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Research article

Density, Morphology and Egg Clusters of Pila scutata Snails at Rice Fields Area in Peringsari Village, Bali

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Abstract.
Pila scutata is a species belonging to the *Ampullariidae* family. One of the habitats of the snail is rice fields. Snails are used as an alternative protein source in Bali. The focus of this research was to determine the snail density, morphology, morphometry, and egg clusters in rice fields in the Selat District of the Karangasem Regency in Bali. Snails were collected in the morning by erecting a 1m x 1m quadrat in each corner of the rice field. Snails ranging in size from small to large were collected in the quadrats, on the surface of the water, in the water, and attached to aquatic plants. Snail egg clusters were discovered while exploring the rice fields where snail samples were collected. Sampling was repeated three times. Snail and egg cluster samples were brought to the lab for examination. The density, frequency of presence, distribution pattern, morphology, and morphometry of the snails were all calculated. The number of eggs in one egg cluster was determined by separating each egg from the egg cluster. According to the findings, the snail density was 3.75 individuals/m2, the presence frequency was absolute, and the distribution pattern was regular. The shell height was 17.02-31.09 mm, and the snails had a subglobose shape with brown transverse band. A single egg cluster could contain 29-67 eggs.

Keywords: *mollusk, ampullariidae, apple snails, Pila*

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1. Introduction

Pila scutata is a freshwater snail known as the apple snail and in Indonesia known as “gondang” snails. The snails is a native species and widespread throughout Southeast Asia including Indonesia (Java, Kalimantan and Bali). In Bali, the species was known as “kakul”. The species was found in calm freshwater habitats, including in rice fields, ponds, and in habitats with slow-moving water flows [1]. Not only the *Pila scutata* snail, other snails belonging to the same family are also sometimes found in rice fields.

The snail is *Pomacea* spp. Both species can be used as alternative protein sources. *Pomacea* spp. is an invasive snail that is very detrimental to farmers because it eats young rice plants so that it can reduce crop yields. The native snail habitat were often invaded by the *Pomacea* spp. [2]. One of the species of the genus Pomacea is *Pomacea canaliculata*. *Pomacea canaliculata* can negatively affect other species, and can affect the community structure of these species. The resulting effects can be different both in their natural habitat and in the invasion area. [3].

The existence of *Pomacea* spp. is thought to have influenced the decline in the population of native snails which are the same family, including *Pila ampullacea*, *Pila polita*, and *Pila scutata* [4]. *Pomacea* spp. has a high adaptability that allows a decline in Pila populations throughout Southeast Asia [2]. The decline in the Pila snail population can also be caused by its selective nature of food, which only eats the plants it likes [5]. In Bali, at several rice fields with different altitude in the Klungkung and Karangasem districts did not find *Pila scutata* species [6]. Likewise in several habitats including ponds and rivers in the Selat District of Karangasem Regency [7]. Based on information from farmers in several locations in Bali, *Pila scutata* is rare.

Because *Pila scutata* snails are rarely found in previous studies and there is no data from other researchers about these snails, further research is needed to ensure the presence of these snails in rice fields, especially in the Subak Umasari rice field area in Selat District, Karangasem Regency. Subak is a irrigation system for rice field on Bali Island. The data obtained are expected to be basic data about *Pila scutata* in Bali related to the density, morphology and eggs of the snail.

2. Methodology

2.1. Sampling of snails and egg cluster

Snail samples were taken in the Subak Uma Sari rice field area, Peringsari Village, Selat District, Karangasem Regency. Samples were taken from three rice fields with rice plants less than one month old. Sampling was done by making a quadrate of 1 x 1 m pipe placed at each corner of the rice field. Sampling was carried out at 06.00-10.00 am by directly collecting the snails that were found. Sampling was repeated three times. Small to large snails in quadrate were taken, both those that were on the surface of the water, in the water or attached to aquatic plants. The samples obtained were put in a container and filled with rice field water. At the time of sampling snails, samples of snail eggs were also taken by tracing the rice fields where the snail samples were taken.

Environmental factors were also measured in situ including: altitude, coordinates, air temperature and humidity, water temperature, water pH, and disolved water oxygen (DO) content.

2.2. Sample observation

The snail obtained were cleaned, observed for their morphological characters and measured for their morphometric characters. Morphological character data was taken by observing the shell morphology, including shell shape, color pattern and other shell ornaments, while morphometric data was taken by measuring the parts of the shell using a caliper. The measured characters refer to [8], including: shell height and width, aperture height and width, and body whorl height. The samples of snail eggs were separated to count the number of eggs in each egg cluster.

2.3. Research Variable

2.3.1. Density, Presence frequency and Distribution pattern

The density of snails were calculated and converted into ind/m^2 using the [9] with formula:

D = Ni/A

Where:

D = number of individuals per unit area (individual/m^2)

Ni = number of individuals in the quadrate

A = area quadrate (m^2).

The presence frequency of *Pila scutata* were calculated using the formula:

Presence frequency = the number of quadrate plots where the species were found x 100%

the total number of quadrate plot.

Where:

0-25% = presence frequency very rare

25-50% = presence frequency rare

50-75% = presence frequency moderate

75-100% = presence frequency absolute.

Distribution pattern of the snails at each location was calculated using the Morisita index, with the formula:

$Id = n [\sum xi^2 - \sum xi / (\sum xi)^2 - \sum xi]$

Where:

Id = Morisita index

n = sum of all quadrate;

xi = number of individuals.

Criteria:

Id = 1: random distribution pattern

Id >1: group distribution pattern

Id<1 : regular distribution pattern

2.3.2. Morphology, morphometry, and egg cluster

The morphology and morphometry of *Pila scutata* snail were observed based on the morphology and morphometry characters of the snail were found, while the number of eggs was calculated by separating the eggs from each sample of the egg cluster.

2.3.3. Data Analysis

Pila scutata data and egg cluster found were analyzed descriptively and presented in the form of tables, figures, and graphs.

3. Result and Discussion

The rice field area where the snail samples were taken is at an altitude of 528 - 546 m above sea level with coordinates S 8^{o}25.984', E 115^o 27.844. Rice plants were less than one month old with an average water depth of 68,3 mm. The environmental factors measured at the time of sampling snails are presented in Table 1.

The density of *Pila scutata* was 3,75 individuals/m^2. The value of the presence frequency was in the range of values of 75 - 100%, so it was included in the category of absolute presence frequency. The value of the Morisita distribution index was less than one. The data for the three variables are presented in Table 2.

Pila scutata was mostly found in protected parts of the rice fields including: near rice plants, under weeds, and near rice fields protected by grass growing on the rice fields.

Table 1: Data on several environmental factors.

Variable	Average
Dissolved Oxygen (mg/L)	6,27
pH	6,83
Water temperature (^{o}C)	22,00
Water depth (mm)	68,3
Air temperature (^{o}C)	21,33
Humidity (%)	86,67

Table 2: Value of density, presence frequency, and Morisita index.

Variable	Value	Category
Density (individuals/m^2)	3,75	-
Presence frequency (%)	83,33	absolute presence frequency
Morisita Index	0,86	regular distribution pattern

Pila scutata egg cluster is white. The snail eggs were found in cluster, not in the water that flooded the rice fields but mostly found in protected places, including: attached to the rice fields, on rotting rice fields near the rice fields and on grass that grew on the rice fields. The snails and their eggs cluster on the rice fields were presented in Figure 1.

Morphologically, the snail shell is brownish green in color, sub-globose in shape with brown transverse bands. These bands have different appearances, some are clearly observable and some are less clear. Other characters are high spire, shallow suture, shallow umbilicus, thick shell cover, outer brown with white color. in the middle shell cap, and the inside of the shell cap is purplish. Figure 2 shows the morphology of the shell and shell cover (operculum).

The morphometric character of the *Pila scutata* shell based on the measurements of several characters carried out shows variations. The range of morphometric measurements of the snail shells is presented in Figure 3.

Data on the presence of *Pila scutata* eggs and the number of eggs in one egg cluster are presented in Figure 4. The range of the number of eggs cluster and the number of eggs in one cluster was presented in Table 3.

Table 3: The range of the number of egg cluster and the number of eggs in one egg cluster.

Parameter	Range
Number of egg cluster	3 – 9
Number of eggs in one egg custer	29 – 67

Figure 1: *Pila scutata* and their egg cluster A= *Pila scutata* among rice plants, B= *Pila scutata* was laying eggs C= egg cluster in the rice field.

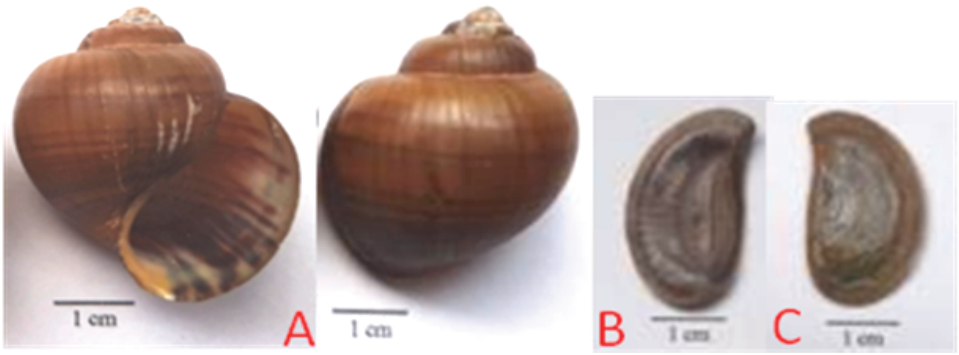

Figure 2: *Pila scutata* shell morphology and shell cover A= *Pila scutata* shell morphology, B= the inside of the shell cover C= the outside of the shell cover.

Based on the density values of *Pila scutata* listed in Table 2, when compared to the density of golden apple snails (*Pomacea canaliculata*), the density of *Pila scutata* was lower because the density of golden apple snails can reach 10,42 individuals/m^2 in a rice field area [10]. The result of calculating the presence frequency of the snail was 83,33%. The presence frequency was in the range of 75 - 100%, so that it includes the absolute presence frequency. Presence frequency is a value that states the number of presences of a species in a habitat so that it can describe how often the species can be found. Based on the results, most of the snails were found in 12 quadrate made during sampling although the density was not too much.

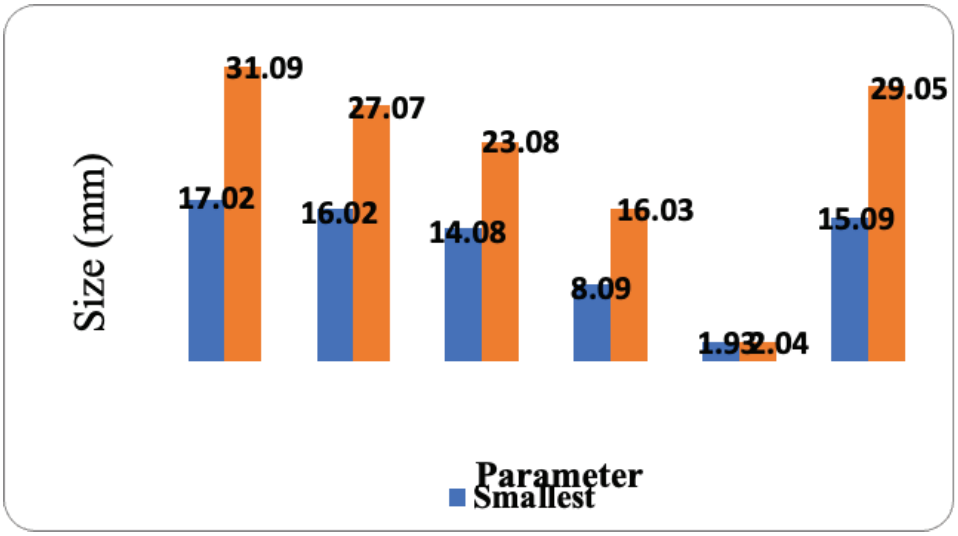

Figure 3: Range of morphometric character values.

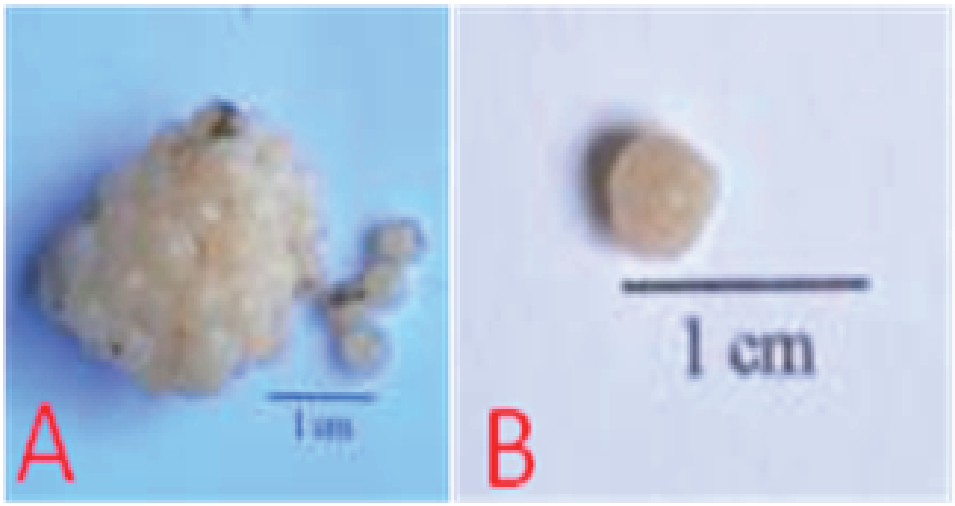

Figure 4: Egg cluster and the size of one snail egg A = one cluster of snail eggs, B = the size of one snail egg.

Pila scutata was most commonly found in protected areas in rice fields (Figure 1), this is in accordance with the statement of [2], namely the snails are usually found in shallow waters between vegetation in freshwater swamps, lakes, ponds, and other tapering water bodies, as well as in ditches or runoff with moderate flow; and likes the edge of nature that is shady and protected.

The morphological characters of the the snail shells found (Figure 2) are in accordance with the characters presented by [2], namely sub-globose shell, shell color yellowish green or greenish brown, plain or with several irregular brown spiral stripes or bands, smooth surface, high spire; round body circle; The umbilicus is usually hidden.

The height of the the snail shell found in this study was 17,02 – 31,09 mm and a width of 16,02 – 27,07 mm (Figure 3). [2] stated that the height of the *Pila scutata* shell can

reach 50 mm while [11] stated that the height of the snail shell was 33,54 - 51,26 mm and width was 28,02 – 44,30 mm.

The cluster of *Pila scutata* eggs found were also mostly in protected places (Figure 1) and this was in accordance with [12] who stated that *Pila scutata* eggs are usually deposited above the waterline, usually in hollows in moist soil, and in sheltered areas under vegetation. In this study, the number of eggs in one egg cluster found ranged from 29-67 eggs (Table 3). The number of eggs found was more than the results of [13] who found *Pila scutata* eggs attached among the stalks of *E. crassipes*, near the water surface with 8 - 20 eggs in one egg cluster. Compared with *Pomacea canaliculata*, the egg cluster of *Pomacea canaliculata* is pink while the egg cluster of *Pila scutata* is white, *Pila scutata* eggs in egg cluster are fewer than egg cluster of *Pomacea canaliculata*. Number of eggs in egg cluster of *Pomacea canaliculata* was 92 – 592 [14]. This affects the number of eggs that hatch, the number of young snails in *Pomacea canaliculata* species, so that it is also related to the density of adult snails.

4. Conclusion

The density of *Pila scutata* was 3,75 individuals/m^2. The value of the presence frequency was in the range of values of 75 - 100% (absolute presence frequency). The value of the Morisita distribution index was less than one. Shell sub globose with brown transverse bands. The bands on some shells are clearly visible and some are less clear. Egg cluster wass white in colour and the number of egg in one egg cluster was 8 - 20 eggs.

5. Acknowledgments

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