Identification of types and important value of aquatic vegetation and their potential (1)

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Identification of types and important value of aquatic vegetation and their potential to improve water quality in irigation canals of Mulyasari Village, Banyuasin District

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Abstract. Irrigation has an important role as a source of irrigating rice fields. Irrigation water is often contaminated by waste from anthropogenic activity. Indications of pollution in irrigation channels because the use of pesticides or other chemicals in agricultural land can be observed based on the number and type of vegetation that grows in the irrigation canal. Vegetation that grows in these waters is also believed to have the potential to improve the quality of water as phytoremediation. This study aims to determine the characteristics of vegetation, identify species that grow around the irrigation canals, and calculate the importance of aquatic and riparian vegetation in the irrigation channels of Mulyasari Village, Banyuasin Regency and analyze the potential of aquatic and riparian vegetation. to improve water quality. The method used to determine the station in this study is purposive sampling method. Vegetation analysis was carried out at 4 station points, research was conducted at low tide.. A bamboo quadrate plot having measurement of 1m x 1m with a perpendicular stake is used for data collection on aquatic vegetation, its type is observed and recorded. The results of the study found 6 types of vegetation, namely: *Eleucharis dulcis*, *Hydrilla verticillata*, *Nymphae alba*, *Swersia hexandra Sw*, *Eleucharis acicularis*, and *Eleusine indica*. Aquatic vegetation is dominated by flowering vegetation with linear leaf type. This study also shows that aquatic or riparian vegetation such as *Eleucharis acicularis* are the species that dominate canal waters with the highest Important Value Index is 46.51-81.22%, while *Eleusine indica* is a type of vegetation that tends to be rarely found (the average important value index is 10.86-19.84 %). Based on this, it was concluded that aquatic vegetation such as *Eleucharis acicularis*, which was found in the irrigation channel was the dominant vegetation in the canal. This vegetation has the potential as a phytoremidiation agent because of its role in maintaining the balance of the aquatic ecosystem so that it can improve the quality of water and can also be used as organic fertilizer, biofilter, and absorbent toxic elements. *Eleucharis dulcis* can improve the quality of water during the dry season by absorbing toxic dissolved ompounds

1. Introduction

Irrigation based on South Sumatra Regional Regulation No. 21 of 2010 is an effort to supply, regulate and discharge irrigation water to support agriculture whose types include surface irrigation, swamp irrigation, underground water irrigation, pump irrigation and pond irrigation. Tidal water channel according to Saputra et al (2013) serves as an inlet and reservoir of water during high tide and rain (regulates water during the growing season and reduces the impact of runoff containing pyrite). Tidal land according to Laoh (2002) has a low soil fertility so that the processing of soil fertility by using fertilizer is carried out. Murtiono and Wuryanta (2016) added that land processing has an impact on decreasing land water quality and weed growth. One component of the ecosystem that plays an

important role in maintaining water quality is the riparian ecosystem. The ecological function of riparian vegetation is to support ecosystem stability because it plays a role in the cycle of carbon, oxygen, nitrogen and the water cycle (Richardson et al, 2007). Riparian degradation occurs due to various disorders such as the entry of pesticide waste into the irrigation canal. The important role of riparian vegetation needs to be our concern.

Aquatic vegetation that grows in the irrigation channel of Desa Mulya Sari is a type of leafy vegetation floating on the surface with roots at the bottom of the water, vegetation that has roots in water and lives on the surface, and vegetation whose leaves is drown in water (Septiani, 2018). Fitra (2008) describes the explosion of a water vegetation population influenced by the increasing number of nutrients in the waters. Water vegetation has enormous potential in improving water quality, according to Rijal (2015), improvement of water quality can be through photosynthesis of aquatic plants which helps aerate waters, clean polluted streams through sedimentation processes, regulating the water flow, and absorption of particles and minerals.

The importance of aquatic vegetation in assisting aeration of the waters requires research on aquatic vegetation in the irrigation channel of Desa Mulyasari. The purpose of this study was to analyze the types of vegetation and important value index (INP) in the tertiary irrigation channels of Desa Mulyasari, Banyuasin District, which included relative density (KR), relative frequency (FR), and frequency of attendance (FK).

2. Research Method

This research located at Irrigation Channel of Mulyasari village, Banyuasin district. The tertiary channel has a length of 800 m and the research station is in the tertiary close to the primary channel 17 and is not far from the secondary irrigation water gate. Vegetation analysis was carried out at 4 station points, research was conducted at low tide. The method used to determine the station in this study is purposive sampling method. A bamboo quadrate plot having measurement of 1m x 1m with a perpendicular stake is used for data collection on aquatic vegetation, its type is observed and recorded. Identification of vegetation conducted at the Ecology Laboratory, Department Biology of Sriwijaya University. Map of the research location is presented in Figure 1 (Source: personal data, 2016).

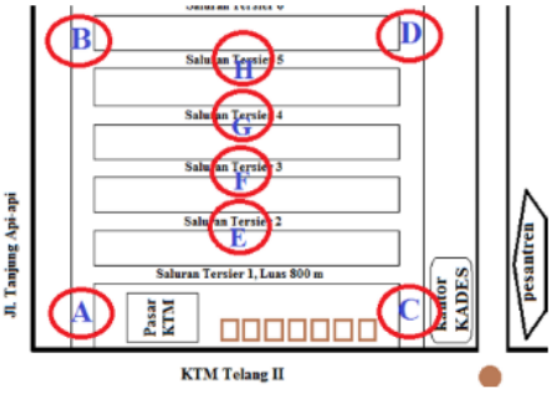

Figure 1. Research Location Map in Tertiary Channels

2.1. Important Value Index

The important value index of each plant species found in tidal irrigation channels is calculated through the following approach (Augusta, 2015).

$$INP = KR + FR$$

where INP : Important Value Index
KR : Relative Density
FR : Relative Frequency

2.1.1. Population Density (KP)

$$KP\,ind/m^2 = \frac{number\ of\ individuals\ of\ a\ type}{plot\ area}$$

2.1.2. Relative Density (KR)

$$KR\ (\%) = \frac{Density\ of\ a\ type}{Number\ of\ density\ of\ whole\ type} \times 100\%$$

2.1.3. Frequency of Attendance (FK)

$$FK = \frac{number\ of\ plot\ occupied\ by\ a\ type}{Total\ number\ of\ plot}$$

2.1.4. Frekuensi Relatif (FR)

$$FR = \frac{FK\ of\ a\ type}{FK\ of\ whole\ type} \times 100\%$$

with, FR : 0 – 25% = very rarely
25 – 50% = rarely
50 – 75% = frequently
> 75% = very frequently

3. Results and Discussions

Vegetation analysis is a way to study the composition and shape of vegetation (Parmadi et al 2016). Quantitative analysis of vegetation can be seen in Table 1 and Table 2.

3.1. Value of Population Density, Relative Density, Relative Frequency and Important Value

The highest Important Value Index is *Eleucharis acicularis* with average value of 46.51 - 81.22%, while the lowest is *Eleusine indica* with 10.86 - 19.84%. Population Density (KP) and Relative Density (KR) have the highest density values in *Eleucharis dulcis* and the lowest in *Eleusine indica*. The frequency of attendance (FK) ranges from 0.33% - 1% the more the number of species found in squares, the higher the frequency of attendance (Parmadi et al, 2016).

Relative frequency (FR) at station A found vegetation such as *Eleucharis acicularis*, *Leersia hexandra* and *Nymphae alba* valued at 27.27% means that the frequency of presence is rarely found, while *Eleusine indica* is very rarely found. Relative frequency (FR) of station B with *Eleucharis dulcis* and *Nymphae alba*, frequency of presence is rarely found, while *Leersia hexandra* is very rarely found. The relative frequency (FR) of station C with *Eleucharis dulcis*, *Nymphae alba* and *Leersia hexandra*, frequency of presence is rarely found, while Eleusine indica is very rarely found. Relative frequency (FR) station D with *Eleucharis dulcis*, *Nymphae alba*, *Leersia hexandra Eleusine indica*, *Eleucharis acicul*aris and *Hydrilla verticillata*, frequency of presence is rarely found. *Eleucharis dulcis* vegetation dominates the attendance compared to other species. *Eleucharis dulcis* vegetation is able to thrive in acid sulphate waters with low fertility. Low density vegetation is *Eleusine indica*, this vegetation cannot survive with acidic water conditions and low soil fertility.

Table 1. Quantitative analysis of vegetation at stations A and B

No	Nama spesies	Station A					Station B				
		KP	**KR**	**FK**	**FR**	**NP**	**KP**	**KR**	**FK**	**FR**	**NP**
1	*Eleucharis dulcis*	29.33	48.89	1	27.27	76.16	30.33	47.89	1	33.3	81.22
2	*Hydrilla verticillata*	0	0	0	0	0	0	0	0	0	0
2	*Nymphae alba*	23.33	38.89	1	27.27	66.16	25.67	40.52	1	33.3	73.85
4	*Leersia hexandra Sw*	6.33	10.56	1	27.27	37.82	6.33	10	0.67	20	32.22
5	*Elecharis acicularis*	0	0	0	0	0	0	0	0	0	0
6	*Eleusine indica*	1	1.67	0.67	18.18	19.84	1	1.57	0.33	11.1	12.69
	Total Sum					200					200
	Total Species			4					4		

Table 2. Value Population Density (KP), Relative Density (KR%), Relative Frequency (FR%) and Important Value (NP) of Station C and D

No	Nama spesies	Stasiun C					Stasiun D				
		KP	**KR**	**FK**	**FR**	**NP**	**KP**	**KR**	**FK**	**FR**	**NP**
1	*Eleucharis dulcis*	15.33	40.70	1	27.27	67.98	39	29.84	1	16.67	46.51
2	*Hydrilla verticillata*	0	0	0	0	0	53	40.56	1	16.67	57.22
3	*Nymphae alba*	13	34.51	1	27.27	61.78	15	11.47	1	16.67	28.14
4	*Leersia hexandra Sw*	6.33	16.81	1	27.27	44.08	5	3.82	1	16.67	20.49
4	*Eleucharis acicularis*	2.33	6.19	0.33	9.09	15.28	16.67	12.75	1	16.67	29.42
6	*Eleusine indica*	0.67	1.76	0.33	9.09	10.86	2	1.53	1	16.67	18.19
	Total Sum					200					200
	Total Species			5					6		

Eleucharis sp or purun is a type of grass plant that lives wild near water or swamps. Usually there are many species in the province of South Sumatra, one of them is in the Organ Ilir district. *Eleucharis sp* plants are wild plants that are flammable when dry (*https://id.wikipedia.org/wiki/Purun*; access Oktober 19, 2018). The dominant riparian vegetation is *Eleucharis dulcis*. *Eleucharis dulcis* is one of the many wild plants found in tidal acid sulphate swamps. This plant functions as a white rice stem borer trapping plant, and can also be used as organic fertilizer, biofilter, and absorbent toxic elements. As a biofilter, *Eleucharis dulcis* can improve the quality of water during the dry season by absorbing toxic dissolved ompounds, such as iron (Fe) and sulfate (SO4) in the inlet (irrigation) and drainage channels, as well as absorbing heavy metal lead (Pb) from the palm oil industry (Asikin and Thamrin, 2012)

3.2. Type of Vegetation Identification

Results of vegetation analysis found 6 types of species in 4 observation stations. The species found in this study were *Eleucharis dulcis*, *Hydrilla verticillata, Nymphae alba*, *Leersia hexandra Sw, Eleucharis acicularis*, and *Eleusine indica* (see Table 3). Species of aquatic vegetation in the tertiary that are directly related to rice fields have a large and varied amount of vegetation, factors that influence the existence of vegetation are N and P substrates from fertilization. Aquatic vegetation found only in tertiary 5 is *H. verticillata*, this vegetation is suitable to live in polluted waters, and according to Silalahi (2009), Hydrilla has the ability to absorb heavy metals in the waters and are plants that drown in the bottom of the waters. To carry out the photosynthesis process, this plant is very dependent on the brightness or penetration of sunlight. The vegetation that dominated in this study was shown by the density of emersed (emerging) type of aquatic plants such as *Eleucharis*

dulcis, *Leersia hexandra*, *Eleucharis acicularis*, and *Eleusine indica*. Floating vegetation, *Nymphae alba* and submerged, are *Hydrilla verticillata* with the shield shape. Tertiary irrigation channels are dominated by flowering plants and have flat leaf margins. The type of leaf arrangement of *Eleucharis dulcis, Nymphae alba* and *Eleucharis acicularis* have been modified so that the type of leaf arrangement is not opposite, alternate and whorled.

Riparian zones are three-dimensional zones of direct interaction between terrestrial and aquatic ecosystems (Gregory *et al*. 1991 *in* Collier, *et. al* 1995). Appropriate changes to the management of riparian zones can be a very effective means of reducing the impacts of catchment development on watercourses while still maintaining production. Because riparian zones occur where major ecosystems – aquatic and land-based – meet, they provide habitats not found elsewhere which are important for the survival of a number of native plants and animals. Collier, *et. al*. (1995) also add that the ecological functions that riparian zones can perform and the in-stream benefits that are buffers banks from erosion, buffers channels from localised changes in morphology, buffers input of nutrients, soil, microbes and pesticides in overland flow. Some of the vegetation identified grew in the waterways in the village of Mulyasari, Banyuasin Regency shown in Table 3.

Table 3. Identification of aquatic vegetation

Species	Local Name	Mode of Life	Habitat	Type of Leaf	Type of Leaf Arrangement	Type of Fringe Leaf	Flower of No Flower
Eleucharis dulcis	Purun tikus	Emersed	Swamp, sour water	Linear	-	Entire	Flower
Hydrilla verticillata	Ganggang air	Submersed	Lake, pond, irrigation, etc.	Linear	Whorled	Entire	Flower
Nymphae alba	Teratai putih	Free-floating	Lake, pond, irrigation	Shield shape	-	Entire	Flower
Leersia hexandra Sw	Benta/banta /uru parai	Emersed	Lakes, rivers, irrigation, swamps, ponds etc.	Linear	Alternate	Entire	Flower
Eleucharis acicularis	Purun air/rumput air	Emersed	Swamp, sour water	Linear	-	Entire	Flower
Eleusine indica	Rumput belulang	Emersed	Lakes, rivers, irrigation, swamps, ponds etc.	Linear	Alternate	Entire	Flower

Riparian vegetation as a phytoremediation agent can reduce heavy metal pollution, so the pH level drops. pH levels decrease due to heavy metals that bind OH, absorbed by phytoremediation agents (Prasetyo and Catur, 2013). If OH is available quite a lot, the heavy metal will not bind OH-with H + and produce low pH levels (Bhargavi and Sudha, 2011 *in* Rachmawati, and Catur, 2014). Riparian vegetation has the potential to reduce water velocity due to the rooting of riparian vegetation which is then useful for suppressing soil erosion caused by irrigation water currents and resulting in low turbidity (Collier *et al*., 1995).

Riparian vegetation plays an important role in improving water quality where the vegetation (hydromacrophyta) is able to reduce the concentration of several water physicochemical parameters such as total suspended solid, total disolve suspended, nitrate, orthophosphate, ammonium, temperature, conductivity and increase dissolved oxygen levels in the downstream irrigation channels (Prasetyo and Catur, 2013).

Research from Septiani et al (2018) on the condition of the waters in the irrigation channel of Mulyasari village tended to be good based on DO, BOD, TSS, and pH values. Septiani et al (2018) added that the quality of water and the character of good irrigation canal sediments were more caused by high DO and TDS values than the effects of temperature, BOD, and pH.

The statement supports the results of research conducted and convinces the notion that the existence of vegetation such as Eleucharis sp in irrigation waters can indeed help to improve the quality of the aquatic environment.

4. Conclusion

Found 6 types of aquatic or riparian vegetation in the tersier irrigation canal in Mulyasari Village, Banyuasin District, namely *Eleucharis dulcis*, *Hydrilla verticillata*, *Nymphae alba*, *Leuria hexandra* Sw, *Eleucharis acicularis*, and *Eleusine* indica. *Eleucharis acicularis* which was found in the irrigation channel was the dominant vegetation in the canal. This vegetation has the potential as a phytoremidiation agent because of its role in maintaining the balance of the aquatic ecosystem so that it can improve the quality of water and its ability as a white rice borer trap, and and can also be used as organic fertilizer, biofilter, and absorbent toxic elements. As a biofilter, *Eleucharis dulcis* can improve the quality of water during the dry season by absorbing toxic dissolved ompounds. Although it is necessary to do research on the ability of these vegetation as phytoremediation agents

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