RESEARCH ARTICLE

Seasonal activity rhythms in a land Slug, *Semperula maculata*

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ABSTRACT

Mollusca is the largest group of organisms after Arthropoda. Slugs, *Semperula maculata*are molluscs without shell. Field survey was made from Satpuda Mountain area and Residential / plane area near and around Ranipur dist-Nandurbar during 2014. These slugs are hermaphrodite and lay eggs in clutches. They lay about 25-30 eggs in a chain found in decaying humus or under stones and decaying leaves of surrounding plants in their habitat. Slugs in various habitats were observed with various length and sizes groups. Studies on maturation and correlation of relationship between diameter and standard length of a slug is r^2=0.0021 whereas between PH of soil and number in plane area is r^2=0.85 and in mountain area is 0.53.

Keywords: Satpuda, seasonal changes, correlation, length-size groups.

INTRODUCTION

Slugs are economically important to man as they cause damage to crop plants, garden plants and forestry. Slugs prefer moist shady and decaying zone of land. Slugs predominantly preferscold placesof environment (Moens and den bruel, 1960, Godan 1983). Slugs are moist and slimy and are more active in monsoon. Slugs,*Semperula maculata*feeds on plant juices from a variety of different species, including some commercial crops. This slug releases much mucus as on offence when disturbed. Many slugs in India and Europe lay eggs in late monsoon and in winter. (Getz, 1959, Kulkarni, 1973).

The biological rhythms of course aredependent on the varied photoperiods and seasonal cycles. Photoperiods play a key role in metabolism (Newell, 1966, Morton, 1979; Magare and Kulkarni, 1993a; 1993b and Panigrahi, 2000). *Semperula maculata* is a pest land slug feeds mostly on cabbage and potatoes. This slug also serves as a pest of horticulture and forestry as it feeds on varieties of vegetables like, tomato, brinjal, cucumber, etc. and some germinating seeds in forest. These are mostly found in association with the slug, *Laevicaulis alte* which is a pest slug of agriculture and horticulture. Raut and Panigrahi, 1988).

In most of the invertebrates a large number of environmental factors affects in various ways. (Magare, 1993.) The relationship between temperature changes and metabolism in a land slug, *Laevicaulis alte*was studied by Kulkarni (1973). As the climate is different in plane and mountain area, the shape and size of slugs found to be different. In present work an

attempt was made to study the seasonal activity pattern in a slug, *Semperula maculata*. By studying maturation, length size relation in plane and mountain area in and around Satpuda Mountains of Nandurbar district.

MATERIAL AND METHOD

Study area: Randomly scattered in and around the area of Ranipur, Mhasawad and Toranmal in Maharashtra, India. The area covers Satpuda Mountains, dense forest, plane are with some residential area distributed frequently at the foot of Satpuda Mountain area. Toranmal is a dense forested mountain area towards North to Ranipur and Mhasawad area is on plane ground and towards south to Ranipur. Both sites have good habitat for slugs feeding and breeding. Observations and data collection were made in field area during July to December, 2014.

Sample Collection and Observation: The slugs, *Semperulamaculata* were collected by hand picking using gloves to prevent infection from slugs. Sample collection was made in field area from two sites i.e. Mountain area (Toranmal and Lenghapani) and Plane area (Mhasawad and Ranipur). The catch from each sampling stations was recorded from 1x1 sq. meter quadrant. The average of three quadrants was taken as a unit of study. After counting the numbers the data of length and diameter of the creeping slug is noted. The identification of slug was carried out as per the records of samples previously identified by Zoological Survey of India, Kolkata. During study period the number of eggs laid by slug is noted. Simultaneously the data on environmental parameters like temperature, PH of soil, humidity, etc. recorded. Observations on copulation and egg laying were made at night also by using torch.

RESULT AND DISCUSSION

Taxonomy:

Land slug *Semperula maculata* is a gastropod mollusk belongs to family veronicellidae of the order systellomopha. The species found randomly scattered in Ranipur area and are abundant in plane area than in mountain area. *Semperula maculata* is an endemic to India and found widely distributed throughout India. (Fig.1)

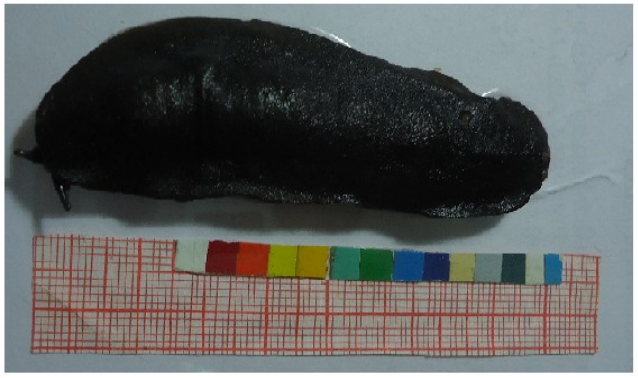

Fig. 1: Land slug, *Semperula maculata* found in satpuda mountain area.

Soil Parameters:

To study the ecology of slug, *Semperula maculata*the soil parameters from the study site was made. Mostly the slugs prefer low temperature ranges between 22-26 °C. and alkaline soil rich in organic carbon.

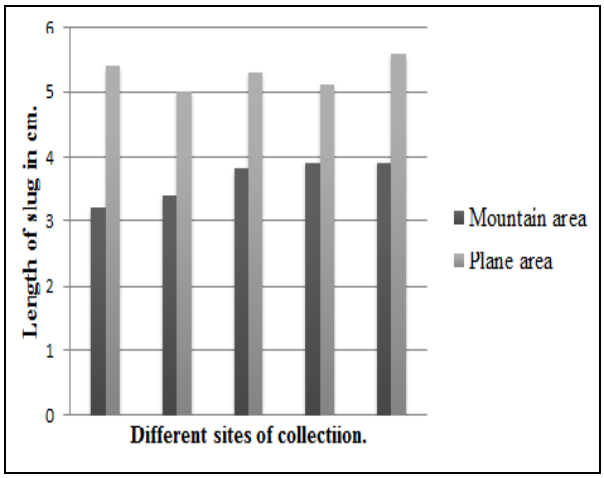

Fig. 2: length size relationship of a slug, *Semperula maculata* form Satpuda mountains

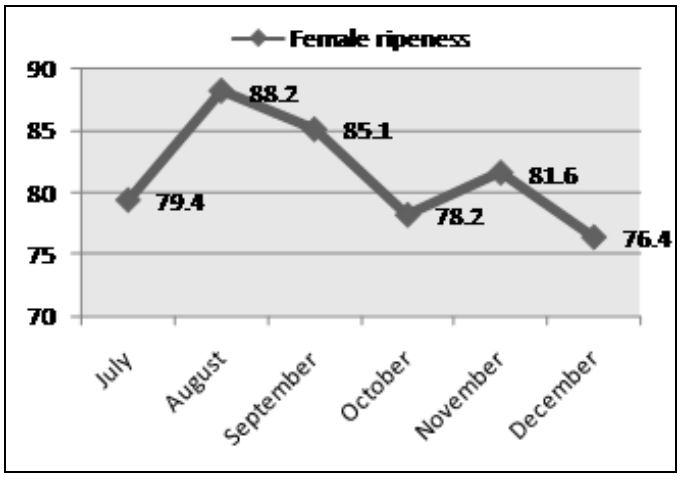

Fig.3: Monthly changes in Female ripeness of a slug, *Semperula maculata*.

The PH of soil ranges between 7.1 to 7.9 in various sites of collection in mountain are whereas it was less alkaline in plane are and ranges between 6.6 to 7.4 The slugs are abundant in moist and humus rich soil. Slugs are few in mountain area whereas are abundant in plane area.

Shape and size relationship:

The slugs were collected from plane area ranges in length size between 5.0-5.6 cm. whereas those from Mountain area are ranges between 3.2-3.9cm. The significant differences between the standard length sizes of the slugs might be due to feeding competition as the population is more, available food quality, more enemies and changed climate in their habitat. The population correlation of the slugs in both the area is r^2 = 0.0021 in plane area and r^2 = 0.5329 in mountain area (Fig.2).

Ripening and egg laying:

The slugs are nocturnal. During day time they hide inside stones, wood or decaying leaves and come out their dwellingsan hour after the sun set and remains active up to early morning. They prefer late monsoon and early winter for breeding and egg laying. Slugs lays about 25-30 eggs in the form of a beaded string in a mucous jelly. The number of adult slugs, *Semperula maculate* in a set of samples showing growth and development of body and reproductive organs as per the arbitrary criteria and development of reproductive organs.

Slugs were collected and maintained in an animal house for observation in nylon net of 1x2 meter on natural grassland and vegetation ground. They were fed with pieces of vegetables like potatoes, brinjal, tomato, cabbage, etc. The reproductive behavior of slugs shows secretion of dart with swellings of erected penial apparatus in body. The excited partners are approaches towards one another and communicate the confirmation by tentacles. Secondly they release excess mucus and moving both mating partners one behind another in a small circle on a ground. Finally male matured releases sperms in the vagina of female matured slug. Copulation lasts for about 40-50 minutes (Fig.3).

Rainfall is more apparent among all environmental factors which cause meaningful changes in reproductive activities of slugs. The mating process among terrestrial slugs was observed in a slug, *Arion empiricorum* (Kunkel, 1900), and*Limax* and other limacids (Gerhardt, 1934). In *Semperula maculata* usually courtship occurs after circular movement on ground and then winds both partners close together for copulation. The present results partly correlated with the finding of Kunkel (1900) on Limax slug.

Seasonal changes in Temperature and PH influences reproduction in a slug, *Semperula maculata*. They also prefer alkaline soil and show more population density whereas in area where humidity is not in favorable range the density of slugs is less. They prefer moist and cold environment which is in favorable range during monsoon, so rainfall is the key factor regulating maximum activity of a slug, *Semperula maculata*. Present findings correlates with the work of Panigrahi (2000).

Slugs are more careful and sensitive regarding the maintenance of body water percentage. Huddling of slugs during aestivation might be an act of conserving body water (Richter, 1976)*Semperula maculata* prefers 17-20 $^{\circ}$ C. (Moens and dVan elen Bruel, 1960) Whereas slugs *Limax flavus*prefers, 21-27 $^{\circ}$ C. range of temperature. The slugs cannot tolerate continuous high temperature and they undergoes deep in soil or inside stone, wood or any suitable substratum.

The activity of many slugs shows rhythmicity which is endogenous (Lewisa, 1969). Slugs *Semperula maculata*are very active at night and in shady and cloudy climate. The results correlate with the findings of white (1959). The activity rhythms of *Semperula maculata*are more in evening and night. The greatest activity rhythms are fond in a slug, *Deroceros reticulatus* during night and mid night. The rhythmic activities of slugs are also controlled by humidity and rainfall.

CONCLUSION:

Field survey of Land Slugs, *Semperulamaculata* was made from Satpuda Mountain area from Residential / plane area near and around Ranipur dist. Nandurbar during 2014. These slugs are hermaphrodite and lay about 25-30 eggs eggs in decaying humus. Slugs in various habitat were studied on maturation and correlation of relationship between diameter and standard length of a slug. The statistical correlation observed between length size is r^2=0.0021 whereas between PH of soil and number of samples in plane area is r^2=0.85 and in mountain area isr^2= 0.53.

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