

# Life table of the Molluscan slug *Laevicaulis alte* (Ferrusac 1822) (Gastropoda: Pulmonata) of Courtallam foothills, Tirunelveli District, Tamil Nadu, India.

M. Kavitha<sup>1</sup>, H.M. Mahilini<sup>2</sup> and Albert Rajendran<sup>2</sup>

<sup>1</sup> Research Department of Zoology, Sri Parasakthi College for Women, Courtallam, Tamil Nadu, India – 6278 02.

<sup>2</sup> Research Department of Zoology, St. John's College, Palayamkottai, Tamil Nadu, India – 627 002.

## Abstract

Life table studies were undertaken to understand the survival and mortality of *Laevicaulis alte* (Ferrusac, 1822) under laboratory conditions from December 2014 to June 2015. Matured adult slugs were brought from natural habitat and kept in simulated terraria. Eggs were deposited in mud crevices or depression in the soil a few days after mating of adult slugs. Eggs laid during warm spring tend to hatch out in approximately three weeks. The total number of eggs laid differs in different individuals. After 13 days of release in the terrarium approximately 50 slugs laid their eggs under mulched leaf debris and in the crevices of the soil of the terrarium in a depth of approximately 2.5cm. The eggs of *Laevicaulis alte* were transparent and pale brown in colour and oval in shape. An average total of 24 eggs were in one clutch and out of it 14 eggs hatched out into young ones. The young ones were pale brownish with body length range  $0.96 \pm 0.08$ mm and breadth  $0.55 \pm 0.08$ mm and with body weight  $0.47 \pm 0.07$ gm. *Laevicaulis alte* juvenile hatchlings reach sexual maturity in about 6-7 months.

Key words: *Laevicaulis alte*, life table, survival, mortality, egg, adult, young ones.

## 1. INTRODUCTION

Slugs lay upto 50 small eggs in clusters at various times of the year depending on the species. They are usually laid in decaying organic matter or just below loose soil surface. At this stage desiccation and frost are capable of causing very high rates of mortality. Eggs laid during warm spring tend to hatch in approximately three weeks. If laid during late autumn however, they may not hatch until the following spring. On hatching, young slugs feed on humus and organic matter below the ground. As they mature, slugs move on to feed on both living and dead plant material. Some species have only one breeding season in a year, while others have two or more.

The total number of eggs laid differs from species to species and more eggs are laid in laboratory cultures than in the field (Carrick, 1938). Rueda (1989) reported that Bean slug lay an average of four egg

clutches containing about 30 eggs for a total egg production of about 120 eggs per slug. He also reported that the a pre-reproductive period of Bean slug is 80 days and a life span exceeding 200 days. Lamkong and Kenny (1989) had reported that *Pila globosa* deposit its eggs above the waterline when they are in aquatic medium or lay eggs in a natural depression or snails made pit in the ground when they live in a terrestrial habitat. Carrick (1942) and South (1992) have reported that the eggs of *Deroceras reticulatum* took 18-22 days for hatching. Development time of slugs varies with weather conditions and among species but several months are commonly required for slugs to reach maturity (<http://entem.dept.uf/misc/gastro/slugsofflorida>, 2012). The reproduction rate and generation time of the slug *Deroceras laeve* were estimated by Birch (1948). Costamagna *et al.* (1999) reported that the retention of litter or residue in the habitat may favour slugs' survival and reproduction.

Slugs may represent upto 8% of the animal biomass of boreal forests (Hawkins *et al.*, 1997). It can act as sensitive indicators of environmental change (Adeyeye, 1996). Many slug species play an important role in the ecosystem by eating dead leaves, fungus and decaying vegetable material (Rollo, 1983). If these slugs are to be effectively conserved, it is essential to understand their natural history and biology. Early works on these land slugs were neglected. Therefore an attempt has been undertaken to monitor the life table and development of *Laevicaulis alte* under laboratory conditions.

## 2. MATERIALS AND METHODS

### 2. (a) Study Area

Slugs were collected from its natural habitat among decayed leaves, plants and in damp places of Ilanji and Courtallam from Tirunelveli District, Tamil Nadu. It is located at the foothill of Southern Western Ghats, lying at latitude 8°56' N and longitude 77°16' E and at an elevation of 160m.

### 2. (b) Construction of the Terrarium

A special device was designed to maintain the slug in active state under simulated controlled conditions. A rectangular tank was filled with graded layers of stones, pebbles, sand, black soil and decayed leaves to depth of 2, 1, 2 and 5 cm respectively. During the rainy season slugs were collected from its natural habitat with varying size and length and they were released and maintained in the terrarium and the slug *Laevicaulis alte* was monitored and activities recorded.

### 2. (c) Collection and Maintenance

The terrestrial slug *Laevicaulis alte* were collected from its natural habitat of decayed leaves, plants and also in damp places. Adult slugs ( $7.21 \pm 0.08\text{gm}$ ) were brought to the laboratory in the month of November and maintained in terrarium. Water was sprinkled on the soil medium everyday to maintain the

optimum temperature (26<sup>0</sup>C) and humidity (80%) and to keep the slugs in an active condition. They were fed *ad libitum* with grass and decayed leaves of various plant species.

After one month, in the month of December, the released animals started laying eggs underneath the soil of the terrarium in a depth of 2 to 3 cm. After they started to lay their eggs, they were counted and transferred to a separate terrarium. Observations were made on the size, shape and colour of the egg and the time of hatching of the young ones.

The average growth size of the slugs from the day of hatching (December 2014) till June 2015 was observed. The percentage survival and mortality were recorded once in every 15 days. The length and breadth of the animal were measured using vernier calipers. The body weight of the slugs was recorded by a sensitive digital balance (accurate to 0.018gm) according to South (1982) and Hommay *et al.*, (2001).

### 3. RESULTS

Table 1 and Figures 1,2 and 3 reveal the following observations of the slug *Laevicaulis alte*.

#### 3.1. Eggs

After 13 days of release in the terrarium approximately 50 slugs laid their eggs under debris and also in the holes of the soil of the terrarium up to a depth of approximately 2.5 cm. The eggs of *Laevicaulis alte* were pale brown and transparent in colour and also oval in shape. These eggs are about 3mm in diameter and weighed about 20mg. An average total of 24 eggs were in one clutch and out of it 14 eggs hatched out into young ones (Table 1)

#### 3.2. Young ones

The 14 hatched out individuals after 10 days of hatching were pale brownish in colour. Its body length was  $0.96 \pm 0.08$ mm, its breath  $0.55 \pm 0.08$ mm and its whole body weight was  $0.47 \pm 0.07$ gm (Table 1, Fig.1)

Fig 1. EGGS OF *LAEVICAULIS ALTE*



Fig.2. YOUNG ONES OF *LAEVICAULIS ALTE*





Table -1

LIFE TABLE OF THE SLUG *LAEVICAULIS ALTE* UNDER LABORATORY CONDITIONS (Dec 2014 To June 2015)

Date	No of individuals	No of individual died	Mortality (%)	Survival rate (%)	Length of the Slug ( cm)
11.12.14	Eggs laid 24	-	-		-
24.12.14	Eggs hatched 14	10	41.67	58.33	0.5
13.01.15	13	1	7.14	92.86	0.9
28.01.15	12	1	7.69	92.31	1.5
12.02.15	10	2	16.67	83.33	1.8
25.02.15	8	2	20.00	80.00	2.0
14.03.15	7	1	12.50	87.50	2.4
30.03.15	6	1	14.29	85.71	2.7
16.04.15	5	1	16.67	83.33	3.0
01.05.15	4	1	20.00	80.00	3.2
19.05.15	3	1	25.00	75.00	3.5
03.06.15	3	-	-	-	3.7

### Summary

11.12.14 → No of eggs laid - 24

24.12.14 → Hatched – 14

03.06.15 → No of slugs surviving – 3

Overall Survival rate (%) = 21.43%

24.12.14 (Date of hatching) to 03.06.15 (10 month rearing)

Mortality rate (%) =  $100 - 21.43 = 78.57\%$

Fig.3. ADULT SLUG *LAEVICAULIS ALTE*



### 3.4. Survival and Mortality Rate

The percentage survival of *Laevicaulis alte* was 58.33% on the first month, 92.86 % on the second month, 80% on the 5<sup>th</sup> month and 75% on the 10<sup>th</sup> month of observation. The percentage of mortality was 41.67% on the 1<sup>st</sup> month, 7.14 on the second month 16.67 on the 8<sup>th</sup> month, and 25% on the 10<sup>th</sup> month. The slugs reached a maximum length of  $3.5 \pm 0.07$ cm during a period of six month observation. The overall survival rate from hatching upto six months of record was 21.43% (Table 1).

## 4. DISCUSSION

Slugs may be arbitrarily divided into two groups according to their habitat. Terrestrial species live on or near the soil surface and subterranean species in the soil (Vanden Bruel and Moens, 1958 and Hunter, 1966). Stephenson (1966) reported that the terrestrial species *Agriolimax reticulatus* lay their eggs in shallow cracks of the soil at the base of plants, under rotting vegetation or in similar moisture retaining places. The current findings revealed that *Laevicaulis alte* laid its eggs most often among plant debris and in crevices of moist soil at a depth of approximately 2.5cm. The total number of eggs laid differs from species to species and more eggs are laid in laboratory cultures than in the field (Carrick, 1938). Karlin and Bacon (1961) reported that the slug *Agriolimax reticulatus* laid about 500 eggs in batches of upto 33 eggs per clutch.

The incubation period of the eggs *Arion hortensis* and *Agriolimax reticulatus* laid in autumn or spring ranges from 18 to 40 days (Fromming, 1954). But according to Carrick (1938) *Agriolimax reticulatus* needs upto 90 days to lay eggs in the field during winter. The observations on *Laevicaulis alte* revealed that it laid 10 to 24 eggs in a clutch and it took upto 10 days for hatching. The banana slugs *Agriolimax columbianus* usually deposited in clumps of 30 eggs that will hatch in 3-8 weeks (Harper, 1988). The colour of the eggs of *Laevicaulis alte* ranges from pale brownish to white and oval in shape. Similar observation was reported in *Achatina fulica* by Lambect (1999). Faberi *et al.* (2006) investigated on the slug and their eggs are initially transparent but become yellowish as they mature and hatch out into young ones in two to three weeks.

Hatching time could vary between 20 to 60 days depending upon the species (Pechanick 1995; Karleskint, 1998). Barrington and Kotpal (1974) reported that hatching time for *Indoplanorbis exustus* varies from 1 to 2 weeks. Our study revealed that the hatching period of *Laevicaulis alte* is 10-14 days. Slugs are sexually mature before they are full grown (Stephenson, 1968). *Laevicaulis alte* took three to five months to reach its sexual maturity. The present study (10 months duration) revealed that higher mortality rate (41%) occurred in December 2009 and higher percentage of survival rate (92%) occurred in January 2010. The reason for this decrease in the percentage survival and the abundance of the slugs *Laevicaulis alte* may be due to the influence of many external factors namely temperature, humidity and the availability of food. This closely follows Runham and Hunter (1970) that decline in the number of slugs during driest and

coldest months of the year. Our study also revealed that less number of slugs were available during the month of May when there was high temperature, low humidity and low rainfall.

## Conclusion

Our records of observation on the slug *Laevicaulis alte* can be used as a valuable tool not only to understand its life table parameters but also to help find out its adaptations to variations in environmental conditions, phylogeny, zoogeographical distribution and its economic potential. Slugs are known to be very important components for the maintenance of soil fertility and nutrient cycling similar to earth worm. Therefore slugs can be referred to as 'indicators of soil health'.

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