



Morphology, Surface Structure and Sensory Receptors of Larvae of *Cueta lineosa* (Rambur 1842) (Neuroptera: Myrmeleontidae)

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ABSTRACT

The morphology of larvae of *Cueta lineosa* (Rambur 1842) is described and figured for the first time by scanning electron microscopy (SEM). The females were collected from Batman, Diyarbakır and Mardin Provinces in South Eastern Anatolian Region of Turkey and maintained in the laboratory. The different parts of the third instar larvae such as antennae, head, mandibles, abdomen and types of sensory receptors are described and illustrated.

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INTRODUCTION

The order Neuroptera (lacewings) comprises 19 families, and Myrmeleontidae (antlions) are the largest family of the order, with about 2000 species distributed throughout the world. Whilst adult antlions are generally nocturnal, resting on plants during the day, the larvae have adopted a variety of predation strategies (Mansell, 1996, 1999). A few antlion larval species build distinctive cone-shaped pits in sandy soil that are used to trap ground dwelling invertebrates, particularly ants (Mansell, 1996). Larval morphological characters have played an important role in the taxonomy of Myrmeleontidae. There are some studies on larvae morphology of Myrmeleontidae (Devetak *et al.*, 2010a, b; Badano and Pantaleoni, 2014). Up to now, few studies on larval characters and sensory receptors with SEM have been made (Satar *et al.*, 2006, 2014a, b; Nicoli Aldini, 2007; Cesaroni *et al.*, 2010; Devetak *et al.*, 2010a, b, 2013), but the studies of larvae of antlions are still insufficient. The third stage larva of *C. lineosa* has been described by Mirmoayedi (2002). However, larval features were not described in detail and there were no clear photographs of corresponding larval characters and sensory receptors. Badano and Pantaleoni (2014) made a detailed study on the morphology of the *C. lineosa* with lack of the characters illustrated by the SEM. Until now, the morphology of larvae of *C. lineosa* have not been described comprehensively by SEM. In this paper the larvae are described and illustrated in detail by use of

light and scanning electron microscopes.

MATERIAL AND METHODS

The gravid females of *C. lineosa* (Fig. 1a) were collected from Batman, Diyarbakır and Mardin Provinces in South Eastern Anatolian Region of Turkey, using nets or light traps between 2014 and 2017. Females were individually isolated in glass boxes of 10x5x5 cm. They laid 3-6 eggs on the bottom of box. Larvae were placed in glass boxes that were filled with soil brought from the localities where the gravid females were collected. The larvae were kept in laboratory at a room temperature. They were fed an assortment of insects such as ants and whitefly (*Chrysoperla carnea*) (Sattar, 2017).. Observations and study were made with an Olympus SZX7 Stereomicroscope and photographed with an Olympus Digital Camera mounted on it. Third instar larvae were examined and measured with a Quanta 250 FEG scanning electron microscope (SEM).

RESULTS

The larvae of *C. lineosa* complete their life cycle in one or two years depending on the abundance of food. The duration of each stage for this species is as follows: from egg to newly hatched larva 15-25 days; second-instar larva 25-40 days; third-instar larva 10-12 months; pupa

Abbreviations

An, antenna; cl, claw; dbrst, digging bristle; f, flagellomere; lp, labial palp; md, mandible; p, palpomeres; s, sternite; sbs, sensilla basiconica; sc, sensillum chaeticum; sco, sensilla coeloconica; smt, submedian tooth; sp, spiracle; stm, stemmata; str, sensilla trichodea; ta, tarsus; to1, toot1; to2, tooth2; to3, tooth 3.

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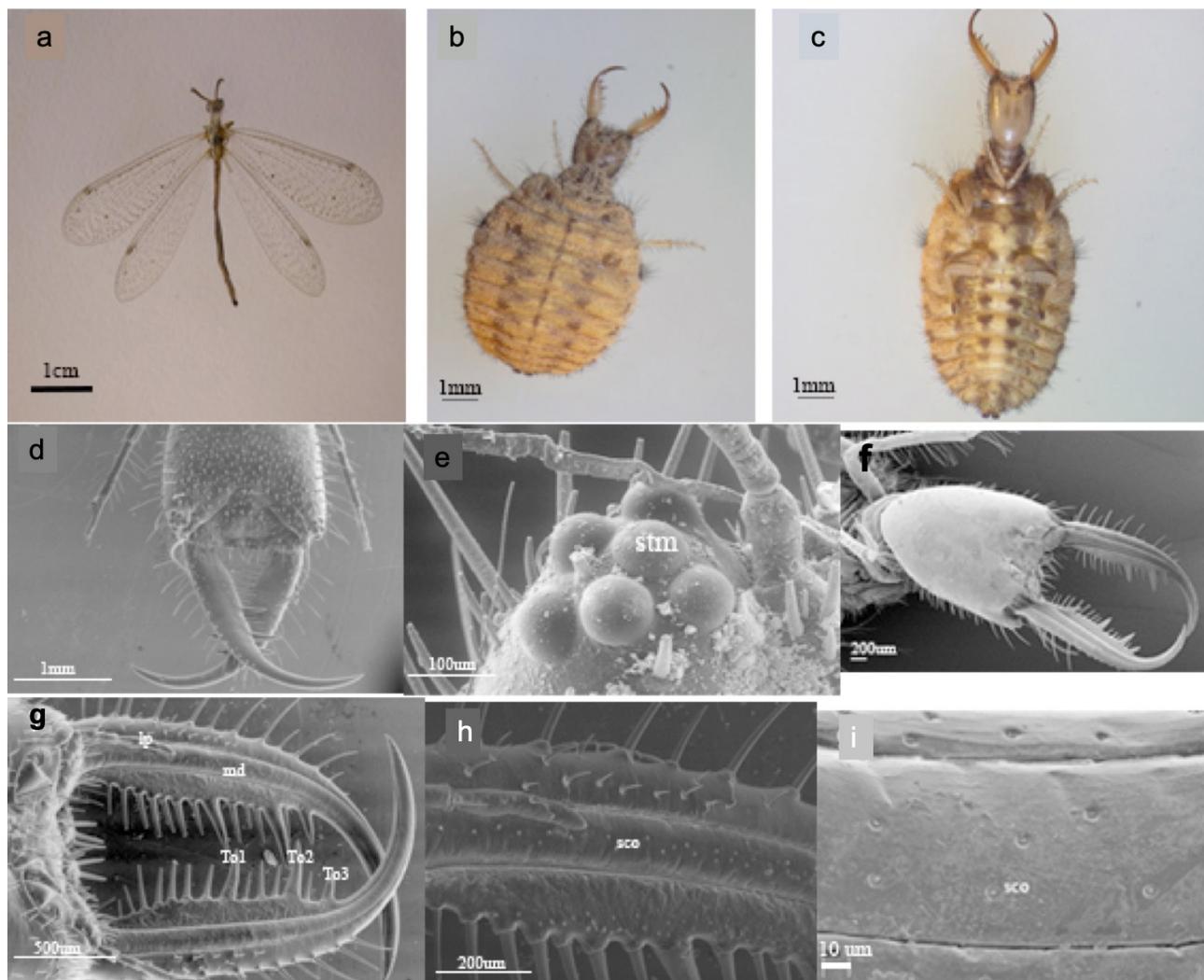


Fig. 1. *Cueta lineosa*: a) Adult; b) third instar larvae, dorsal view; c) third instar larva, ventral view; d) head: longer than wide; with dorsal view and eye tubercles; e) stemmata, lateral view; f) mandible, ventral view; g) first, second and third mandibular tooth; h and i) Sensilla coeloconica on mandible

15-25 days. These numbers are based on a sample of 20 larvae.

Third instar larva of *C. lineosa* (Figs. 1b and 1c): Body color light brown, covered with long setae and clavate dolichasters. Size (based on 12 specimens): Body length 5.5-6.5 mm (without mandibles), width (widest part) 4.5 mm (3.9-4.6). Head: longer than wide; with v-shaped; length 2.75 mm (2.7-2.86); width at widest part 1.40 mm (1.3-1.6); dark brown, covered with black hairs and clavate dolichasters on dorsal surface (Fig. 1d). Surface of prothorax fine granular and with clavate dolichasters. Eyes black, with seven stemmata. Six of which are close together and at the top while the other is below and slightly further away (Figs. 1d, 1f). Mandibles longer than head

capsule width. Mandible 1.9 (1.9-2.1) mm long, Mandibles black-brown with three teeth, the tooth 2 is the longest and in contact with tooth 3. Tooth 3 is the shortest one (Figs. 1f and 1g). Shape of teeth look like in *M. trigrammus* (Devetak *et al.*, 2013). Surface mandibles and maxillae bear a great number of sensilla coeloconica as Figures 1f, 1g, 1i and Fig 2a; eight long black bristles between base of the mandible and first tooth; three to four black bristles between first and second tooth, only one bristle between second and third tooth or no bristles there, but no bristle between the third tooth and pointed end of mandible (Figs 1f, 1g). Labial palpus with distal four palpomeres. On their distal segment occur sensilla basiconica as in Figures 2b, 2c and 2d. Each antenna with 11 flagellar segments and

on the distal part of the last flagellomere a group of three sensilla basiconica are found (Figs. 2e and 2f). Pronotum small, sclerotized, convex, roughly elliptical and nearly as broad as long, bearing tubercles, no scoli. Lateral margins of each thoracic and abdominal segment (except prothorax and terminal segments 9 and 10 of abdomen) prolonged into a pair of scoli, ten pairs in all. Thoracic spiracles very large (Fig. 2f); all other spiracles smaller, ventro-laterally located, one pair for each of the first eight abdominal segments. Abdomen broad, pale brown with white dolichasters and with sensilla (see for an abdominal sensillum trichodeum Figure 2g). Sternite 8 with two small submedian teeth (Fig. 2h). For digging bristles see. Legs: tarsi of fore and mid legs covered with longitudinally grooved bristles. The tip of the tarsus of all legs has two

claws. Between the claws, two short sensilla trichodea occur (Fig. 2i).

DISCUSSION

The genus *Cueta* comprises at least 80 known species distributed in the arid areas of Eurasia and Africa (Stange, 2004). The larvae are known only for a handful of species (Willmann, 1977; Stange *et al.*, 2003; Krivokhatsky, 2011). Larvae form ball-like cocoons, construct pitfall traps, such as species of the genera *Myrmecaelurus*.

Up to now several larval morphology of the Palearctic antlion taxa has been described by the using of SEM: *Myrmeleon formicarius* Linnaeus (Eisenbeis and Wichard, 1987), *Distoleon tetragrammicus* (Fabricius)

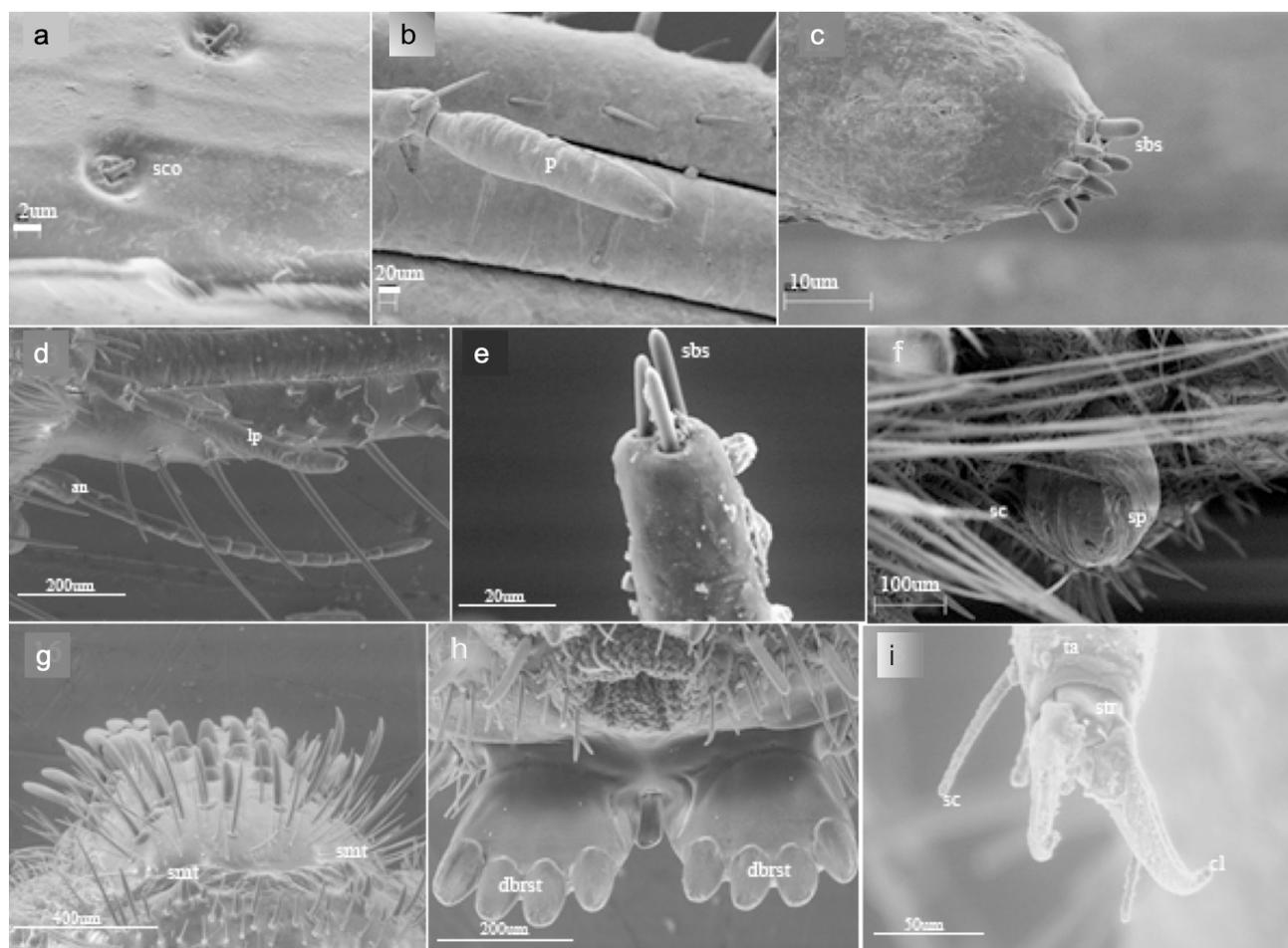


Fig. 2. *Cueta lineosa*: a) Sensilla coeloconica on mandible; b, c and d) labial palpus with distal four palpomeres, with sensilla basiconica; d and e) each antenna with ten flagellar segments and apex of last flagellomere with three finger shaped lobes sensilla basiconica; f) thoracic spiracles; g) abdomen with white dolichasters and sternite eighth with two small submedian teeth; h) digging bristles; i) the tip of the tarsus of all legs has two claws. Between the claws with two short sensilla trichodea and surface tarsus has sensillum chaeticum.

(Satar *et al.* 2006), *Myrmeleon inconspicuus* Rambur (Nicoli-Aldini, 2007), *Myrmeleon bore* (Tjeder) (Nicoli-Aldini, 2007), *Macronemurus bilineatus* and *Megistopus flavicornis* (Suludere *et al.*, 2009), *Myrmeleon mariaemathildae* (Pantaleoni *et al.*, 2010), *Myrmeleon yemenicus* Hölzel (Devetak *et al.*, 2010b), *Neuroleon microstenus* (McLachlan) (Devetak *et al.*, 2010), *Gymnocnemia variegata* (Schneider) (Cesaroni *et al.*, 2010), *Megistopus flavicornis* (Rossi) (Cesaroni *et al.*, 2010), *Myrmecaelurus trigrammus* (Pallas, 1771) (Devetak *et al.*, 2013), *Gepus gibbosus* Hölzel, 1968 (Satar *et al.*, 2014a), *Solter ledereri* Navas, 1912 (Satar *et al.*, 2014b), *Tricholeon relictus* (Hölzel and Monserrat, 2002) and *Nemoleon notatus* (Rambur, 1842) (Badano *et al.*, 2017).

Larvae of *C. lineosa* have non-prominent eye tubercles and numerous bristles on the jaws, which are both characteristic for pit-builders, like *Myrmeleon* species (Eisenbeis and Wichard, 1987; Nicoli Aldini, 2007; Devetak *et al.*, 2013).

Mandibles of *C. lineosa* longer than head capsule while in *Myrmecaelurus trigrammus* (Pallas, 1771) length of mandibles equal to head capsule (Devetak *et al.*, 2013). Labial palps are four-segmented and on their distal segment one on the tip, the other subterminally two groups of sensilla basiconica occur. With these features *C. lineosa* is same as *Myrmecaelurus trigrammus* (Pallas, 1771) (Devetak *et al.*, 2013).

Each eye tubercle in *C. lineosa* larvae bears seven stemmata. In the eyes of all larval antlion species studied so far (Jockusch, 1967; Eisenbeis and Wichard, 1987; Nicoli-Aldini, 2007; Satar *et al.*, 2006; Cesaroni *et al.*, 2010; Pantaleoni *et al.*, 2010; Devetak *et al.*, 2010a,b, 2013; Satar *et al.*, 2014a, b) an eye tubercle bears seven stemmata. Six of them are on the dorsal anterior part of the tubercle, and the seventh one oriented ventrally.

On the abdominal tip of *C. lineosa* two groups of digging bristles are arranged in the same way as in *Distoleon tetragrammicus* (Satar *et al.*, 2006) and *Myrmecaelurus trigrammus* (Pallas, 1771) (Devetak *et al.*, 2013) and in a similar pattern as in *Neuroleon* species (Steffan, 1975; Devetak *et al.*, 2010a) and *Cueta beieri* (Hölzel, 1969; Badano and Pantaleoni, 2014).

The number of the teeth (three teeth) on the inside of the jaw is general feature of antlions specimens. Shape of teeth look like in *Myrmecaelurus trigrammus* (Pallas, 1771) (Devetak *et al.*, 2013) and *Cueta beieri* U(Hölzel, 1969; Badano and Pantaleoni, 2014). In *C. lineosa* eight long black bristles between mandibular base and tooth 1, and three to four bristles between tooth 1 and 2 and one or none bristle between tooth 2 and 3 are appear. There are no bristles between the third tooth and pointed end of the

mandible. The bristles are respectively eight to nine (rarely seven), two to four, none and none in *Myrmecaelurus trigrammus* (Pallas, 1771) (Devetak *et al.*, 2013).

CONCLUSION

The larval morphology of *C. Lineosa* has been described in details using scanning electron microscope (SEM).

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Statement of conflict of interest

The authors declare no conflict of interest.

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