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## Anatomy of digestive tract of the Indian garden slug, *Laevicaulis alte* (Férussac, 1822)

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**Abstract**

Observations of the anatomy of digestive tract (alimentary canal) of the Indian garden slug, *Laevicaulis alte* (Férussac, 1822) were made during 2013-2014. Present study emphasizes the anatomical studies on alimentary canal of the slug *Laevicaulis alte* in relation to its feeding habit. These slugs were recovered from local gardens of Kulbhaskar Ashram P.G. College Allahabad. The said slug belongs to class: Gastropoda, order: Systellommatophora and family: Veronicellidae. This slug *Laevicaulis alte* is thought to be of African origin, but has been introduced to southern Asia, Australia and many Pacific islands [1].

**Keywords:** *Laevicaulis alte*, Pest, Anatomy, Histology, Alimentary canal.

**1. Introduction**

*Laevicaulis alte* is commonly referred as the "leather leaf or Indian garden slug". The mantle is leathery and its surface has a slightly granulated appearance. Shell is absent. Mantle covers the entire dorsum and overlaps the head. Anteriorly, it has one pair of tentacles bearing eyes. This slug can grow up to 12 cm in length [2]. It has several adaptations such as leathery dorsal surface and narrow foot to reduce evaporation for inhabiting in dry conditions. A good summer rainfall and increased relative humidity provide a favourable environment for growth and abundance of this species [3].

It is a serious agri-horticultural invasive slug pest [4] in India and neighbouring countries [5]. The host plants include lettuce, spinach and coriander as well as tobacco. It is herbivorous in feeding habit and commonly feeds on the vegetation available in its habitat. It prefers the leaves of kunduroo (*Coccinia indica*), cabbage, carrots, cauliflower, tomato and decaying wood and leaves and other vegetables present in the gardens. It feeds actively in night and early morning. It also feeds on a number of ornamental plants such as balsam, marigold, verbena, dahlia, cosmos, narcissus and lily [6].

The slug *Laevicaulis alte* is well known as a pest of flower beds in India and as a serious garden pest. It can seriously damage seedlings and young plants of bean, cabbage, gourd, lettuce and marigold. It is reported that this slug has been found to damage oil palm seedlings also [7].

Though it is common in vegetable and kitchen gardens but little attention has been paid to its anatomy and behaviour of feeding. A lot of diversity exists in the internal anatomy of gastropods. The chief account regarding the anatomy and histology of the alimentary canal of some members of the family Veronicellidae are found in the works of [8, 9, 10]. In present study, the authors have studied and described the alimentary canal of *Laevicaulis alte* in relation to its feeding habit.

**Materials and Methods**

Some adult slugs were obtained from local gardens of Kulbhaskar Ashram P.G. College Allahabad District Allahabad Uttar Pradesh. They were brought to the laboratory for further study. The slugs were kept on washed vegetation for few days and narcotized by hot water before dissection. The dissection was done for the study of anatomy of alimentary canal. Small pieces of various parts of the alimentary canal were cut and kept in 5% saline water. The tissues were immediately fixed in Bouin's fluid for 24 hours and washed with 70% alcohols to remove picric acid. Paraffin blocks were made of all the tissues of alimentary canal after dehydration. Sections were cut at 6  $\mu$  and stained by double staining method (Haematoxylin and Eosin) for histological details.

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## Results and Discussion

The digestive tract of *Laevicaulis alte* is an elongated coiled tube and well developed for its herbivorous feeding habit. It can be divided into: mouth, buccal cavity and pharynx (with two salivary glands opening into it), a small oesophagus, dilated, spacious and tubular crop, stomach receiving the ducts of anterior and posterior digestive glands, coiled intestine and the hindgut or rectum which is embedded within the body wall in the posterior right half of the body.

### Anatomy of Different Parts of Alimentary Canal

#### Mouth, buccal cavity and pharynx

The mouth is a narrow, median and roughly triangular slit like aperture at the anterior end of the snout. It leads into buccal cavity. The duct of the supra-pedal gland opens just below the mouth and provides some sort of lubricating material to moisten the food so that radula can act more efficiently. The supra-pedal gland is a J-shaped structure, about 7 mm long and hidden below the buccal mass.

The buccal cavity is surrounded by a large, thick walled, highly muscular bulbous structure, the buccal mass, sometimes also termed as pharyngeal bulb. It is about 6 mm long. The buccal cavity is a large, spacious and sac-like structure having a radula in the radular pocket. The radula is uncuspid and its function is to rasp the food particles. A single upper jaw is present anteriorly on the roof of buccal cavity. The jaw is crescentic in shape and striated and consists of approximately 21 cuticular units or teeth, whose number differs according to the age of slug. The jaw teeth are bigger in size in the middle of the jaw but gradually become smaller towards the lateral sides. It helps to cut the leaves into pieces and in the retention of the food material inside the buccal cavity.

The lumen of the buccal cavity posteriorly becomes T-shaped and represents the pharynx. The lower limb of T-shaped buccal cavity dilates to lodge the radula. It is found in radular pocket and inserted into the odontophore. The radula is finely toothed. They are arranged in 5 rows, each row having about 60 teeth.

The paired salivary glands are found on the posterior part of the buccal mass. The salivary glands are white in colour and branched structure, and lies on either side of the oesophagus. Each salivary gland is about 4 mm long, branched structure and opens by small duct (about 2 mm long) into the posterior upper part of buccal cavity.

#### Oesophagus and Crop

The oesophagus starts from the roof of the buccal cavity and passes through the nerve-ring and opens into crop. The oesophagus is slender tube-like structure about 5 mm long. It dilates abruptly to form a spacious sac-like elongated tube, the crop which is about 16 mm long. It extends posteriorly a bit away from the middle part of the body where it opens into stomach. It becomes narrower gradually towards its posterior end. It serves to store the food material.

#### Stomach

The stomach is a small sac-like structure. It is about 7 mm long and 4 mm in width in a mature slug. It is situated in the posterior half of the body cavity. The major part of the stomach is covered by the lobes of anterior and posterior digestive glands. The anterior digestive gland opens into the stomach at crop stomach intestine loop and posterior digestive gland into posterior side of the stomach.

## Intestine

The intestine originates from the anterior side of stomach which forms the longest part of alimentary canal. It is a tube-like structure and about 58 mm in length. Emerging from the stomach, it moves anteriorly up to the oesophagus and then turns posteriorly forming a U-shaped loop over the crop and ultimately penetrates into the body wall on the right side in the posterior half of the body and continues as rectum. The intestine can be divided into two parts namely the anterior part and the posterior part. The anterior part is known as typhlosolar intestine which has a typhlosolar ridge on its inner cavity, is about 10 mm long and extends upto a valve found in the inner cavity of intestine. The posterior part of intestine has no ridge on its inner cavity and is known as post typhlosolar intestine. It forms the longest part of intestine and opens posteriorly into rectum.

## Rectum

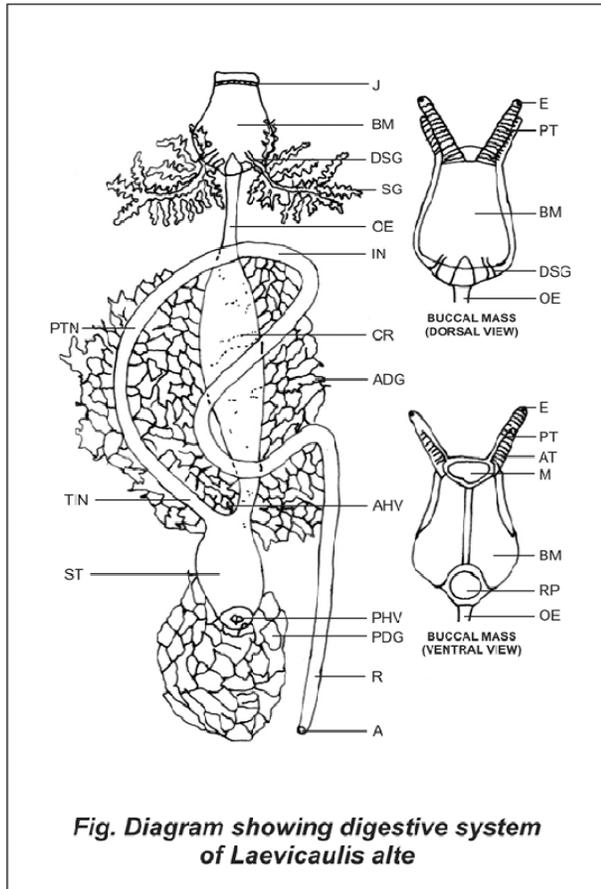
It forms the last part of alimentary canal and is about 14 mm in length and remains embedded in the body wall. The rectum starts quite close to the vagina on the right posterior part of body and runs upto posterior end of body and opens outside through cloaca. Both the rectum and ureter run side by side and at some places both are intercommunicated with each other. Both the structures open into a common sac which widens to form an anal sphincter sometimes called as cloaca.

## Conclusions

Practically no effect of torsion is seen in the alimentary canal of *Laevicaulis alte* as in other gastropods. The presence of an upper jaw is also supported by <sup>[11]</sup> in *Oxychilus cellarius*. The structure of the supra-pedal gland and salivary gland support the observations of <sup>[8]</sup> and <sup>[11, 12]</sup> and <sup>[13, 14]</sup>. All the radular teeth of *Laevicaulis alte* are uncuspid supporting the observation of <sup>[10]</sup>. The general histology regarding the folds and the formation of typhlosole support the view of <sup>[11]</sup>. <sup>[10]</sup> Did not report the presence of well demarcated typhlosole in the intestine of this slug.

None of the authors have described the presence of a well-developed valve in the intestine. Though, <sup>[11]</sup> have divided the intestine histologically into typhlosolar and post-typhlosolar parts but they did not report the demarcation between the two parts of intestine <sup>[10]</sup> is silent about the presence of a valve in the intestine of *Laevicaulis alte*. In present study a well-developed valve was observed. This valve forms the demarcation line between the two parts of the intestine, not only internally but also externally. The rectum remains embedded in the body wall of *Laevicaulis alte*, but none authors has mentioned this fact.





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