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COMMUNICATION

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ILLUSTRATED DESCRIPTION AND NOTES ON BIOLOGY OF *DICRANOCEPHALUS LATERALIS* (SIGNORET) (COREOIDEA: STENOCEPHALIDAE) FROM MAHARASHTRA STATE, INDIA

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Abstract: *Dicranocephalus lateralis* (Signoret), 1879, a bug from the family Stenocephalidae, is briefly redescribed with colour and scanning electron microscopy (SEM) illustrations of general morphology, including details of male and female genitalia, metathoracic scent gland (MTG), exoskeletal male abdominal glands, eggs and nymphal stages. The status of other species of this genus in India is also discussed. This will be the first well-illustrated account of the morphology and life cycle of this bug from India.

Keywords: *Dicranocephalus*; egg structure, genitalia, Heteroptera, nymphs, Stenocephalidae.

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Author contribution: BVS - collected and maintained life cycle of *Dicranocephalus lateralis*, did main fieldwork in Shirur. NUJ & SSB - preparations of photo plates used in manuscript and finalization. SSG & PPP - collection and field work. HVG - identification of bugs, photography and manuscript writing.

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INTRODUCTION

During surveys for Heteroptera in Jambut Village, Shirur (near Pune, Maharashtra State), one of us found a good population of elongate coreid bugs in a sugar cane plantation area (Image 1A) where patches of *Euphorbia hirta* Linnaeus were growing in vacant areas among plantations (Image 1B). Bugs were observed feeding on the inflorescence and mating pairs were located on this plant during September–October 2016 (Image 1C). Later, nymphs were also found on the same plant, and in January 2017 when vegetation had become dry, bugs were found mating in mud crevices (Image 1D). These slender bugs were identified as *Stenocephalus lateralis* Signoret, 1879 using the fauna volume on bugs by Distant (1902). The current valid name of this bug is *Dicranocephalus lateralis* (Signoret), and it was placed by Distant in the family Coreidae, division Stenocephalaria, but now it is placed in the family Stenocephalidae Dallas, 1852 (Scudder 1957, Lansbury 1965, 1966; Schuh & Slater 1995; Coreoidea website by Coreoidea SF Team (Coreoidea Species File Online. Version 5.0/5.0. [Retrieval date 18 February 2017] <http://Coreoidea.SpeciesFile.org>). The distribution of *D. lateralis* given in the same website is: China, India, Iran, Japan, Pakistan and Sri Lanka. Thus it is a widely-distributed yet less known species. This was the only species of the genus included in Distant's Fauna (Distant 1902), but we discuss later other possible species that were overlooked.

Distant (1902) gave habitus illustration as well as a redescription of *D. lateralis*; later a more detailed description, along with a habitus diagram and figures of genitalia, parameres and spermatheca, was provided by Lansbury (1965). Distant mentioned this species as being present in Bombay and Madras, and outside India in Ceylon (= Sri Lanka) (Distant 1902). Paiva (1906) obtained a specimen in Purneah District of the then Bengal Presidency (now Bihar), and stated that "this bug does not seem to be very common there," but also stated that the species may be widespread. This appears to be true, as listed by the Coreoidea SF Team referred to above. Lansbury recorded its presence in southern India and Bengal, Peradeniya in Ceylon, and Hong Kong; the type is preserved in the Natural History Museum, Vienna, Austria. The image provided here for first time for the type of this species, with label data (Image 1E) is said to be from 'Indies Orient' without definite locality (Lansbury 1965) [label data on type says 'Nordindien' 'Holotypus male'].

Previously, *D. lateralis* appeared to be an uncommon bug, with only four specimens collected in a decade

before this study in Pune (Hemant V. Ghate, unpublished). However, recent fieldwork in Jambut showed good density of the Euphorbiaceae host plant and proved this bug to be a common species. *Dicranocephalus* spp. are known to be associated with Euphorbiaceae plants in many places, as discussed by Lansbury (1965), and Ahmad et al. (1979) had recorded *Euphorbia hirta* as the host plant in Pakistan. It is the same plant on which we also recorded this population. More recently another plant, namely *Euphorbia hypericifolia*, was also found to be a host in the same place.

This paper attempts to briefly redescribe and illustrate the important morphological characters of *D. lateralis*. Thus, the photographs of morphological characters of male / female including male genitalia as well as the 'exoskeletal abdominal organs', sensu Lansbury, found in the male, spermatheca of the female, metathoracic scent gland (MTG), eggs, nymphs, host plant and habitat are provided along with comments on biology and taxonomy. Scanning Electron Microscopy (SEM) images are also provided for certain characters.

MATERIAL AND METHODS

A few mating pairs were collected from Jambut, near Shirur, very close to the Kukadi River, Maharashtra (about 75km northeast of Pune), during late September 2016, and brought to the laboratory for rearing and study of the life cycle. Insects were kept in large plastic 10 litre jars containing host plants, and jars were covered with muslin cloth or plastic mesh. A photo of laboratory potted plant and few nymphs in a small cup is shown in Image 1F. Transparent walls of the jars and bottles allowed examination from outside. Daily observations on mating pairs were made until egg laying occurred. Isolated nymphs were observed for metamorphosis. Bugs were observed till complete development and metamorphosis of the nymphs. In addition, one male (Shrigonda, Ahmednagar District, coll. Subodh Gaikwad, 10 March 2016) and one female (Daund, Pune District, coll. Swapnil Boyane, 9 March 2016) of *D. lateralis* were also studied. All these localities are from Maharashtra State, India. Regular field visits to Jambut were made to check the life cycle in nature as well.

The male and female (two each) specimens were dissected after treatment with hot KOH for about 15 minutes. Pygophore was dissected and kept in 10% KOH overnight at room temperature and then the phallus was dissected. Exoskeletal abdominal organs/glands of the male were also separated at the same time. Methods



Image 1 A–F. *Dicranocephalus lateralis*.

A - Habitat; B - Host plant; C&D - Mating pairs; E - Type and label data; F - Laboratory maintenance of the bug.

for measurement, photography follow Kulkarni & Ghate (2016) while SEM methods have been described previously (Sheth & Ghate 2014). Some photos were taken under microscope using 13 megapixels (Samsung E7) mobile phone camera.

Illustrated description

Stenocephalidae Dallas, 1852

Dicranocephalus Hahn, 1826

Dicranocephalus lateralis (Signoret, 1879)

Stenocephalus lateralis: Distant 1902: 406, (Fauna Brit. India)

Dicranocephalus lateralis: Lansbury 1964: 71 (Revision Stenocephalidae)

Dicranocephalus lateralis: Moulet 1994: 362 (synonymies in Stenocephalidae)

Dicranocephalus lateralis: Tschernova 1996: 105 (on East Palaearctic species)

All measurements given below are in mm. Male and female measurements are separated as male / female and are average of two males and two females.

Total length: 9.2 / 9.8

Head length measured dorsally along midline- 1.76 /

2; eye length - 0.4 / 0.4; inter ocellar distance 0.8 / 0.8, inter-ocular distance 0.5 / 0.5; antenna: first segment - 1.12 / 1; second segment - 2 / 1.8; third segment - 1.4 / 1.3; fourth segment - 2.2 / 2.1; head breadth at eyes - 1 / 1.1; pronotum breadth at humeral angles - 2 / 2.1; pronotum breadth at anterior margin - 0.8 / 0.8 (same as head breadth at base); maximum breadth at mid abdomen - 2.2 / 2.4; labium - 3.6 / 3.6; fore femur length - 2.5 / 2.2; fore tibia length - 2.4 / 2.3; fore tarsus with claw - 1.6 / 1.5; mid femur length- 2.6 / 2.4; mid tibia length- 2.6 / 2.4; mid tarsus with claw - 1.3 / 1.2; hind femur length- 3.8 / 3.6; hind tibia length - 4.1 / 4; hind tarsus with claw - 1.6 / 1.6; bucullae short - 0.16 / 0.16; respectively; corium length - 4.6 / 4.75; membrane length - 3.8 / 3.8.

Habitus and overall colouration

Elongate insect, brownish above, with dark brown punctures. Head darker, almost blackish due to two broad longitudinal stripes along entire length starting from base; antennal first segment entirely dark brown and swollen, second segment apically pale brown, third segment dark brown in distal two thirds, fourth segment pale brown in distal two thirds but pale at

base; anterior lobe of pronotum with four narrow but distinct longitudinal dark lines, with pearly white spots around, while remaining pronotum and scutellum more or less of same brownish colour, with black punctures, extreme tip of humeral angle pearly white but preceded by black spot; hemelytra with clavus and corium similar to pronotum, outermost margin of corium pale cream without any punctures, membrane smoky with darker veins, area between veins appearing as dark bands due to closely placed dark spots; connexivum with segmental dark black patches (in posterior part) that are also visible ventrally; legs pale cream, hind femora dark brown in distal one third; all tibiae at distal tip and all tarsi in distal half dark brown. Underside of head and prosternum darker due to closely set brown punctures. Mesosternum impunctate on disc, metasternum very narrow and dark. Abdomen beneath dark brown medially, especially in male, laterally pale. Overall colour dorsally brownish (with reddish tinge in life) with dark punctures, ventrally overall pale brown with a few dark areas mentioned above; legs much paler. Minor variation seen in male and female, as illustrated in (Image 2A,B).

Morphology

Head elongate, cylindrical, antecular longer than postocular. Mandibular plates projecting in front of clypeus, left one slightly longer than right one in one specimen; darker in colour with pale pearly tubercles all over in front of eye. Antenniferous tubercles partly visible from above, slightly projecting laterally. Antenna moderately long, setose with long black setae which are densest on first antennomere; first antennomere thickened, slightly convex on inner side, dark brown with few pearly white spots; second and third antennomeres long, with sparse long black setae; third shorter than second, slightly dilated apically and densely setose in apical two thirds; fourth antennomere somewhat rounded at apex, finely setose but without long black setae. Eyes large; ocelli reddish situated in between posterior border of eye and base of head, slightly closer to eye than to each other (Image 2C). Underside of head with pale pearly granules; bucculae short; labium long, extending slightly beyond mid coxae, second segment longest, first two segments pale, third and fourth brownish (Image 2D). SEM of dorsal part of head shows small tubercles and setae (Image 2E) while details of antennal colouration and setae are shown in (Image 2F).

Pronotum sloping towards head, trapezoidal; anterior margin straight, lateral margin delicately sinuate, posterior margin straight over scutellum, humeral angles very slightly produced with an obtuse, pale point, area

just inside of humeral angle slightly depressed while middle area between humeral angles slightly raised. Entire dorsal surface with dark brown punctures. Anterior lobe demarked by transverse depression, with many pearly white spots and fine punctures; posterior lobe with only dark brown punctures. A thin transverse depressed line, close to anterior border, with many large black punctures and tubercles. Callar area with cluster of pearly tubercles surrounded by finely sculptured, impunctate brownish area all around.

Scutellum triangular, slightly longer than broad, its sides parallel in one tenth of basal region, then narrowed towards apex, apex pearly white, impunctate (Image 2G). SEM image of the pronotum shows the anterior granular part and the posterior part with setigerous large punctures very clearly (Image 2H). In hemelytra, corium and clavus uniformly punctured with dark brown; extreme outer margin with tubercles which are larger in basal half than distal half, veins prominent; membrane long, slightly extending beyond abdominal tip in male (Image 2I).

Prosternum dark brown punctures all over; disc of meso and metasternum impunctate, lateral parts (pleura) moderately densely punctured. Metasternum with median, oblong, spindle shaped area of dark colour on disc (Image 2J).

Metathoracic gland aperture situated ventro-laterally, between meso and metacoxae, occupying about 40% area (inclusive of evaporatorium) of metapleuron, its ostiole long and wide, peritreme divided into 2 lobes: anterior and posterior, peritremal lobes that are joined basally, evaporatorium area large and spread on all sides around gland showing typical microsculpture (called as 'mushroom bodies') visible under SEM (Image 3A, B, C).

Legs long, slender and setose. All coxae impunctate, glossy, each with two prominent setae, trochanters impunctate, with short white setae; femora with stiff, long black setae arranged in rows; tibia slender than femur and covered with stiff, black, spinous setae like those on femur but are more numerous; all tarsi more densely setose than femora, with long black setae.

Abdomen slightly compressed, median ventral line appearing as fine carina up to pre-pygophoral segment in male, discal area darker, finely punctured with very small, moderately dense white setae and sparse, long, black setae; spiracles lateral, closer to anterior than lateral border of segment; in female abdomen ventrally slightly different as shown here (Image 4 A,B).

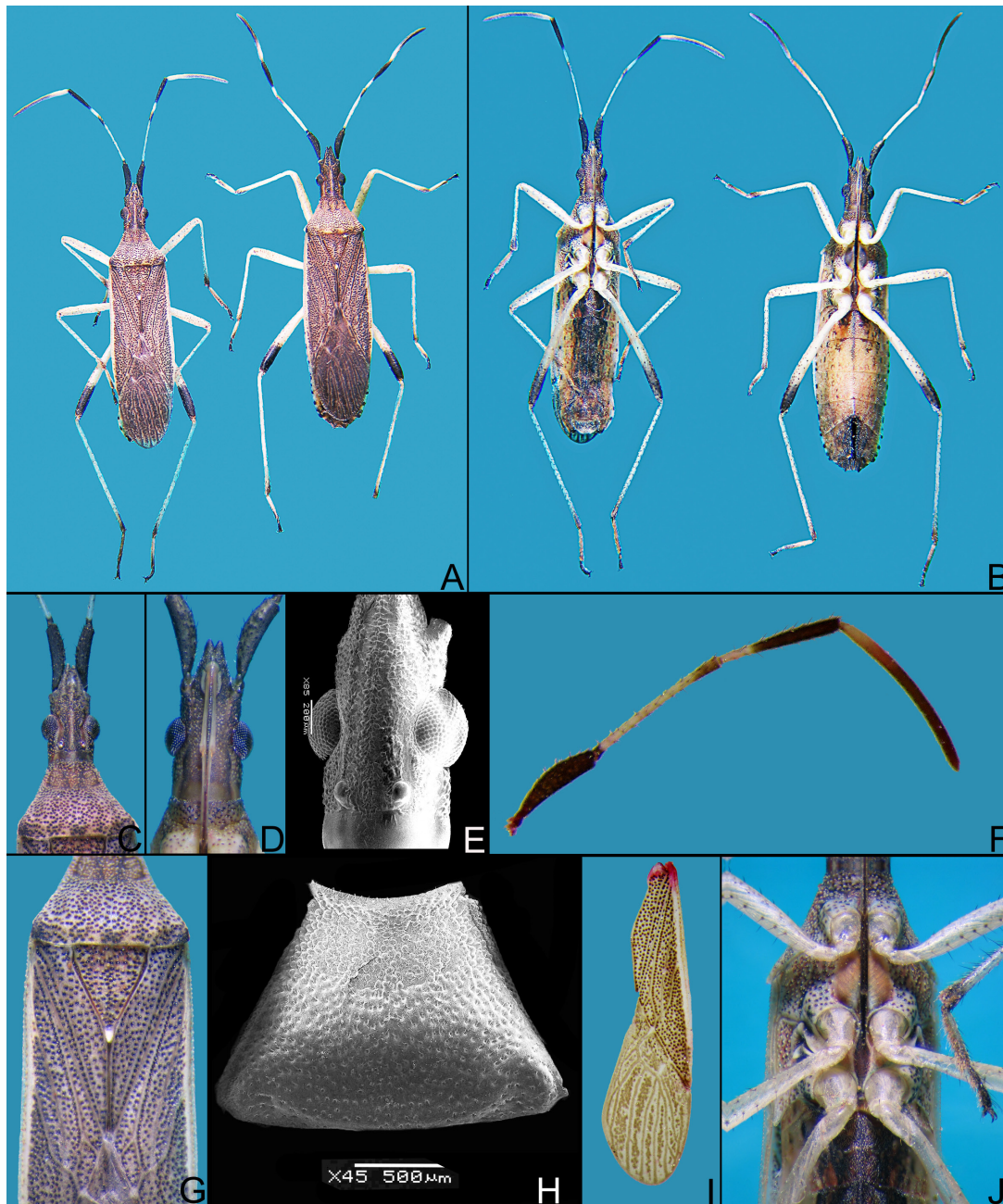


Image 2 A–J. *Dicranocephalus lateralis*. A&B - Dorsal and ventral habitus of male (on left) and female; C&D - Head in dorsal and ventral view; E - SEM dorsal view of head; F - Antenna; G - Pronotum, scutellum, clavus and corium details; H - SEM dorsal view of pronotum; I - Hemelytra; J - Ventral view thorax, note black setae on femur, tibia and tarsus

Morphology of male specific glands

Male abdominal organs (glands) are present close to seventh and eighth sternum. There are two rounded bulbs with a network of cavities with some black stellate forms similar to melanocytes. Because of KOH treatment glandular nature (nuclei / cytoplasm of any cell) was not detected. A partially sclerotised rounded plate associated with this organ is visible between two bulbs

(Image 4 C).

Morphology of genitalia

Pygophore *in situ* not visible from dorsal side (Image 4D), covered over by transversely rugulose tergite, convex ventrally and flat dorsally; it is setose ventrally (Image 4E) as well as laterally, especially in distal part. Pygophore more or less circular from dorsal / ventral side, with wide posterior opening and only a short, sclerotised

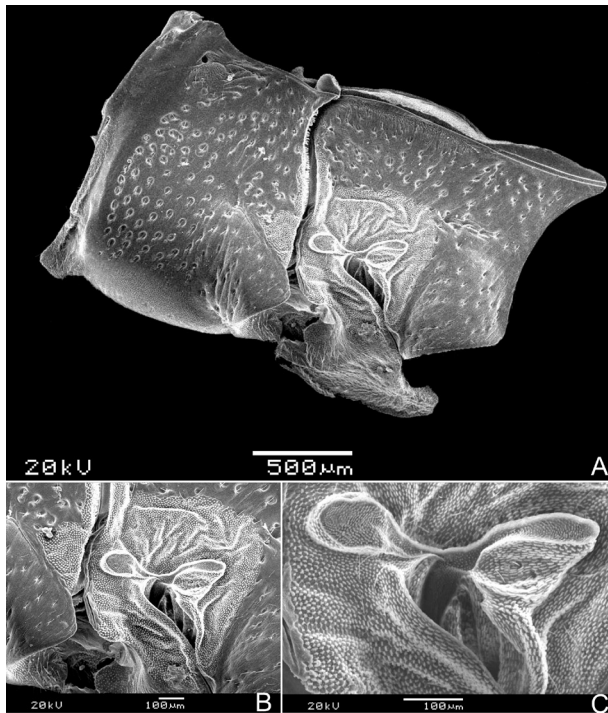


Image 3 A–C. *Dicranocephalus lateralis*: metathoracic gland (MTG) and details.

bridge proximally (Image 4F,G), with anterior opening of moderate size; ventrally strongly convex, ventro-median angular process (or posterosuperior process) projects between parameres, clearly visible in posterior view only (Image 4H). The wall of pygophore has bulb like projection (suspensory apodeme?) on inner side, one on either side laterally (Image 4I). Parameres stout, broad at base and tapering towards apex, apical region strongly bent and setose; both parameres identical and are shown here in two views (Image 5A). Aedeagus very small, with moderately sclerotized phallobase and more strongly sclerotized vesica tube, shown here in dorsal, ventral and lateral views (Image 5B,C,D); various parts of aedeagus such as basal plate and articulatory apparatus, basally situated, round ejaculatory fluid pump, ejaculatory duct and reservoir as well as conjunctiva and vesica are seen. Lateral wing like sclerotized small structures on either side of reservoir are also clearly visible. Female terminalia are shown in (Image 5E). Spermatheca with considerable sclerotisation and with spherical apical bulb, spermathecal duct between the bulb and the pump flange short and straight, not long and convoluted, as mentioned by Scudder (1957) for

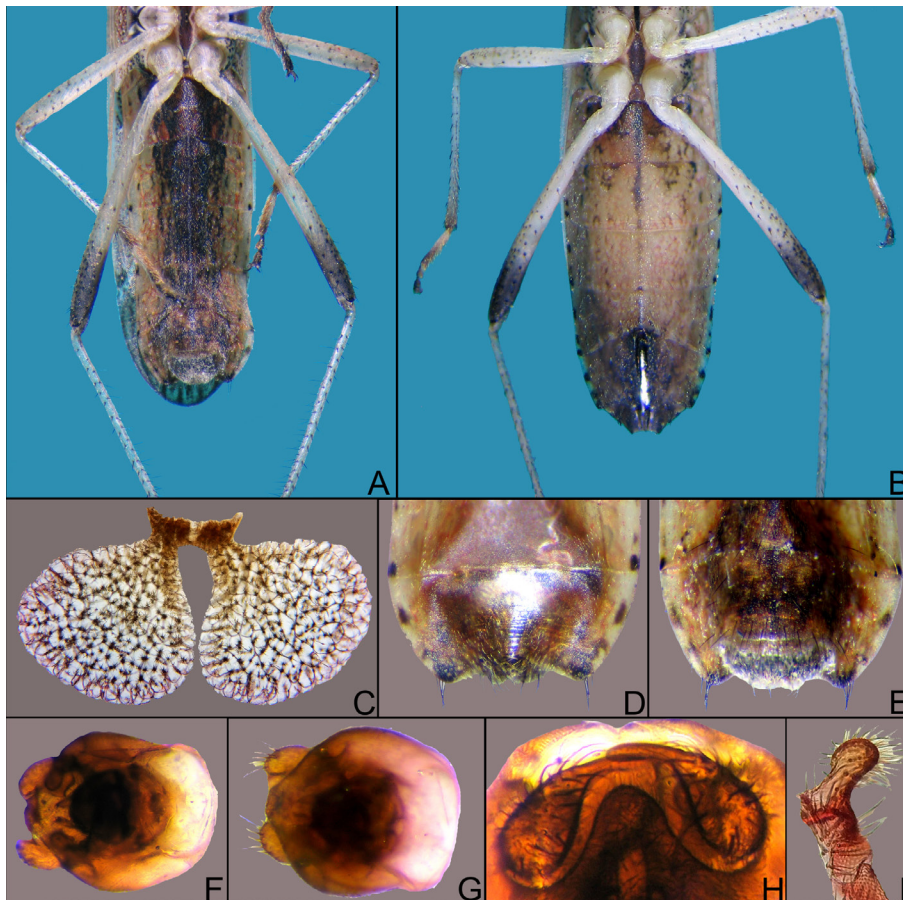


Image 4 A–I. *Dicranocephalus lateralis*.

A - Male abdomen in ventral view; B - Female abdomen in ventral view; C - Exoskeletal abdominal gland of male; D - Dorsal view male abdominal tip; E - Ventral view male abdominal tip; F - Pygophore in dorsal view; G - Pygophore in ventral view; H - Pygophore in posterior view; I - Lateral projection of inner wall of pygophore.

D. agilis (Scopoli) and later also illustrated by Lansbury (1964–1965). Scudder further designated two types of spermatheca : type I for *D. lateralis* and type II for *D. agilis*, seen in this genus (Image 5F).

Biology and Life Cycle of *D. lateralis*

Mating pairs of *D. lateralis* were noted in the field as well as in lab during October 2016. Mating occurred on *E. hirta* plant, usually on or near inflorescence. Duration of mating was variable and ranged from four hours to two days. The mating position is typical end-to-end as in other Heteroptera (see mating pair photo in (Image 1C,D). Entire life cycle was completed in about 30–33 days in November–December 2016, even when the ambient temperature was around 10°C for part of the day. Although we noted mating pairs in the mud crevices in the field during January 2017 also, we are

yet to note fresh egg laying after this period. Second instar nymphs were, however, noted in similar crevices indicating another period of egg laying activity in late December of 2016.

Eggs and nymphs

Approximately three or four days post mating, the eggs were laid on the leaves near the inflorescence, often closely spaced and lodged between dense hairs on plant surface (Image 6A). Two females laid 25 eggs in three days. Eggs were elongate, pale white when fresh but turned pale brown within about 24 hours. Each egg is about 1.2mm long and 0.55mm broad and has at least six micropylar projections at the broad, anterior pole (Image 6B,C).

At hatching the first instar comes out partly breaking the wall at anterior pole in semi-circular manner, close to micropylar projections. This first instar is about 1.2mm

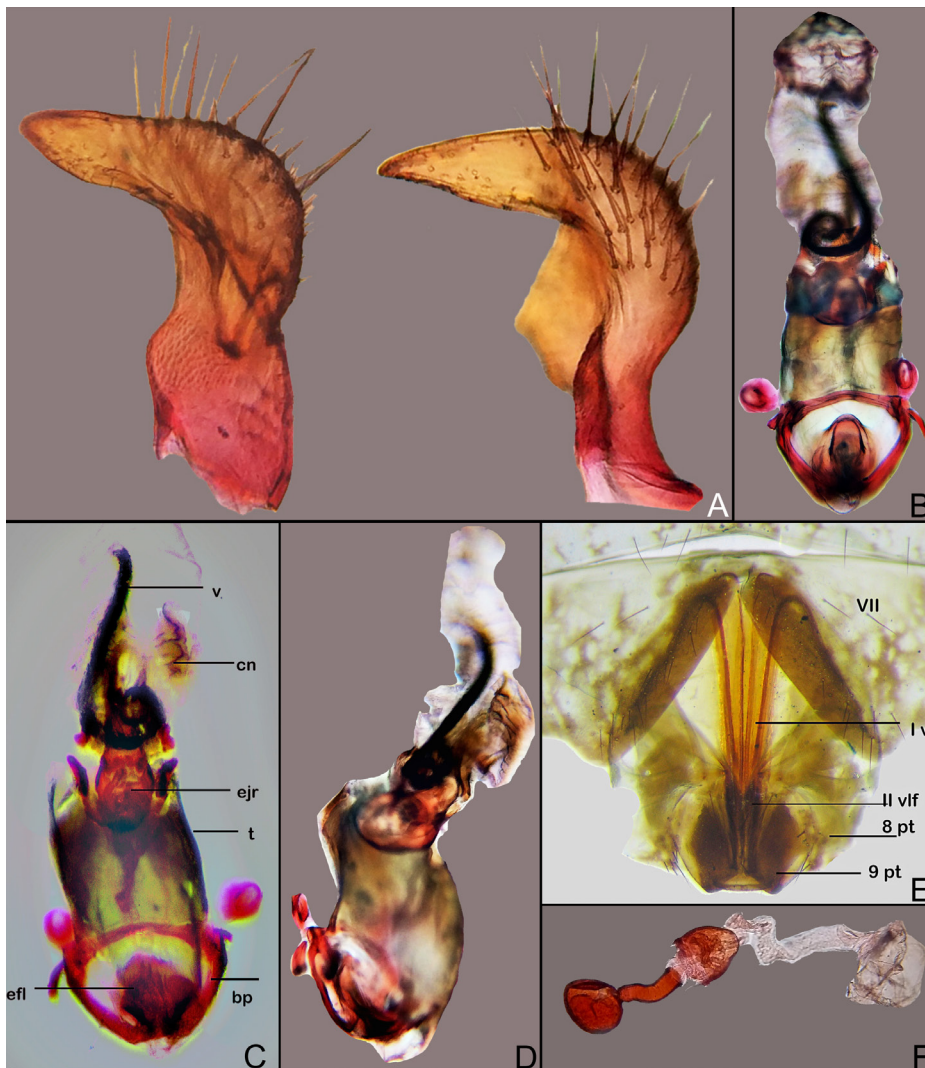


Image 5 A–F. *Dicranocephalus lateralis*.

A - Paramere in two views; B–D - Aedeagus in dorsal, ventral and lateral views, (labels: bp - basal plate, efl - ejaculatory fluid pump, ejr - ejaculatory duct reservoir, t - phallosome, cn - conjunctiva and v - vesica); E - Female Terminalia (KOH macerated preparation; VII - sternite seven, I V first valvulae, II vlf - second valvifer, 8 pt and 9 pt are eighth and ninth paratergites); F - Spermatheca.

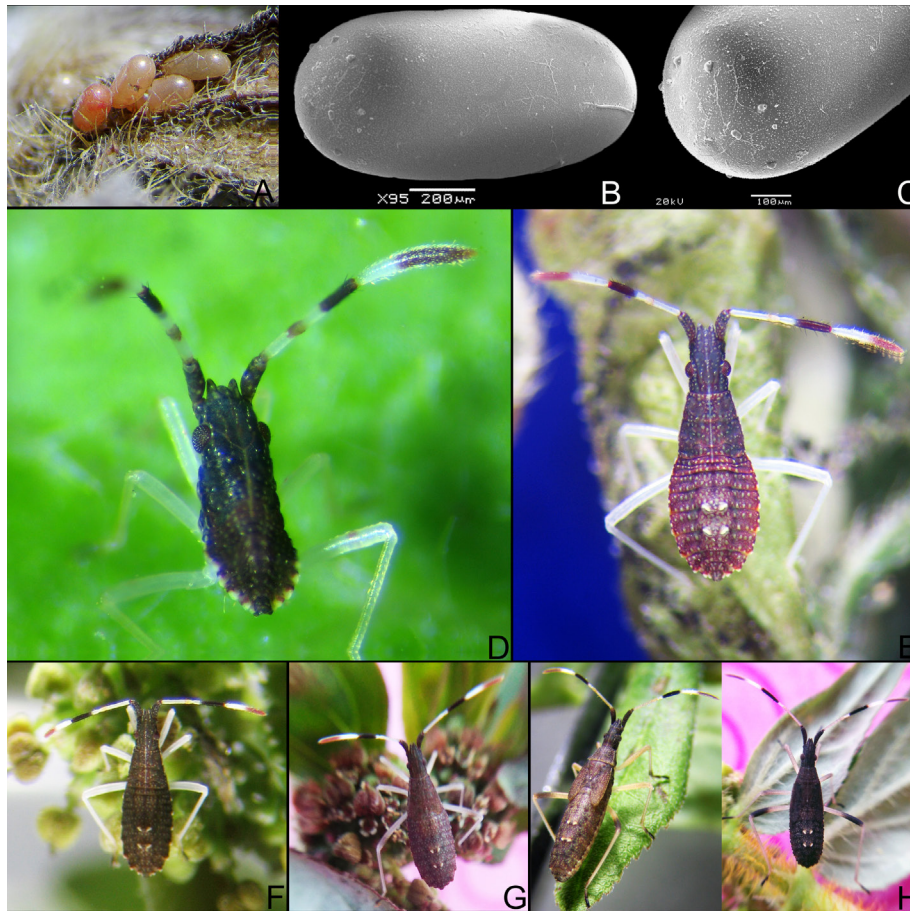


Image 6 A–H. *Dicranocephalus lateralis*, life cycle.
 A - Eggs in natural situation;
 B - SEM egg; C - SEM anterior pole of egg showing micropyles; D–G - First to fourth instar nymphs respectively; H - fifth instar nymph, early (on left) and late (on right), respectively.

long, pinkish red in colour except for legs which are creamy white but soon after it becomes brownish red, legs remaining creamy white except for terminal tarsal segment which is dark brown to black. A median pale ochraceous line is present on thoracic segments and at least on first two abdominal segments. Abdominal margin has white patches and some whitish fine spots are scattered all over the body. Dorsal abdominal glands are not seen but their positions (between 4/5 and 5/6 tergites) can be marked by round white spots. Ventral body colour is dark brown with few white spots. Head has relatively large eyes, mandibular lobes extend much beyond clypeus while labium reaches just beyond hind coxae. Antennal first segment is broad and dark brown with setae and a few whitish spots, second segment is creamy with basal thin brownish band and distal brown ring, third segment is pale cream but brownish in distal two third, fourth segment has basal one third pale cream and remaining part dark brown, fourth segment is also longest and has fine short setae all over. In the second instar antennae show only slight change in coloration, which is maintained throughout the remaining nymphal instars.

From second to fifth instars the coloration remains more or less the same, only hind femora start becoming brownish in distal one third from fourth instar onward. The major differences are in relative length of mandibular plates, development of wing pads and prominence of Dorsal Abdominal Glands (DAG). The second instar shows very little development of wing pads and dorsal glands are distinct. In the third instar, the wing pads can be very well seen but barely reach posterior border of the first tergite and the dorsal glands are very prominent, elevated, with large white patch above. Fourth and fifth instar differ from each other mainly in total length and development of wing pads, most other characters are identical. All the five instars are shown here in live colours (Image 6D,E,F,G,H).

SEM structure of nymph

A series of SEM images (Image 7A,B,C,D,E) of the fifth instar show the typical head of this species, eyes, pronotum, relative lengths of the four antennomeres, the setose last antennomere, abdomen dorsally showing wing pads and the 'scent gland plates' sensu Kumar (1966) or Dorsal Abdominal Glands (DAG); details of the

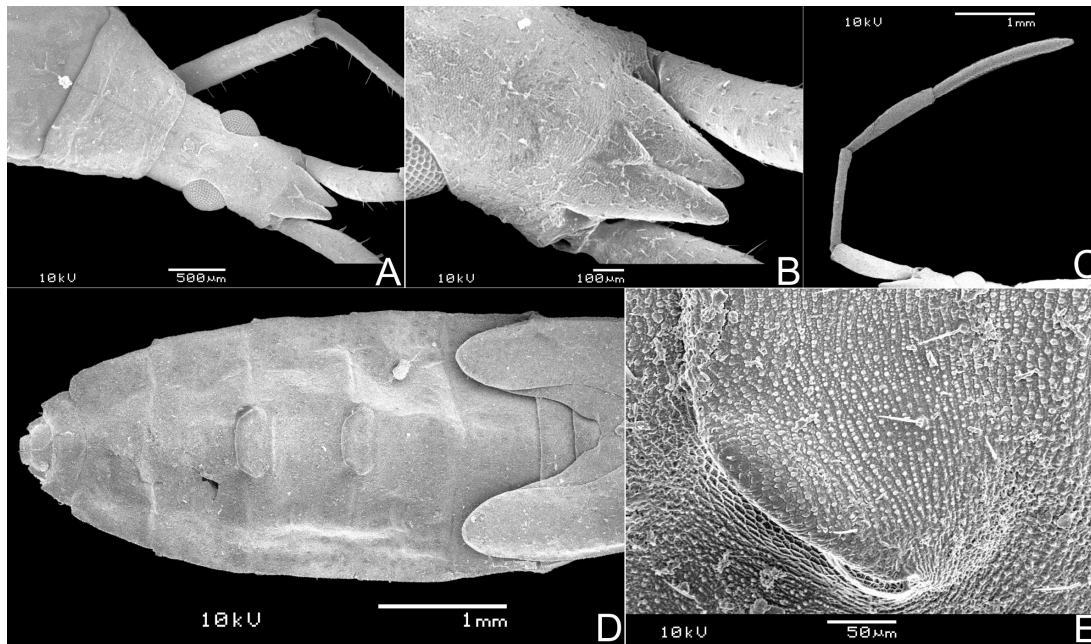


Image 7 A–E. *Dicranocephalus lateralis*, SEM images of fifth instar nymph.

A - Head and pronotum in dorsal view; B - Head details in dorsal view; C - Antenna; D - Wing buds and abdomen in dorsal view showing glands; E - Details of one gland with evaporatory area.

DAG show plate or hood of the gland, the actual opening is not seen as it is situated posterolaterally under this flap, a small amount of evaporatory area is evident as seen dorsally.

Hatching and duration of nymphal stages

All 25 eggs under observation hatched after 12–13 days. First instar was 1.2 mm long from head to tip of abdomen. It was seen inserting labium in soft tissue and so was apparently feeding in first 24 hrs and after four to five days it moulted into second instar (length 3–3.1 mm). The second moulted after three to four days to enter in the third instar which was about 4.1–4.3 mm long. The third instar took four to five days to moult into fourth instar which was 6.6–6.8 mm, which, after a duration of five to six days moulted to fifth instar (length 8.3–8.6 mm). SEM images of this stage are provided. Fifth instar lasted for seven to nine days, after that it metamorphosed into adult. Entire period from egg to adult required about 30 to 33 days. During this time, the ambient temperature varied between 10–22 °C.

DISCUSSION

A. Morphology and status of the family Stenocephalidae

Scudder (1957) first discussed the systematic position of the genus *Dicranocephalus* Hahn based

on the structure of genitalia, egg structure and other morphological features, and also gave characters of the family Stenocephalidae, citing Douglas & Scott (1865) who provided the basic diagnosis of the family. Lansbury (1965, 1966) first revised the family Stenocephalidae, gave distinctive characters of this family and also discussed the names of the valid genera. Currently the genus *Stenocephalus* is treated as a junior synonym of *Dicranocephalus* and the family Stenocephalidae now includes only the genus *Dicranocephalus*; further Lansbury also discussed the systematic position of Stenocephalidae and possible relationship with Coreidae and Lygaeidae [For history, distribution and synonyms, see Lansbury (1965, 1966); Moulet (1994)]. Brailovsky et al. (2001), while describing a new species of *Dicranocephalus* from Australia, again pointed out that Stenocephalidae are of special taxonomic interest as these species show characters that are intermediate between Coreidae and Lygaeidae and also gave a brief diagnosis of the family. According to Lansbury (1965) “Stenocephalidae are widely distributed from Ireland across Europe and Asia to Japan. Many species are found in Africa and a small number in Arabia and India” and as stated by Brailovsky et al (2001): “the majority of the species are from the tropics and subtropics of the Eastern Hemisphere”.

Distant’s redescription (Distant 1902) and additional information by Lansbury (1965), was useful in confirming

the diagnosis. Other details of morphology have been given by Lansbury (1965) and later by Schaefer (1964, 1981) who also discussed relationship between Stenocephalidae, Lygaeidae, Largidae, Hyocephalidae, etc. Our observations on the morphology of *D. lateralis* match well with those of the above referred workers and it appears that the genus is homogeneous with very little morphological variation. Although these authors provided several diagrams for various morphological characters of the other species of *Dicranocephalus*, good colour photographs or SEM photos of the various features of this Indian species have never been published before. *D. lateralis* was recently reported from Chattisgarh with diagnostic characters, some measurements and a single low resolution image of the dorsal habitus of unknown sex, by Biswas et al. (2014). The present paper primarily intends to add details to supplement previous outstanding works and add good quality images and some new information about the Indian species.

B. Male and female genitalia

Structure of the pygophore and parameres is also similar to that shown by Lansbury (1965) for *D. albipes* (pygophore) and *D. lateralis* (aedeagus, parameres), Yang (year uncertain) described male genitalia in *D. lateralis* and gave a very diagrammatic figure (no photograph) and used very different terminology. The structure of female genitalia in *D. agilis* has been described in considerable detail, including associated muscles, by Scudder (1957) and, later, a much exhaustive treatment of female genitalia (including that of *D. agilis*) and its bearing on the higher classification of the Coreoidea, simultaneously correcting some earlier misinterpretations, was provided by Schaefer (1964). The image provided here clearly shows Lygaeidae type lacinate female terminalia, as also illustrated by Scudder (1957).

C. Male-specific glands and metathoracic scent gland

The so called 'exoskeletal abdominal organs' found in the male of *D. lateralis*, and which were said "to be unique" to this genus, are very similar to that described by Lansbury (1965) for *D. albipes* (F), with only slight difference in the shape; the position of the organ is identical; however, the function of these organs is not yet definitely known. Similar glands have been noticed and their histology described in the other Heteroptera, including the other species of *Dicranocephalus* (see Thouvenin 1965).

Metathoracic scent glands in *Dicranocephalus agilis*

(Scopoli) were shown by Scudder (1957) and of *D. pallidus* (Signoret) were illustrated by Lansbury (1965) while Schaefer (1981) described in some details the structure in *D. agilis* and *D. pilosus* (Bergroth), here we have provided additional details of the structure with the help of SEM illustrations. The glands are in general similar in the genus and the overall ultrastructure is similar to that of other bugs.

D. Biology

Biology of *D. lateralis* has not been studied in India so far, thus the observations provided here are new. Data on egg structure and nymphs of *D. lateralis* has not been published before, although the host plant was recorded to be the same in Pakistan (Ahmad et al 1979). Some information on egg laying, egg structure and nymphs of European species *D. agilis* (Scopoli) are published (Scudder 1957; Puchkova 1962 as cited by Lansbury [not seen in original], Moulet 1995) but even these are without any photos. Diagrams of eggs of *D. agilis* given by Scudder (1957) and Moulet (1995) match with our photos very well suggesting that the structure of the egg is more or less similar in the other species of this genus and that it is of Lygaeid type rather than Coreoid type. Lansbury (1965, citing Puchkova's 1955 [not seen in original]) pointed out that eggs are not inserted in plant tissue, despite a lacinate type of ovipositor, but are deposited on surface. For *D. lateralis* we have provided photographic evidence here to show that this is true. The appearance of nymphs is not at all different from that shown in diagrams by Moulet (1995). We have observed mating pairs during Sept-Oct 2016 and again in January 2017, in the same area of Jambut near Shirur, even a few nymphs were seen in crevices of the dry ground. It is likely that the mature individuals of September–October period mate and lay eggs again, but this needs to be verified further.

Comments on other species of *Dicranocephalus* that may be present in India

Distant (1902) redescribed *D. lateralis* with habitus illustration. Subsequently, Lansbury (1965) described *Dicranocephalus kashmiriensis* as a new species based on two females. The holotype (female) from Kresh-nula, Kashmir, is held in the Zoological Museum of the Academy of Sciences in St Petersburg. Moulet (1994) examined a large collection of Stenocephalidae and synonymised many earlier known species, and in this process, *D. kashmiriensis* Lansbury, 1965, was synonymised with *D. marginicollis* (Puton, 1881), suggesting that it is only a colour variant of low altitude form. A later

reconsideration by Tshernova (1996) reinstated *D. kashmiriensis* and the Coreoidea Website, cited above, also maintains it as a valid species at present. Moulet (2013) has again discussed this issue and, till this is settled, we treat *D. kashmiriensis* Lansbury as a distinct species. Thus, there are, at present, two Indian species under the genus *Dicranocephalus*.

Actually, Distant had described another species, *Stenocephalus orientalis* from Mumbai (Distant 1880) but in the Fauna volume Distant (1902) synonymised his own species, *S. orientalis* Distant, 1880 with *S. lateralis*. Subsequently, a part of that *D. orientalis* material was treated as a synonym of *Dicranocephalus marginatus* (Ferrari) by Lansbury (1965), a species known from Russia, Iran and adjacent areas, a fact also seen in Moulet's synonymy (Moulet 1994), but it is a species otherwise unknown from India. The form of spermatheca of the two species is, however, very different according to Scudder (1957), so dissection of the type (lectotype) of *S. orientalis*, in the NHM, London, may add some more light on this matter. Further, as Lansbury (1965, page 68) regarded the female from 'Bombay' as 'Distant's holotype' - so making this Indian female the 'lectotype' (according to the ICZN) and including India in the distribution (of *D. marginatus*) on the basis of this single specimen. So there will be three species of *Dicranocephalus* in India but the matter has not been resolved as yet and needs further investigation. While nothing more is known about *D. kashmiriensis* and *D. orientalis* (or *D. marginatus*), we have attempted to give sufficient details about the identity as well as biology of *D. lateralis* in this work. The information provided here will make it easy to identify this species now.

The genus *Dicranocephalus* is a rather homogeneous one, as pointed out by Lansbury (1965), with a number of external features common among species; the three species of this genus, found in India, can be diagnosed on the basis of the following external characters, although there are no further reports of species other than *D. lateralis* from India. We feel that exhaustive survey and molecular work may resolve this issue further.

Differences useful in distinguishing the above-mentioned species of Indian *Dicranocephalus*

***Dicranocephalus lateralis*:** Brownish ochraceous; antennal pedicel with two brown bands; lateral margin of hemelytra pale cream and with fine tubercles; connexivum with few dark spots at posterior part of segment (not mono-coloured as stated by Lansbury); fore and mid femora mono-coloured, distal one third of hind femur dark brown.

***Dicranocephalus kashmiriensis*:** Reddish-brown with head and anterior part of pronotum black, antennal pedicel with two brown bands; lateral margin of pronotum yellow; connexivum dark brown in more than one half in posterior part of segment; all femora entirely black, all tibiae pale brown medially and dark brown in proximal and distal part.

***Dicranocephalus marginatus*:** Reddish-brown dorsally and ventrally, antennal pedicel with three dark brown bands, fore and median femora slightly darker distally.

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