Population Density of Damselfly Agriocnemis femina (Odonata: Coenagrionidae) in Manik Rambung Ricefield, Simalungun-Sumatera Utara

Kepadatan Populasi Capung *Agriocnemis femina* (Odonata: Coenagrionidae) di Pertanaman Padi Sawah di Desa Manik Rambung, Simalungun-Sumatera Utara

Ameilia Zuliyanti Siregar[1], Che Salmah Md. Rawi[2], and Zulkifli Nasution[3]
[1]Postgraduate Student in School of Biological Sciences-University Science Malaysia
[2]School of Biological Sciences-University Science Malaysia
[3]Dept.Agroecotechnology of Faculty of Agriculture-Universitas Sumatera Utara
zuliyanti@yahoo.com, azs_yanti@gmail.com

Abstract

The objective of this research was to study effect and correlation of physics-chemistries with density of A. femina. The method using Mark Release Recapture with 8 stations in Manik Rambung Village, Simalungun District. The result showed 2351 individuals of A. femina, consist of male 1345 individuals and female 1006 individuals. Comparison of male and female were 87% and 13%, while score of Lincoln's indices highest calculated in twelve sampling were 451 individuals. The result of analysis correlation showed humidity given effects on population of density A. femina recapture were 0.432.
Keyswords : *Density, damselfly, Agriocnemis femina, rice field, Simalungun.*

Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh dan korelasi faktor fisik-kimia lingkungan dengan kepadatan capung A. femina. Metoda yang digunakan adalah teknik tandai-lepas-tangkap pada delapan titik stasiun pengamatan di Desa Manik Rambung, Simalungun-Sumatera Utara. Hasil penelitian menunjukkan sebanyak 2351 individu A. femina, terdiri dari 1345 ekor jantan dan 1006 ekor betina. Persentase perbandingan jantan dan betina adalah 87% dan 13%, sedangkan nilai indeks Lincoln's tertinggi tercatat pada pengambilan sampel kedua belas sebesar 451 ekor. Hasil korelasi menunjukkan bahwa kelembaban udara mempengaruhi kepadatan populasi capung yang tertangkap sebesar 0.432.
Kata Kunci : kepadatan, capung, Agriocnemis femina, padi sawah, Simalungun.

Introduction

North Sumatra Province is an agricultural area that became the center of the development of plantations and horticulture. The area of irrigated agricultural land covers 135,872 ha of technical, non technical irrigation rice field area of 141,383 ha, with irrigation canal primary, secondary and tertiary throughout the 820,462 meters. In 2008, these fields produce more than 3 million tons of paddy and rice production forecast will continue to increase in 2010 (BPS North Sumatra, 2010). According to the BPS North Sumatra (2010), Simalungun District is one of the major rice granary areas in North Sumatra. Many varies type of rice that cultivate in Simalungun is such as Ciherang, IR 42, IR 36, IR 64, IR 66 (BBPTP, 2009). Based on information from the Ministry of Agriculture of North Sumatra (2009), altitude Simalungun regency between 20-1400 m above sea level, including in the Manik Rambung Village with altitude were 594-602 m above sea level (Siregar et. al., 2009).

In rice cultivation often encountered many obstacles, including the influence of climate and pests attack (Sudarmo, 1991). Analyze the population of natural enemies in pest control is very important done

(Harahap, 1994). The presence of insect predators of rice pests is less abundance, it is probably caused by human activities such as improper use of pesticide doses and targets, so that the existence of types of rice insect pest predators decreased.

Damselfly of *Agriocnemis* spp. are various types of pest predators in the area of paddy fields (Gangurde, 2007; Erniwati, 2009; Poorani, 1990; Siregar, et al., 2005; Barrion and Litsinger, 1994 *in* Gunathilagaraj., et al., 1999). Triplehorn and Norman (2005), explained the damselflies prey on insects such as gnats, mosquitoes, small moths as well as other pests such as Ganjur (*Orseolia oryzae*), brown plant hopper (*Nilaparvata lugens*), white black plant hopper (*Sogatella furcifera*), green leafhoppers (*Nephotettix* spp.) and others found in paddy rice field ecosystem. Otherwise, it is not known the population of *A. femina* and its correlation to the physical and chemical environmental factors on upland rice field. Based on this reason, research on population density of *A. femin*a were done.

Materials and Methods

Time and Place

This research was conducted on March 18, 2010 until June 6, 2010 in paddy rice cultivation in Manik Rambung Village, North Sumatra. The research sampling at altitude are 2°53'52.8 "N and longitude were 99°00'24.4" E. Observations were carried out 24 times, starting from rice cultivation until harvest, with a sampling time interval for 3-4 days. Each observation performed on since early morning until late afternoon for ± 3 hours.

Tools and Materials

The tools used are: lux meter, hygrometer, thermometer, ruler size 30 cm, the meter size of 5 m, pH meters, micrometer scrubs, dragonfly net diameter 30 cm (Odonata net), Odonata box, the sample bottle, brush, plastic, books identification of Odonata (Susanti, 1998; Orr, et al. 2005; Morse et al., (1994); Merritt and Cummins (1996). The material used were dragonfly (*A. femina*), aquadest destilate, ink-marker (May 1980; Mc Vey 1985; Tan & Jaal 1986) with several colors (Salmah *et al.* 2000), red, blue, green, yellow, orange, and brown.

Determination Area Sampling Plot

Eighth point research station is determined using *purposive random sampling method* in paddy rice fields (Che Salmah, 2000). Furthermore, measurements were taken ordinate point on the sampling area (altitude and longitude) using a Garmin GPS 7.0. Then sampling sites determine such as Figure 1 below.

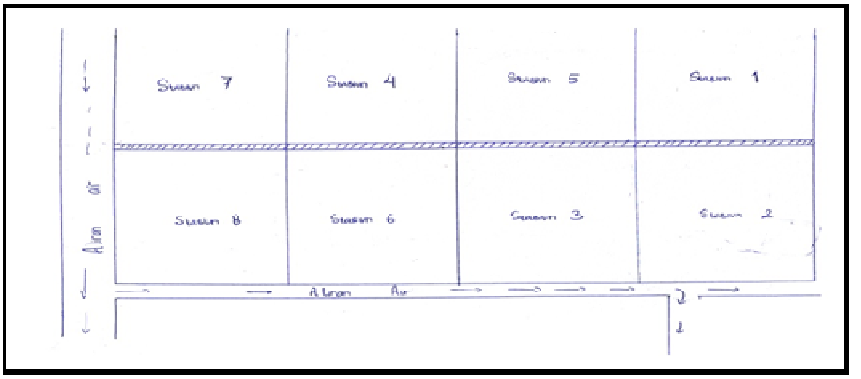

Figure 1. Map of sampling station plots (15 mx 15 m, 1800 m 2) (Ameilia et al, 2010)

Sampling Method

Sampling method was done using *Mark Release recapture methods* (MRR) using Odonata net, with the following procedures below.

1. Dragonfly wings marked captured using the ink-marker, marking should be done in accordance with the station making (Figure 2).

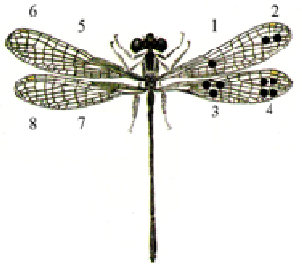

Figure 2. Labeling of damselfly wings (Ameilia, 2010)

2. Further note the sex of dragonflies (male and female) using the manual Susan (1998), Orr et al., (2005); and Morse et al., (1984).
3. Then the dragonfly is inserted into the Odonata box. After the capture and tagging all the dragonfly is finished, then all the dragonflies are released at each sampling station initially.
4. Conducted sampling for ± 20 minutes at each station. When taking the data found a dragonfly that has been identified in previous sampling, then the wings are marked with different color ink marker.

Measurement of Physics-Chemical Factors

Measurement of Physics-Chemicals Factors performed as Table 1 below:

Table 1. Physical-Chemical Factors Measurements

No	Parameter Physics – Chemicals	Measure	Tool	Procedure
1.	Air Temperature	°C	Thermometer	In – situ
2.	Water Temperature	°C	Thermometer	In – situ
3.	Light Intensity	Candela	Lux meter	In – situ
4.	Humidity	%	Hygrometer	In - situ
5.	RainFall	mm	Funnel Rainwater	In - situ
6.	Wind Speed	m/s	Anemometer	In – situ
7.	Tall Steams of Rice Plant	Cm	Ruler 30 cm & 5 m	In - situ
8.	Water Depth	Cm	Ruler 5 m	In - situ
9.	pH	-	pH meter	In - situ
10.	Content of Organic Substrate (N & P)	%	Oven and Tanur	Laboratorium

Analysis of Data

Each sampling at each station are calculated: the total dragonfly, male and female ratio, density, relative density, Lincoln index (Suin, 2003), and correlation of physical-chemical factors on the population density of *A. femina* was caught using Pearson correlation analysis (SPSS) version 15.00.

Population density (K)

K di stationss 1 = $\frac{\textit{Jumlah individu suatu jenis}}{\textit{Jumlah plot ditempati seluruh individu / luas / volume}}$

Relative density (KR)

$$KR1 = \frac{ni}{\sum N} \times 100\ \%$$

Where:

Ni = the value of K species, a station

∑ N = total individuals of all stations

Insect Population Density (Lincoln Index)

$$N = \frac{F1XF2}{F3}$$

With 95% confidence interval index and 99% using the formula:
* Index of 95% confidence interval = F 1 : (p + $1{,}96\sqrt{pxq : F2}$) sampai dengan F 1 : (p - $1{,}96\sqrt{pxq : F2}$)

* 99% confidence interval index = F1 : (p + $2{,}58\sqrt{pxq : F2}$) sampai dengan F 1 : (p - $2{,}58\sqrt{pxq : F2}$)

Where:
N : Total population
F 1 : Number of animals results in the arrest of the first mark and pull back
F 2 : Number of animal results to two arrests
F 3 : Number of animals marked the second arrest

p : F3/F2

q : $\frac{F2 - F3}{F2}$

According Sugiyono (2005), the degree of correlation index values listed in Table 2

Table 2. Relationship value correlation with population density of *A. femina*

Coefficient of internal	Relation Level	Interpretation
0.00 – 0.199	Very Low	No Association
0.20 – 0.399	Small	Related Low
0.40 – 0.599	Medium	Related
0.60 – 0.799	Strong	Strong Related
0.80 – 1.00	Strongest	Very Cosely Related

Results and Discussion

Distribution Damselfly of *A. femina*

Comparison and distribution males and females of *Agriocnemis femina* from 24 times mark release recapture shown in Figure 3.

Figure 3 recorded the highest number of males in tenth sampling on 18 April 2010 were found 93 individuals. While taking in fourteenth and sixteenth, the number of males arrested decreased. Then increases individuals of male of *A. femina* until finally fell back on making from 24th sampling were 30 individuals. It's no differences by males, females also experienced the same thing which is the highest number of females in twelve sampling on 25 April 2010 recorded 78 individuals. While it has decreased while at making the 16 individuals and 18 individuals, until finally rising and falling back on making the 24th sampling from 16 individuals.

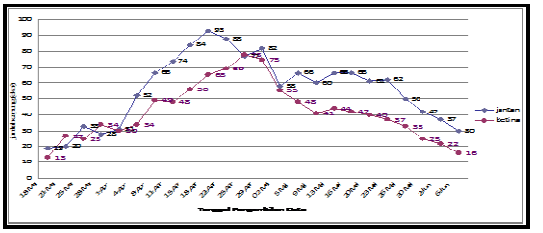

Figure 3. Graph Distribution of Males and Females of *A.femina*

Differences of gender distribution *A.femina* is influenced by environmental factors, including climate, population density, and dietary factors (Borror et al., 2004; Merritt & Cummins, 2006; McCafferty and Provonsha, 1981). Natawigena (1990) describes *Aspidiotus destructor rigidis* (coconut aphids) if sufficient food is a balanced ratio of male and female. But when food is not available, then the next most insect male offspring. According Suin (2003), population growth running all the time. Changes that occur during the course of time, there is a rapid and some are slow.

From these values can be assumed that these stations are suitable habitat for the dragonfly's life, where the station has a lush paddy crop as well as close to the flow of drainage. Sukarsono (2009) explains the presence of a population of animals in one place and spread of animal species is always associated with the habitats and ecological niches they occupy. Supported by Buchwald (1994), the number of species Odonata

depending on the structure and composition of vegetation. According to Orr (2005), *A. femina* commonly found in drains and in the pool, on an open area with an altitude of somewhere between 0-1600 m above sea level, the habitat is suitable and appropriate for the dragonflies to breed and survive in paddy rice cultivation, which almost always have a puddle of water. For most of dragonflies live near the water.

While McCafferty and Arwin (1981) argues damselflies and dragonflies perched on vegetation stems of plants while copulation. According to Triplehorn & Norman (2005) states the majority of species of dragonfly suborder Zygoptera after copulation, the female will lay her eggs into the water. Orr (2005), adding the species *A. femina* breed in stagnant water and strong flow of water with low flow.

A birthrate in new individual dragonflies also affect population density in the area. According Suin (2003) density of a species in one place is never fixed, always someone coming (birth and immigration), and go (death and emigration). Births cause increasing population number. Natawigena (1990) added that the birthrate is the ability of insect species to give birth to new offspring. Insects generally have a relatively high birth. The smaller size of insects, usually the greater of it's birth, supported by Susan (1998), that the body size of *A. femina* is only ± 2 cm.

Because *A. femina* is a small damselflies flying speeds are low, so that the displacement from one station to another station is limited. According Triplehorn and Norman (2005); Parr and Parr (1979), family Coenagrionidae is a damselfly that has the ability to fly a bit weak, supported by opinion of Che Salmah (2000), who conducted the study using *Ischnura elegans* (Coenagrionidae) with flight range of not more than 100 meters, so it seems clear that the movement groups of damselflies (suborder Zygoptera) is lower than dragonflies (suborder Anisoptera).

Total Male And Female *A. femina* While Recapture

Total male and female *A. femina* (Odonata: Coenagrionidae), which is marked and caught back from 24 times the observations such as Figure 4 below.

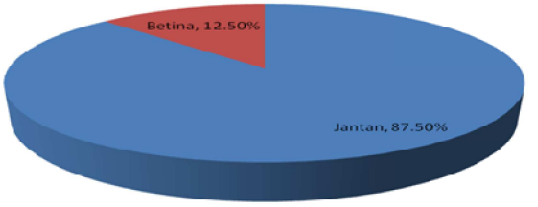

Figure 4. Percentage diagram of male and female of *A. femina*

From Figure 4 seen a male who was caught again have a larger number than the females, where the comparison value of 21 (87%): 3 (13%). This research supported Hannon and Hafernik (2006) of *Ischnura gemina*, where a total of 244 tetangkap dragonfly tail, where the male has a total return which caught most by 75%. From 3 replication arrests made, they earn 40% male (replicate I), 42% (replicate II), 57% (replicate III), and the percentage of females caught again very low at only 18% (replicate I), 8% (replicate II), and 33% (replicate III).

Calculation Value of *A. femina* Using Lincoln Index

Calculation value of *A. femina* using Lincoln Index for 24 times MRR shown in Figure 5.

Figure 5. Graph value calculations using the Lincoln Index

Lincoln Index using to estimate the population density of animals which move likely Odonata (Suin, 2003, Borror et al., 2004). By these method the number of animals will allegedly members of the population was arrested in part, marked, released, arrested then recapture again. Prediction by this method indicated that the organism is based blend perfectly with the other members of the population. In the example of Lincoln's prediction method on the scrap heap obtained population counts as many as 1000 larvae of flies (*Bratocera* sp).

Figure 5 describes the highest scores (*top climax*) damselfly population shown in 12th MRR were 451 individuals. High or low value of the Lincoln index associated with the process of re-re-caught *A. femina*. In addition, various biotic factors (high birthrate, low mortality), and abiotic factors on the optimum conditions (temperature, humidity, rainfall, wind speed), as well as dietary factors (Kandibane et.al., 2005, & Krishnasamy et al. 1983) will affect the process of capture-mark-recapture of *A. Femina*.

Accordance to Heckman (1979), Barrion and Litsinger (1994), and Siregar (2009), the species *A. femina* is a dragonfly pin which is a predator in the ecosystem of paddy fields. Then Che Salmah (1996) argues low percentage *N. tullia* associated with the value of recapture again. Where the sample to-12 is a state that supports the development of dragonfly which the value of air temperature (21.3°C), humidity (80%), rainfall (0 mm), and wind speed (1.39 m/sec).

Supported by Suin (2003) of predation is one of limiting the population density of the reciprocal nature, where life depends on prey, predators because their prey is a source of food. When observed parameters that determine population growth (birth, death, migration), then the predator is one that causes the high rate of mortality for the prey. Conversely a lack of prey will lead to food shortages predators and therefore contributes to the level of his birth, so that will cause low birth rates are predators.

Analysis Correlation *A.femina* with Physics-Chemical Parameters

Correlation between physics-chemical parameters with a total population of density *A. femina* were analyzed using SPSS version 15:00 as Table 3 below.

Table 3. Correlation *A. femina* with Physics-Chemicals Parameter

Parameter	value	Information
Light Intensity	-0.424 (*)	(-) negative (opposite) (*) Corelation significant to level 0.05
Humidity	+0.432(*)	(+) positive (unidirection) (*) korelasi significant to level 0.05
Air Temperature	-0.163	(+) positive (unidirection)
RainFall	-0.104	(-) negative (opposite)
Wind Speed	-0.352	(-) negative (opposite)
Tall Steams of Rice Plant	-0.009	(-) negative (opposite)
Water Temperature	+0.130	(-) negative (opposite)
Water depth	-0.751(**)	(-) negative (opposite) (**) corelation significant to level 0.01
pH	-0.230	(-) negative (opposite)
Totality of N	+0.108	(+) positive (unidirection)
Nitrate- N	+0.174	(+) positive (unidirection)
P-available in soil	-0.563(**)	(-) negative (opposite) (**) corelation significant to level 0.01
Phospate-P	-0.040	(-) negative (opposite)

Table 3 showed the results of Pearson Correlation Analysis of chemical-physical parameters on the number of damselfly. There are 4 parameters are correlated, three of parameters have correlation with a negative value of light intensity, water depth, and the availability of phosphate in the soil. Presumably, the three parameters related to the existence *A. femina* but does not support the population of density damselfly recaptured. Humidity is the only parameter that has a correlation with a positive value to the number of damselfies were caught, where values of humidity were ranged between 76-82%. Otherwise, the higher value of the air humidity increased population of density of *A. femina*. Insects have the tolerance to weather changes, presence/number density of dragonfly *A. femina* closely related to the high and low value of physical-chemical factors, such movements are highly influenced by moisture and vegetation.

According to Che Salmah (1998), humidity factor strongly supports the life of damselflies. Buchwald (1994) opinon the number of species Odonata depending on the structure and composition of vegetation. Che Salmah (2000), adding the presence of dragonflies is influenced by the hedge of grass which is suitable for their habitat. Suin (2002) argues a state of vegetation is strongly linked to the spread of animals in an area. Bambaradeniya and Amerasinghe (2003) suggests the growth of rice plants cause changes in biota in paddy fields.

Sukarsono (2009) reported on land (terrestrial), temperature and humidity will be a strong limiting factor for animals. This can be seen from the distribution and abundance. The more extreme temperature and humidity, the less the type and number of individuals who will live in that place. Natawigena (1990) adds, humidity and temperature is closely related to rainfall, rain/water, water is an absolute necessity for insect life. Sukarsono (2009) also argues fauna that live in an area affected by the distribution of rainfall throughout the year. If the rainfall is concentrated only in certain months only, then at some time organisms are exposed to the dry season. In this period, the water will act as a controlling factor for the occurrence of seasonal activity.

Change the value of physical-chemical parameters in the suspect is due to the various activities undertaken by humans that are harmful to the dragonfly indirectly. According to Susan (1998), Lower number of dragonfly populations caused by the destruction of places to live (habitat) due to human activities, such as drying of the river or lake water, deforestation, pollution from pesticides drugs in agriculture, industrial waste and domestic waste that endanger and destroy the dragonfly nymphs.

Bambaradeniya and Amerasinghe (2003) add agronomic practices to be the main factor controlling the changes in the ecological environment and biodiversity of wetland ecosystems. Climatic factors such as solar radiation, temperature, relative humidity and wind speed will control the evaporation of water the fields, but rainfall also contributed to the fluctuations of chemical compounds in water. Climate parameters will ultimately affect the composition of biota and growth of rice plants.

Conclusions

a. Total individual of *A. femina* were recorded were 2351 individuals, consist of 1345 individual male (87%) and 1006 individuals of female (13%).
b. Lincoln Index calculation highest value in the decision-to-12 that is equal to 451 birds. Air humidity is one of the physical-chemical environmental factors that have a positive correlation to the number of dragonfly populations caught in the amount of 0432 with categorized moderately correlation criteria.

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