014	Unspecified location, not include in map	Ady Septianto Hermawan *pers.com*

Coming as 'foreigner' in 2009, summarize recent records of *A. terpsicore* in Sumatra suggest that *A. terpsicore* has wide spread to and colonialized. Species present in a region but not native have been termed *allien*, *exotic*, *non-indigenous* and *non-native*, but the various nonbiological uses, sometimes pejorative, of the terms *allien* and *exotic* have lead biologists to use nonindigenous and especially nonnative for species not native to a region [34]. When species move into new regions, they become exotics; over time, this species 'naturalise' and become native [35]. As people in that many natives are immigrants that have been in a country long enough become members and citizens of a community [36]. The presence of *A. terpsicore* in Sumatra and other islands in Indonesia have been meet this phenomenon.

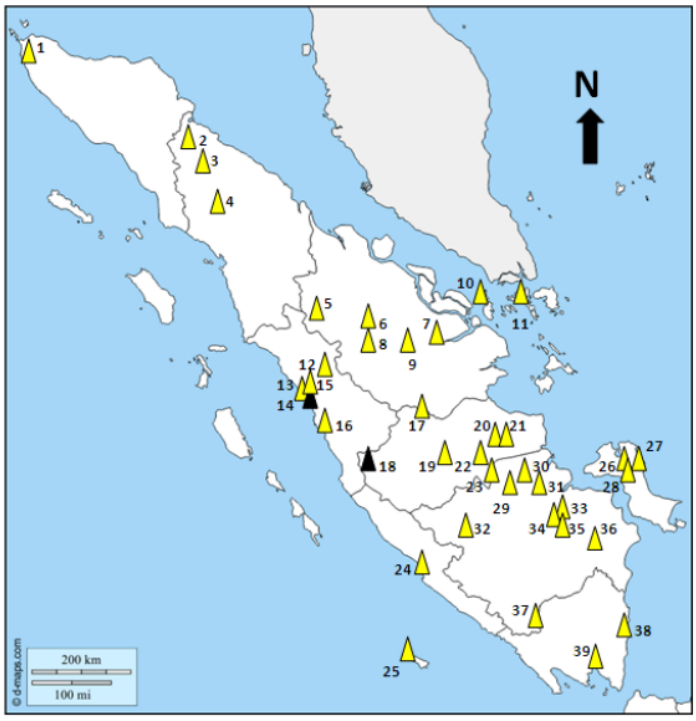

Figure 1. Records of *A. terpsicore* in Sumatra. Black triangles show records in Braby et al. (2014) and yellow triangles are recent reords.

Figure 2. Tawny coster *A. terpsicore* in Sumatra: **A.** Female from Enggano island, Bengkulu province, 28 February 2020; **B.** Male from Enggano island, Bengkulu province, 28 February 2020; **C.** Young male from Pemayungan, Jambi province, 17 January 2020; **D.** Male from Bangka city, Bangka Belitung povince, 2 October 2014 (©Muhammad Iqbal).

The *A. terpsicore* occurs in highly modified open areas, cultivated lands, disturbed grassland, degraded forest, including suburban roadsides [12, 37]. In the recent years, number of forested areas to be converted for various purposes have been increased, providing many open habitats and grass land areas, which support potential and suitable habitat for *A.terpsicore*. This species unlikely to become an economic pest of tropical agriculture [37], but it may pose a biodiversity threat to native *Acraea* sp (eg. *Acraea issoria*) in Sumatra because the larvae competion for food plants. For this reason, further monitoring is needed to looking at trend of *A. terpsicore* and its impact to native butterflies population in the future.

4. Conclusion

A total of 40 confirmed records of *A. terpsicore* suggest this species has been wide spread and established in Sumatra. As a non-native species in Sumatra, *A. terpsicore* has been came as foreigner to be a naturalization species recently.

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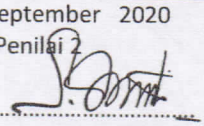
Kelengkapan dan Kesesuaian unsur isi jurnal (10%)				2		1
Ruang lingkup dan kedalaman pembahasan (30%)				6		5
Kecukupan dan Kemutahiran data/informasi dan metodologi (30%)				6		5
Kelengkapan unsur dan kualitas penerbit (30%)				6		6
Total = (100%)				20		17
Kontribusi Pengusul (Penulis Pertama /Anggota Utama)	BIOVALENTIA: Biological Research Journal. Vol. 6(2): 21-26 Edisi November 2020. Penulis ke 3 dari 3. Nilai maksimal 85%. Nilai pengusul: (0,4 x 0,90 x 20)/2 = 2,67					**1,7**

KOMENTAR/ULASAN *PEER REVIEW*	
• Kelengkapan dan Kesesuaian Unsur:	Lengkap dan berurutan sesuai aturan. Paper ke dua dalam satu edisi, masih memenuhi sarat untuk PAK.
• Ruang Lingkup dan Kedalaman Pembahasan:	Ruang lingkup masih terkait bidang ilmu biologi konservasi. Pembahasan cukup.
• Kecukupan & Kemutakhiran Data & Metodologi:	Data sudah cukup dan gambar menarik. Metode sudah sering dilakukan peneliti lain.
• Kelengkapan Unsur & Kualitas Penerbit:	Penerbit berkualitas. Terakreditasi Sinta 3

Yogyakarta, 12 September 2020
Penilai 2



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