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Studies on two Indian species of genus *Graptostethus* Stal (Hemiptera: Lygaeidae)

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Abstract

The two known Indian species of the genus *Graptostethus* Stal i.e. *nigriceps* Stal and *quadrisignatus* Distant have been studied in detail both for morphological characters as well as for male and female external genitalia. Illustrations have been given for all the morphological and genitalic structures for the first time. A key to the species is also provided.

Keywords: *Graptostethus*, External genitalia, Key.

Introduction

This genus *Graptostethus* is found in Palaearctic, Ethiopian and Oriental regions. According to Distant [1, 2, 3] only three species have been reported from British India. It is very close to genus *Spilostethus* but differs by few characters. Diagnostic features of this genus are pronotum with posterior margin straight, a central carina absent; scutellum beyond middle obtusely carinate; posterior margin of metasternum obliquely truncate, its posterior angles acute, apices round; femora unarmed. Both the species are distinguished from each other as shown in the key. Distribution of both the species is also given. These two species have been found along with other species of milkweed bugs on milk plants. Several species occur together on the same plant. External genitalia plays a very important role in the identification of the species Ashlock [4] and Scudder [5]. The pygophore, paramere and aedeagus are important structure in the male genitalia while in female, genital plate and spermatheca are important structures. A detailed description of both the species has been written following the current pattern in Heteroptera and photographs have been provided for various morphological structures as well as the external genitalia.

Materials and methods

The bugs were collected during the years 2009-2011 by beating vegetation and branches of trees below which a white sheet was spread. After collection the bugs were killed with ethyl acetate vapours and pinned, stretched and kept in wooden boxes for further examination. For dissection of male and female genitalia the dried specimens were relaxed by keeping them in a pertidish under wet conditions for few hours. Their abdomens were separated from the whole insect and were kept in 10% KOH at 70° temperature for 40-80 minutes depending upon the size of the insect. After dissections the structures were washed in distilled water and then dehydrated through ascending grades of alcohol, cleared in clove oil and preserved. Photography was done using image processing unit located in the Department of Zoology and Environmental Sciences, Punjabi University, Patiala. Orientation of the genital structures was arranged in such a way that it clearly depicted its distinctive features. All the measurements have been made under stereozoom binocular microscope fitted with a graph eye piece (ocular grid).

Key to the studied species of genus *Graptostethus* Stal

1. Anterior margin of pronotum red. paramere with short stem, blade long, thin and highly curved with tip highly prominently pointed; pygophore much broad; spermathecal duct very long and bulb with round apex..... *nigriceps* Stal
2. Anterior margin of pronotum black. paramere with long stem, blade short, thick and with tip rounded; pygophore less broad; spermathecal duct short and bulb with straight apex *quadrisignatus* Distant

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Graptostethus nigriceps* Stal*(Figs. 1- 11)***Cimex servus*, Fabricius 1787, *Mant.*, **2**: p. 300.*Lygaeus servus*, Fabricius 1794, *Ent. Syst.*, **4**: p. 156.*Lygaeus incomptus*, Herrich-Schaffer 1848, *Wanz.*, **8**: p. 104.*Lygaeus ornatus*, Uhler 1860, *Proc. Ac. N. S. Philad.*, p. 227.*Lygaeus inaequalis*, Walker 1872, *Cat. Het.*, **5**: p. 57.Var. *maculicollis*, Germ. 1817, *Faun. Ins. Europ.*, p. 24.Var. *nigriceps*, *manillensis*, Stal 1874, *En. Hem.*, **4**: p. 117.*Graptostethus servus*, Distant 1902, *Fauna Brit. Ind.*, **2**: p. 8.*Graptostethus nigriceps*: Barber 1958, *Ins. Micrones.*, **7**(4): p. 178.**Male**

Dorsal coloration: Head black with lateral areas red, clypeus black and pubescent, paraclypei red; eyes black; ocelli dark red; pronotum a mixture of red and black, anterior side red following a black ring, next to black ring a red area with two round spots, on posterior margin black area with a yellow median thick line; scutellum black, apex red; clavus mixture of red and black; corium black with apical edges pale red, lateral margin red with small hair; hemelytral membrane translucent and chocolate brown, basal area black; antennal segments I-IV black and pubescent; connexiva red.

Ventral coloration: Venter of head red; rostral segments black, prosternum red with black squarish area near propleuron, mesosternum black with red area near mesoleg, metasternum black with red area near propleuron and near legs; abdominal sternites black with red lateral areas, longitudinal black slit on each abdominal sternite; metathoracic peritreme black; genital capsule black.

Legs: Legs black and pubescent.

Structure

Head (Fig. 2): Head broad at base, narrow at tip, wider than long, clypeus longer than paraclypei, protruding inward, clypeus and paraclypei fused, lateral margins of head above eyes sinuate, central region of head sinuate, length of anteocular region less than remainder of head; eyes subquadrate; antenniferous tubercles widely separated; antennal segment I stout segments II and III slender, cylindrical, segment IV fusiform, antennal formula I < III < IV < II; buccula long, extending beyond antenniferous tubercles; rostrum long, reaching up to metacoxae, rostral formula IV < I < II = III.

Thorax: Pronotum (Fig. 3) moderately declivent, trapezoidal in shape, wider than long, anterior angles subacute, anterior margin convex, anterolateral sides sinuate, posterolateral sides straight, humeral angles round, posterior margin substraight; scutellum subtriangular, apex subacute, wider than long; lateral margin of corium substraight; ostiolar peritreme (Fig. 4) broad with apex broadly round and directed posteriorly; evaporative area laterally equally prominent, reaching little near lateral margin, away from posterior margin.

Abdomen: Hemelytral membrane reaching above last abdominal segment; connexiva not visible from outside; posterior margin produced in to short obtuse projections; ventroposterior margin of abdominal sternite VII concave (Fig.5).

Legs: Legs slender and pubescent, femora apically dilated.

Male genitalia: Pygophore (Fig. 9) squarish with anterior margin concave, outer lateral margin round, posterior margin subround, hairs on posterior region, in lateral view anterior margin subround; paramere (Fig. 10) with short stem, inner and outer margins substraight, inner projection thin and rod shaped, not much projecting outside, blade long, broad and highly curved with blunt apex, outer and inner margins round; aedeagus (Fig. 11) with phallosome wide, long and more sclerotized laterally, conjunctiva short with a pair of lateral lobes, vesica thick and less coiled, gonoporal process with two or three coils, ejaculatory reservoir complete, wings short and broad.

Measurements (in mm): Head length: 1.30; width across eyes: 1.70; length of anteocular region: 0.55; length of remainder head: 0.75; interocular space: 1.00; interocellar space: 0.65; length of antennal segments I: 0.40, II: 1.10, III: 1.00, IV: 1.05; length of labial segments I: 0.75, II: 1.25, III: 1.25, IV: 0.50; pronotum length: 2.05, width across humeral angles: 2.62; scutellar length: 1.25; width: 1.30; length base scutellum to apex clavus: 1.00; claval commissure: 2.25; length of corium: 3.90; length of hemelytra: 5.50; width of membrane: 2.50; length apex scutellum to apex abdomen including membrane: 4.50; maximum width of abdomen: 2.90; total body length: 8.50.

Female

Coloration: Coloration similar to male except, genital plate black.

Structure: Abdominal sternite VII bifurcated, ventroposterior margin forming triangular structure (Fig. 6).

Female genitalia: (Fig. 7) 1st gonocoxa triangular, 2nd gonapophysis narrow with subacute edge, 8th paratergite squarish with outer and inner margins sinuate, 9th paratergite more or less triangular, larger than 8th; spermatheca (Fig. 8) with long tubular bulb, apically narrow and curved, duct long with several coils, highly pigmented.

Measurements (in mm): Head length: 1.40; width across eyes: 1.70; length of anteocular region: 0.65; length of remainder head: 0.75; interocular space: 1.20; interocellar space: 0.85; length of antennal segments I: 0.50, II: 1.25, III: 1.00, IV: 0.75; length of labial segments I: 0.90, II: 1.00, III: 0.75, IV: 0.75; pronotum length: 2.25, width at posterior margin: 3.00; scutellar length: 1.00; width: 1.50; length base scutellum to apex clavus: 1.00; claval commissure: 2.55; length of corium: 4.00; length of hemelytra: 5.60; width of membrane: 1.30; length apex scutellum to apex abdomen including membrane: 4.70; maximum width of abdomen: 3.10; total body length: 9.10.

Morphological variations: Punctures on pronotum less numerous; color of membrane dark brown; abdominal sternites dark brown; size of male varies from 7.50 mm- 9.50 mm; size of female varies from 8.60 mm- 9.10 mm.

Material examined: Punjab: Ropar, 6.VIII.2010- 1♂; Hoshiarpur, 11.IV.2010- 1♂; Pathankot, 22.IV.2009- 1♀. Himachal Pradesh: Solan, 12.VI.2009- 3♂♂5♀♀, 10.VI.2009- 2♂♂. Uttarakhand: Dehradun, 26.VII. 2009- 1♂1♀, 14.IX.2010- 1♂1♂.

Distribution: Sri Lanka, Myanmar; India: Meghalaya, Maharashtra, West Bengal, Karnataka, Tamilnadu, Punjab, Himachal Pradesh and Uttarakhand.

Remarks: This species is found in abundance in many regions of the world. It is found along with other species from milkweed plants. It occurs along with *pandurus* and *quadrisignatus* and is similar to *quadrisignatus* but differs by the characters as given in the key. It is distributed throughout the Malayan Archipelago to Australasia. It is also known from China, South Africa as well as in south Palaearctic region.

***Graptostethus quadrisignatus* Distant**
(Figs. 12- 22)

Graptostethus quadrisignatus: Distant 1879, *A. M. N. H.*, 3(5): p. 130.

Male

Dorsal coloration: Head red with apex black, lateral areas surrounding ocelli black, clypeus black, paraclypei black; antennal segments black and pubescent, apical annual ring of segment II golden; eyes black; ocelli dark red; pronotum a mixture of red and black, anterior disc black more on middle, two dark black fascia on lateral posterior side, two dark black spots on fascia, centre red, posterior margin red; scutellum black, apex red; clavus red, corium suture black, corium red with two black areas on posterior side near costal margin, costal margin with golden pubescence; hemelytral membrane chocolate brown, basal angles white, apex shining white.

Ventral coloration: Venter of head red; rostral segments black, prosternum red with black squarish area near propleuron; mesosternum black with red area on anterior side, mesosternum black on posterior side and mesopleuron red; metasternum anterior and posterior red, area near leg of each prosternum, mesosternum and metasternum red, a black discoidal spot near posterior of each prosternum, mesosternum and metasternum; abdominal sternites black with red lateral areas, connexiva red, body below pubescent, genital capsule black and pubescent.

Legs: Legs dark brown with pubescence.

Structure

Head (Fig. 13): Head broad at base, narrow at tip, wider than long, area near eyes thickened, clypeus and paraclypei fused, clypeus longer than paraclypei, clypeus protruding inward, central spot on posterior margin of head yellow, length of anteocular region less than remainder of head; eyes subquadrate; ocelli near eyes; antennal segment I stout, segment II and III slender, cylindrical, segment IV thick, antennal formula $I < II < IV < II$; buccula long, extending beyond antenniferous tubercles; rostrum long, reaching up to metacoxae, rostral formula $IV < III < II < I$.

Thorax: Pronotum (Fig. 14) moderately declivent, trapezoidal, wider than long, anterior margin convex, lateral side obliquely straight, posterior margin straight, humeral angles round; scutellum subtriangular, apex subacute, wider than long; ostiolar peritreme (Fig. 15) broad; evaporatoria reaching little near to lateral margins and not reaching up to posterior margin, evaporatoria well developed.

Abdomen: Hemelytral membrane reaching above last abdominal segments; connexiva visible from outside, posterior margin produced in to short obtuse projections; ventroposterior margin of abdominal sternite VII truncate shape (Fig. 16).

Legs: Legs slender, cylindrical, femora dilated.

Male genitalia: Pygophore (Fig. 20) almost squarish with anterior margin concave, outer lateral margins subround, long hair on posterior margin, in lateral view anterior margin substraight, short hair on lateral sides; paramere (Fig. 21) with stem long and broad, outer and inner margins sinuate, inner projection in form of a rod projecting outside, outer projection small and round, blade broad; thick and curved with subround narrow apex, long hair on blade; aedeagus (Fig. 22) with phallosoma long and wide, sclerotized more toward lateral sides, conjunctiva short without any lobe, vesica thick and coiled, gonoporal process loosely coiled, ejaculatory reservoir small with wings, body broad squarish, ring sclerite present.

Measurements (in mm): Head length: 1.45; width across eyes: 1.80; length of anteocular region: 0.65; length of remainder head: 0.80; interocular space: 1.00; interocellar space: 0.70; length of antennal segments I: 0.55, II: 1.80, III: 1.20, IV: 1.40; length of labial segments I, : 1.10 II: 1.05, III: 0.90, IV: 0.80; pronotum length: 2.25, width at posterior margin: 3.00; scutellar length: 1.50; width: 2.00; length base scutellum to apex clavus: 2.10; claval commissure: 1.10; length of corium: 4.50; length of hemelytra: 6.50; width of membrane: 2.20; length apex scutellum to apex abdomen including membrane: 5.10; maximum width of abdomen: 3.20; total body length: 8.70.

Female

Coloration: Coloration similar to male except connexival segments VIII and IX black, genital plate black.

Structure: Ventroposterior margin of abdominal sternite VII divided medially, ventroanterior margin of abdominal sternite VII bifurcated medially (Fig. 17).

Female genitalia: (Fig. 18) 1st gonocoxa squarish, 1st gonapophysis broad with subacute edge, 8th paratergite squarish with outer margin sinuate and inner margins substraight, 9th paratergite broad, squarish and longer than 8th; (Fig. 19) spermathecal bulb long, narrow and apically tubular, duct long and of equal breadth with three coils.

Measurements (in mm): Head length: 1.50; width across eyes: 1.85; length of anteocular region: 0.75; length of remainder head: 0.75; interocular space: 1.05; interocellar space: 0.70; length of antennal segments I: 0.60, II: 1.45, III: 1.20, IV: 1.20; length of labial segments I: 1.05, II: 1.07, III: 1.00, IV: 0.90; pronotum length: 2.10, width at posterior margin: 3.05; scutellar length: 1.50; width: 2.00; length base scutellum to apex clavus: 2.50; claval commissure: 1.50; length of corium: 4.70; length of hemelytra: 7.00; width of membrane: 3.00; length apex scutellum to apex abdomen including membrane: 5.50; maximum width of abdomen: 3.20; total body length: 9.00.

Morphological variations: Black fascia covering whole of corium; white spot on hemelytral membrane small; Pronotum pale orange; size of male varies from 9.20 mm- 9.50 mm; size of female varies from 9.50 mm- 10.00 mm.

Material examined: Punjab: Hoshiarpur, 18.VIII.2009- 1♂1♀.

Distribution: India: Tamilnadu, Meghalaya and Punjab.

Remarks: This species is rare in its natural habitat and only few specimens have been collected from milkweed plants in

Punjab. It is morphologically very similar to *nigriceps* but differs by the characters as given in the key. It has been recorded for the first time from north India and was earlier reported from Meghalaya and Tamilnadu only.

Figures

***Graptostethus nigriceps* Stal**

(Adult- 1, Head- 2, Pronotum- 3, Scent gland- 4, Male abdomen (V.V.)- 5, Female abdomen (V.V.)- 6, Genital plate- 7, spermatheca- 8, Pygophore- 9, Paramere- 10, Aedeagus- 11).

***Graptostethus quadrisignatus* Distant**

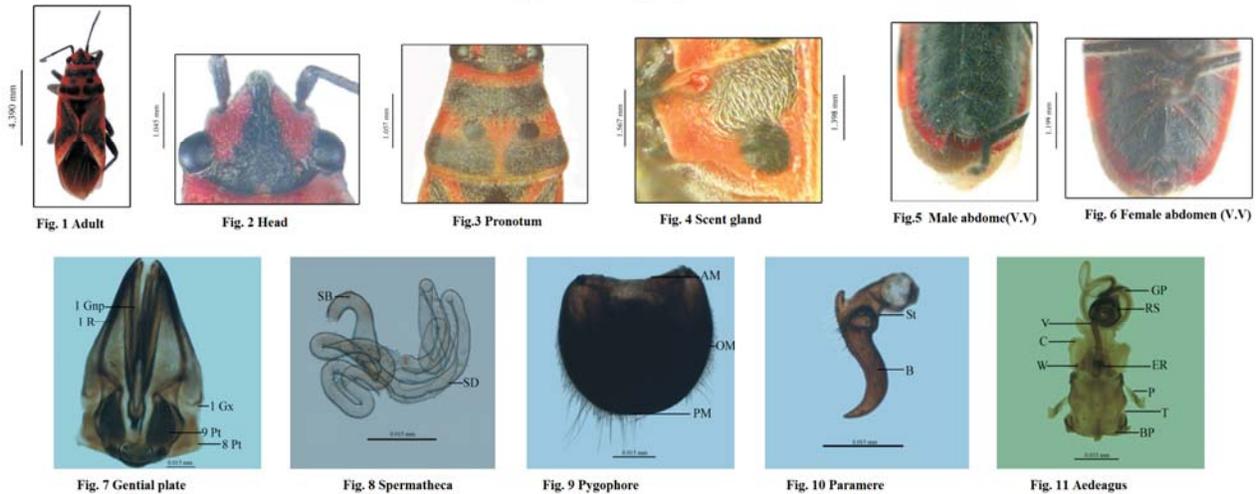
(Adult- 12, Head- 13, Pronotum- 14, Scent gland- 15, Male

abdomen (V.V.)- 16, Female abdomen (V.V.)- 17, Genital plate-18, spermatheca- 19, Pygophore- 20, Paramere- 21, Aedeagus- 22).

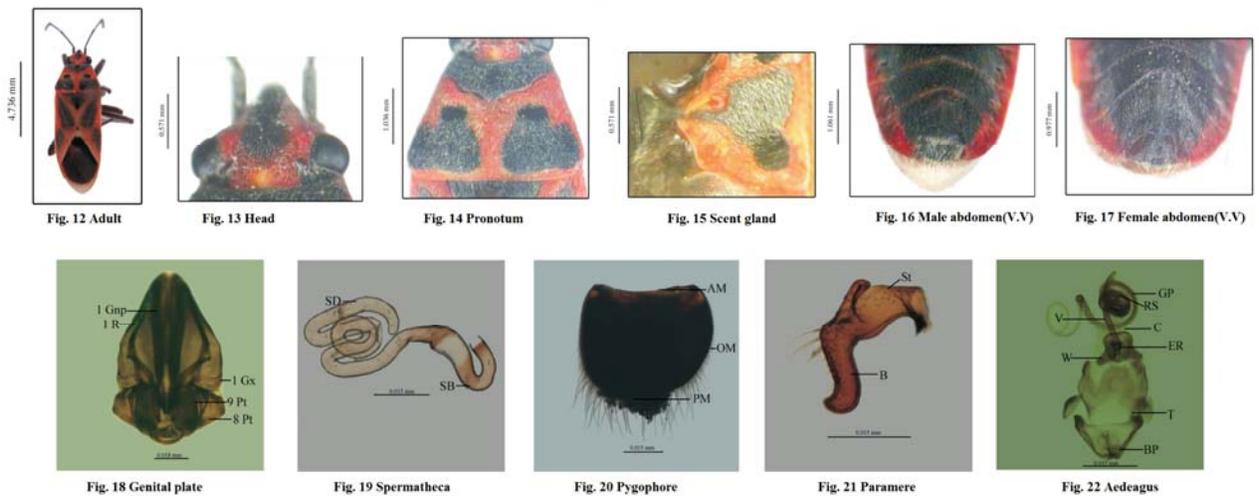
List of Abbreviations Used

AM: Anterior Margin, B: Blade, BP: Basal Plate, C: Conjunctiva, ER: Ejaculatory Reservoir, Fig.: Figure, Gnp: Gonapophysis, GP: Gonoporal Process, Gx: Gonocoxa, LSL: Lateral sclerotized lobe, mm: Millimeters, MP: Median Projection, OM: Outer Margin, P: Pivot, PM: Posterior Margin, Pt: Paratergite, R: Ramus, RS: Ring Sclerite, SB: Spermathecal Bulb, SD: Spermathecal Duct, St: Stem, T: Theca, V: Vesica, W: Wing.

***Graptostethus nigriceps* Stal**



***Graptostethus quadrisignatus* Distant**



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