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INDIAN SPECIES OF LISTROGNATHUS TSCHEK (Hymenoptera: Ichneumonidae)

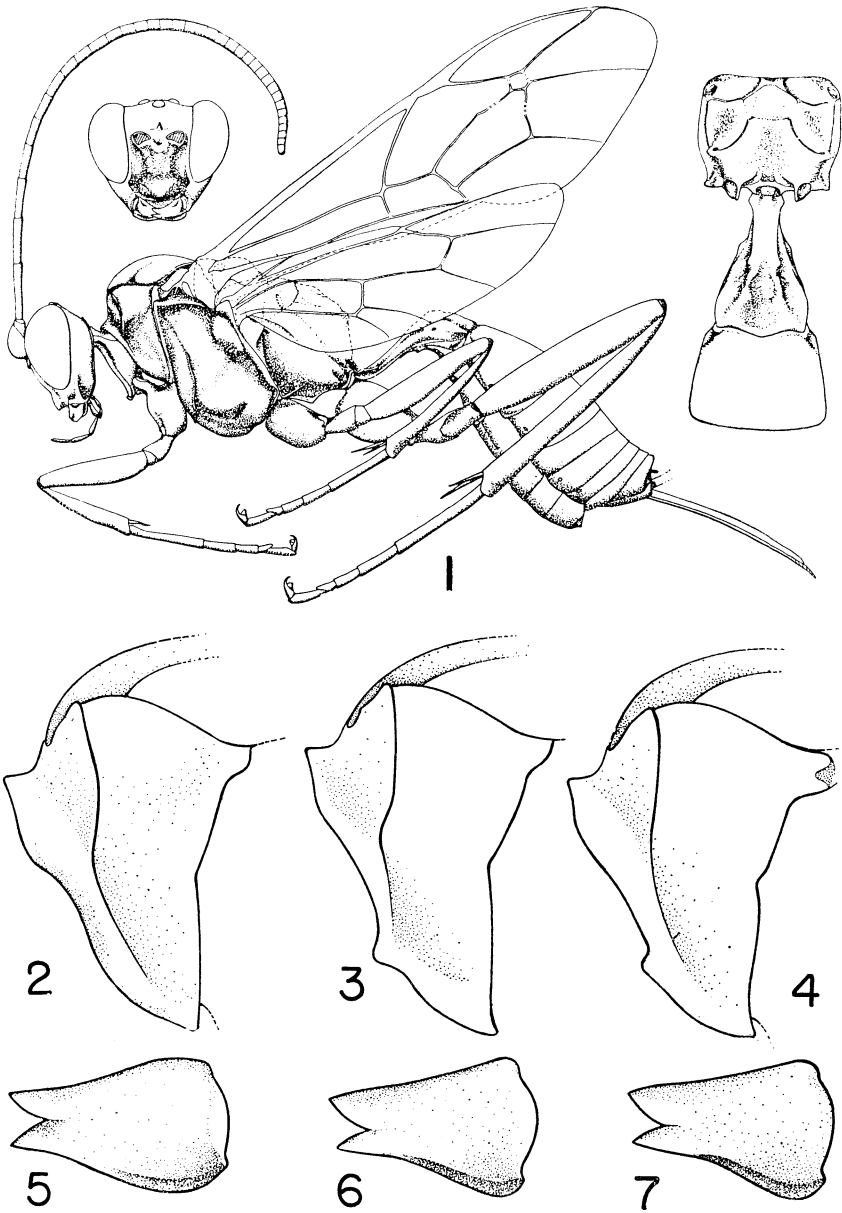
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Abstract: A revision of the Indian species of *Listrognathus* (tribe Mesostenini) is attempted. Seven new species of *Listrognathus*, viz., *L. (L.) perfecta*, *L. (L.) confracta*, *L. (L.) assamensis*, *L. (L.) nigriabdominalis*, *L. (L.) acuminata*, *L. (Stivadens) tirkyi* and *L. (S.) flavopetiolata* are described. A key to all the previously described species from the Indo-Australian area, including new species is given. The subgenus *Suvalta* Cameron is synonymised with the subgenus *Listrognathus* and the species previously included under the subgenus *Suvalta*, viz., *Suvalta rugifrons* Cam., *laevifrons* Cam., *mobilis* (Tosq.), *pallidinerva* Cam., and *spinifrons* Cam., are transferred to the subgenus *Listrognathus*. *L. (L.) spinifrons*, *pallidinerva* and *L. (Stivadens) annulipes* are redescribed based on the material in our collections.

The genus *Listrognathus* Tschek, belongs to the tribe Mesostenini of the subfamily Gelininae. It comprises medium-sized species which occur mostly among bushes. They have been collected in India from the plains to an elevation of 1925 meters, but most of them occur at lower elevations, from 450 to 1400 m. The genus is common in the Indo-Australian area and is probably almost world-wide in distribution (Townes & Townes 1962). *Listrognathus eccopteromus* Uchida and *L. hispanicus* Szepliget, have been reared from

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Figs. 1-7. 1, *Listrognathus cornuta* Tschek ♀, generotype; 2, pronotal collar of *L. (L.) perfecta*; 3, pronotal collar of *L. (I.) acuminata*; 4, pronotal collar of *L. (S.) flavopetiolata*; 5, mandible of *perfecta*; 6, mandible of *acuminata*; 7, mandible of *flavopetiolata*.

Macrocthonina fervens Butl. (Lepidoptera: Phalaenidae) and *Zygaena occitanica* Vill. (Lep.: Zygaenidae), in Japan and Spain respectively (Thompson 1957). The genus is characterized below.

Genus **Listrognathus** Tschek (Fig. 1)

Front wing 4.8–13.5 mm long; body moderately stout; frons with a sharp, pyramidal to conical median horn, horn sometimes with a short dorsal accessory horn or tine; antenna in ♀ weakly fusiform, basal 1/2 cylindrical, preapical segments flattened, then tapering towards apex; antenna of ♂ stouter and evenly tapering from base to apex; clypeus rather small, moderately to strongly convex, its apical 1/3 usually abruptly declivous so that it appears pyramidal in profile, the apical margin of clypeus evenly convex or subtruncate, without a median point; mesoscutum weakly convex, polished or subpolished, with coarse punctures; notaulus varying from sharp to indistinct, usually reaching to center of mesoscutum and sometimes beyond; epomia very strong, ending dorsally on an angulate projection on upper margin of pronotum; prepectal carina present on mesopleurum; sternaulus distinct, 1/2 as long as mesopleurum; propodeum strongly convex, its basal carina sharp and complete, its apical carina varying from complete and sharp with more or less distinct sublateral crests to absent except for strong sublateral tubercles; propodeal spiracle short, elliptic to linear and elongate; areolet very small, quadrangular, square, or a little higher than wide, 2nd intercubitus weak; ramellus absent; nervulus basad of basal vein by about 0.3 its length; 2nd discoidal cell broad at base; mediella weakly arched; nervellus broken near its lower end; 1st abdominal segment rather stout, the spiracle far behind middle and postpetiole strongly expanded, with a strong subbasal lateral tooth, its ventrolateral carina strong and either complete or obsolete basally, its dorsolateral carina blunt, usually distinct near apex of postpetiole, sometimes sharp and distinct on petiole, its median dorsal carinae blunt and vestigial or sometimes sharp on apical part of petiole and basal part of postpetiole; 2nd tergite with strong coarse punctures that are moderately close to crowded; ovipositor sheath about 0.3 as long as front wing; ovipositor stout, compressed or subcylindrical, its tip various.

Listrognathus is a rather distinct genus readily distinguished by its single, sharp, conical, median frontal horn; moderately convex to pyramidal clypeus; small squarish areolet; distinct sublateral crests or tubercles on propodeum and strongly punctate 2nd and 3rd abdominal tergites.

Townes (1961, 1962) recognized four subgenera of *Listrognathus*, viz., *Fenestula*, *Listrognathus*, *Suvalta* and *Stivadens*. The subgeneric divisions were based primarily on the nature of the thyridium on the 2nd tergite, the occipital and hypostomal carinae and the mode of joining of the former with latter, pronotal shoulders and the nature of apical transverse carina of the propodeum.

Our studies revealed several exceptions in these characters in the taxa available with us and as such it became difficult to assign the different species to their respective subgenera. Since the types were not available for a comparative study, we corresponded extensively with Mr G. J. Kerrich of the Commonwealth Institute of Entomology, London, who kindly provided us detailed notes on the types of *Vagenatha armata* Cameron, *Suvalta rugifrons* Cameron, *S. laevifrons* Cameron, *S. pallidinerva* Cameron, *S. spinifrons* Cameron, *S. annulipes* Cameron and *S. transversa* Cameron.

In the case of *V. armata* (subgenus *Listrognathus*) and *S. rugifrons* (generotype of subgenus *Suvalta*), the hypostomal carina is high and the occipital carina meets the hypostomal carina almost at a right angle. According to Kerrich (pers. comm.) these two characters are identical in both these species. In one of our new species, *L. assamensis* (fig. 12), the above character is the same as in *armata* and *rugifrons* and is intermediate between true *Listrognathus* (figs. 10, 11) and true *Suvalta* (figs. 13, 14, 15), and, therefore, these two subgenera cannot be considered distinct on the basis of the above mentioned characters. All other characters studied, i.e., the presence or absence of a tooth-like projection on the lower margin of pronotal collar, mandibular teeth, pronotal tubercles and apical transverse carina of propodeum, do not make clear cut divisions of species into subgeneric group and seem to vary independently of each other. It therefore seems necessary to synonymise *Suvalta* with *Listrognathus*.

The subgenus *Fenestula* can be easily differentiated from the rest by its having the thyridium narrower than its distance from the base of the 2nd abdominal tergite; clypeus moderately convex; lower end of occipital carina moderately incurved, joining hypostomal carina at an acute angle, not recurved or interrupted; apical transverse carina of propodeum not interrupted medially, forming only weak apophyses; and the lower edge of 1st tergite simple.

One male specimen of this subgenus has been collected from Khajjiar (1925 m) in Punjab Himalaya (Himachal Pradesh), indicating that *Fenestula* might also occur in the Himalayan ranges. Since our material of this is inadequate, we have refrained from including it in the present study.

The presence of one or two strong teeth on the lower lateral edge of the 1st abdominal tergite near or anterior to its midlength (fig. 30), separates *Stivadens* from *Listrognathus* and *Fenestula*. We are describing the Indian species belonging to the subgenera *Listrognathus* (including *Suvalta* as a synonym) and *Stivadens*, including seven new species. The subgenera as defined above can be distinguished by the following key:

KEY TO SUBGENERA OF LISTROGNATHUS

1. Thyridium narrow, about 0.8 as wide as its distance from base of 2nd tergite; clypeus in profile moderately convex, not sharply pyramidal, lower end of occipital carina moderately incurved joining hypostomal carina at an acute angle; apical transverse carina of propodeum complete and strong, not interrupted medially; propodeum with weak apophyses (Nearctic, Eastern Palearctic and India)..... **Fenestula**
- Thyridium wide, about 1.3-2.5 as wide as its distance from base of 2nd tergite; clypeus pyramidal in profile; lower end of occipital carina variously joining hypostomal carina (figs. 10-15); apical transverse carina of propodeum present or absent (if present, not stronger than other rugosities medially, sometimes interrupted medially); propodeum with strong sublateral crests or tubercles..... 2
2. Lower lateral edge of 1st abdominal tergite simple; apical transverse carina of propodeum weak or interrupted medially, forming strong sublateral crests; mandibular teeth equal or unequal in shape; lower lateral edge of pronotal collar with or without a tooth-like prominence; postpetiole moderately wide to

very wide (Holarctic, Indo-Australian and Neotropic) **Listrognathus**
 Lower lateral edge of 1st abdominal tergite with 1 or 2 strong teeth near its
 midlength; apical carina of propodeum absent, propodeum with strong sub-
 lateral tubercles; lower lateral edge of pronotal collar with a prominent tooth-
 like projection; post-petiole very wide (Indo-Australian) **Stivadens**

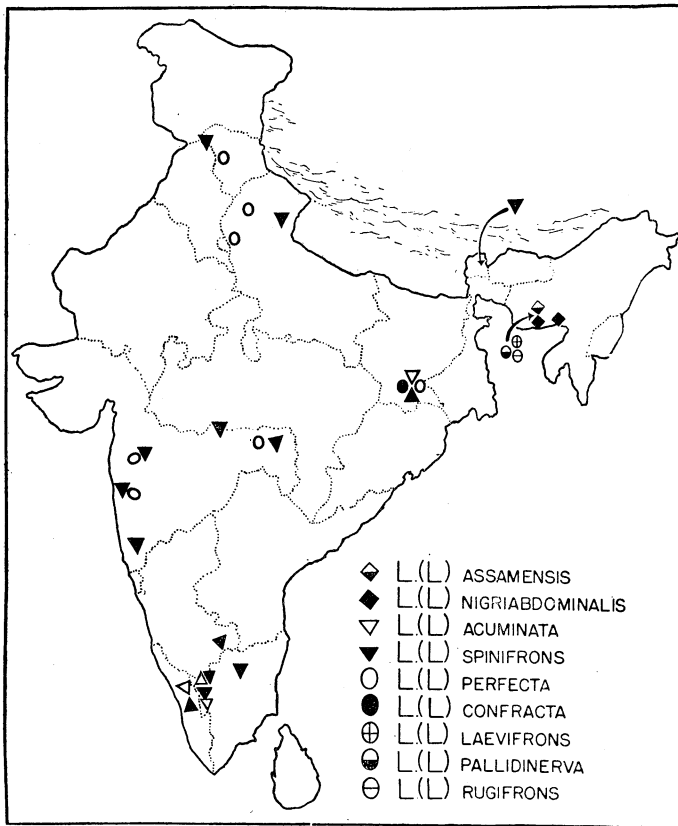
Subgenus **Listrogeathus** Tschek

Fig. 1, Map 1.

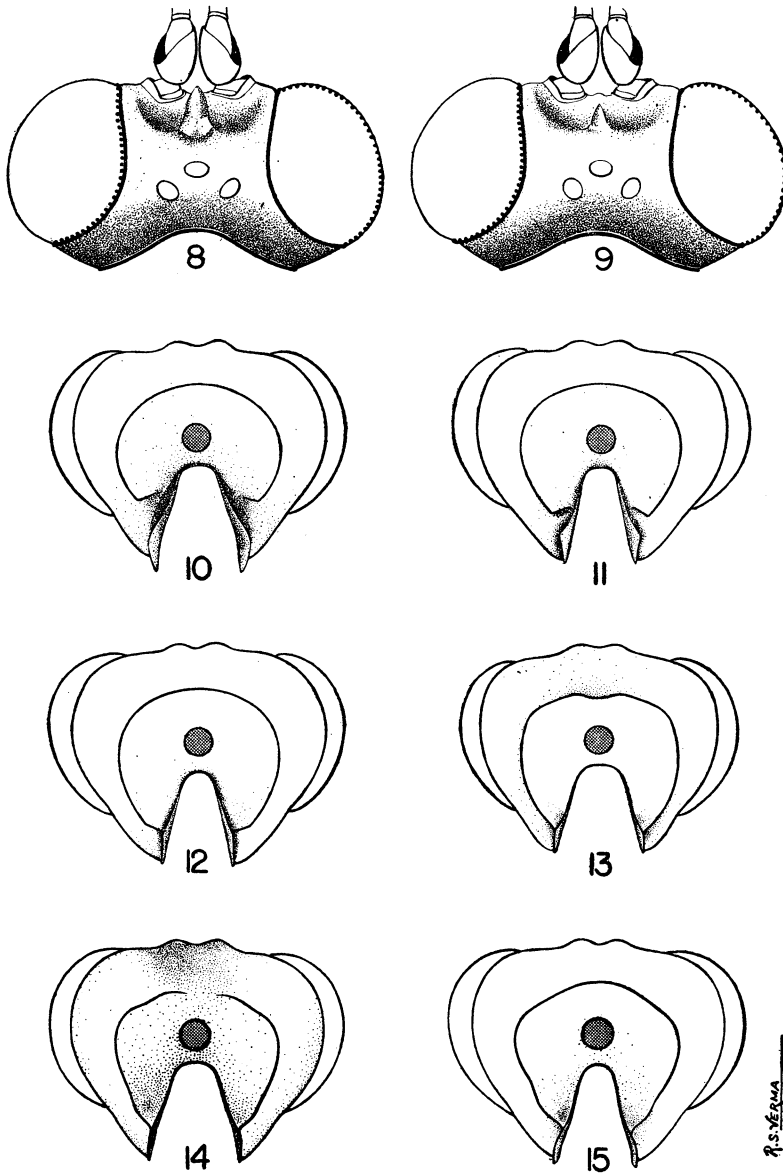
Listrognathus Tschek, 1870, Verh. Zool.-Bot. Ges. Wien. **20**: 153 (type: *Listrognathus cornutus* Tschek=*pubescens* Fonscolombe; monobasic).—Townes, Townes & Gupta, 1961, Mem. Am. Ent. Inst. **1**: 176, 439.—Townes & Townes, 1962, Bull U.S. Natl. Mus. **216** (3): 408, 413-425.—Townes, Momoi & Townes, 1965, Mem. Am. Ent. Inst. **5**: 191-192, 569.

Mesostenoides Ashmead, 1900, Proc. U.S. Natl. Mus. **23**: 45 (type: *Mesostenus albomaculatus* Cresson; orig. design.).

Suvalta Cameron, 1903, Zs. Syst. Hym. Dipt. **3**: 301 (type: *Suvalta rugifrons* Cameron;



Map 1. Distribution of species of *Listrognathus* (*Listrognathus*).



Figs. 8-15. Vertex and frontal horn of 8, *Listrognathus* (*L.*) *perfecta*; 9, *confracta*; occipital and hypostomal carinae of 10, *perfecta*, 11, *confracta*, 12, *assamensis*, 13, *nigriabdominalis*, 14, *acuminata* and 15, *spinifrons*.

design. by Viereck, 1914). **New Synonymy.**—Townes, Townes & Gupta, 1961, Mem. Am. Ent. Inst. **1**: 176-177, 439.—Townes & Townes, 1962, Bull. U.S. Natl. Mus. **216** (3): 408, 412.

Front wing 4.7-12.5 mm long; clypeus sharply elevated medially, pyramidal in profile;

Table 1. Comparison of species of the subgenus *Listrognathus*.

| Characters | sauteri | perfecta | contracta | rugi- frons | armata | assa- mensis | nigriabdo- minalis | acumi- nata | laevi- frons | pallidi- nerva | spini- frons | mobilis |
|--|---------|----------|-----------|----------------|--------|-----------------|-----------------------|----------------|-----------------|-------------------|-----------------|---------|
| 1. Frons : striated (+); smooth polished (-). | + | + | + | + | + | + | + | + | - | - | - | - |
| 2. Hypostomal carina : raised (+); normal (-). | + | + | + | + | + | ± (moderate) | - | - | - | - | - | - |
| 3. Curvature of lower end of occipital carina : sharply bent (++); moderately bent (+); weakly curved (-). | +? | ++ | ++ | + | + | + | - | - | - | - | - | - |
| 4. Distance between junction of occipital and hypostomal carinae and base of mandible, compared with basal width of mandible: greater (+); lesser (-). | +? | + | + | ± | ± | ± | - | - | - | - | - | -? |
| 5. Occipital carina joining hypostomal carina at: an acute angle (-); right angle (+); more than right angle or broken (++). | ? | ++ | ++ | + | + | + | - | - | - | - | - | -? |
| 6. Pronotal shoulders : obtuse (+); acute (-). | ? | + | + | - | - | - | - | - | + | - | - | -? |
| 7. Tooth-like projection on pronotal collar; present (+); absent (-). | ? | - | - | - | + | + | + | + | + | + | + | +? |
| 8. Mandibular teeth : equal in shape (+); unequal in shape (-). | ? | + | + | + | - | - | - | - | + | + | - | +? |
| 9. Apical propodeal carina : present medially (+); + absent, present around crests (-). | + | + | + | + | + | - | - | - | - | - | - | - |

frons smooth or striated; mandibular teeth equal (fig. 5) or upper tooth broader than lower (fig. 6); lower end of occipital carina sharply angled or recurved and meeting hypostomal carina at a right angle, to weakly curved and joining hypostomal carina at an acute angle (figs. 10-15); sometimes occipital carina interrupted near hypostomal carina (fig. 10); hypostomal carina conspicuously raised to normal; lower margin of pronotal collar with or without a tooth-like projection near its lower end (figs. 2, 3); pronotal shoulders obtuse or acute; apical transverse carina of propodeum weak to absent medially, forming strong sublateral crests; propodeal spiracle short elliptic to linear and elongate; lower lateral edge of 1st abdominal tergite simple, without tooth; thyridium wider (1.3 to 2.5) than its distance from base of 2nd tergite; ovipositor compressed or subcylindric, its tip various, compressed, flattened or depressed.

We include in this subgenus all those species from the Indo-Australian area which have been previously referred to the subgenera *Listrognathus* and *Suwalta*. There are *Listrognathus sauteri* Uchida, 1932, *Suwalta laevifrons* Cameron, 1903, *S. rugifrons* Cam., 1903, *S. pallidinerva* Cam., 1904, *S. spinifrons* Cam., 1905, *Vagenatha armata* Cam., 1905 and *Cryptus mobilis* Tosquinet, 1903. Five new species are here described with redescriptions of the old species available. A key is provided, based on notes provided by Mr Kerrich on the types in British Museum (Nat. Hist.) and in Oxford University Museum and also from their published descriptions. The salient characters are also tabulated in Table 1.

Notes on the types of *L. sauteri* Uchida and *L. mobilis* (Tosq.) have not been available. The description of the former is inadequate and does not permit a detailed comparison; only the male was described. The description of the latter is fairly detailed but certain characters used in the present classification have not been mentioned.

Species of this subgenus show considerable variation in the nature of the occipital and hypostomal carinae, pronotal shoulders, mandibular teeth and the tooth-like projection on the lower margin of pronotal collar (table I). They can, however, be arranged into species groups on the basis of the sculpture of frons and the nature of the occipital and hypostomal carinae. The species groups are:

1. The *laevifrons* group, characterized by having the frons smooth and polished, without any striations, hypostomal carina normal, occipital carina weakly curved near hypostomal carina and meeting the latter in an acute angle (fig. 15), their junction being closer to the base of mandible than the basal width of mandible. This group includes *L. (L.) laevifrons*, *spinifrons*, *pallidinerva* and *mobilis*.

2. The *perfecta* group, characterized by having the frons striated, hypostomal carina high and raised, occipital carina sharply bent or recurved near hypostomal carina and meeting the latter at an angle greater than a right angle (or slightly erased near junction) (figs. 10, 11), their junction being further from the base of mandible than the basal width of mandible. This group includes *L. (L.) perfecta* and *confracta*. *L. (L.) sauteri*, will probably also come here, but as the description is adequate, we cannot place it here with certainty.

3. The *rugifrons* group, characterized by having the frons striated, hypostomal carina well raised to moderately raised, occipital carina moderately curved and meeting the hypostomal carina at almost a right angle (fig. 12), their junction being not further from the base of mandible than the basal width of mandible. This group includes *L. (L.) ru-*

gifrons, *armata* and *assamensis*.

4. The *nigriabdominalis* group, characterized by having the frons striated, hypostomal carina normal, not conspicuously raised, occipital carina evenly curved or arched near hypostomal carina and meeting the latter in an acute angle (figs. 13, 14), their junction being closer to the base of mandible than the basal width of mandible. This group is essentially similar to the *laevifrons* group except for the striated frons. The species included here are *L. (L.) nigriabdominalis* and *acuminata*.

A female specimen identified as "*Suvalta rugifrons* Cam." (label no: H/1541-Chapra, Bengal-Col Mackenzie) and another female identified as "*Suvalta laevifrons* Cam." (label no: H/1542-Poona, Bombay-F.M.K., 19.iv.'04) both by Claude Morley in 1913 and present in National Pusa Collection (NPC), do not belong to *Listroganathus*. The former belongs to the subfamily Ichneumoninae and the latter is *Gotra marginata* Brulle.

KEY TO SPECIES OF SUBGENUS LISTROGNATHUS

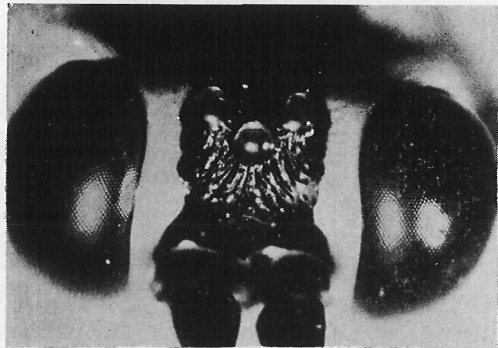
1. Frons polished and smooth (fig. 19) 2
 - Frons strongly striated (figs. 16-18).....5
- 2 (1). Base of scutellum yellow, apex largely black; oculo-ocellar area with fine punctures and irregularly longitudinally rugose (India)**laevifrons** (Cam.)
Scutellum largely yellow; oculo-ocellar area mat to smooth 3
- 3 (2). Notauli distinctly impressed, generally extending to middle of mesoscutum; mesoscutum with a pair of yellow stripes in middle; lateral carinae of scutellum with yellow markings (India)..... 6. **spinifrons** (Cam.)
Notauli faintly indicated on mesoscutum; sometimes basally distinct; mesoscutum without any yellow stripes; lateral carinae of scutellum without any yellow markings..... 4
- 4 (3). Fore femur and tibia yellow but with dark brown lines (sometimes tibia fuscous); hind leg with apical 0.7 of femur black; hind tibia yellow with a basal and an enlarged apical (0.4 to 0.5) black band; hind tarsus yellow with 1st and 5th segments basally black (Java)..... 8. **mobilis** (Tosq.)
Fore femur and tibia tawny yellow but femur lined with brown above (tibia less fuscous) hind leg with apical 0.3-0.4 of femur and apical 0.25-0.3 of tibia black; hind tarsus with 1st segment basally black, rest yellow (India)..... 7. **pallidinerva** (Cam.)
- 5 (1). Face finely punctate; notauli weakly marked on mesoscutum; propodeum with apical transverse carina complete; base color of 1st 3 abdominal segments brown; hind tibia largely black (China, Taiwan)..... **sauteri** (Uch.)
Face strongly punctate; notauli sharply impressed to middle of mesoscutum; apical transverse carina of propodeum complete to interrupted in middle (if present weak medially); base color of all abdominal segments black; hind tibia largely yellow or reddish brown 6
- 6 (5). Mandibular teeth equal in shape (fig. 5); lower lateral margin of pronotal collar without a tooth-like prominence (fig. 2) 7
Mandibular teeth unequal in shape (fig. 6); lower margin of pronotal collar with a tooth-like projection (fig. 3).....9
- 7 (6). Lower end of occipital carina moderately incurved and meeting hypostomal

- carina at about a right angle, not further from base of mandible than basal width of mandible; postpetiole basally raised (India).....**rugifrons** (Cam.)
 Lower end of occipital carina sharply angled and recurved, meeting hypostomal carina at a right angle or more or less interrupted at hypostomal carina; lower end of occipital carina far removed from base of mandible (figs. 10, 11); postpetiole evenly curved at base 8
- 8 (7). Apical carina of propodeum complete in middle (fig. 24), sometimes weak; frontal horn medium-sized, 0.5 as long as scape (fig. 8); hind tarsus with 1st and 5th segments black, 2nd segment to basal 1/2 of 4th segment infusate to yellow (fig. 33) (India) 1. **perfecta***
 Apical carina of propodeum interrupted in middle (fig. 25), sometimes faintly represented but broken; frontal horn small to very small, 0.2 to 0.3 as long as scape (fig. 9); hind tarsus wholly brownish black (fig. 32) (India) 2. **confracta***
- 9 (6). Hypostomal carina conspicuously raised; apical carina of propodeum complete, though less sharply defined from other rugosities (Sarawak).....
 **armata** (Cam.)
 Hypostomal carina normal to moderately raised; apical carina of propodeum incomplete, confined only around crests 10
- 10 (9). Vertex polished and smooth behind; occipital carina interrupted above (fig. 14); 1st 4 abdominal segments with complete yellow apical bands (fig. 22); ovipositor tip laterally compressed and finely pointed at apex (fig. 37) (India)..... 5. **acuminata***
 Vertex coarsely punctate, medially obliquely striated behind; occipital carina complete above (figs. 12, 13); abdominal segments with or without yellow bands apically (figs. 20, 21); ovipositor tip flattened or depressed dorsally and gradually tapered..... 11
- 11 (10). Frons with oblique and almost parallel striations between horn and median ocellus (fig. 16); postscutellum with a broad yellow spot; abdominal segments with an apical yellow band broadly interrupted in middle (fig. 20); ovipositor tip seen from above, flattened, tapering gradually, without a median carina (fig. 36) (India)..... 3. **assamensis***
 Frons with transverse as well as oblique striations between horn and median ocellus (fig. 17); postscutellum black; abdominal segments wholly black, sometimes with faint, narrow yellow stripes along apical margins (fig. 21); ovipositor tip as seen from above depressed and broadly rounded at apex, with a distinct median carina (figs. 34, 35) (India)... 4. **nigriabdominalis***

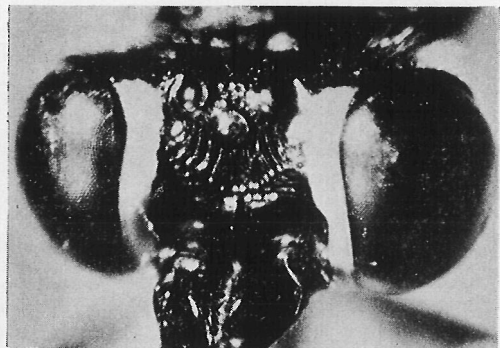
1. **Listrognathus (Listrognathus) perfecta** Gupta and Kamath, new species
 Figs. 2, 5, 8, 10, 24, 33.

This species can easily be distinguished from others by having lower end of occipital carina sharply recurved and interrupted near the well raised hypostomal carina, the lower end of it is far removed from the base of mandible, the distance being greater than the

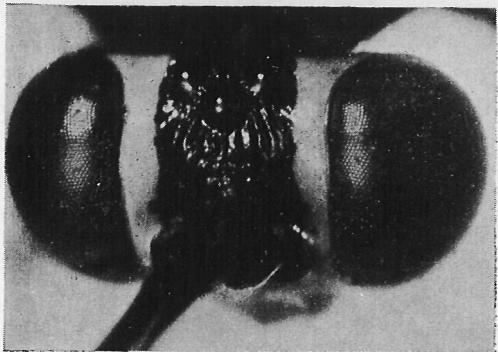
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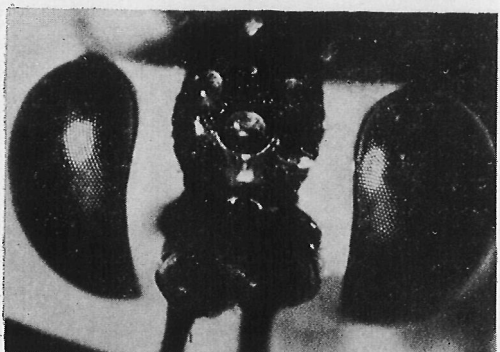
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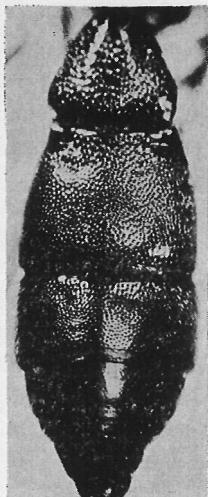
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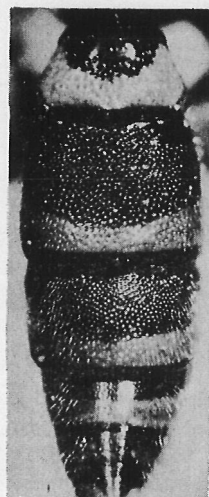
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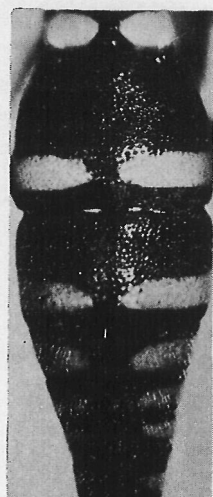
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Figs. 16-23. Sculpture of frons in 16, *Listrognathus* (*L.*) *assamensis*, 17, *nigriabdominalis*, 18, *acuminata*, and 19, *spinifrons*; abdomen of 20, *assamensis*, 21, *nigriabdominalis*, 22, *acuminata* and 23, *spinifrons*.

basal width of mandible (fig. 10).

♀. Face with coarse, shallow punctures, the punctures becoming sparse towards orbits, somewhat rugose just below antennal sockets; clypeus pyramidal in profile, sparsely, shallowly punctate; mandibular teeth equal in shape (fig. 5); occipital carina sharply recurved and interrupted near the well raised hypostomal carina (fig. 10); frons with a conical median horn of moderate size, 0.5 as long as scape (fig. 8), the area between horn and median ocellus irregularly striated; vertex coarsely punctate posteriorly, punctures in inter-ocellar area coarse and deep, oculo-ocellar area mat; temple moderately broad, flat and distinctly punctate; malar space mat, as wide as basal width of mandible; pronotum rugoso-punctate; epomia long and strong, reaching upper margin of pronotal shoulders and turning mesad giving an angular edge; pronotal shoulder obtuse; pronotal collar (fig. 2), evenly curved at its lower margin without any tooth-like projection; mesoscutum rugoso-punctate, notaulus sharp, extending to its middle; scutellum shiny, evenly convex, sparsely punctate; postscutellum smooth and shiny; propodeum strongly rugosostriate, basolateral area more punctate than striate, apical carina complete (fig. 24), moderately strong to weak, being not much stronger than other rugosities, forming short, obtuse sublateral crests; mesopleurum rugoso-punctate; metapleurum rugoso-punctate; postpetiole moderately broad, evenly curved at base, with sparse shallow punctures medially, becoming dense towards lateral margins and apex; 2nd and 3rd tergites densely coarsely punctate, punctures on 3rd tergite smaller than those on 2nd; rest of tergites shiny and smooth; ovipositor subcylindrical, flattened at tip.

Black. A squarish spot on face above clypeus, a dorsal stripe on 6-10 segments of flagellum, a spot on base of mandible above, clypeus except apical depression, inner orbits completely and rather broadly, malar space and lower 0.3 of outer orbits narrowly, yellow; a spot at lower end of pronotal collar, sometimes extending as a stripe slightly beyond epomia, pronotal shoulders broadly, yellow; tegula, subtegular ridge, a triangular or oval mark just below middle of mesopleurum and a triangular mark at base of hind wings, yellow; scutellum and a spot on a postscutellum, yellow; apicolateral slopes including crests of propodeum, yellow; a mark on fore and middle coxae in front and laterally on outer side, narrowed obliquely towards apex, yellowish white; trochanters, femora, tibiae, spurs and 1st 4 tarsal segments of fore and middle legs, reddish brown, the last tarsal segment brownish black; hind leg with coxa, trochanter and femur, reddish brown, extreme apex of femur, extreme base and apical 0.3 of tibia black, rest reddish brown; 1st, apical 1/2 of 4th, and 5th hind tarsal segments black, 2nd to basal 1/2 of 4th segments light infuscate to yellow (fig. 33); wings hyaline, stigma and nervures dark brown; 1st 2 abdominal segments with yellow broad complete apical bands and remainder with narrow, laterally incomplete bands; ovipositor sheath black.

One ♀ collected from Palampur, 1400 m, (Punjab Himalaya) on 10.VI.1963, varies from the type in having a smaller frontal horn, 0.3 as long as the scape of antenna. Another ♀ collected at Matheran, 900 m (Western Ghats) on 10.XI.1965, has the hind tarsus wholly brownish black but in other characters it agrees with the type described. A ♀ from Java has the hind tarsus entirely blackish, the apical propodeal carina with a median dip and the postpetiole with less punctures. It may be possible to segregate it into a subspecies if more specimens are available.

♂. Agrees with ♀ in general structure and color, but with apical transverse carina

of propodeum very strong between the crests; face, inner orbits and clypeus, coarsely punctate, punctures deep; postpetiole coarsely shallowly punctate, punctures moderately dense in middle, becoming denser towards margins.

Black. A macula on scape in front, a stripe on 8-15 segments of flagellum, face wholly, malar space, 0.3 of lower outer orbits, mandible except teeth and 1st trochanteral segment of fore leg, laterally on inner side, yellow; rest of color patterns as in ♀.

Length: ♀, 8-10 mm, fore wing 6 mm, ovipositor 3.5 mm; ♂, 6-8 mm, fore wing 5-6 mm.

Holotype ♀, India: Mowar (Maharashtra), 3.I.1966, D. T. Tikar, Coll. No. T146 (DELHI U.). Allotype ♂, India: Devlali (Maharashtra), 8.X.1962, Coll. Capt. S. K. Gupta (DELHI U.). Paratypes: 7♀♀, 2♂♂. India: 1♀, Namkum, Ranchi (Bihar), 15.VII.1956; 1♀, 2. XII.1955 and 1♀, 7.I.1957, Coll. S. N. & V. K. Gupta; 2♀♀, New Forest, Dehra Dun, 600 m, in Kumaon Himalaya (U. P.), 20.VI.1962 and 27.XI.1965, V. K. Gupta, Coll. Nos. 20 & 141; 1♀, Palampur, 1400 m, in Punjab Himalaya (H. P.), 10.XII.1963, V. K. Gupta; 1♀, Matheran, 900 m, in Western Ghats (Maharashtra), 10.XI.1965, Kamath, Coll. No. K40; 1♀, Muradnagar (U. P.), 11.XII.1965, D. Ram, Coll. No. 146 (DELHI U.). Java: 1♀, Tjibodas (TOWNES).

DISTRIBUTION: India: Bihar, Maharashtra, Uttar Pradesh and Himachal Pradesh. Java.

The name of this species is derived from the Latin word *perfectus* = perfect, referring to the complete nature of the apical propodeal carina.

2. *Listrognathus* (*Listrognathus*) *contracta* Gupta and Kamath, new species

Figs. 9, 11, 25, 32.

This species is very close to *L. (L.) perfecta* in general sculpture and color pattern. The shape and size of the frontal horn (fig. 9), the nature of the apical propodeal carina (fig. 25) and the punctures on the postpetiole, justify its specific identity. The lower end of occipital carina is far removed from the base of mandible as in *perfecta* but it is not interrupted and joins the hypostomal carina as shown in fig. 11.

♀. Face strongly rugoso-punctate, distinctly punctured; mandibular teeth as in *perfecta*; the lower end of occipital carina sharply recurved, joining the well raised hypostomal carina at more than a right angle (fig. 11); frons rugoso-striate, sometimes also with punctures between median ocellus and frontal horn, frontal horn small to very small, about 0.2-0.3 as long as the scape (fig. 9); pronotum rugoso-punctate, the punctures coarse and shallow above, rest strongly irregularly striated; pronotal shoulders obtuse, shallowly punctate; pronotal collar as in *perfecta*; mesoscutum coarsely, deeply punctate, notauli distinct almost reaching its middle; scutellum shiny with sparse deep punctures at basal 2/3; propodeum strongly reticulo-punctate, punctures on basolateral area smaller, sublateral crests short and obtuse, apical carina between crests interrupted or faintly indicated but broken (fig. 25); postpetiole moderately broad, with coarse shallow punctures becoming denser on dorsolateral corners; 2nd and 3rd tergites densely coarsely punctate, punctures on 3rd tergite smaller; rest of tergites, shiny, smooth; ovipositor more or less sub-cylindric, flattened between nodus and apex, the lower valve with weak, oblique ridges.

Black. Resembles *L. (L.) perfecta* in color pattern except that the hind tarsus is wholly

brownish black (fig. 32).

Two ♀♀ collected at Namkum, Ranchi, on 17.IV.1957 and 29.IV.1957 respectively, show a little variation from the type described. In one the frontal horn is about 0.5 as long as the scape and in the other, the hind tarsus is like that in *perfecta*. In all other respects they agree with the type.

♂: Unknown.

Length: ♀, 6–10 mm, fore wing 4.5–5.8 mm, ovipositor 3 mm.

Holotype ♀, India: Namkum, Ranchi (Bihar), 15.IV.1957, Coll. C. Tirky (DELHI U.).
Paratypes: 6♀♀. India: 1♀, Namkum, Ranchi, 1♀, 26.III.1955; 1.V.1956; 1♀, 17.IV.1957 and 1♀, 29.IV.1957, S. N. & V. K. Gupta; 1♀, 15.IV.1957, Coll. S. N. Gupta; 1♀, Sal Forest, Ranchi, 1♀, 23.IV.1956; 1♀, Namkum, Ranchi, V.1957, C. Tirky (DELHI U.).

DISTRIBUTION: India: Bihar.

The name of this species is derived from the Latin word *confractus*=broken, referring to the incomplete nature of the apical propodeal carina.

3. *Listrognathus (Listrognathus) assamensis* Gupta and Kamath, new species

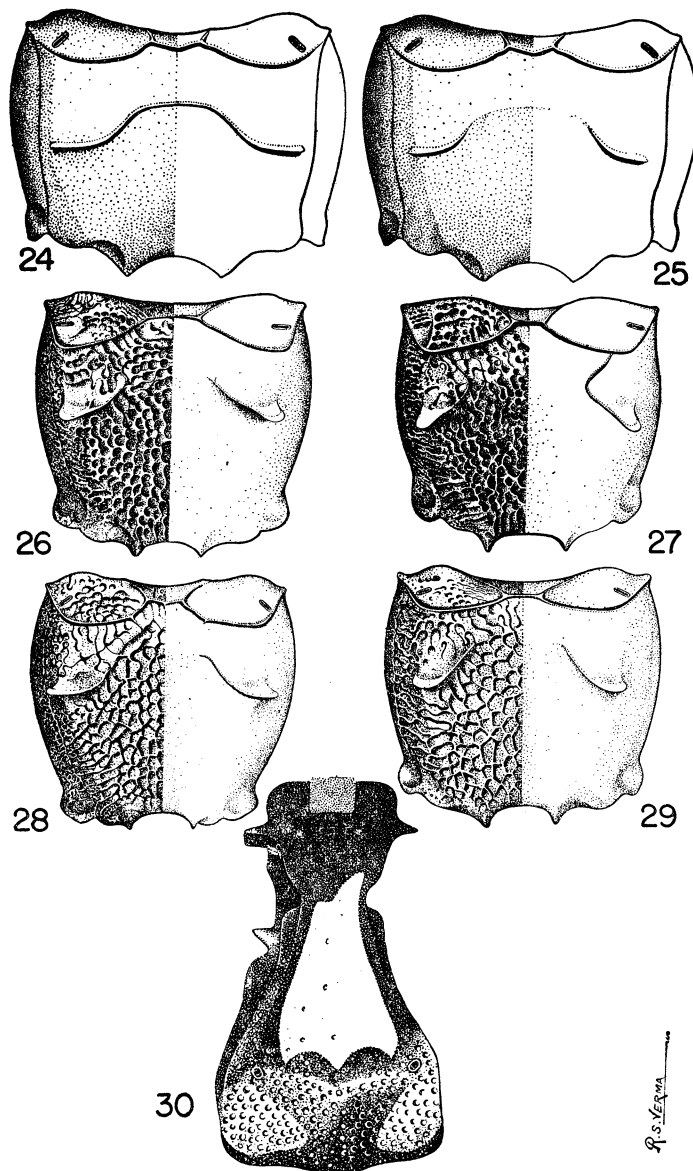
Figs. 12, 16, 20, 26, 36.

This species differs from the rest in having the occipital carina moderately recurved and meeting the moderately elevated hypostomal carina almost at a right angle (fig. 12). The lower end of occipital carina is not further from the base of mandible than the basal width of mandible.

♀. Face and clypeus shiny, punctate, punctures tending to be rugose in middle; inner orbits somewhat mat and with a few scattered punctures (in paratype face and clypeus more shiny and with less punctures); mandibular teeth subequal in shape; hypostomal carina moderately raised; occipital carina moderately recurved, meeting hypostomal carina almost at a right angle (fig. 12); frons with a moderately long, conical median horn, with oblique, parallel striations between horn and median ocellus (fig. 16); vertex coarsely punctate, except in ocello-ocular area, strongly striated medially behind; temples finely punctate; malar space finely rugulose; pronotum coarsely striato-punctate, lower margin of pronotal collar with scattered, fine punctures and with an angular tooth at its middle (as in *acuminata*, fig. 3); epomia starting from a raised flange anteriorly on pronotal collar; pronotal shoulders strong and acute, with broad sparse punctures; mesoscutum strongly rugoso-punctate, notauli distinct, reaching 1/2 its length; scutellum shiny, moderately punctured, apex smooth; postscutellum smooth and shiny; propodeum (fig. 26) coarsely reticulo-punctate, its basolateral area tending to be rugoso-punctate, apical, carina broadly interrupted in middle, forming strong, broad, sublateral crests; mesopleurum strongly rugoso-punctate, tending to be striate just above middle coxa; metapleurum reticulo-punctate; abdomen (fig. 20) with postpetiole medially raised at base, bent at right angle to the petiole, with distinct and deep, well separated punctures, sparse in the middle, moderately dense apically and laterally; 2nd tergite with large, deep punctures, 3rd tergite with small punctures, their apical margins and following segments smooth, shiny; ovipositor subcylindrical, broadly tapering at apex (fig. 36), dorsal valve between nodus and apex evenly flattened and with notches at nodus, without a median carina, lower

valve with slanting ridges.

Black. Face, clypeus except apical margin, mandible except teeth, malar space and lower temple, yellow; a stripe extending broadly along inner margin of eye to vertex, slightly behind level of lateral ocellus, yellow; antenna with a dorsal yellow stripe on 7-



Figs. 24-30. Propodeum of 24, *Listrognathus* (*L.*) *perfecta*, 25, *confRACTA*, 26, *assamensis*, 27, *nigriabdominalis*, 28, *acuminata* and 29, *spinifrons*; 30, petiole of *L.* (*S.*) *flavopetiolata*.

12 flagellar segments; a broad stripe on lower margin of pronotal collar and pronotal shoulders, yellow; scutellum broadly yellow, except basolateral corners including its lateral carinae; postscutellum with a yellow spot; propodeum with its apicolateral slopes including crests broadly yellow; mesopleurum with an almost squarish spot in middle, tegula, subtegular ridge, an oval spot at base of hind wings, yellow; fore coxa except for an irregular black mark basally below, trochanters, middle coxa and trochanters, yellow; fore and middle femora tawny yellow, tibiae and tarsi tawny yellow with blackish-brown markings, 5th tarsal segment including claws wholly black; hind coxa largely black with an oval dorsal and an irregular ventral yellow spot, the 2 spots uniting on inner side; hind trochanter, basal 0.6 of femur and tibia except its extreme base and apical 0.25, tawny yellow; hind tarsus, except for basal 0.2 of 1st and all of 5th segment, yellow; tibial spurs black; wings hyaline, stigma and nervures black; postpetiole with broad triangular yellow spots on apicolateral corners; abdominal tergites with wide yellow apical bands broadly interrupted in middle (fig. 20); ovipositor sheath black.

♂. Unknown.

Length: ♀, 13.5 mm, fore wing 11 mm, ovipositor 5 mm.

Holotype ♀, India: Cherrapunji, 1400 m, in Khasi Hills (Assam), 3.IV.1966, M. K. Kamath, Coll. No. K75 (DELHI U.). Paratype: ♀, India; same data as holotype, but 7. IV.1966, Coll. No. K79 (DELHI U.). Burma: Mt Victoria, 1400 m, III.1938, G. Heinrich (TOWNES). This paratype has a complete band on the post-petiole; markings on other tergites are also closer in the middle.

DISTRIBUTION: India: Assam State. Burma.

L. (L.) assamensis is related to *L. (L.) rugifrons* and *L. (L.) armata*: these three species having almost the same type of occipital and hypostomal carinae, and forming a distinct species group, the *rugifrons* group. In *rugifrons*, the pronotal collar is without a tooth-like projection near the middle of its lower margin and the mandibular teeth are equal in shape, while in *armata* and *assamensis*, the pronotal collar is with a tooth-like projection and the mandibular teeth are of unequal shape. *L. (L.) armata* is different from *assamensis* in having the apical carina of propodeum complete, which is also the case in *rugifrons*. The succeeding two species, *nigriabdominalis* and *acuminata*, although different from the species of *rugifrons* group in the nature of occipital and hypostomal carinae and forming a species group of their own (*nigriabdominalis* group), are however similar to *assamensis* in the nature of pronotal shoulders, pronotal collar, mandibular teeth and propodeal carinae (table I).

4. *Listrognathus (Listrognathus) nigriabdominalis* Gupta and Kamath, new species

Figs. 13, 17, 21, 27, 34, 35.

This species can be easily distinguished by its moderately stronger build and the color of the abdomen, which is wholly black, except for very narrow, faint yellow stripes on extreme apices of tergites (fig. 21); frons exhibiting transverse as well as longitudinal striations between horn and median ocellus (fig. 17); occipital carina not incurved and meets hypostomal carina at an acute angle (fig. 13); both carinae normal and moderately strong; ovipositor subcylindrical, tip depressed with a distinct median carina on dorsal valve between nodus and apex (figs. 34, 35).

♀. Face and basal 0.3 of clypeus coarsely punctate, rest of clypeus smooth; inner orbits with scattered punctures; upper tooth of mandible broader than lower; occipital carina evenly curved, joining hypostomal carina at an acute angle (fig. 13) and closer to base of mandible; frons (fig. 17) with a median horn of moderate size, blunt at apex, with transverse and oblique parallel striations between horn and median ocellus; vertex coarsely punctate, obliquely striate medially behind and mat near orbits; temples with moderately dense shallow punctures; malar space rugulose; pronotal collar strongly striate, its lower margin punctate and with an angular tooth-like prominence near its middle; pronotal shoulders strong and acute, punctate and somewhat broader than in *assamensis*; mesoscutum coarsely, deeply, rugoso-punctate; notauli shallow, region of notauli strongly trans-striate; scutellum shiny, with moderately big sparse punctures, its apex smooth; post-scutellum smooth and shiny; propodeum (fig. 27) including its basolateral area, reticulo-punctate, its apical carina interrupted in middle, turned basad and almost joining basal carina, propodeal crests moderately long, obtuse, margined sharply by apical carina above; mesopleurum rugoso-punctate; metapleurum reticulo-punctate; abdomen (fig. 21) with postpetiole medially raised basally, distinctly and coarsely punctured, knob smooth with a few scattered punctures in middle, rest strongly punctate; 2nd tergite coarsely, deeply punctate, punctures at places coalescing; 3rd tergite with smaller and well separated punctures, its middle region with scattered punctures, apical bands of 2nd and 3rd tergites and following tergites wholly smooth and shiny; ovipositor (figs. 34, 35) subcylindrical, its dorsal valve depressed between nodus and apex, with a median carina, tip broadly rounded at apex.

Black. Face, clypeus except apically, mandible except its teeth, inner orbits completely, lower 1/2 of outer orbits broadly and malar space, yellow; 6-13 flagellar segments with a dorsal yellow stripe; pronotal collar with a small spot in middle; pronotal shoulders broadly yellow; scutellum broadly yellow, base and basolateral corners and lateral carinae black; postscutellum black; apicolateral slopes of propodeum including crests broadly yellow; mesopleurum with an oblong mark in its middle, tegula, subtegular ridge and a broad spot at base of hind wings, yellow; fore and middle legs tawny yellow, with their coxae broadly yellow above and black below and trochanters yellow; fore femur on outer side and middle femur on inner side with broad black stripes; extreme apices of fore and middle femora, bases of their tibiae on lateral sides and apices of 3rd and 4th tarsal segments with brownish-black markings, 5th tarsal segment wholly brownish black; hind leg with coxa black with a yellow spot above, first trochanteral segment with a brown streak above, almost apical 0.5 of femur, extreme base and apical 0.3 of tibia, spurs and apical 1/2 of 5th tarsal segment including claws, black; rest of hind leg yellow to tawny yellow; wings hyaline, stigma and nervures brownish black; abdomen (fig. 21) wholly black except for apical, very narrow, faint, yellow stripes on 3rd, 4th and 7th segments, 2nd tergite somewhat brown at apex, 5th and 6th obscurely yellow at apex and 7th with its lateral side also broadly yellow; ovipositor sheath black.

♂. Unknown.

Length: ♀, 15.5 mm, fore wing 12 mm, ovipositor 5.5 mm.

Holotype ♀, India: Cherrapunji, 1400 m, in Khasi Hills (Assam), 5.IV.1966, M. K. Kamath, Coll. No. K77 (DELHI U.). Paratypes: ♂, India: Pynursla, 1350 m, in Jaintia Hills (Assam), 11.IV.1966, J. K. Jonathan, Coll. No. J127 (DELHI U.).

DISTRIBUTION: India: Assam State.

The name of this species is derived from the Latin *nigra*=black+*abdominalis*, referring to the striking black color of the abdomen without bands.

5. **Listrognathus (Listrognathus) acuminata** Gupta and Kamath, new species.

Figs. 3, 6, 14, 18, 22, 28, 37.

Easily recognized from other species by its compressed ovipositor, the tip of which is very finely pointed at apex (fig. 37). The occipital carina, which is interrupted above, unites with hypostomal carina at a moderately acute angle (fig. 14); latter not conspicuously raised. Apical yellow bands on the 1st 4 abdominal tergites (fig. 22) complete and not interrupted in middle.

♀. Face with coarse punctures, clypeus sparsely punctate; inner orbits smooth, polished; mandibular teeth (fig. 6) unequal in shape; occipital carina interrupted above, meets hypostomal carina at a moderately acute angle (fig. 14); hypostomal carina normal; frons (fig. 18) with a moderate-sized, conical median horn and with irregular striations between horn and median ocellus; vertex rugose in ocellar triangle, smooth and polished in oculo-ocellar region and behind; temple evenly convex with fine punctures; malar space finely rugulose; head, viewed from above, abruptly sloping behind eyes; pronotum with coarse punctures above, below strongly trans-striate; pronotal collar smooth with a tooth-like projection on its lower margin (fig. 3), epomia starting from a raised flange at about mid-length of collar; pronotal shoulders acute, distinctly punctate; mesoscutum strongly rugoso-punctate; notauli weakly marked; scutellum with distinct, shallow punctures; postscutellum smooth and polished; propodeum (fig. 28) reticulate, basolateral area reticulo-punctate, apicolateral slope trans-striate, apical carina broadly interrupted in middle, forming moderately strong, acute sublateral crests; prepectus coarsely rugose, rest of mesopleurum striato-rugose; metapleurum reticulo-punctate; abdomen (fig. 22) with postpetiole raised medially at base, with dense shallow punctures at apex, punctures scattered in middle; 2nd and 3rd tergites coarsely, deeply punctate, punctures more crowded basally and medially, but sparse at apex, following tergites smooth and polished; ovipositor (fig. 37) with notches at nodus, compressed, tip finely pointed at apex.

Black. Face, clypeus except extreme apex, mandibles except teeth, inner orbits, lower 1/2 of outer orbits wholly and malar space, yellow; scape brown, flagellum brownish black with 7-11 segments with a dorsal yellow stripe; a yellow stripe on pronotal collar wider below, tapering above and beyond epomia; pronotal shoulders broadly yellow; scutellum yellow; postscutellum yellow; apicolateral slopes including crests of propodeum, yellow; tegula, subtegular ridge, an almost oval mark in middle of mesopleurum and a broad triangular mark at base of hind wings, yellow; fore and middle legs tawny yellow, with coxae and trochanters light yellow, fore coxa at its extreme base brownish below; 5th segment of fore and middle tarsi, brownish black; hind leg with coxa light brown to deep brown with an oblique elongate yellow mark above, extreme apex of femur, extreme base and apical 0.25 of tibia, its spurs and 1st, 4th and 5th tarsal segments, brownish black, 2nd and 3rd segments light yellow, rest tawny yellow; wings hyaline, stigma and nervures brownish black; abdomen (fig. 22) with apices of 1-4 tergites with complete broad yellow bands (not interrupted in middle), tergites 5-8 with an apical medi-

aly interrupted yellow band; ovipositor sheath black.

♂. Resembles ♀ in all respects except that face strongly punctured; propodeal carinae strong; postpetiole with moderately dense, deep punctures throughout; abdominal segments with somewhat deeper punctures; antennal flagellum without a yellow stripe; hind leg with coxa black and with an oblique elongate yellow mark above, 1st trochanteral segment black, apical 0.3 of femur, extreme base and apical 0.3 of tibia, 1st tarsal segment wholly, basal 1/2 (or more) of 2nd segment and whole of 5th segment, brownish black, rest tawny yellow.

Length: ♀, 10-12 mm, fore wing 8.5 mm, ovipositor 3.5 mm, ♂, 10.5 mm, fore wing 8 mm.

Holotype ♀, India: Ranchi (Bihar) in G. E. L. Mission compound, 14.IV.1957, V. K. Gupta (DELHI U.). Allotype ♂, India: Namkum, Ranchi (Bihar), 4.IV.1957, V. K. Gupta (DELHI U.). Paratypes: 9♀♀, 2♂♂. India: Namkum, Ranchi (Bihar), 1♀, 1♂, I. 1957; 2♀♀, IV.1957; 1♀, 12.IV.1957, V. K. Gupta; 1♀, Namkum, Ranchi, 15.IV.1957, S. N. Gupta (DELHI U.). 2♀♀, Cherrangode, 1100 m, in Nilgiri Hills (Madras State), XI. 1950; 2♀♀, Walayar Forests, 300 m, in Western Ghats (Kerala), IX.1952 and X.1956, P. S. Nathan (OTTAWA, CAN.); 1♂, Coimbatore (Madras State), XII.1951, P. S. Nathan (TOWNES).

DISTRIBUTION: India: Bihar, Madras and Kerala.

The name of this species is derived from the Latin word *acuminatus*=sharply pointed, indicating the finely tapered, sharply pointed ovipositor.

6. *Listrognathus* (*Listrognathus*) *spinifrons* (Cameron) Figs. 15, 19, 23, 29, 38.

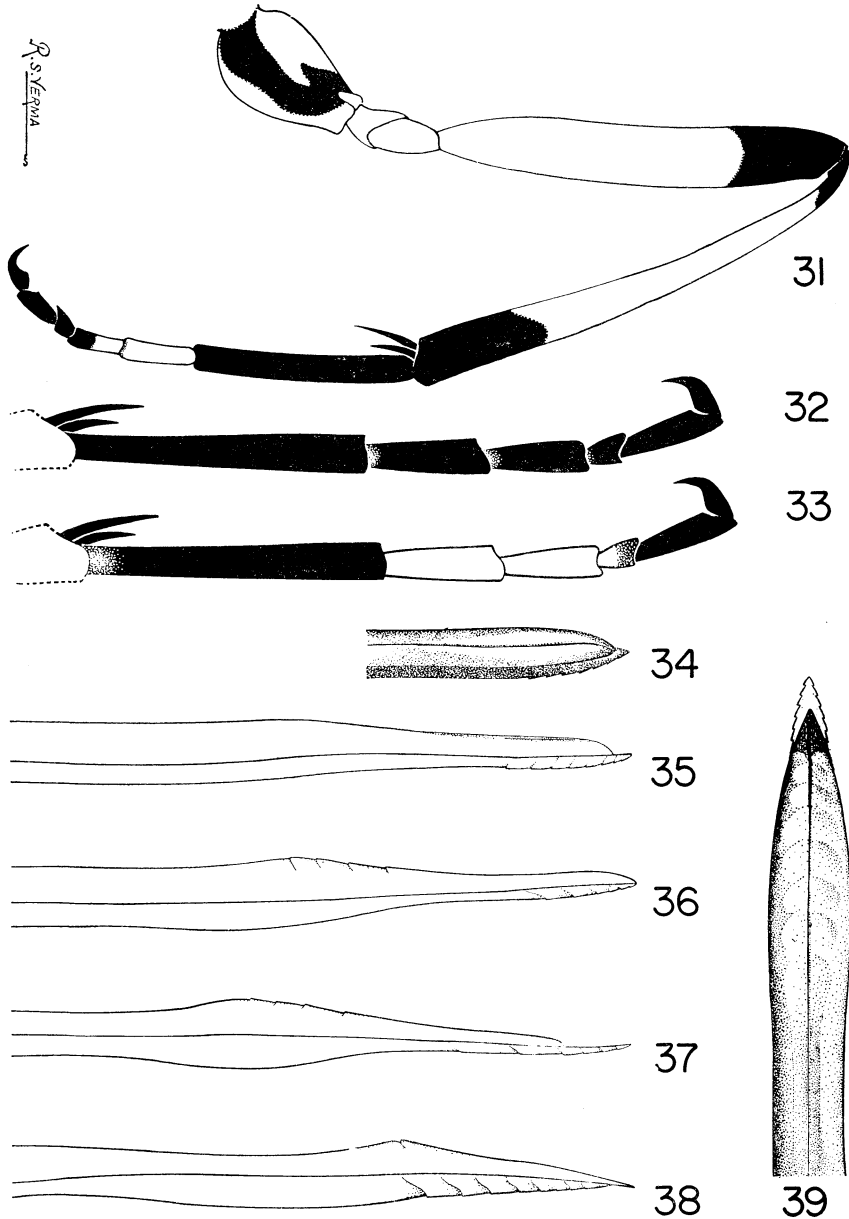
Suwalta spinifrons Cameron, 1905, Zs. Syst. Hym. Dipt. 5: 143, ♀, des. (type: ♀, Iandi: "Sikkim Himalayas" (London)).

Listrognathus (*Suwalta*) *spinifrons*: Townes, Townes, & Gupta, 1961, Mem. Am. Ent. Inst. 1: 177.—Townes & Townes, 1962, Bull. U. S. Natl. Mus. 216 (3): 412.

This species differs from all the preceding species in having the frons smooth and shiny, a feature also shared by *laevifrons* Cameron, *pallidinerva* Cameron and *mobilis* (Tosquinet). These four species form a species group, the *laevifrons* group. The present species differs from other members of the *laevifrons* group in having the mandibular teeth of unequal shape. A pair of yellow stripes in the middle of mesoscutum and the lateral carinae of scutellum with yellow markings further distinguish it from other species.

♀. Face rugose in middle, shallowly punctate at sides, clypeus sparsely punctate; inner orbits smooth and shiny with a few scattered punctures along eye margin; mandibular teeth unequal in shape; occipital carina complete, weakly curved toward hypostomal carina and meeting latter at an acute angle (fig. 15); hypostomal carina normal; frons smooth and polished (fig. 19), with a median small to moderate-sized horn, horn sometimes with a dorsal tine or an accessory horn; vertex rugose between ocelli, ocello-ocular region smooth to mat; temple finely punctate; malar space rugulose; head viewed from above, sharply contracted behind eyes; pronotum coarsely, shallowly punctured, trans-striate in middle; pronotal shoulders acute, sparsely and somewhat shallowly punctate, pronotal collar with a tooth on its lower margin and with a flange anteriorly; epomia strong, starting from base of flange; mesoscutum rugoso-punctate, notauli clearly

marked reaching 1/2 its length; scutellum with coarse, shallow punctures laterally, leaving a smooth median area; post-scutellum shiny, smooth; propodeum (fig. 29) strongly reticulo-punctate and with basolateral areas polished, sometimes faintly trans-striate, ex-



Figs. 31-39. 31, hind leg of *Listrognathus (Stivadens) flavopetiolata*; hind tarsus of 32, *L. (L.) confracta* and 33, *perfecta*; ovipositor tip of 34, 35, *nigriabdominalis*, 36, *as-samensis*, 37, *acuminata*, 38, *spinifrons* and 39, *L. (S.) flavopetiolata* (dorsal view).

treme base obscurely punctured; apicolateral crests long and moderately broad, sharply bordered by apical carina, apical carina broadly interrupted in middle; prepectus rugoso-punctate, the oval yellow mark in middle of mesopleurum with well separated punctures, rest of mesopleurum striate; metapleurum strongly rugoso-punctate, tending to be reticulate; abdomen with postpetiole evenly curved with scattered punctures at base, becoming moderately dense at apex, postpetiole polished and shallowly depressed in middle; second tergite (fig. 23) with dense punctures, punctures coarse and deep; 3rd tergite with small, more crowded punctures, punctures becoming sparse towards apex; rest of segments smooth; ovipositor (fig. 38) compressed with a notch at nodus.

Black. Face, clypeus except at apex, mandibles except teeth, inner orbits broadly to just behind level of eyes, outer orbits from near top and malar space, yellow; antennal scape brownish black, flagellum brownish black with a dorsal yellow stripe on 8-12 segments; an elongate stripe on pronotal collar, pronotal shoulders broadly yellow; a pair of median stripes on mesoscutum, yellow; scutellum wholly yellow, sometimes its extreme apex black, its lateral carinae yellow; post-scutellum black; apicolateral slopes including crests of propodeum, yellow; tegula, subtegular ridge, a mark in middle of mesopleurum and an irregular mark at base of hind wings, yellow; fore and middle legs tawny yellow, their 5th tarsal segments, brownish black; fore coxa brownish basally below; fore and middle coxae and their trochanters light yellow; hind leg with its coxa broadly yellow, with an irregular black to brown mark at base, black mark above continuous as a stripe between base and apex, 1st trochanteral segment with a black mark above, femur with an infuscate band at its extreme apex, extreme base and apical 0.25 of tibia, spurs, 1st and 5th tarsal segments wholly black, rest light yellow; wings hyaline, stigma and nervures black; abdominal tergites (fig. 23) with a broad yellow apical band interrupted in middle; ovipositor sheath black.

♂. Similar in structure and color to ♀, but antennal segments 12-16 with a yellow stripe; scutellum broadly yellow, apex black; hind coxa broadly black with 2 oblong yellow spots laterally above and 1 apically below (sometimes with an oblong yellow spot above).

Variation from typical *spinifrons* has been noted in 4 specimens. One ♀ collected at Chikalda, 1100 m, (Maharashtra) on 23.X.1965 differs from *spinifrons* in having its body wholly reddish brown; mesoscutum with 2 pairs of yellow stripes in addition to the usual pair of median stripes, 1 pair near to base on middle lobe and the other bordering the lateral margins in middle; apart from these, the grooves of notauli are marked with ivory-white stripes and the apical yellow band on postpetiole is almost complete. Three ♀♀, each one collected at Ambera Bero, Ranchi (Bihar) on 23.XI.1957, Mohan in Kumaon Himalaya (U. P.) on 7.IV.1965 and Khajjiar, 1925 m, in Punjab Himalaya (H. P.) on 30.VI.1965, do not have any median pair of yellow stripes on mesoscutum. In all other details, structural as well as color characteristics, the above mentioned specimens agree with the ♀ of *spinifrons*.

Length: ♀, 10.5-12.5 mm, fore wing 8 mm, ovipositor 4 mm; ♂, 10-12.5 mm, fore wing 7.5-10 mm.

SPECIMENS EXAMINED: 28♀♀, 19♂♂. India: 1♀, Chikalda, 1100 m, in Satpura Hills (Maharashtra), 21.X.1965; 1♀, 22.X.1965; 3♀♀, 23.X.1965; 1♀, 15♂♂, 24.X.1965; 1♀, 1♂, 25.X.1965, D. T. Tikar, Coll. Nos. T93-T96 and T98; 1♀, Devlali (Maharashtra), 30,

IX.1962, Capt. S. K. Gupta; 2♀♀, Matheran, 900 m, in Western Ghats (Maharashtra), 10-11.XI.1965, M. K. Kamath, Coll. Nos. K41-42; 1♂, 10.XI.1965, J. K. Jonathan, Coll. No. J93; 1♀, Panhala Fort (Kolhapur Dist., Maharashtra), 17.XI.1965, Jonathan Coll. No. J98; 2♀♀, Namkum, Ranchi (Bihar), 13.IV.1956 & 1.V.1956, S. N. & V. K. Gupta; 1♀, Namkum, Ranchi, 13.IV.1956; 1♀, 14.IV.1956; 1♀, 24.IV.1956; 1♀, 24.IV.1956; Ambera Bero, Ranchi (Bihar), 1♀, 23.XI.1957, C. Tirky; 1♀, Mohan in Kumaon Himalaya (U. P.), 7.IV.1965, V.K. Gupta, Coll. No. 72; 1♀, Khajjiar, 1925 m, in Punjab Himalaya (H. P.), 30.VI.1965, D. Ram, Coll. No. 124; 1♀, Coimbatore, 425 m, (Madras State), XI.1962, Nathan (DELHI U.); 1♀, Singara, 1050 m, in Nilgiri Hills (Madras State), V.1948; 1♀, Coimbatore, IX.1953; 3♀♀, Yercaud, 1400 m, in Shevaroy Hills (Madras State), XII.1954, II.1955 & III.1955; 3♀♀, 2♂♂, Walayar Forests, 300 m, in Western Ghats (Kerala), IX.1956, Nathan (OTTAWA, CAN.); 1♀, Bangalore, Mysore State, 6.XI.1961, *ex cocoon* on *Casuarina*, CIBC Coll. (BMNH).

A ♀ specimen identified as "*Suvalta rugifrons* Cam." (label no: H/1540—Nagpur (C. P.)—Coll. M.B.S., 16.X.'06) by C. Morley, V.1913, and present in National Pusa Collection, New Delhi, is actually *Listrognathus (Listrognathus) spinifrons* Cameron.

DISTRIBUTION: India: Bihar, Uttar Pradesh, Himachal Pradesh, Maharashtra, Mysore, Madras and Kerala. Sikkim.

7. *Listrognathus (Listrognathus) pallidinerva* (Cameron)

Suvalta pallidinerva Cameron, 1904, Ann. Mag. Nat. Hist. ser. 7, **13**: 221 [♀], des. [type: ♀, India: Khasi Hills in Assam. (Oxford)].

Listrognathus (Suvalta) pallidinerva: Townes, Townes & Gupta, Mem. Am. Ent. Inst. **1**: 177.

This species is close to *L. (L.) spinifrons* (Cam.) and can be distinguished from the latter by not having yellow markings on mesoscutum and lateral carina of scutellum. The notaulus is also faintly indicated. We have not seen any specimens of it from India but in Townes collection there are specimens from Burma which are referable to this species.

♂ and ♀. Similar in color and sculpture to *spinifrons* and distinguished by having the mandibular teeth of equal shape; frontal horn comparatively longer; notauli weakly marked; pronotal collar strongly striate in middle; propodeum basally striate; and whole of thorax and propodeum comparatively more hairy.

Mesoscutum and lateral carinae of scutellum without yellow stripes or markings; fore and middle femora lined above with black; hind coxa and trochanters black with yellow marks; hind femur black in apical 0.3-0.4; hind tibia black in apical 0.25-0.3; 1st hind tarsal segment only basally black, rest of tarsus yellow.

SPECIMENS EXAMINED: Burma: 2♀♀, Mt. Popa, 600-1000 m, X.1937, G. Heinrich (TOWNES Coll.).

DISTRIBUTION: India, Burma.

8. *Listrognathus (Listrognathus) mobilis* (Tosquinet)

Cryptus mobilis Tosquinet, 1903, Mem. Soc. Ent. Belg. **10**: 206, ♀, des. (type: ♀, Java:

Mt Gedeh, 1200 m; BRUSSELS).

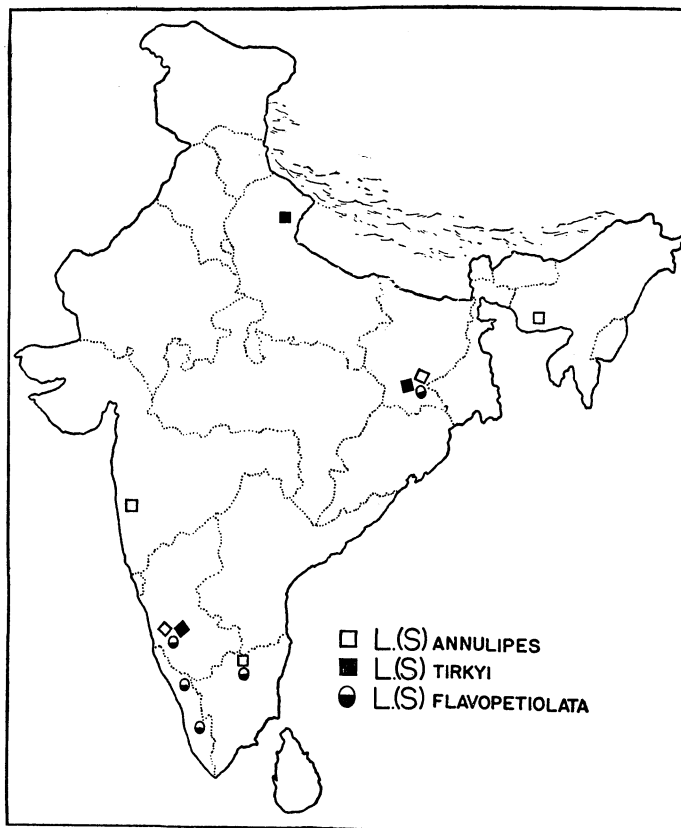
Cryptus serius Tosquinet, 1903, *l.c.*, 231, ♀, des. (type: ♀, Java: Mt Gedeh, 1200 m; BRUSSELS).

Listrognathus (Suvalta) mobilis: Townes, Townes & Gupta, 1961, *Mem. Am. Ent. Inst.* 1: 176. syn.

We refer to this species two males and one female from Java present in Townes collection. We have not seen the type but the description is fairly detailed and Townes specimens fit well with the description. This species appears to be very close to *pallidinerva* (Cameron) from India and Burma and further study might reveal that the two species may well be considered as subspecies. In *mobilis*, the legs have more extensive black markings, especially on the hind femur, the apical 0.7 of which is black. The thorax is slightly more elongate than in *pallidinerva*.

SPECIMENS EXAMINED: Java: 1♀, Radjamandla, 350 m, 10.III.1940, J. Olthof; 1♀, Moreria Mts, Tjolo, 800 m, 20-24.X.1939, M. A. Lieftinck; 1♂, Soekabomi (TOWNES).

DISTRIBUTION: Java.



Map 2. Distribution of species of *Listrognathus* (*Stivadens*).

Subgenus **Stivadens** Townes

Map 2.

Stivadens Townes, 1961, Mem. Am. Ent. Inst. **1**: 472. (type: *Suwalta annulipes* Cameron; orig. design.).—Townes & Townes, 1962, Bull. U. S. Natl. Mus. **216** (3): 408, 412.

Front wing 9.0 to 12.5 mm long; frons smooth and polished; upper tooth of mandible broader than lower (fig. 7); lower end of occipital carina weakly curved, meeting hypostomal carina at an acute angle; hypostomal carina normal; pronotal collar with an angulate tooth at its lower end (fig. 4); pronotal shoulders moderately developed and weakly obtuse; propodeum with prominent sublateral tubercles, apical transverse carina absent; lower lateral edge of 1st abdominal tergite with 1 or 2 strong teeth near its midlength; ovipositor subcylindrical, tip broadly depressed, sometimes with paired impressions on the dorsal valve.

KEY TO SPECIES OF SUBGENUS STIVADENS

1. Propodeum shiny with well separated punctures, basolateral area finely trans-triate, propodeal tubercles large, weakly raised; 2nd abdominal tergite mat to finely reticulate; mesoscutum punctate basally (Molucca Is.: Aru)..... **transversa** (Cam.)
 Propodeum distinctly reticulate, basolateral area reticulate or rugose to weakly trans-triate, propodeal tubercles small, short, conical; 2nd abdominal tergite distinctly punctate; mesoscutum rugose to rugoso-punctate at least basally 2
2. Lower margin of 1st tergite with a single strong tooth near its midlength, 1st abdominal tergite with a broad yellow triangular mark in middle, but not extending to postpetiole (fig. 30); ovipositor 0.5 length of fore wing, its dorsal valve between nodus and apex depressed and with a series of fine, paired impressions (fig. 39) (India)..... **11. flavopetiolata***
 Lower margin of 1st tergite with 2 strong teeth, 1 median and the other subbasal, petiole without any yellow mark; ovipositor less than 0.5 length of fore wing, its dorsal valve between nodus and apex slightly to moderately flattened, without any impressions 3
3. Hind femur black in its apical 0.4; 1st hind tarsal segment basally (in ♂♂ most of it or wholly) blackish, about 2.7 as long as 2nd segment (less than 3.0); 4th segment yellow; flagellar segments 7 to 13-15 with a yellow stripe; post-petiole conspicuously widened posteriorly, with scattered punctures around knob-like elevation; baso-lateral area of propodeum rugose. (India, Burma) ... **9. annulipes** (Cam.)
 Hind femur black in its apical 0.2; 1st, 4th & 5th hind tarsal segments wholly black; 1st segment 3.0 as long as 2nd segment; flagellar segments 9-12 with a yellow stripe; post-petiole not conspicuously widened, knob-like elevation smooth, with very few sparse punctures around; baso-lateral area of propodeum trans-triate (India) **10. tirkyi***

9. **Listrognathus** (*Stivadens*) **annulipes** (Cameron)

Suwalta annulipes Cameron, 1904, Ann. Mag. Nat. Hist. ser. 7, **13**: 220, "♀" = ♂. des. (type;

♂, India: Khasi Hills in Assam; OXFORD).

Listrognathus (Stivadens) annulipes: Townes, Townes & Gupta, 1961, Mem. Am. Ent. Inst. **1**: 177, 472.—Townes & Townes, 1962, Bull. U. S. Natl. Mus. **216** (3): 412.

This species can be distinguished from the other Indian species by its mesoscutum being more rugoso-punctate than in other species; the lateral lobes have more punctures and the shagreened area is either inconspicuous or small.

♀. Face rugose with an arched carina just below antennal sockets; clypeus strongly pyramidal in profile with a few scattered punctures; frons smooth, shiny with a very small pointed horn; vertex with sparse but distinct punctures between ocelli, sharply contracted behind eyes, shiny and smooth in oculo-ocellar region and behind; inner orbits smooth; mandibles with a few scattered punctures at base and middle; temple almost smooth, subpolished; malar space rugolose; pronotum above with moderately dense, deep punctures, below strongly trans-striate; pronotal shoulders moderately developed, weakly obtuse with shallow punctures; pronotal collar with a tooth at its lower end; epomia present but starting from a weakly developed flange anteriorly; mesoscutum rugoso-punctate, more so on middle lobe, rugosities superimposed on a shagreened surface, shagreened surface slightly more prominent laterally and with punctures, notauli deeply marked, reaching more than 1/2 its length, groove of notaulus strongly cross-ridged anteriorly; scutellum shiny with a few scattered, shallow punctures; postscutellum shiny, smooth; propodeum reticulate, basolateral area strongly rugose to reticulate, apicolateral slopes punctate, apical carina absent, tubercles short and obtuse; prepectus of mesopleurum strongly rugoso-striate, rest obliquely striated, middle yellow mark striato-punctate; metapleurum rugoso-punctate; 1st hind tarsal segment 2.7 (less than 3.0) as long as 2nd, lower margin of 1st tergite with 2 strong teeth, 1 subbasal and the other median; postpetiole widened posteriorly, with a knob-like elevation at base, with moderately dense, small but deep punctures in apicolateral corners and with scattered punctures around raised portion, sometimes median-dorsal aspect of postpetiole slightly depressed; 2nd and 3rd tergites with crowded coarse punctures, not becoming sparse in mid-apical region; rest of tergites smooth, polished; ovipositor subcylindrical, less than 0.5 length of fore wing, its dorsal valve between nodus and apex slightly flattened without any impressions as in *L. (S.) flavopetiolata*.

Black. Face, clypeus except median apical portion triangularly, mandibles broadly except teeth, a dorsal stripe on 7 to 13–15 flagellar segments, inner orbits broadly to slightly behind level of eyes, lower 1/2 of temple broadly and malar space, yellow; an elongated stripe on pronotal collar and pronotal shoulders broadly, yellow; a pair of elongated median stripes on mesoscutum, yellow; scutellum wholly yellow, except extreme base and basolateral corners, black; postscutellum, black; dorsolateral slopes of propodeum including tubercles, yellow; tegula, subtegular ridge, a median rectangular oblique mark on mesopleurum and an irregular mark at base of hind wings, yellow; fore coxa except base below, whole of middle coxa, their trochanters, light yellow; fore and middle femora tawny yellow, tibiae tawny yellow with a median brownish streak above, 1st to 4th tarsal segments light brown to deep brown, 5th tarsal segments including claws, brownish black; hind leg with coxa black, with a broad oblique mark above and below, broadly yellow, extreme base of 1st trochanteral segment, apical 0.4 of femur, extreme base and apical 0.4 of tibia, spurs, 1st tarsal segment basally (sometimes more and usually entirely in ♂) and entire 5th tarsal segment including claws, black, 1st tarsal segment otherwise and 2nd to

4th segments light yellow; rest of hind leg tawny yellow; wings hyaline, stigma and nervures brown to brownish black; 1st tergite with broad triangular apicolateral yellow spots and rest of tergites with yellow apical bands, broadly interrupted in middle; ovipositor sheath black.

♂. Mostly resembles ♀ except that punctures on face are a little stronger, clypeus almost without punctures, mesoscutum strongly rugoso-punctate and punctures on mid-apical region of 3rd tergite sparse.

A dorsal stripe on segments 12-18 of flagellum, yellow; yellow mark on mesopleurum elongate but almost oval and not rectangular as in ♀; extreme bases of fore and middle coxae below, black; 1st 4 tarsal segments of fore and middle legs wholly yellow; hind coxa, except for an oblique yellow mark above, black; basal 0.6 of hind femur reddish yellow, not quite apical 1/2 of tibia black; 1st hind tarsal segment almost entirely black; rest of leg color as in ♀.

This species exhibits variations in the sculpture of the mesoscutum; in most Indian specimens the lateral lobes are more punctured than shagreened, while in Burmese specimens and a specimen from Sikkim and one from Ranchi (31.III.1957), the shagreened areas are more prominent, in which condition they approach *tirkyi*, n. sp. The color of the 1st hind tarsal segment varies from mostly yellow to mostly black, but not completely black except in the ♂.

Length: ♀, 11.5-12.5 mm, fore wing 9.5 mm, ovipositor 4 mm; ♂, 10.5 mm, fore wing 9.5 mm.

SPECIMENS EXAMINED: 18♀♀, 1♂. India: 1♀, Namkum, Ranchi (Bihar), 11.IV.1957; 1♀, G. E. L. Mission compound, Ranchi (Bihar), 31.III.1957, V. K. Gupta; 2♀♀, Mahabaleswar, 1400 m, in Western Ghats (Maharashtra), 13.XI.1965, D. T. Tikar, Coll. No. TIO8; 1♀, 1♂, Kottegehar, 650 m, in Western Ghats (Mysore State), 2.XII.1965, Jonathan & Kamath, Coll. Nos. J107 and K54 respectively (DELHI U.); 2♀♀, Yercaud, 1400 m, in Shevaroy Hills (Madras State), XII.1954, Nathan (OTTAWA, CAN.). Sikkim: 1♀, Bingham Coll. (TOWNES). BURMA: 8♀♀, Maymyo, 800 m, XII.1937, G. Heinrich; 1♀, Mt Victoria, 500 m, III.1938, Heinrich (TOWNES). Hainan I.: 1♀, Ta Hian, 12.VI.1935 J. L. Gressitt (TOWNES).

DISTRIBUTION: India: Assam, Bihar, Maharashtra, Madras and Mysore; Sikkim; Burma; China.

10. *Listrognathus* (*Stivadens*) *tirkyi* Gupta and Kamath, new species

Similar to *L. (S.) annulipes* but differs in its color of antenna and hind leg, the sculpture of basolateral areas of propodeum and the punctuation of abdominal tergites. From *L. (S.) flavopetiolata*, it differs in having the petiole entirely black.

♀. Agrees in most respects with the ♀ of *annulipes*, except as below:

Median lobe of mesoscutum rugoso-punctate, the punctures somewhat sparser apically and more prominent than in *annulipes*, superimposed on a shagreened surface, lateral lobes largely shagreened, shiny, but with a few scattered punctures along margins; basolateral areas of propodeum trans-striate to weakly rugose, tubercles short and obtuse, shorter than those in *annulipes*; 1st hind tarsal segment 3.0 as long as 2nd; 2nd and 3rd abdominal tergites with coarse punctures, punctures more crowded at base, becoming less dense towards apex and sparse and scattered in the mid-apical region.

Black. Antenna with a yellow stripe on flagellar segments 9-12; hind leg with coxa brownish black with reddish tinge at apex above and with an oblique broad yellow spot at base, below broadly yellow, trochanters tawny yellow, apical 0.2 of femur, extreme base and apical 0.45 of tibia, 1st tarsal segment broadly, & 4th and 5th segments entirely black, rest tawny yellow.

♂. Unknown.

One ♀ collected from Kottegehar (Mysore State) on 2.XII.1965 varies from the type with respect to the sculpture on the basolateral area of propodeum. The rugosities in this area are more prominent as is the case in *annulipes*. Two females collected at Namkum, Ranchi (Bihar) have a yellow stripe on metapleurum.

Length: ♀, 11.5-14 mm, fore wing 9.5-10.5 mm, ovipositor 4 mm.

Holotype ♀, India: Ranchi (Bihar) in G. E. L. Mission compound, 14.IV.1957, C. Tirky (DELHI U.). Paratypes: 18♀♀. India: 1♀, Namkum, Ranchi (Bihar), 12.III.1956; 2♀♀, 13.IV.1956; 1♀, 17.IV.1956; 2♀♀, IV.1957; 4♀♀, 11.IV.1957; 1♀, 12.IV.1957; 2♀♀, in G. E. L. Mission compound, 14.IV.1957 and 24.I.1958, S. N. & V. K. Gupta; 1♀, Namkum, Ranchi (Bihar), 3.V.1956; 1♀, 11.IV.1957; and 1♀, Ambera Bero, Ranchi (Bihar), 25.XI.1957, C. Tirky; 1♀, Garjia in Kumaon Himalaya (U.P.), 5.IV.1965, D. T. Tikar, Coll. No. T1; 1♀, Kottegehar 650 m, in Western Ghats (Mysore State), 2.XII.1965, Kamath, Coll. No. K54 (DELHI U.).

DISTRIBUTION: India: Bihar, Uttar Pradesh and Mysore.

11. *Listrognathus (Stivadens) flavopetiolata* Gupta and Kamath, new species

Figs. 4, 7, 30, 31, 39.

Easily recognized from the other two species by its stouter and stronger build and in having a single strong tooth on the lower lateral edge of 1st abdominal tergite a little anterior to its midlength. Petiole with a dorsal broad, elongate yellow mark (fig. 30). The ovipositor is about 0.5 the length of the fore wing and has paired impressions on the dorsal valve between nodus and apex (fig. 39).

♀. Face coarsely punctate in middle, punctures becoming sparse towards orbits; clypeus less strongly and more sparsely punctate; mandibular teeth (fig. 7) subequal in shape; frons smooth and shiny, frontal horn moderate-sized; vertex smooth and shiny with a few scattered punctures between ocelli; temple moderately broad, smooth; malar space mat; pronotum with punctures above, rest trans-striate, pronotal shoulders moderately developed, weakly obtuse and with sparse, distinct punctures; pronotal collar (fig. 4) with a well defined angular tooth at its lower end, anterior margin of collar thickened, not forming a flange; mesoscutum rugoso-punctate chiefly at base, along lateral margins, around region of notauli and posteriorly, rugosities superimposed on a shagreened surface, apical part of middle lobe with sparse, coarse punctures, lateral lobes largely shagreened; notauli deeply marked, grooves of notauli at yellow marks, smooth; scutellum sparsely but distinctly punctate, sometimes with very few punctures; postscutellum smooth and shiny; propodeum strongly reticulate, basolateral areas rugoso-striate, apical carina absent, tubercles short, obtuse and slightly flattened; perpectus rugose, rest of mesopleurum striato-punctate, punctures in middle shallow; metapleurum strongly rugose; lower margin of 1st tergite (fig. 30) with a single strong tooth near its midlength; postpetiole strongly raised in middle

at base with moderately strong punctures, extreme apex smooth; 2nd tergite with moderately dense, coarse punctures becoming sparse towards apex, punctures on 3rd tergite smaller than those on 2nd, its apical 1/2 smooth except for a few scattered, shallow punctures; following segments smooth and polished; ovipositor subcylindrical, broadly depressed at tip, dorsal valve with a series of fine paired impressions (fig. 39), usually 6, between nodus and apex.

Black. Face, clypeus except median apical portion, mandibles broadly except teeth, inner orbits broadly, extending to slightly behind level of lateral ocelli, a stripe on 10-14 flagellar segments, lower 1/2 of temple wholly and malar space, yellow; a stripe on pronotal collar and pronotal shoulders broadly, yellow; mesoscutum with 2 median longish yellow stripes; scutellum entirely yellow; apicolateral slopes including tubercles of propodeum, yellow; a broad basal spot on tegula, subtegular ridge, an almost rectangular mark in middle of mesopleurum, a mark at base of hind wings, yellow; fore leg with coxa light yellow, base below black; fore trochanters light yellow; fore femur tawny yellow above, light yellow below; fore tibia tawny yellow with a median fuscous streak above; fore tarsus with 1st tarsal segment infusate, 5th including claws entirely brownish black, rest light brown; color pattern of middle leg same as that of fore leg, except that coxa entirely light yellow and 1st 4 tarsal segments infusate above; hind leg (fig. 31) with coxa black and with an irregular oblique yellow spot at base above, broadly yellow below; hind trochanters, femur except its apical 0.2, extreme base and apical 0.3 of tibia, all of 1st tarsal segment, apex of third segment and all of 4th and 5th segments including claws, black; sometimes 1st-4th hind tarsal segments wholly yellow; wings hyaline, nervures black; a broad, elongate mark on petiole (fig. 30) (not extending to postpetiole), apicolateral corners of postpetiole triangularly and other tergites with apical bands, broadly interrupted in middle, yellow; ovipositor sheath black.

♂. Unknown.

Length: ♀, 13-16.5 mm, fore wing 10-11.5 mm, ovipositor 5.5-6 mm.

Holotype ♀, India: Kottegehar, 650 m, in Western Ghats (Mysore State), 30.XI.1965, D. T. Tikar, Coll. No. T122 (DELHI U.). Paratypes: 8♀♀ India: 1♀, Namkum, Ranchi (Bihar), 28.XII.1955, S. N. & V. K. Gupta; 1♀, Thekkady Wild Life Sanctuary, 1000 m, in Southern Ghats (Kerala), XII.1964, V. K. Gupta & Santosh Gupta (DELHI U.); 1♀, Yercaud, 1400 m, in Shevaroy Hills (Madras State), III.1955; 2♀♀, Walayar Forests, 300 m, in Western Ghats (Kerala), IX.1956 and 1♀, X.1957, P. S. Nathan (OTTAWA, CAN.). Hainan I.: 1♀, Ta Hian, 14.VI.1935, J. L. Gressitt (TOWNES). Java: 1♀, Dedjoeng, Genteng Bay, V.1939 (TOWNES).

DISTRIBUTION: India: Bihar, Madras, Mysore and Kerala; China; Java.

The name of this species is derived from the Latin *flavus*=yellow + *petiolata*=petiole, referring to the 1st tergite with a broad yellow mark.

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