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Morphotaxonomy and external genitalia of three species of genus *Tolumnia* Stål (Heteroptera: Pentatomidae) from North India

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Abstract

The morphological structures and shapes with special reference to metathoracic scent gland osteolar peritreme along with the male and female external genitalia of three species belonging to the genus *Tolumnia* Stål i.e. *basalis* Dallas, *maxima* Distant and *latipes* (Dallas) have been studied from North India. A key to the studied species is also given.

Keywords: *Tolumnia*, external genitalia, North India

Introduction

The three species of genus *Tolumnia* Stål were segregated initially based on the morphological approach with respect to various reliable taxonomical characters viz., dorsal and ventral colorations, specific markings on pronotum and scutellum, shapes and structures of head, pronotum, metathoracic scent gland osteolar peritreme, ventral anterior and ventroposterior margins of abdominal sternite VIIth of both the sexes. All the three species studied in the present paper have been earlier reported from Eastern part of India but without sufficient details with respect to their morphometric measurements, dorsal and ventral colorations and their male and female external genitalic structures. Five species of this genus were revised from Indo-Pakistan subcontinent i.e. *trinotata* (Westwood), *immaculata* Distant, *antennata* Distant, *maxima* Distant and *latipes* Dallas and the keys were also provided ^[10]. *T. basalis* till now has not been treated taxonomically. The present paper includes the detailed illustrations of its female genitalia also.

Materials and Methods

Individuals belonging to this genus were collected from different localities of North Indian states i.e. Punjab, Haryana, Himachal Pradesh, Uttarakhand, NCR region of Delhi and parts of Jammu and Kashmir. For preparing the slides of external female genitalia, the abdomen was potashed in 10% KOH and boiled for 5-10 minutes on a gas burner. The potashed sclerites were removed to expose genital plate and spermatheca. For external male genitalia, the entire abdomen was potashed in 10% KOH, boiled for 3-5 minutes, and then kept in oven for 15-20 minutes. The pygophore was dehydrated in various grades of ethyl alcohol and preserved in clove oil for further studies. Later, the pygophore was dissected to separate out the internal parts viz., paramere and aedeagus. After proper dehydration, the material was cleared in clove oil and preserved. The procedure and nomenclature ^[5] for male genitalia and for female genitalia ^[7] was adopted. The photographs of various external genitalic structures were taken by the digital camera installed in the DRS laboratory of the Department of Zoology and Environmental Sciences, Punjabi University, Patiala.

Genus *Tolumnia* Stål

Tolumnia, Stål (1867) ^[8] Öfv. VetAk. Förh, p. 515.

Type species – *Tolumnia trinotata* Westwood, a species found in Cambodia and the Malay Archipelago.

Diagnosis: Pronotum with the anterior and the antero-lateral margins elevated, anterior margin concave, slightly truncated behind the eyes with subprominent lateral angles; head forwardly narrowed with rounded apex, lateral margins slightly sinuate near middle and

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central lobe slightly longer than the lateral lobes; labium passing metacoxae; corium with the apical margin slightly sinuate near the apical angle, which is somewhat rounded at extremity; mesosternum distinctly carinate; abdominal segmental angles slightly acutely prominent; anterior tibiae sometimes moderately dilated.

Remarks: The genus *Tolumnia* Stål is represented by 13 species from the world. Keys to only 6 species collected from India, China, Philippines, Thailand, Java, Southeast Asia, Malaysia and western Indonesia have been provided so far^[4]. No major pest status has been recorded for its species till now.

Tolumnia basalis Dallas

(Fig. 1A)

Tolumnia basalis: Dallas (1851)^[2] List, p. 237

Female

Measurements (mm): Head length: 1.70; width across eyes: 1.12; interocular space: 1.10; interocellar space: 0.60; preocular distance: 0.92; length of posterior head including eyes: 0.77; antennal segments lengths: I: 0.50, II: 0.90, III: 1.05, IV: 1.20, V: 1.57; pronotal length: 2.0; width across humeral angles: 5.28; scutellar length: 3.60; scutellar width: 3.30; length of abdomen: 4.50; maximum width of abdomen: 5.28; length of rostral segments: I: 0.80, II: 1.20, III: 1.00, IV: 0.85; Distance - base scutellum-apex clavus: 2.87; apex clavus-apex scutellum: 0.68; apex scutellum-apex abdomen including membrane: 2.75; total body length: 10.

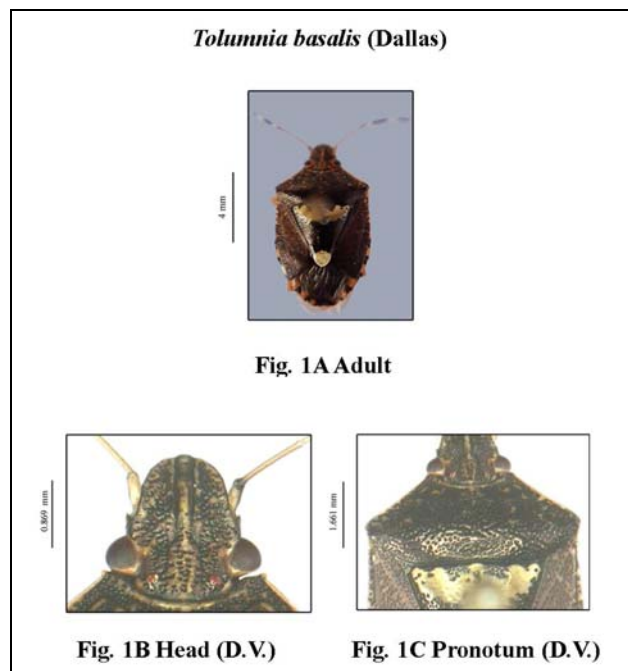
Dorsal Coloration: Head brownish-yellow with black punctures; inner and outer margin of paraclypei and posterior margin of head black, medial clypeal area scarcely punctate, area around eyes brownish-yellow; eyes blackish-red; ocelli pink; antennal segments 1st, 2nd and 3rd brownish-yellow, basal one-third of 4th and half 5th pale-whitish, rest black; pronotum brownish-yellow, coarsely and densely punctured with black; anterior and lateral two-thirds margin of pronotum and humeral angles brownish-yellow, rest black; anterior margin of pronotum with two transverse brownish-yellow callosities, bordered with black punctures; scutellum brownish, punctured densely with dark black color; scutellar base with irregular maculate pale yellow patch, apex pale yellow and impunctate; clavus, corium and costal margin is admixture of red, green and yellowish tinge; costal margin thickly punctured with black, except anteriormost costal margin pale yellow; connexiva pale yellowish-brown, anterior and posterior margins with distinct black patch; hemelytral membrane suffused with black and brown, outer margin translucent.

Ventral Coloration: Labium pale yellow with dark brown central area and black apex; head pale yellow, except lateral margins and below antennal segment black; sternum yellow, punctate with double series of four black spots, one on anterior margin of sternite, one on base of coxae; metasternite with additional pair of spots on lateral margin; metathoracic scent gland opening pale yellow and impunctate, evaporatorium pale whitish; abdomen finely punctured, admixture of pale brownish yellow with green tinge; genital capsule brownish yellow; spiracles yellow; lateral margin of abdomen pale; connexiva concolorous to dorsal surface; legs brownish yellow, finely spotted with black, tarsi darker.

Structure

Head (Fig.1B): Head longer than broad, moderately declivent, subrounded at apex; paraclypei subequal to clypeus, latter slightly lobulated and medially raised; lateral margins of paraclypei slightly sinuous above eyes, reflexed anterolaterally and arrowed at apex; 1st antennal segment not reaching apex of head; antennal segmental formula – I<II<III<IV<V; labium long, slender just reaching metacoxae; labial length formula – I<IV<III<II; Thorax: Pronotum (Fig.1C) about 2.5X wider than long, moderately deflected anteriorly, calloused posteriorly with anterior margin concave, subtruncate behind eyes, protruding as small tuberculate obtuse angles anterolateral, lateral margins smooth, obliquely straight; humeral angles subprominent and obtuse; frenal region distinctly greater than post-frenal, beyond frena narrowed as subtriangular apical lobe; connexiva well exposed at repose dorsally; metathoracic scent gland osteolar peritreme (Fig.1D) long, elongated, sinuously concave, narrowed acutely at apex, reaching about three fourth way to metapleural margin; evaporatorium with well-developed equally extended anterior and posterior margins, medially concave forming V-shaped structure covering two-third area of sternite; legs without any modifications, femora slightly pilosed, tarsi and posterior end of tibiae pilosed with golden pubescence; abdomen medially convex, depressed laterally; connexiva exposed at repose; genital capsule with golden pubescence; ventral anterior margin of VIIth abdominal sternite concave, somewhat an inverted U-shaped, with acute posterior angles (Fig.1E); hemelytral membrane passing moderately beyond apex of abdomen.

Female Genitalia: 1st gonococcie subtriangular, sinuate on inner margin; 2nd gonococcie somewhat rectangular, anterior margin sinuate; 8th paratergites elongate, triangular; 9th paratergites broad, lobulate, subrounded at posterior margin, not passing beyond fused posterior margins of 8th paratergites (Fig.1F); spermatheca (Fig.1G) with distinct distal and proximal flanges; pump region small, spiral tube like, distinctly shorter than distal spermathecal duct; bulb elongate with two finger like processes; proximal spermathecal duct distinctly longer than distal spermathecal duct.



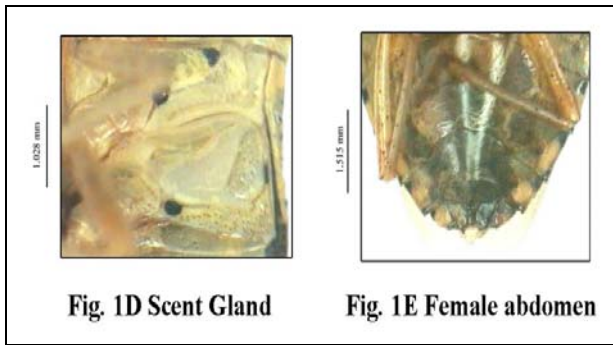


Fig. 1D Scent Gland

Fig. 1E Female abdomen

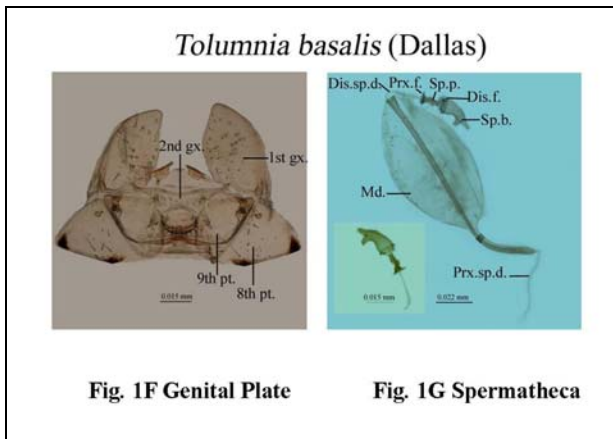


Fig. 1F Genital Plate

Fig. 1G Spermatheca

Tolumnia basalis (Dallas)

Material Examined

Himachal Pradesh: Paonta Sahib, 04. x. 2009 - 1♀

Uttarakhand: Sahastradhara, 16. ix. 2010 - 1♀

Distribution: India (Uttarakhand, Himachal Pradesh, Meghalaya).

Remarks: The species closely resembles *T. maxima* and *T. latipes* in general body form, but can be easily separated from the two in having scutellar base with transverse extensive pale fascia forming distinct irregular band; antennae with 1st and 2nd segments brownish yellow and spermathecal bulb with two distinct finger like processes as compared to scutellum with distinct pale basal angular spots; antennae piceous with bases of joints paler and spermathecal bulb without distinct finger like processes in the mentioned species. It is a new record from North India.

Tolumnia maxima Distant

(Fig. 2A)

Tolumnia maxima: Distant (1902) ^[3] *Faun. Brit. Ind. Rh.*, 1: pp: 154 & 155.

Female

Measurements (mm): Head length: 2.09; width across eyes: 2.09; interocular space: 1.20; interocellar space: 0.75; preocular distance: 1.10; length of posterior head including eyes: 0.99; antennal segments lengths: I: 0.50, II: 1.05, III: 1.20, IV: 1.20 V: 1.90; pronotal length: 2.88; width across humeral angles: 6.60; scutellar length: 4.60; width: 4.20; length of abdomen: 5.0; maximum width of abdomen: 6.435; length of rostral segments: I: 0.85, II: 1.40, III: 1.0, IV: 0.85; Distance - base scutellum-apex clavus: 2.875, apex clavus-apex scutellum: 1.375, apex scutellum-apex abdomen including membrane: 3.25; total body length: 12.0.

Dorsal Coloration: Head pale chocolate brown, thickly punctured with coarse black punctures and yellowish-brown irrorations which are more pronounced on clypeal lobe; eyes reddish-brown, bordered with yellowish-brown, a distinct yellowish-brown patch below eye; ocelli deep red; antennae yellowish-brown, speckled with black, base of 4th pale brownish-yellow, base of 5th segment darker; pronotum chocolate brown, coarsely punctured with black, punctures more pronounced on anterolateral and posterior area, along with broad black fascia on posterior area; anterior pronotal area with two chocolate brown callosities, impunctate; scutellum paler, thickly punctured with dark brown, base of scutellum with 5 brownish-yellow spots, apex pale, lateral area with chocolate brown fascia; clavus, corium and costa slightly fainted with black punctures, speckled with grayish-black fascia; anteriormost region of costal margin pale, levigate; connexiva alternating with black and brownish-yellow fascia; hemelytral membrane hyaline.

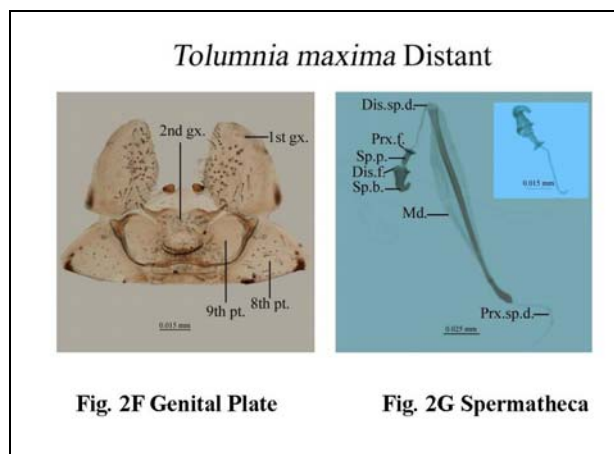
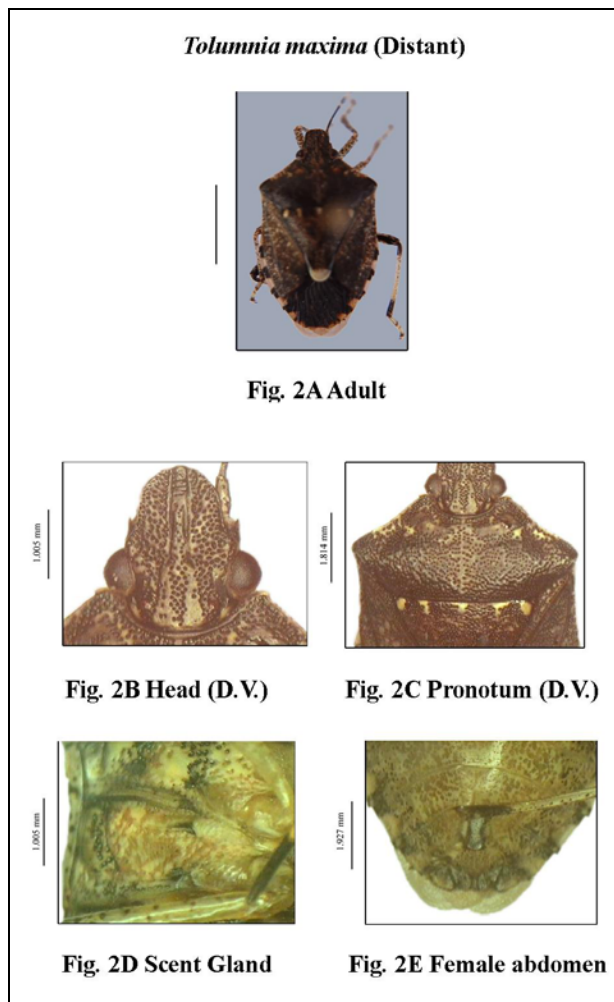
Ventral Coloration: Labium pale brownish-yellow with black apex; head with lateral area pale brownish-yellow, scarcely punctured with black, area below 1st labial segment impunctate; area between legs paler with reddish tinge, impunctate; sternum pale brownish-yellow, with a double series of black punctures, some tinged with green; metathoracic scent gland opening black, rest concolorous; abdomen centrally pale, punctured with light brown; lateral area blackly punctured; spiracles black; connexivum with black anterior and posterior margins, and central broad pale area; VIIth abdominal segment with an elongate central black spot on disk; genital capsule light greenish, pilosed; legs pale brownish-yellow, apices of femora spotted with black, apex of tarsi, base and apices of tibiae speckled with black.

Structure

Head (Fig.2B): Head moderately deflected, subrounded at apex; clypeal lobe slightly raised medially, marginally longer than paraclypei, later sinuous above eyes and distinctly reflexed anterolaterally; antennal segmental formula – I<II<III=IV<V; labium long, just reaching base of metacoxae, labial lengths formula – I=IV<III<II. Thorax: Pronotum (Fig.2C) declivent, slightly raised posteriorly; anterior pronotal margin concave with subacute tubercles directed anteriorly, lateral margins calloused, slightly concave medially, humeral angles prominent, subacute, posterior margin straight; scutellum beyond frena narrowed into subrounded apical lobe; connexiva well exposed at repose dorsally and ventrally with acute connexival angles; metathoracic scent gland osteolar peritreme (Fig.2D) long, medially concave, narrowed apically, covering more than half way to metapleural margin, evaporatorium broad, with subprominent anterior and posterior margins, covering two-third of sternite; legs with tibiae, tarsi and genital capsule pilosed with golden hairs. Abdomen: callosed medially, flattened laterally; ventral anterior and ventroposterior margin of VIIth abdominal sternite broadly concave, somewhat an inverted U-shaped (Fig.2E); hemelytral membrane passing beyond apex of abdomen.

Female Genitalia: 1st gonococcie quadrangular; 2nd gonococcie with sinuate anterior margin; 9th paratergites broad, less wide apart, subrounded at apex, not reaching fused posterior margins of 8th paratergites; 8th paratergites triangular without any spine on posterior margins (Fig.2F); spermatheca (Fig.2G) with distinct distal and proximal flanges; pump

region small, slightly broad, tube like, distinctly 3X shorter than thin distal spermathecal duct; bulb trapezoidal, curved and pointed at apex; proximal spermathecal duct distinctly longer than distal spermathecal duct



Material Examined

Uttarakhand: Nainital, 20. viii. 2011 - 1 ♀

Himachal Pradesh: Solan, 14. x. 2011 - 1 ♀

Distribution: Myanmar; India (Uttarakhand, Himachal Pradesh, Paschim Banga).

Remarks: This species closely resembles *T. latipes* in body form and general coloration, but can be easily separated from

it in having five distinct small spots across base of scutellum; spermathecal bulb somewhat trapezoidal, extended downwardly with single curved process and 9th paratergites broad, not passing beyond the posterior margin of 8th paratergites. It is a new record from North India.

***Tolumnia latipes* (Dallas)** **(Fig. 3A)**

Pentatoma latipes, Dallas (1851) ^[2] *List Hem.*, 1: p. 238.

Dalpada obtusicollis, Ellendr. (1862) ^[4] *Nat. Tijdschr. Ind.*, 24: p. 143.

Pentatoma trispila, Walker (1867) ^[9] *Cat. Het.*, 2: p. 302.

Var. *Pentatoma contingens*, Walker. *loc. cit.* p. 302.

Tolumnia latipes: Breddin (1900) ^[1] *Abh. Naturforsch. Ges. Halle.* 24: p. 298.

MALE:

Measurements (mm): Head length: 1.70; width across eyes: 1.90; interocular space: 1.90; interocellar space: 0.90; preocular distance: 0.60; length of posterior head including eyes: 0.90; antennal segments lengths: I: 0.50, II: 0.90, III: 1.0, IV: 1.20, V: 1.65; pronotal length: 2.20; width across humeral angles: 5.61; scutellar length: 4.0; scutellar width: 3.60; length of abdomen: 4.375; maximum width of abdomen: 5.61; length of rostral segments: I: 0.85, II: 1.20, III: 0.95, IV: 0.85; Distance - base scutellum-apex clavus: 2.50; apex clavus-apex scutellum: 1.25; apex scutellum-apex abdomen including membrane: 3.0; total body length: 8.50.

Dorsal Coloration: Head shining black, with irregular obscure brownish yellow spots and thick lamelliform black punctures; a median longitudinal line, levigate deep brownish-yellow; concolorous small spots just behind eye; eyes reddish black; ocelli bright red; antennae multicoloured, 1st segment brownish black, 2nd and 3rd yellowish brown, 4th and 5th black, except base of 4th and basal half of 5th deep brownish yellow; pronotum dark chocolate brown, thickly punctured with black and obscure brownish yellow irrorations, anterior area with two yellowish brown impunctate transverse callosities, anterolateral margins levigate, brownish yellow, rest black, tip of humeral angle pale yellow; scutellum chocolate brown with black punctures, and few brownish-yellow irrorations, base of scutellum with three levigate pale spots (one central, two angular), apex broadly levigate, deep brownish yellow; clavus and corium slightly paler than scutellum with maculate concolorous spots, a large brownish-yellow spot just at the tip of suture between corium and costa, anteriormost portion of costa pale, impunctate; connexiva paler, impunctate with anterior and posterior margins blackly punctate; hemelytral membrane brownish, outer margins transparent, veins darker.

Ventral Coloration: Labium pale brownish yellow, apex black; head with lateral edges black, lateral areas pale yellowish-white; sternum with three black spots, each at base of coxae one small black spot just below anterior margin of mesosternite; humeral angles black; metathoracic scent gland peristeme and evaporatorium pale brownish-yellow and finely punctate; abdomen deep brownish-yellow and scarcely punctured with fine punctures; connexiva pale brownish-yellow alternating with broad impunctate black anterior and posterior margins, posterior connexival angles black; spiracles yellow bordered with dark brown; legs deep brownish-yellow spotted with black, apex of femora, base and apex of tibiae and entire tarsi black; genital capsule brownish-yellow.

Structure

Head (Fig.3B): Head slightly wider than long, moderately deflected, subrounded at apex; paraclypeal lobes subequal to slightly lobulated clypeus; former very slightly sinuate above eyes, anterolaterally reflexed upwards and narrowed at apex; 1st antennal segment not reaching apex of head. Antennal segmental formula – I<II<III<IV<V; labium long, reaching metacoxae, labial lengths formula – I=IV<III<II. Thorax: Pronotum (Fig.3C) slightly deflected anteriorly, raised medially, anterior margin concave, truncated behind eyes, produced as small tuberculate spines directed antero-laterad, lateral margins obscurely sinuate, humeral angles subprominent, obtuse; scutellum as long as broad, raised anteriorly, apically flattened and distinctly narrowed as subrounded apical lobe beyond frenal region; metathoracic scent gland osteolar peritreme (Fig. 3D) long, broad at orifice, narrowed acutely at apex, reaching three fourth way to metapleural margin; evaporatorium well defined, broad, subequally extended anterior and posterior margins, deeply concave medially, covering large area of sternite. Abdomen: slightly calloused, flattened laterally; connexivum well exposed at repose dorsally and ventrally; legs with tibiae and tarsi pilosed; genital capsule with golden pubescence; ventral anterior and ventroposterior margin of abdominal sternite VIIth deeply concave, somewhat an inverted V-shaped with subacute angles (Fig.3E); hemelytral membrane passing moderately beyond abdominal apex.

Female

Measurements (mm): Head length: 1.70; width across eyes: 1.90; interocular space: 1.90; interocellar space: 0.60; preocular distance: 0.80; length of posterior head including eyes: 0.90; antennal segments lengths: I: 0.50, II: 0.90, III: 1.0, IV: 1.20, V: 1.65; pronotal length: 2.20; width across humeral angles: 5.61; scutellar length: 4.0; scutellar width: 3.60; length of abdomen: 4.37; maximum width of abdomen: 5.61; length of rostral segments: I: 0.85, II: 1.20, III: 0.95, IV: 0.85; Distance - base scutellum-apex clavus: 2.50; apex clavus-apex scutellum: 1.25; apex scutellum-apex abdomen including membrane: 3.0; total body length: 9.0.

Coloration and Structure: Body coloration and form similar to males except, ventral anterior margin of abdominal sternite VIIth concave with acute posterior connexival angles and ventroposterior margin broadly concave (Fig. 3F).

Female Genitalia: 1st gonococcie broad, quadrangular, 2nd gonococcie short, anterior and posterior margin concave; 8th paratergites triangular with small acute spines at posterior margin; 9th paratergites lobulate, rounded at posterior margin, reaching fused posterior margin of 8th paratergites (Fig.3G); spermatheca (Fig.3H) with distinct distal and proximal flanges; pump region small, tube like, spiral; bulb squarish with two small finger like processes; proximal spermathecal duct slightly longer than distal spermathecal duct.

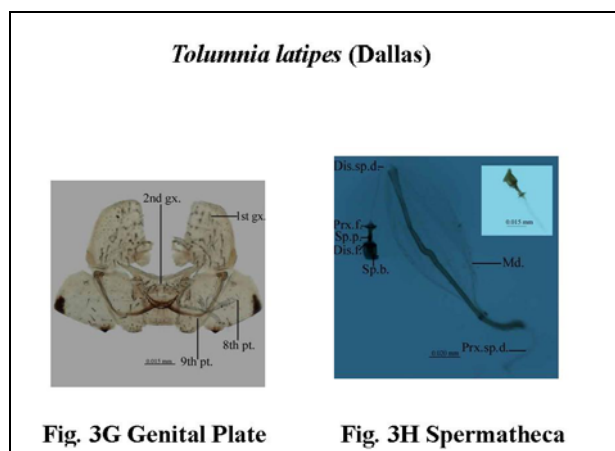
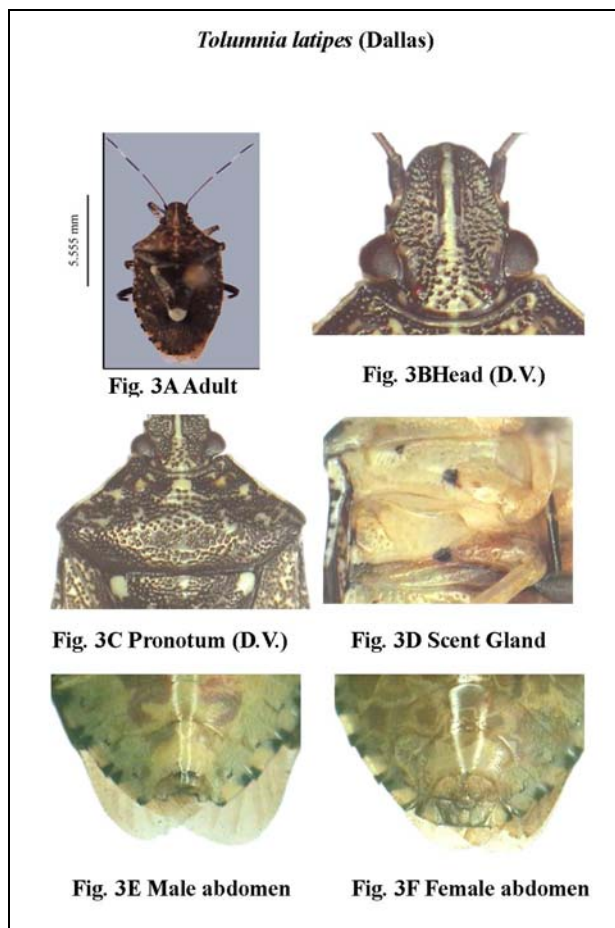
Male Genitalia: Pygophore (Fig.3I) broader than long, somewhat U-shaped, with well developed dorsolateral lobes, broadly rounded at apex; ventroposterior margin sinuate and concave; dorsal opening extremely large; paramere (Fig.3J) L-shaped, without any projection, inner margin concave with small notch near base; aedeagus (Fig.3K,3L) with theca unilobed, rectangular, with elongated nod like medial penial lobes, dorsal membranous conjunctival appendages; vesica moderately long, not passing beyond distal appendages; ejaculatory reservoir broad.

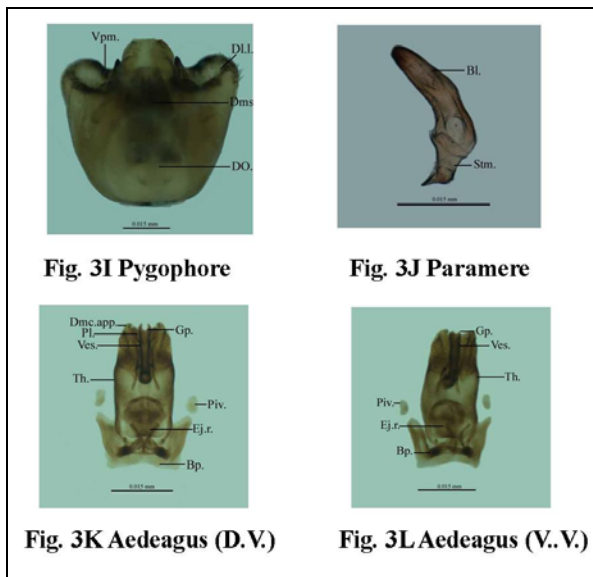
Material Examined

Uttarakhand: Dehradun, 24. vi. 2010 - 1♀, Sahastradhara, 16.ix. 2010 - 1♀, Mussoorie, 16. ix. 2010 - 1♂

Distribution: Myanmar; India (Uttarakhand, Paschim Banga, Sikkim, Meghalaya, Nagaland).

Remarks: This species closely resembles to *T. maxima* in having humeral angles not produced and in general body shape, but can be easily separated on the basis of few morphological and female genitalic attributes as discussed earlier. It is a new record from North India.





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Key to the studied species of genus *Tolumnia* Stål

1	Scutellum with distinct pale basal angular spots; antennae piceous with bases of joints paler; spermathecal bulb without distinct finger-like processes; 1 st gonococcie quadrangular, straight on inner margin.....	2
-	Scutellar base with transverse extensive pale fascia forming distinct irregular band; antennae with 1 st and 2 nd segments brownish yellow; spermathecal bulb with two distinct finger-like processes; 1 st gonococcie somewhat triangular, slightly concave at inner margin.....	<i>basalis</i> Dallas
2.	Body length: 12mm; five distinct small yellowish-brown spots across base of scutellum; spermathecal bulb somewhat trapezoidal, extended downwardly with single curved process, 9 th paratergites broad, less wide apart, not passing beyond the posterior margin of 8 th paratergites.....	<i>maxima</i> Distant
-	Body length: 9 mm; two distinct oval or roundish yellowish-brown spots at each basal angle of scutellum; spermathecal bulb squarish with two tuberculate processes opposite in direction; 9 th paratergites elongated passing beyond the posterior margin of 8 th paratergites.....	<i>latipes</i> (Dallas)

Abbreviations

8th pt. - Eight paratergites; 9th pt. - Ninth paratergites; Sp. b. - Spermathecal bulb; Dis. f. - Distal flange; Prx. f. - Proximal flange; Dis. sp. d. - Distal spermathecal duct; Prx. sp. d. - Proximal spermathecal duct; Md. - Median dilation; Sp. p. - Spermathecal pump; Vpm. - Ventroposterior margin; Dl. l. - Dorsolateral lobes; Dms. - Dorsomedial surface; DO. - Dorsal Opening; Bl. – Blade; Stm. – Stem; Bp. - Basal plate; Piv. – Pivot; Th. – Theca; Ves. – Vesica; Gp. – Gonopore; Pl. - Penial lobe; Vmc. app. - Ventral membranous conjunctival sspendages; Dlmc. app. - Dorsolateral membranous conjunctival appendages; Mdmc. App. - Median dorsal membranous conjunctival appendages; Th. App. - Thecal appendages; Ej. r. - Ejaculatory reservoir.

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