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New record of three species of grass feeding leafhopper genus *Leofa* distant 1918, from Maharashtra

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Abstract

The genus *Leofa* Distant is the common grass feeding brachypterous leafhopper genus from tribe Chiasmini Distant and subfamily Deltocephalinae. The genus is commonly found in grassland ecosystems of the country with 7 endemic species to India. Three species of genus *Leofa* Distant viz., *Leofa mysorensis*, *L. neela* and *L. pulchellus* recorded for the first time from Maharashtra. Their detail redescription and diagnosis along with the illustrations for the species of genus are provided.

Keywords: Leafhopper, *Leofa*, new record and Maharashtra

Introduction

These are brachypterous and stoutly built insects. The genus *Leofa* was originally described by Distant in 1918 with five new species exclusively from India with *Leofa mysorensis* Distant (1918) [3] as its type.

New macropterous species was added into the genus *Leofa* by Pruthi (1930) [9]. Viraktamath and Viraktamath (1992) [12] while revising the genus added descriptions of four new Indian species namely *L. naga*, *L. neela*, *L. robusta* and *L. truncata*. Subsequently Chalam and Rao (2005) also added one more species *L. mushroomi*. The genus *Prasutagus* was erected by Distant (1918) [3] for *Prasutagus pulchellus* Distant, 1918 as its type. Earlier this genus *Leofa* was placed in the tribe Stenometopiini but later transferred to Chiasmini by Zahniser (2008) [13]. He also synonymized genus *Oneratulus* Vilbaste, 1975 described for *Jassus? curtulus* Motschulsky from Sri Lanka, *Prasutagus* Distant, 1918, and *Tortotettix* Theron, 1982 with *Leofa* Distant 1918, also considered *Prasutagus* as one of his recognized four genera. Subgenus *Leofa* (*Prasutagus*) Distant reviewed by Duan, *et al.* (2009) [4] along with the description of two new species from China. Duan, *et al.*, 2012 [5], recently provided the description of one more new species from Thailand with a checklist of the genus *Leofa* Distant. The genus includes 16 species worldwide including 7 Indian species.

This genus can be distinguished from the other Chiasmini by having brachypterous to submacropterous forewing, ocellus in close proximity of eye, pygofer deprived of modified or thickened setae, and V-shaped connective without stem or a very short stem.

Materials and Methods

The terminology follows that of Viraktamath & Viraktamath (1992) [12]. Photographs were taken with a Leica DFC 425C digital camera on the Leica M205FA stereozoom automontage microscope. Male genitalia dissections were carried out as described by Oman (1949) [8] and Knight (1965) [6]. Materials examined in this study are deposited in the NPC, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India.

Results and Discussion

Redescriptions

***Leofa mysorensis* Distant, 1918** [Plate 1. Figs. a-j; Plate 2. Figs. a-j].

Leofa mysorensis Distant, 1918:86

Leofa affinis Distant, 1918:87

Leofa sanguinalis Distant, 1918:87

Leofa pedestris Distant, 1918:88

Leofa unicolor Distant, 1918:88

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Leofa parwala Singh-Pruthi, 1930:26

Color variable, ochraceous with brown and black markings, first 5 abdominal segments each with longitudinal band medially along with 4-5 tiny spots on each abdominal terga, abdomen with transvers black spots on the abdominal terga (Plate 1. a, b; Plate 2. a, b). Vertex with rectangular brown spots (Plate 1. c; Plate 2. c). Eyes dark brown and surrounded by dark ocular band, ocelli dark. Face light brown to ochraceous, frontoclypeus with transverse strips not converging in middle, anteclypeus creamy white to black in male and completely umber brown in female (Plate 1. d; Plate 2. d). Pronotum with a pair of thin brown bands on either side of lateral margin, translucent, and a faint central pair, with or without a large dark spot along the posterior margin along with scattered hyaline spots. Scutellum creamy yellow anteriorly and brownish basally. (Plate 1. c; Plate 2. c) Wing venation prominent with posterior wing margin of the forewing rectangular with dark spots (Plate 1. a; Plate 2. a). Head angulate, 0.9x narrower than pronotum, slightly produced. Vertex with sinuate markings in between eyes and on the apical margin, 1.1x longer than distance between eyes. Frontal suture originating in between eyes and ocelli. Eyes large, slightly covering the pronotum, ocelli minute, distance between eyes and ocelli 1.4x larger than the ocelli diameter. Frontoclypeus is depressed in the center, anteclypeus straight extending well beyond the apical margin. Antenna arising from slightly above the base of the eyes, area at the base of the antenna is sunken and dark (Plate 1. d; Plate 2. d). Pronotum is slightly broader than the head across the eyes, 1.3x shorter than the vertex length, and with central ring of minute sunken spots. Scutellum is small and triangular, length is 2.1x shorter than the hind margin of the pronotum (Plate 1. c; Plate 2. c). Forewings brachypterous, hindwing degenerated.

Male Genitalia: Pygofer 1.4x longer than wide with central constrictions, surface area centrally with microsetae, caudal margins oblique (Plate 1. e). Valve triangular with concaved posterior margin. Subgenital plates oblique, truncate, covered with scattered macrosetae mostly placed in posterior margin (Plate 1. f). Style caudally curved apical apophysis beak like, laterally produced pointed beak like process, without well-developed preapical lobe (Plate 1. g). Connective V-shaped stem is extremely short, arms slender widely separated (Plate 1. j). Aedeagal shaft is rather slender and sinuate with robust base, caudal hood less pronounced, two lateral processes with an asymmetrically placed gonopore, basal process coming the half of the shaft, caudally curved with plate like apical process oriented towards the apical hood, ventral appendages reaching the apex of the shaft (Plate 1. h-i).

Female genitalia: Female genitalia extended well beyond the abdomen (Plate 2. a, b). The seventh sternite at the posterior margin bisinuate, with two black patches one on either side of the central midline (Plate 2. e). First vulva with submarginal granulose patterns, margins uneven tapering apex (Plate 2. f, h). Second vulva with dorsal distinctly serrated margin, submarginal maculose dorsal margin, central ridge surrounded by the deeply excavated furrows demarcated by irregular ridges running backwards and downwards from the apex and vice versa from the basal area (Plate 2. g, i).

Measurements: Male: 3.1 mm long, 1.0 mm wide across eyes, 0.7 mm wide across hind margin of pronotum. Female: 3.5 mm long, 1.0 mm wide across eyes, 0.7 mm wide across hind margin of pronotum.

Material examined: 10♂ and 9♀, INDIA: Chikhaldara (21°24'10.84"N, 77°19'36.52"E), 19.xii.2017; 18♂ and 13♀, Brahman Wada (21°07'02.6"N, 77°56'53.9"E), 20.xii.2017, net sweep, Coll. Akash Nikoshe (NPC).

Distribution: Karnataka. Andhra Pradesh, Himachal Pradesh and Maharashtra.

Remarks: *L. mysorensis* is clearly associated with *L. mushroomi* externally but differs in the shape of the aedeagus which lacks well developed caudal hood.

Leofa neela Viraktamath & Viraktamath, 1992^[12] [Plate 3. Figs. a-k]

Leofa neela Viraktamath & Viraktamath, 1992:8^[12]

Adult: Ochraceous adults with dark marks throughout (Plate 3. a, b). Vertex anterior brown fasciae with central depression distinct brown spots on hind margin. Eyes dark with creamy ocular band, ocelli are dark. Face brownish, frontoclypeus yellowish brown, with transvers dark bands, do not converge medially, anteclypeus pitch black (Plate 3. d). Pronotum translucent with a pair of laterally located longitudinal strips, having medial depression encasing two dark spots, with minute submarginal hairs. Scutellum with central longitudinal dark stripe, brownish (Plate 3. c).

Head including eyes slightly narrower than width of the pronotum. Vertex 1.3x longer than the pronotum. Eyes large, slightly extending over pronotum on posterior margin, ocelli located away from the anterior margin of the head, distance between eyes and ocelli 1.5x, the ocelli diameter. Face with frontal suture originates from the vertex, frontoclypeus broader, narrowing apically, anteclypeus wide and cylindrical, exceeding well beyond facial margin, lorum semicircular. Pronotum 1.8x as broad as scutellum. Scutellum triangular with downward scutoscuteellar suture. Hind margin of pronotum 1.2x wider than the scutellum.

Male Genitalia: Pygofer 1.6x longer than its own width with caudal and lower margins oblique with dorsally placed macrosetae (Plate 3. e). Valve subtriangular, broad basally Subgenital plate elongated, 3x as long as the wide, medial elongate sclerotized ridge running up to the caudal margin of the plate. (Plate 3. f). Style well sclerotized with broader base and caudally bilobed apophysis having sinuate markings (Plate 3. g). Connective Y-shaped with very small stem which is 12x shorter than the arms (Plate 3. k). Aedeagus with basal processes on shaft reaching half the length of the shaft, circular gonopore opening have a brim with tooth like processes, caudally shaft having ventrally directed process, apically broader extending beyond the length of the shaft, caudal hood well developed (Plate 3. h-j).

Measurements: Male: 3.0 mm long, 1.0 mm wide across eyes, 0.6 mm wide across hind margin of pronotum.

Material examined: 2♂, INDIA: Maharashtra: Brahman Wada (21°07'02.6"N, 77°56'53.9"E), 20.xii.2017, net sweep, Coll. Akash Nikoshe (NPC).

Distribution: Karnataka and Maharashtra.

Remarks: This species is externally similar to *L. naga* but differs in having vertical caudal margin of the pygofer, elongated subgenital plate. Ornamented tip of the aedeagal shaft, with rim surrounding the gonopore opening.

Subgenus *Leofa* (*Prasutagus*) Distant, 1918

Prasutagus Distant, 1918:53 (Type: *Prasutagus pulchella* Distant, 1918)

Oneratulus Vilbaste, 1975:233 (Type: *Jassus curtula* Motschulsky, 1863)

Subgenus characters: Subgenus *Leofa* (*Prasutagus*) members are distinguished by the presence of slightly submacropterous or shortened forewings with a white stripe on the forewings and the pygofer laterally with a large internal appendage ascending from the base of the upper lobe extending to the apex.

***Leofa* (*Prasutagus*) *pulchellus* Distant, 1918 [Plate 4. Figs. a-j; Plate 5. Figs. a-i]**

Prasutagus pulchella Distant, 1918: 53

Ochraceous with dark brown to black body with whitish markings (Plate 4. a, b; Plate 5. a, b). Head margins are black with central area yellowish white (Plate 4. c; Plate 5. c). Eyes black with coronal margin surrounded by a silvery band, ocelli light brown in color. Face black throughout, sometimes with few whitish patches, frontoclypeus anteriorly with alternate black and brown transvers markings, anteclypeus entirely dark, lorum with white spot (Plate 4. d; Plate 5. d). Pronotum with central yellowish white distinct band along the anterior margin, remaining area silvery grey with dark black areas on the lateral margins along, covered with hairs. Scutellum silvery grey with black margins and central dark elongated streak (Plate 4. c; Plate 5 c). Forewings with shiny translucent white veins, generally with black to dark brown borders, claval region with distinct white stripes (Plate 4. a; Plate 5. a).

Head including eyes slightly wider than pronotum. Vertex 1.1x longer than pronotum; Eyes large with posterior margin slightly expanded over pronotum, ocelli located away from the anterior margin of the head, raised, distance between eyes ocelli 1.7x less than the ocelli diameter. Frontoclypeus wider with slight sunken area in the center, anteclypeus slightly narrowing apically, lorum complete. Pronotum as wide as head including eyes, 2.5x wider than long anterior margin circular and posterior margin straight, hind margin of pronotum slightly wider than scutellum. Scutellum triangular, 1.4x wider than long, with downward curved scutoscuteellar suture and tapering apex. Forewings submacropterous, truncate, appendix either present or absent, tip of wing often reaching to apex of 8th abdominal tergite, outer anteapical cell small, constricted or completely absent, hindwing reduced completely.

Male Genitalia: Pygofer 1.4x longer than wide, devoid of membranous cleft, caudal lobes on dorsal margin abruptly narrowed near base of anal tube and obliquely slanted posteriorly, thus forming two lobe-like areas, internally sclerotized and bears few long macrosetae, large inner processes arising from base of upper lobe and extends to the apex of pygofer (Plate 4. e). Valve triangular with pointed apex. Subgenital plate 2.8x longer than wide, basal half obliquely truncated rest wider, few irregularly arranged short macrosetae present on apical region, (Plate 4. f). Style slender, apophysis apically foot-like, preapical lobe with few microsetae (Plate 4. g). Connective Y-shaped with stem short, arms 4.1x longer than stem, slender and widely separated (Plate 3. k). Aedeagus with laterally compressed cylindrical shaft, with two paired processes and basal dorsolateral flanges, gonopore apically located with very short basal apodeme which is highly sclerotized, a single elongate, recurved process connecting aedeagus and connective, extending well beyond the apex of the shaft (Plate 4. h-j).

Female genitalia: Ovipositor extending fairly beyond pygofer (Plate 5. a, b). Seventh sternite with hind margin slightly protruded in middle forming a central lobe, with two dark spots one on either side of the central midline, dorsal and lateral margins straight (Plate 5. e). First vulva have submarginal granulose pattern not extending up to the tip of the apex dorsally but rather ventrally around the apex, area below the central ridge more or less laminate, apex acute and margins uneven (Plate 5. f, h). Second vulva having serrated dorsal margin, hind margin medially excavated, prominent sculpturing is present on both sides of the central ridge (Plate 5. g, i).

Measurements: Male: 2.8 mm long, 0.8 mm wide across eyes, 0.6 mm wide across hind margin of pronotum. Female: 2.9 mm long, 0.9 mm wide across eyes, 0.7 mm wide across hind margin of pronotum.

Material examined: 5♂ and 3♀, INDIA: Maharashtra: Brahman Wada (21°07'02.1"N, 77°56'53.9"E), 20.xii.2017; 3♂, Chikhaldara (21°24'10.84"N, 77°19'36.52"E), 19.xii.2017, net sweep, Coll. Akash Nikoshe (NPC).

Distribution: Karnataka and Maharashtra.

Remarks: This species is distinguished from the other *Leofa* species by their submacropterous black forewings with a white stripe on the clavus, pygofer with a large inner appendage arising from the base of the upper lobe that extends to pygofer apex, aedeagal with shaft lateral pair of triangular flanges and greatly elongated ventral appendage.

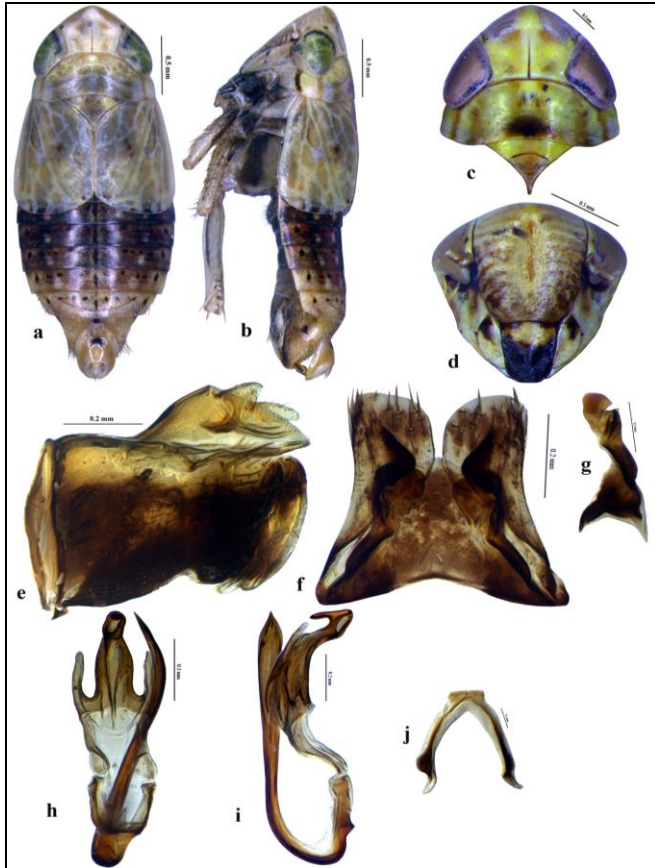


Plate 1: a-j. *Leofa mysorensis* Distant, male: a. Habitus dorsal; b. habitus lateral; c. Head; d. face; e. Pygofer; f. subgenital plate; g. style, h. aedeagus dorsal; i. aedeagus lateral; j. connective.

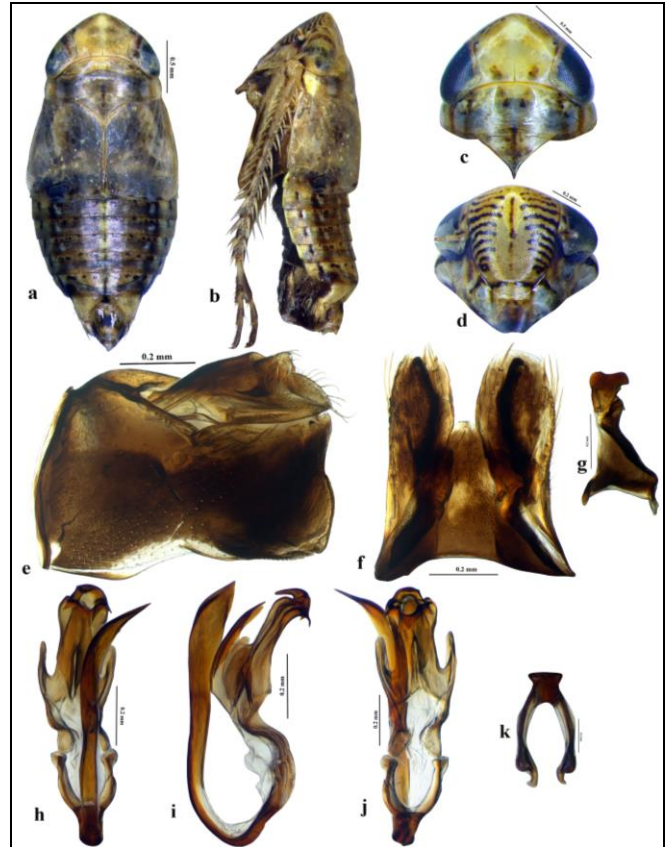


Plate 3: a-k. *Leofa neela* Viraktamath & Viraktamath, male: a. habitus dorsal; b. habitus lateral; c. Head; d. face; e. Pygofer; f. subgenital plate; g. style, h. aedeagus dorsal; i. aedeagus lateral; j. ae- deagus; k. connective.

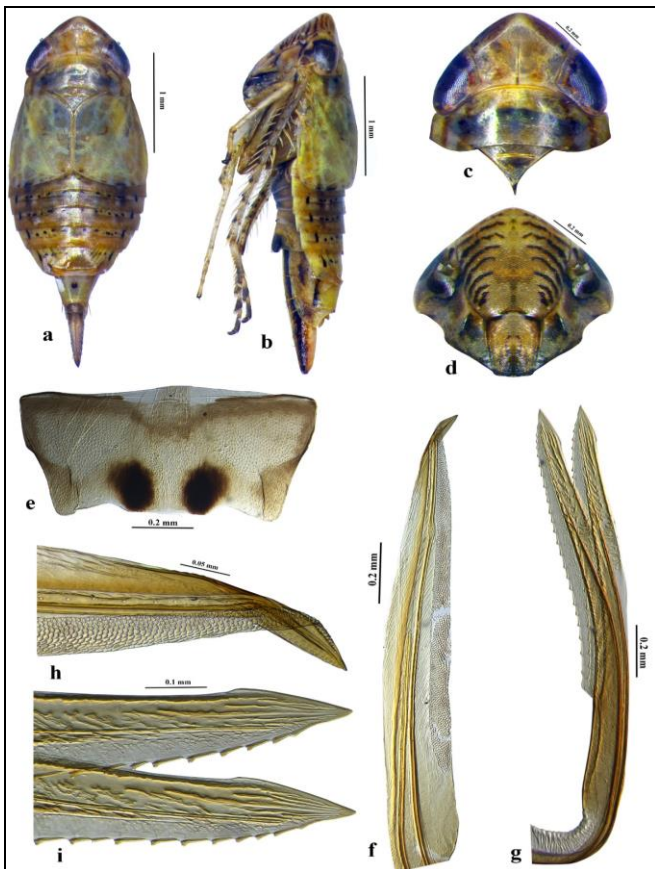


Plate 2: a-i. *L. mysorensis* Distant female: a. Habitus dorsal, b. Habitus lateral, c. Head, d. Face, e. 7th sterna, f. 1st vulva, g. 2nd vulva, h. 1st vulva magnified, i. 2nd vulva magnified

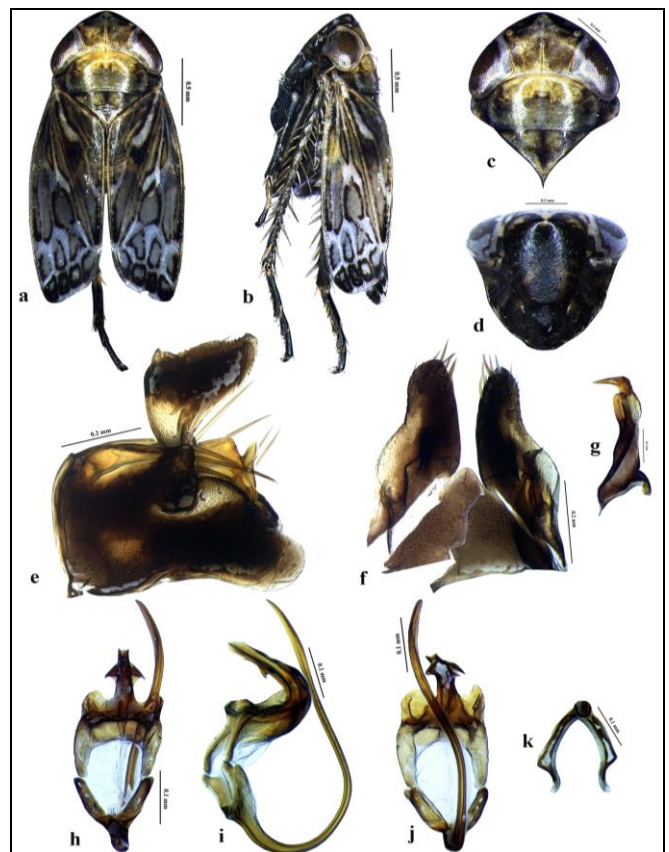


Plate 4: a-k. *Leofa (prasutagus) pulchellus* Distant, male: a. habitus dorsal; b. habitus lateral; c. Head; d. face; e. Pygofer; f. subgenital plate; g. style, h. aedeagus dorsal; i. aedeagus lateral; j. aedeagus; k. connective.

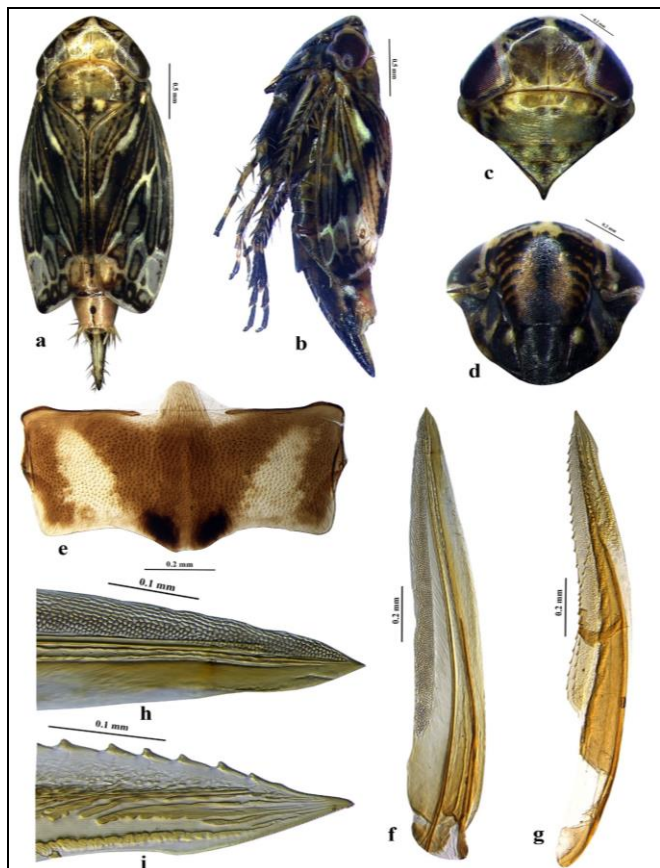


Plate 5: a-i. *L. (Prasutagus) pulchellus* Distant female: a. Habitus dorsal, b. Habitus lateral, c. Head, d. Face, e. 7th sternite, f. 1st vulva, g. 2nd vulva, h. 1st vulva magnified, i. 2nd vulva magnified

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