SOME ASPECTS ON THE ECOLOGY OF MANGROVE WHELK *TELESCOPIUM TELESCOPIUM* (LINNE, 1758) (MOLLUSCA, GASTROPODA : POTAMIDIDAE)

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ABSTRACT

An ecological study of Telescopium telescopium *was conducted in regard to its distribution and density, and brief observations were made on its foraging activities. The study was carried out in 12 mangrove forests, distributed in Java, Maluku and Irian Jaya. The result indicates that the snail occured at a very low frequency and density. It may be due to its preference to an open area, as well as its restricted distribution within the forest. The shell is of two forms, the typical and the smooth form. There is a distinct habitat segregation between the two forms owing to the degree of shadiness. The time of activity is related to the tidal regime, with movement begun when animals are exposed to the air. During their inactive phase, these snails are burried into the muddy substrate. The fact that the animal are not active simultaneously leads into a suggestion that the snail is able to maintain its feeding activity from its burrow, even during high tide.*

INTRODUCTION

Telescopium telescopium (LINNE, 1758) is the largest snail found living at the mangrove forest. It has a wide geographical distribution in the Indo West Pacific region, from Madagascar to the Philippines and northern coast of Australia (BENTHEM JUTTING, 1956; BRANDT, 1974). Another species of this genus was recently described by Butot (1954), *T. mauritsi*, differs from the former species being much smoother and has a much stronger columellar folds. Careful study done by Brandt (1974) proved that *T. mauritsi* is but a fully adult form of *T. telescopium*. This finding was confirmed by KURNIATI (1987), who has done a comparative study on external morphology and reproductive system of the two forms of the species.

Despite its wide geographical distribution, they are also found in great abundance in several localities throughout its range. However, little is known about the ecology of this species. This present paper examines some aspects of the ecology of *T. telescopium*, such as the distribution and abundance in relation to some physical and chemical factors operating in the environment, and their daily activity pattern.

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The field surveys and observations were carried out in 12 mangrove forests in Java, Maluku, and Irian Jaya region, from 1979 to 1986.

MATERIAL AND METHODS

Forty six transects were established across 12 study sites, from shore to landward edges, to examine the distribution and abundance of *T. telescopium*. The snails were sampled quantitatively from 50 cm x 50 cm plots placed at intervals of five meters along the transects. Daily activities were observed at Kao, Halmahera, by establishing six permanent plots of 2 m x 2 m. To avoid disturbing the animal's activities, the area was studied from its perimeters only, and the animals were never removed from it.

The environment and biological data were anlysed by using Principal Component Analysis (PCA).

RESULTS AND DISCUSSION

Twelve sites were chosen for this study, i.e. one at mangrove forest at Baluran (East Java), one at Sorong (Irian Jaya), and the other 10 at Maluku (Halmahera Island: Kao, Tabobo, and Jailolo; Seram Island: Kotania, Talaga, Latal, Wailale, and Elpaputih; Aru Islands; and Saumlaki in Tanimbar Island) (Fig. 1). Most of the study areas are coral-reef associated mangrove forest, except Sorong, Tabobo, and Kao, which are estuarine mangroves.

General and descriptive studies of the distribution of mangrove molluscs in some of the study area, i.e. Elpaputih and Wailale (BUDIMAN, 1985), Jailolo (BUDIMAN and DWINANTO, 1987), Saumlaki (HERYANTO *et al.*, 1987), and Kao and Tabobo (BUDIMAN, 1988) show that *T. telescopium* has a very low frequency and abundance compared to other potamidid species. This is also true for other areas presently studied. This is due to its restricted distribution, mostly at the midle and landward edge zone of the mangrove intertidal zone, as well as its preference to live in open areas in a sparse mangrove community. The average density and frequency were 0.312 ± 0.128 indv./m2 (± 95% Confidence Interval) and 4.104 ± 1.702 % respectively.

In view of the shell forms, they are of two types. The one, which is of the typical form, shows a regular conical shape with strong spiral grooves. The other is smooth, suddenly broadened at the body

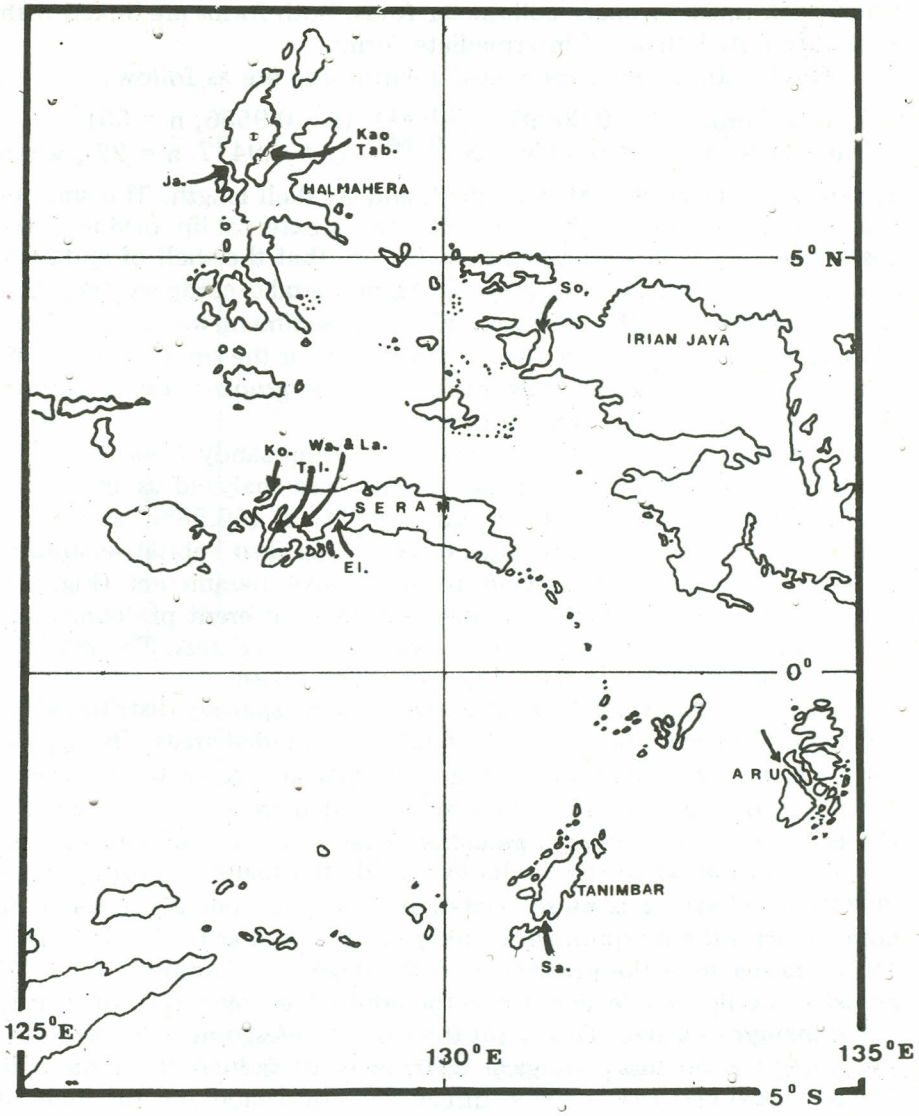

Fig. 1. Map of Maluku and Irian Jaya showing the study localities (So = Sorong, Ta = Tabobo, Ja = Jailolo, Tal = Talaga, Ko = Kotania, Wa = Wailale, La = Latal, El = Elpaputih, and Sa = Saumlaki). The mangrove forest in Baluran, East Java, is not shown here.

whorl with much stronger collumelar folds. Both forms are linked with an uninterupted chain of intermediate forms.

The length-weight exponential relationship are as follows :

— Typical form : $Y = 0.00097\ X^{2.45945}$ ($r = 0.9556$; $n = 35$)
— Smooth form : $Y = 0.73661\ X^{1.03842}$ ($r = 0.9477$; $n = 22$), where

Y, represents body weight with shell; and X, shell length. The smooth type has greater weight (Fig. 2) owing to its external lip, or due to the coating of the shell. It is a common feature that the shell of epifaunal molluscs is coated by deposists of organo-metalic complex (Fe, Mn) which present at the sediment-air and sediment-water interfaces (PLAZIAT, 1984). This may also be the reason for the smoothness of the shell, since the materials may fill the sutural grooves resulting from corrosion, as well as its spiral grooves.

The soil texture of their habitat vary from sandy loam, loam, to silt loam. Soil texture and organic content was analyzed using a PCA. The first two components account for PC 1 (56.58%) and PC 2 (27.65%) respectively of the total variance. No clear habitat separation between the two forms owing to the above parameters (Fig. 3). However, it was observed that they did have different preferences of habitat due to the difference in the degree of shadiness. The shade is especially important as a humidity preserving factor.

The smooth form are found to live solitary, sparsely distributed on the semifluid stream beds or run-off gulleys at shaded areas. The typical form, on the other hand, was found in abundance, aggregated on a semi-fluid mud or small pools at open and unshaded areas. This behaviour is similar to that of *Terebralia palustris*, where their young are found to live in mud flat while the adults live inside the mangrove forest. Their migration behaviour is more related to change in diet which seems to coincide with the morphological change of the radular teeth (PLAZIAT, 1977), rather than the preference in the degree of shadiness. Young *T. palustris* are deposit feeders while the adults feed by means of rasping fallen mangrove leaves. This is not the case of *Telescopium telescopium*, since there is no morphological differences of radular teeth on both forms (KURNIATI, 1987). The direct role of shade on the habitat preference of these two forms of *T. telescopium* is not yet fully understood.

The daily activities of *T. telescopium* were observed in a simple construction of brackish pond at Kao, Halmahera. The observation site was located next to the mangrove forest, separated only by an irrigation ditch. The quadrate size used in the observation is considered as natural, since the animals maintain their feeding and breeding in it.

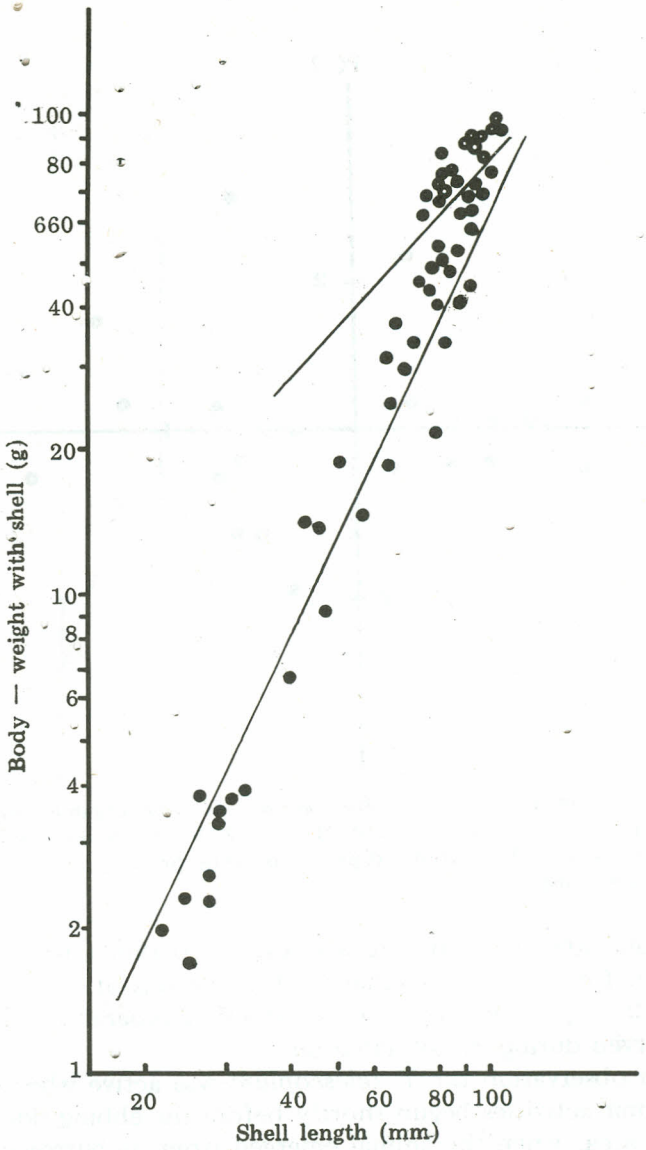

Fig. 2. Relationship between shell-length (X) and body weight (Y) in *Telescopium telescopium*. Solid circles indicate the typical form and open circles the smooth form.

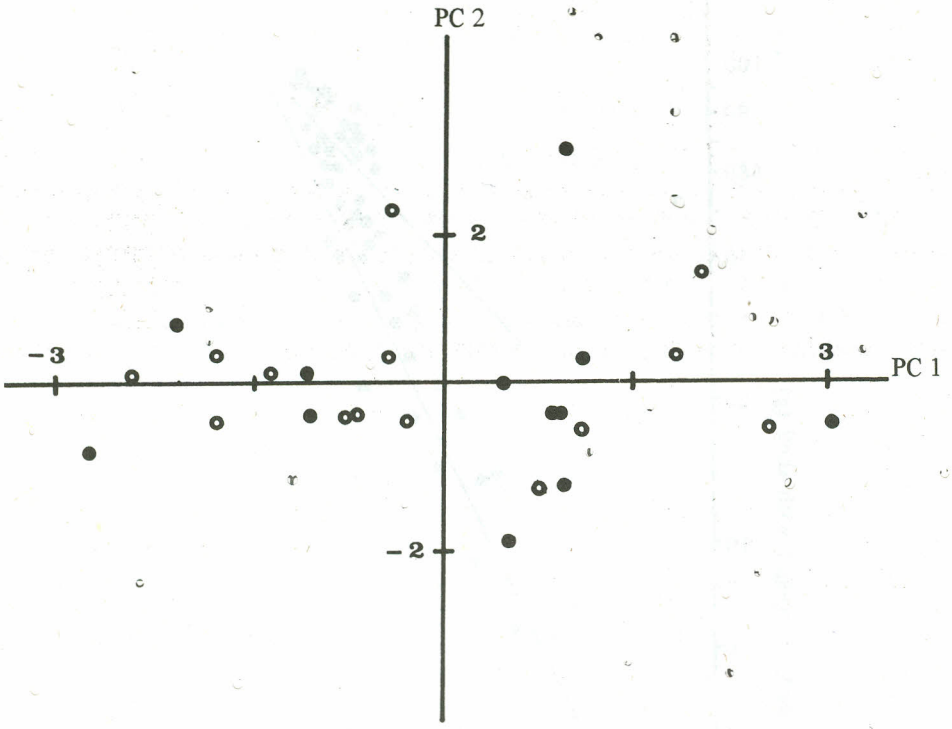

Fig. 3. Ordination model of the observations based on organic content and soil texture. PC = 56.58 % and PC 2 = 27.65 %. Solid circles indicate 1 plots where the smooth type snails were present, and open circle the typical form.

Observations were done during low tide, two times per day, day and night time, for 10 days. No marked fluctuations of water-soil salinity (3.0 — 3.2 $^{o}/_{oo}$), pH (6.5 — 6.8), or soil temperature (29 — 330C) were observed during the observation.

Upon observation the *T. telescopium* was active when exposed to the air. Their activities begun shortly before the ebbing tide uncovered the study area, when the animal emerged from its burrowed position, and started creeping on the soft mud. Their activities including rasping on semi-fluid mud, copulating, and moving about at an average speed of 1.5 cm/min (determined by measuring the distance covered during 10 minutes for 44 animals). No direct effects of temperature or shade on their activities were evidenced, since no significance difference was found on average speed and number of active animals between day and night time observations.

The animals did not emerge or retreat at the same time. Instead, some of them were active and the rest were inactive in the population. The number of the animals increased and getting more or less steady after the second hour, and then declined at about the fifth hour of exposure. All activity ceased during the hours of high tide (Fig. 4).

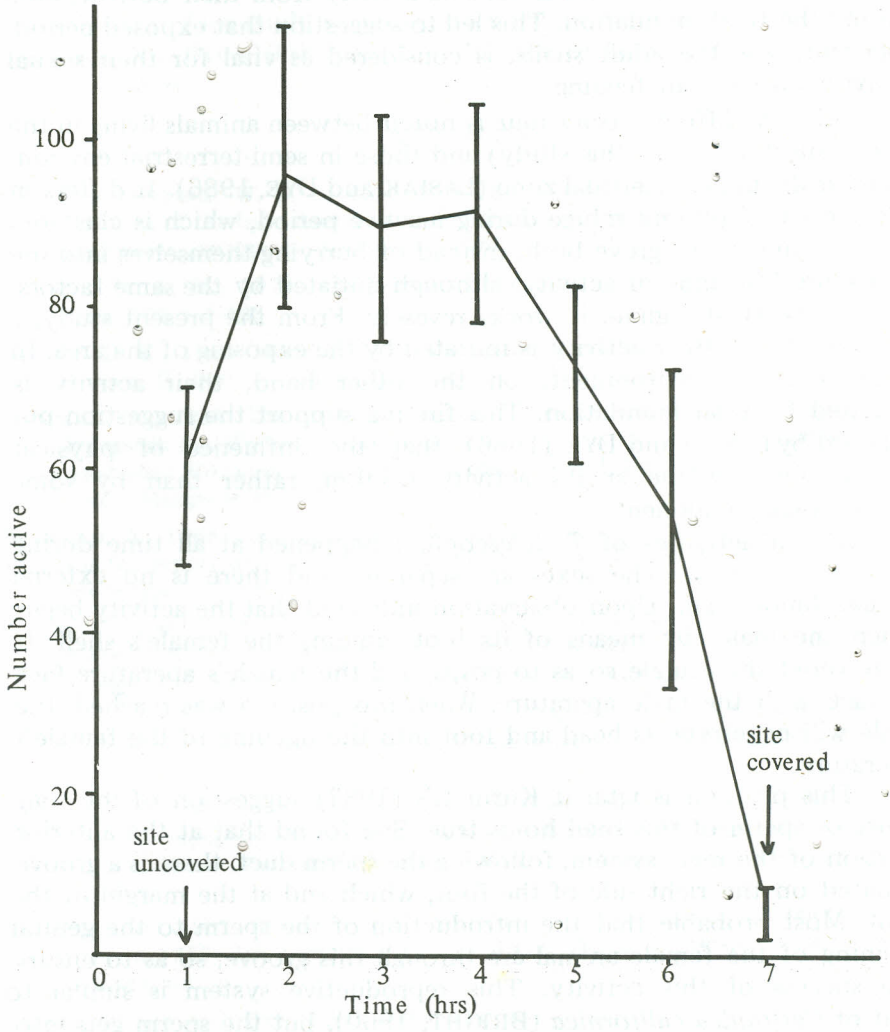

Fig. 4. The mean number of active animals. The bars represented the 95 % confidence interval.

During inactive state the animals burrowed themselves into the muddy substrate, taking up a semi-vertical position just below the surface. In inactive state during low tide, they were also active to do feeding. They feed by means of its protrusible proboscis. This, and the fact that the animals did not active simultaniously, suggest that the snails could maintained their feeding activity from their burrow, even during the tidal inundation. This led to suggestion that exposed period, especially for the adult snails, is considered as vital for their sexual activity rather than feeding.

Slightly different behaviour is noted between animals living in the lower intertidal zone (this study) and those in semi-terrestrial environment at the upper intertidal zone (LASIAK and DYE, 1986). It differs in the means of finding refuge during inactive period, which is clustered together under mangrove bush, instead of burrying themselves into the soft mud. The time of activity, although initiated by the same factors, that is the tidal regime, it works revesely. From the present study, it was noted that their activity is initiated by the exposing of the area. In semi-terrestrial environment, on the other hand, their activity is initiated by tidal inundation. This finding support the suggestion put forward by LASIAK and DYE (1986) that the influence of physical factors regulate the snail's activity rhythm, rather than by some endogenous component.

Sexual activities of *T. telescopium* happened at all time during the active period. The sexes are separate, and there is no external sexual dimorphism. Upon obsarvation indicated that the activity begun when the male, by means of its foot, holding the female's shell. It manuvered the female so as to positioned the female's aperature face to face with the male aperature. When this position was reached, the male will penetrate its head and foot into the opening of the female's aperature.

This position is vital if Kurniati's (1987) suggestion of the transport of sperm of this snail holds true. She found that at the anterior portion of the male system, following the sperm duct, there is a groove situated on the right side of the foot, which end at the margin of the foot. Most probable that the introduction of the sperm to the genital opening of the female animal are through this groove, so as to ensure the success of this activity. This reproductive system is similar to that of *Cerithidea californica* (BRIGHT, 1960), but the sperm gets into the tube instead of groove form. Further detailed study on reproductive system of *T. telescopium* is still needed to clarify the above problem.

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