



Ecology of the Slug, *Girasia crocea* (Godwin-Austen) (Stylommatophora : Ariophantidae)

M. M. S. Bhuiyan¹, M. R. Rahman², M. S. Jahan³ and ⁴M. Haque

¹Barura Shahid Smriti Government College, Comilla

^{2,3}Institute of Environmental Science, University of Rajshahi, Rajshahi- 6205, Bangladesh

⁴Dr. Khandaker Mosharraf Hossain College, Daudkandi, Comilla, Bangladesh

Abstract: Slug *Girasia crocea* (Godwin-Austen) is an herbivore, feeds on soft twigs or leaves of plants. The slug *G. crocea* are active for period of March-November. They use to overcome winter month (December-February) through hibernation. Sometimes they were seen to winter morning. In nature, they have a wide range of food acceptability. The feeding and foraging activities are confined to night ours. In nature, breeding period extends from March to November. The egg laying and other breeding activities are maintained at an equal temperature during the whole active period. In laboratory, they thrived well on *Amranthus* sp. And *Spinacea* sp., while temperature. They attained adult at the age of 196 days to 201 days. They lay eggs lay in cluster. The eggs are round in shape and white in colour. Individual slugs on an average, added 9.5mm, 2.5mm and 40mg; 13.5mm, 3.5mm and 40mg; 17mm, 5mm and 50mg; 24mm, 5mm and 60 mg; 35.5mm, 6 mm and 485mg; 52mm, 10mm and 1190mg; 65mm, 8.5 and 1114mg; 65mm, 9.5mm and 1117mg and 57mm, 10mm and 1134mg to their body length, body width and body weight respectively at temperature of 26 - 31.5°C during the study period. On an average an egg was measured 3.85mm in diameter.

Keywords: Breeding Biology, Ecology, *Girasia crocea*, Growth rate, Slug, Temperatures

Introduction

Slug and snails causing damage to economic plants have drawn the attention of a number of workers (Hyman, 1967; Runham and Hunter, 1970; Godan, 1983). Besides these, numerous paper have been published on the other members of the pulmonate snails, viz., *Achatina fulica*, *M. indica* and *M. sequax* (Mead, 1950, Ghose, 1959, 1960, 1963; Hodasi, 1962, 1975, 1979; Raut, 1979, 1981; Raut and Ghose, 1982, 1983a, 1983b, 1984). But no records are yet available on the natural history of the species *Girasia crocea* (Godwin-Austen). These species are an agro horticulture slug pest in Bangladesh and neighboring countries. The information on their biology and ecology is still wanting. In the present study an attempt has been made to study their ecology.

Material and Methods

Observation on the ecology of the Slug *Girasia crocea* have been made from Bangladesh Academy for Rural Development (BARD) forest, located in the Comilla district, Bangladesh. During the summer (March-April) the temperature ranges 30-33.2^o C, while in winter (December-January) 12.1-27.6^oC. In other month temperature ranges from 29-32^oC.

Observations under laboratory conditions have been made at the Institute of Environmental Science (IES) Laboratory University of Rajshahi. For the laboratory studies two clutch of eggs consisting of 35 and 38 eggs respectively collected from BARD forest, located in the Comilla district. The eggs were released in two wooden 50×50×10cm each in size. The boxes were provided with loose, moist soil up to 5cm of its height. The upper side of the box was protected with a

piece of nylon net (0.1mm mesh). Throughout the period of study 40-45% soil was maintained through regular water spraying. After hatching the leaves of *Amaranth gangeticus* and *Spinacea oleracea* were supplied regularly as their food. The unused food materials and the faecal matters were removed daily from the boxes with a view to maintain a strict hygienic condition. The soils were also change 15days interval to avoid any kind of infection.

Through regular observations fortnightly length, width and weight were studied. Incubation and hatching percentage were calculated from the emergence of juvenile snails from the eggs. The experiment was continued until the entire slug died.

For the study of desired traits depending on the availability of hatching (0 day old snails) two batches of wooden box (5 for each species) set up. The slugs considered for experiment carefully until the last individual of each batch died. Randomly 5 species from each batch were consider for measurement of the length, width and weight with the help of divider and electrical balance (model, no.HF-200h, Max-210, d=0.001) after 15 days. The experimented was started July 2007 and terminated on 30 September 2008.

Result and Discussion

Breeding Biology in the Natural Habitat

The slug *G. crocea* are active for period of March-November. They are nocturnal. In day time they were seen under stones, bricks and dead logs etc. With the approach of darkness these creature were seen to come out of their hiding places. These slugs have wide ranges of food plant acceptability both cultivated and wild variety. The Slugs laid eggs in

cluster. Though the fresh laid eggs are found in cluster and the developed eggs are always seen in isolated condition. The eggs are round in shape, white in colour and transparent in early age. The eggs size from 3.1-4.6mm. With the advent of winter the slugs inter to protective place usually under the stones, bricks and wooden logs *etc.* to the tide over the colder period (from December to February) every year.

Breeding Biology in the Simultaneous Laboratory Condition (Table 1 – 13)

In Box one, the 48 eggs, 35 hatched on 17 March, 2008, while the remaining 13 did not hatched. In Box (Terrarium) two, 73 eggs, 38 hatched on same date as Box 1.17 March, 2008, while the remaining 35 did not hatched.

The newly hatched slugs measured 6.5-11.5 (average mm) mm, 2.5-3.5 (average 3.00 mm) mm and 30-40mg (average 35 mg) in body length, width and

weight respectively. They fed mostly *Amaranthus sp.* and *Spinacea sp.*

Again, after 15 days, in Box 1 and 2 body length, width, weight and mortality rate were measured. Later, on 20th April, 5th May, 20th May, 7 July, 23 July, 24th August, 9th September and 25th September body length, width, weight and mortality rate were measured. Due to unavoidable circumstance body length, width, weight and mortality rate were not measured June 2008.

On September 25, 2008, two slugs were alive. Their body length, width and weight are given table 10. Of the two slugs, one died on September 25, 2008 at the age of 196 days and other individual died on 30 September 30 at the age of 201 days. The eggs hatched between 26-31.5^oC temperatures. A total of 73 eggs hatched out 105, giving 69.52% successful hatching.

Table 1. Length, width and weight of *G. crocea* (0 day old)

Sample no.	Length (mm)	Width (mm)	Weight (gm)
Juvenile 1	9.5	2.5	40.00
Juvenile 2	9.00	3.00	38.00
Juvenile 3	6.5	3.5	30.
Juvenile 4	11.5	3.00	46.00
Juvenile 5	10.5	3.5	45.00

Table 2. Length, width and weight of *G. crocea* (15 days old) (Box 1)

Sample no.	Length (mm)	Width (mm)	Weight (gm)	Mortality number
Juvenile 1	15.5	3.5	48.00	15 juvenile died out of 35 slugs
Juvenile 2	14.00	3	40.00	
Juvenile 3	13.5	3.00	40.00	
Juvenile 4	13.00	3.5	40.00	
Juvenile 5	15.5	3.5	48.00	

Table 3. Length, width and weight of *G. crocea* (15 days old) (Box 2)

Sample no.	Length (mm)	Width (mm)	Weight (mg)	Mortality number
Juvenile 1	12.00	4.00	36.00	4 juvenile died out of 38 slugs
Juvenile 2	13.00	4.00	40.00	
Juvenile 3	11.00	2.00	36.00	
Juvenile 4	14.00	4.00	48.00	
Juvenile 5	10.00	3.25	36.00	

Table 4. Length, width and weight of *G. crocea* (30 days old) (Box 1)

Sample no.	Length (mm)	Width (mm)	Weight (mg)	Mortality number
Juvenile 1	17.00	5.00	50.00	10 juvenile died out of 20 slugs
Juvenile 2	18.00	6.00	90.00	
Juvenile 3	18.00	6.5	90.00	
Juvenile 4	12.1	3.00	60.00	
Juvenile 5	15.00	4.00	95.00	



Plate A. Egg cluster



Plate B. Newly hatched (0 Day)



Plate C. 15 days old aged



Plate D. 30 days old aged



Plate E. 45 days old aged



Plate F. 60 days old aged



Plate G. 108 days old aged



Plate H. 153 days old aged



Plate I. 183 days old aged

Table 5. Length, width and weight of *G. crocea* (30 days old) (Box 2)

Sample no.	Length (mm)	Width (mm)	Weight (mg)	Mortality number
1	12.00	6.00	121.00	35 juvenile died out of 38 slugs
2	12.00	5.00	90.00	
3	7.50	4.00	50.00	

Table 6. Length, width and weight of *G. crocea* (45 days old) (Box 1)

Sample no.	Length (mm)	Width (mm)	Weight (mg)	Mortality number
1	24.00	5.00	60.00	2 juvenile died out of 10 slugs
2	24.5	4.5	100.00	
3	26.00	5.00	150.00	
4	27.00	5.00	130.00	
5	22.00	4.00	50.00	

Table 7. Length, width and weight of *G. crocea* (45 days old) (Box 2)

Sample no.	Length (mm)	Width (mm)	Weight (mg)	Mortality number
1	26.00	6.00	210.00	2 juvenile died out of 10 slugs
2	27.000	4.5	130.00	
3	17.00	4.00		

Table 8. Length, width and weight of *G. crocea* (60 days old)

Sample no.	Length (mm)	Width (mm)	Weight (mg)
1	27.00	7.00	70.00
2	29.00	6.00	84.00
3	22.00	6.00	72.00
4	21.00	5.00	60.00
5	20.00	5.00	60.00

Table 9. Length, width and weight of *G. crocea* (108days old)

Sample no.	Length (mm)	Width (mm)	Weight (mg)
1	35.50	6.00	485.00
2	35.00	7.00	809.00
3	43.00	8.00	910.00

Table 10. Length, width and weight of *G. crocea* (123 days old)

Sample no.	Length (mm)	Width (mm)	Weight (mg)
1	52.00	10.00	1190.00
2	44.00	8.00	1111.00
3	36.00	7.00	490.00

Table 11. Length, width and weight of *G. crocea* (153 days old)

Sample no.	Length (mm)	Width (mm)	Weight (mg)
1	65.00	8.5	1114.00
2	50.00	8.5	1117.26

Table 12. Length, width and weight of *G. crocea* (168 days old)

Sample no.	Length (mm)	Width (mm)	Weight (mg)
1	65.00	9.5	1117.00
2	56.00	9.00	1152.00

Table 13. Length, width and weight of *G. crocea* (183 days old)

Sample no.	Length (mm)	Width (mm)	Weight (mg)
1	49.00	11.00	1104.00
2	57.00	10.00	1134.00

G. crocea are hermaphrodite. In nature they become adult at the age of 6 months. The result of field and laboratory observations clearly indicate that the slugs are adapted to moderate temperature and they are confined to some district of North eastern region (Comilla, Habiganj, Maulvibzar, Sylhet districts), Eastern region (Chittagong and Chittagong Hill tracts) and Rajshahi of Bangladesh where average temperature prevails around 15 – 33.5°C and humidity 70-87 % due to regular shower. Though the studies on the distribution of this slug species are not on record it is apparent that *G. crocea* have not close affinity with the slug occurring in cold countries. Further information on the distribution of this slug species is needed to determine the original home land of *G. crocea* and its pattern of distribution in the tropical countries.

While all other biological activities of *G. crocea* are more or less similar to *Mariaella dussumeri* (Raut *et al.*, 1990) and other slug species studied so far (Runham and Hunter, 1970; Godan, 1983) egg nesting demand is special attention. A number of workers studied egg nesting behaviour of a number of pulmonates in different ecological conditions *viz.*, *Achatina fulica*, *M. indica* (Ghose, 1959), *Achatina fulica* (Hodasi, 1975, 1979), *M. turgurium* and *Cryptaustenia ovata* (Saha and Roy, 1994). All of them stated that breeding seasons of the above snails species commence at the advent of monsoon and egg laying are preceded by making an egg chamber into which the eggs are deposited. In the present study it is clear that *G. crocea* are used to deposit eggs in clusters but deposition of eggs, completely separate from each other, though rare is also practice. In nature, end of the summer and advent of monsoon they starts laying eggs. It seems that the art of deposition of eggs by the slugs is very much related with the care of eggs laid.

The care of eggs not only involved with the protection of eggs from any kind of damage following displacement but saves the eggs from desiccation to ensure cent prevent hatchability. Besides, deposition of eggs inside the litters by *G. crocea* give added protection from enemies and desiccation. Like as *G. crocea* same kind of deposition of eggs was found in slug *Mariaella dussumeri*. In addition, the Slug *Laevicaulis alte* perhaps developed a unique divide to ensure cent percent hatching of eggs by depositing faecal pellets over the egg mass (Raut and Panigrahi, 1988).

The age of sexual maturity in pestiferous land snails varies. The age at which sexual maturity is reached possibly varies with the influence of environmental factors. *Macrochlamys indica* sexually mature by 130 days (Raut and Ghose, 1984). The growth rate of *M.*

indica for a period of 57 weeks suggest that the attainment of reproductive age influence the process (Raut and Ghose, 1984). Slow growth rate following has also been reported by (Fromming, 1954). Ghose (1963) holds that the growth rate in *Achatina fulica* faster till the attainment of sexual maturity. The number of eggs per clutch, egg diameter, incubation period and hatchability of *M. indica* as 12-40, 3.0-3.5mm, 10-17 days and 96%, were described by (Raut and Ghose, 1984). In *M. turgurium* and *Cryptaustenia ovata*, eggs per clutch and incubation period and hatchability were recorded per 100.88±10.96 and 34.17±3.34, 15 to 26 days, 9 to 26 days 91.9% respectively. But during the present investigation were found as 48-57, 11-13 days and 69.52% respectively.

Some workers (Hodasi, 1979; Raut and Ghose, 1982) studied the life history, mortality rate and life table for land molluscs. Raut and Ghose (1981) recorded 30-46% for 100-105 days age group and 90-98.33% for 0-35 day's age groups as survival values of *M. indica*. They found the maximum and minimum mortality in 82-189 and 49-56 days age groups. Again, the overall expectation of life was maximum of 14.45 days for 0 day individuals and minimum was 0.50 days for 189 day. During the present experiment the maximum life span of *G. crocea* was recorded in laboratory condition as 196 -201 days respectively. All the individual of same lot died within 196 - 201 days. In *G. crocea* maximum growth occurred 168 days and then it declined (Table 8). *G. crocea* is a vegetable pest.

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