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NEW SPECIES AND RECORDS OF THE *TRICENTRUS PROJECTUS* GROUP (HOMOPTERA: MEMBRACIDAE: TRICENTRINI) FROM PAKISTAN, AZAD KASHMIR AND BANGLADESH, WITH PHYLOGENETIC CONSIDERATIONS[1]

By **Imtiaz Ahmad and Nikhat Yasmeen**[2]

Abstract: The *Tricentrus projectus* group is defined and includes 9 species from Pakistan, Azad Kashmir and Bangladesh. Of these, 6 are described as new and 3 other species are recorded for the first time from these areas. The species group includes 10 additional species occurring elsewhere, including *Centrotoscelus concavus* and *Xanthosticta pseudocornis*, which are transferred to *Tricentrus*. The former 9 species are keyed and illustrated.

During our studies of the genus *Tricentrus* Stål from Pakistan, Azad Kashmir and Bangladesh, we encountered a group of specimens having the frontoclypeus with lateral lobes entirely fused with the median and the latter extending ½ or less than ½ its length below the lower margins of the vertex. These exhibited remarkable variation in the form of posterior process, suprahumeral horns, general size and pigmentation of the body and are presently treated under the *T. projectus* group. These species agree with other species of *Tricentrus* Stål in the characters of short and stubbed subgenital plates, slender parameres and acutely pointed aedeagi.

The group includes 6 species described here as new from northern areas of Pakistan, Azad Kashmir and Bangladesh and 3 species described by Distant and previously known from India, Burma, Malaysia and the Philippines. The latter 3 species are recorded for the first time from Pakistan, Azad Kashmir and Bangladesh. The included taxa are compared with 10 related species occurring elsewhere belonging to the same group. The phylogeny of the *Tricentrus projectus* group is briefly discussed in light of the characters of the frontoclypeus, posterior process and male genitalia and with a consideration to the zoogeography of its members.

Two of Funkhouser's (1918–1920) species, *Centrotoscelus concavus* and *Xanthosticta pseudocornis*, are transferred to *Tricentrus* Stål, with short notes classifying their present taxonomic status.

For the study of male genitalia, the abdomen was macerated in warm 10% KOH, then washed in acidified water and studied in glycerine. Genitalia were stored in a microvial with a drop of glycerine and pinned with the specimen. A series of specimens of each species was dissected. Variations found in the shape and size of suprahumeral horns within the sexes and in different populations of 1 species are given in the description. The distribution range of each species was given.

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Depositories for material and symbols for these used in the text are given below:

AC	Dr Imtiaz Ahmad's collection, Department of Zoology, University of Karachi, Karachi
BISHOP	Bishop Museum, Honolulu
BMNH	British Museum Natural History, London
NHMUK	Natural History Museum, University of Karachi, Karachi
NIM	National Insects Museum, Department of Plant Protection, Karachi
PFI	Pakistan Forest Institute, Peshawar
USNM	United States National Museum of Natural History, Washington
ZMUH	Zoologisches Institut und Zoologisches Museum, Universität Hamburg

Genus **Tricentrus** Stål

Tricentrus Stål, 1866, Hemipt. Afr. **4:** 89.—Distant, 1908, Faun. Br. India **4:** 45, 53, 60.—Funkhouser, 1927, Gen. Cat. Hemipt. **1:** 495.—Goding, 1931, J. N. Y. Entomol. Soc. **39:** 303.—Metcalf & Wade, 1965, Gen. Cat. Homopt. **1**(1): 379–413.—Ahmad & Yasmeen, 1974, Mitt. Hamb. Zool. Mus. Inst. **71:** 175–91.

Terentius Buckton, 1903, A Monograph of the Membracidae: 270.—Metcalf & Wade, 1965, Gen. Cat. Homopt. **1**(1): 379–413.

Otaris Buckton, 1903, A Monograph of the Membracidae: 249.—Ahmad & Yasmeen, 1974, Mitt. Hamb. Zool. Mus. Inst. **71:** 175–91.

Taloipa Buckton, 1905, Trans. Linn. Soc. London **9:** 334.—Ahmad & Yasmeen, 1974, Mitt. Hamb. Zool. Mus. Inst. **71:** 175–91.

Centrotus (in part), Matsumura, 1912, Annot. Zool. Jpn **8:** 20.—Ahmad & Yasmeen, 1974, Mitt. Hamb. Zool. Mus. Inst. **71:** 175–91.

Centrotoscelus Funkhouser, 1914, Pomona J. Entomol. & Zool.**6:** 72.—Ahmad & Yasmeen, 1974, Mitt. Hamb. Zool. Mus. Inst. **71:** 175–91.

Arisanagargara Kato, 1928, Insect World [In Japanese.] **32:** 48.—Metcalf & Wade, 1965, Gen. Cat. Homopt. **1**(1): 379–413.

KEY TO SPECIES OF THE *Tricentrus projectus* GROUP FROM PAKISTAN, AZAD KASHMIR AND BANGLADESH

1. Apex of posterior process always extending beyond internal angles of tegmina; ♀ light ferruginous or dark brown, with head, anterior portion of metopidium and tip of posterior process black; always with developed horns extending outward beyond humeral angles, ranging from less than ½ to as long as their intervening space; ♂ unknown ..... **kashmirensis, n. sp.**
   Apex of posterior process never extending beyond internal angles of tegmina; ♂ usually black, exhibiting wide range of development of horns; ♀ usually patterned as above but sometimes entirely black, usually horned, latter showing various gradations 2
2. Apex of posterior process distinctly reaching internal angles of tegmina 3
   Apex of posterior process never reaching internal angles of tegmina 6
3. ♂ usually black, ranging from hornless to having the horns as long as their intervening space, ♀ usually ferruginous with head and anterior portion of metopidium black, but sometimes entirely black, never hornless, exhibiting wide range of development of suprahumeral horns from being less than ½ in length, not even extending on to humeral angles, to as long as their intervening space ..... **variabilis, n. sp.**

♂ not uniformly black, never horned, ♀ not colored as above, always with well developed suprahumeral horns 4

4. ♂ ferruginous or pale brown with head and anterior portion of metopidium black, always hornless, ♀ ferruginous brown with suprahumeral horns ranging from as long as to greater than their intervening space ..... **pseudobifurcus, n. sp.**
♂ unknown; ♀ uniformly colored with remarkably developed suprahumeral horns, always greater than their intervening space 5

5. ♀ castaneous brown, suprahumeral horns slender, oblique with their tips directing backward ... . **aeneus**
♀ dark ferruginous, suprahumeral horns not slender with tips not directing backward; posterior process with distinct gibba at the base ..... **gibbiformis, n. sp.**

6. ♂ usually uniformly black but sometimes with median carina of posterior process ferruginous, exhibiting wide range of development of suprahumeral horns from being hornless to as long as their intervening space; ♀ always ferruginous with head and anterior portion of metopidium black, never hornless, always with well developed suprahumeral horns, ranging from as long as to greater than their intervening space ..... **russellae, n. sp.**
♂ not colored as above, not showing wide range of development of suprahumeral horns, ♀ usually uniformly colored exhibiting wide range of development of suprahumeral horns from entirely hornless to horns greater than their intervening space 7

7. ♂ ferruginous or pale brown with head and anterior portion of metopidium black, usually entirely hornless but sometimes showing slight carina on pronotum, ♀ uniformly ferruginous sometimes with head darker in color, suprahumeral horns ranging from ½ to slightly greater than their intervening space ..... **bifurcus**
♂ unknown, ♀ usually uniformly colored, rarely hornless, usually with well-developed suprahumeral horns 8

8. Small (3.5 mm), entirely black, always hornless, posterior process short, robust, abruptly narrowing towards acute tip ..... **nigra, n. sp.**
Large (4.68 mm) castaneous brown, suprahumeral horns remarkably developed, projecting forward, always greater than their intervening space ..... **projectus**

Tricentrus aeneus Distant FIG. 1–3

Tricentrus aeneus Distant, 1916, Fauna India, Rhyn. **6:** 167.—Funkhouser, 1927, Gen. Cat. Hemipt. **1**(1): 496; 1951, Gen. Insect. **208:** 208.

Otaris aeneus Goding, 1934, J. N. Y. Entomol. Soc. **42:** 480.—Metcalf & Wade, 1965, Gen. Cat. Homopt. **1**(1): 421.

♀. Generally ferruginous brown.

Head vertical, vertex about 2× as wide as long, finely punctate, densely pubescent, upper margin arcuate and feebly sinuate, lower margins oblique, sinuate, ridged and extended on frontoclypeus, eyes large, pale brownish, ocelli unicolorus, nearer to the eyes than from each other and situated above centro-ocular line, frontoclypeus black with apical area ferruginous, wider than long, extending for about ½ its length below lower margins of vertex, lateral lobes entirely fused with median lobe, their sutures impunctate, tip almost rounded. Pronotum finely punctate with golden pilosity, median carina percurrent throughout, metopidium unicolorous, supra-ocular callosities brown, impunctate, humeral angles subacute, suprahumeral horns ½ of the front and entire hind margins black, long obliquely directed upward and outward beyond humeral angles, greater than their intervening space with apex distinctly darker, acute and directing backward, posterior process tricarinate, robust, convexly sloping, short, tip subacute, black, just reaching internal angles of tegmina, scutellum narrowly exposed, punctate with dense pubescence, tegmina pale, subhyaline, veins brown, base distinctly darker and punctate, 5 apical and 2 discoidal cells, hind wings with 3 apical cells, legs with femora black, tibiae and tarsi ferruginous, sides of thorax black and without white spot or pubescence. Under surface of body and abdomen black.

Length from front of head to tips of tegmina, 5.0 mm, width between tips of suprahumeral horns, 3.2 mm.

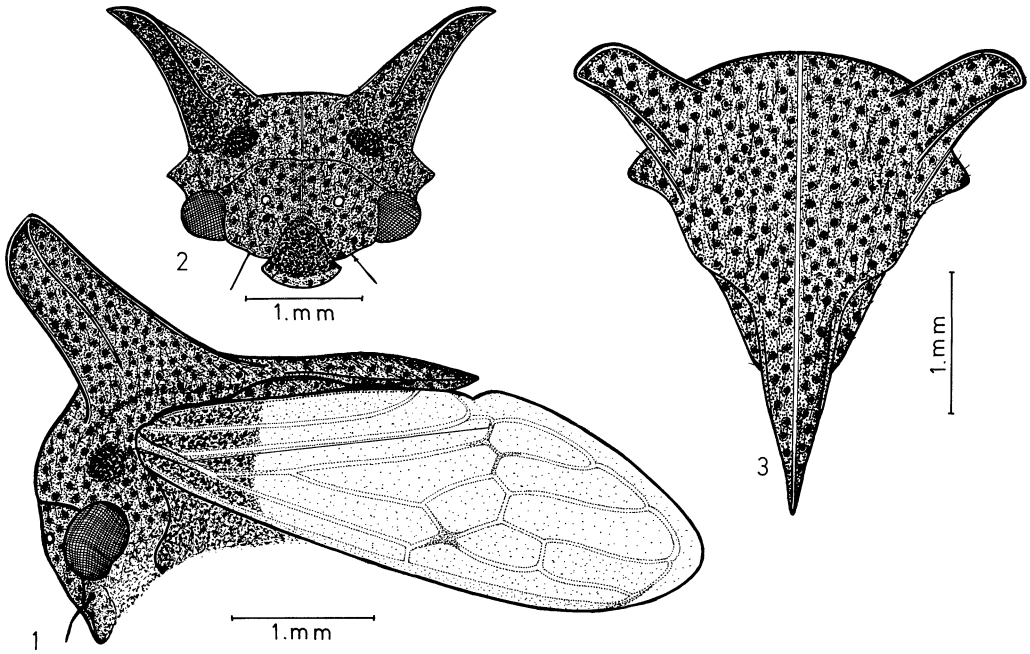

FIG. 1–3. *Tricentrus aeneus*: 1, head, pronotum and wing, lateral view; 2, head, frontal view; 3, ♀ pronotum, dorsal view.

Material examined. Lectotype ♀ (designated by P. S. Broomfield in 1971), with labels, "Type/Ind. Mus. Kurseong, 1538.43 meters, E. Himalayas, 9.IX.09, N. A." (BMNH). New records: 1 ♀ (det. P. S. Broomfield 1972), BANGLADESH: Sreemangal, on wild bush, 6.III.1969, F. Ahmad (NHMUK).

Remarks. This species is most closely related to *T. gibbiformis,* n. sp., but can easily be separated by its well developed suprahumeral horns with the apices directed backward and the absence of gibba at the base of posterior process.

Tricentrus bifurcus Distant FIG. 4–11

Tricentrus bifurcus Distant, 1916, Fauna India, Rhyn. **6:** 165, fig. 121.—Funkhouser, 1927, Gen. Cat. Hemipt. **1**(1): 498; 1951, Gen. Insect. **208:** 208.—Goding, 1939, J. N. Y. Entomol. Soc. **47:** 318, 324.—Mathur, 1953, Indian For. Leafl. (Entomol.) **121**(3): 156.—Metcalf & Wade, 1965, Gen. Cat. Homopt. **1**(1): 388.

♂. Generally dark ferruginous.

Head vertical, vertex black, slightly wider than long, deeply punctate with golden pilosity, upper margin arcuate, distinctly sinuate, lower margins oblique, strongly ridged, weakly sinuate and slightly extended on frontoclypeus, eyes large, brown, ocelli unicolorous and nearer to the eyes than from each other, situated above centro-ocular line, frontoclypeus black, wider than long, extending for distinctly ½ its length below lower margins of vertex, lateral lobes entirely fused with median lobe, their suture rather obscure, tip rounded and slightly pilose. Pronotum deeply punctate, and irregularly pilose, median carina percur-

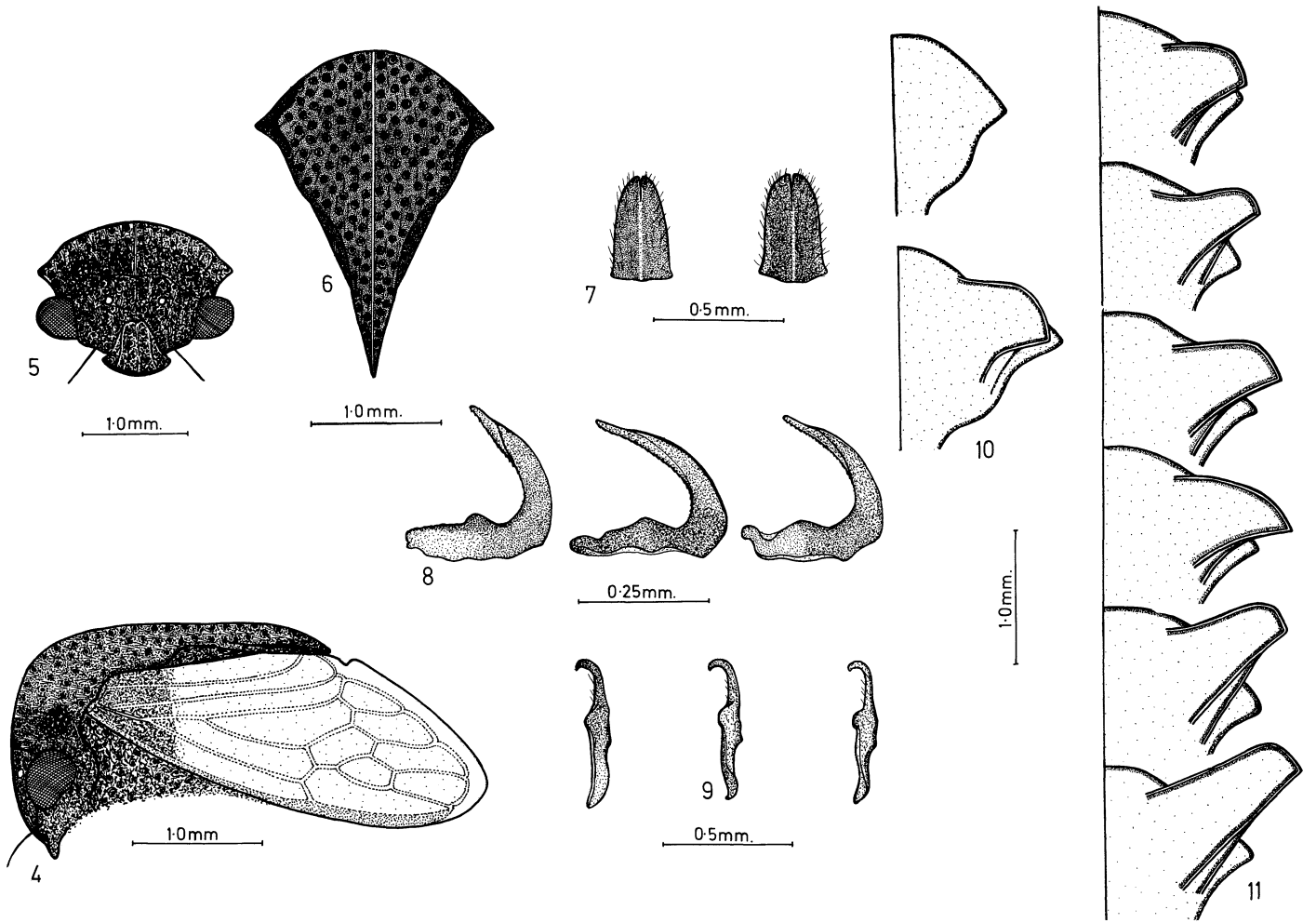

FIG. 4–11. *Tricentrus bifurcus*: 4, head, pronotum and wing, lateral view; 5, head, frontal view; 6, ♂ pronotum, dorsal view; 7, subgenital plate, ventral view; 8, aedeagus, lateral view; 9, paramere, lateral view; 10, ♂ pronotum, dorsal view, and 11, ♀ pronotum, dorsal view, showing variations of suprahumeral horns found in both sexes.

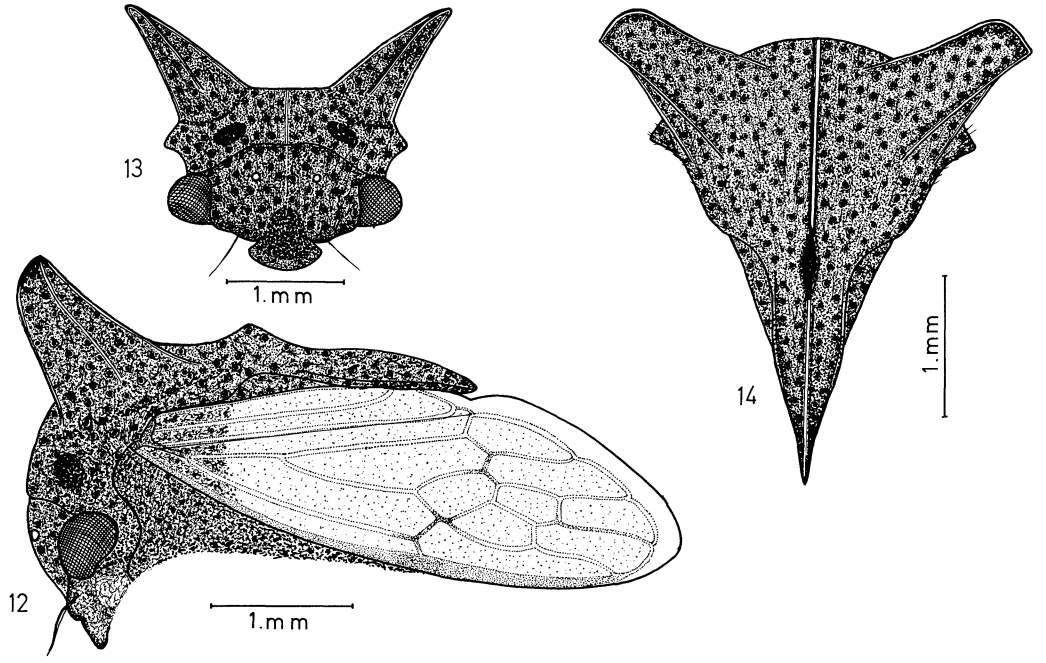

FIG. 12–14. *Tricentrus gibbiformis*: 12, head, pronotum and wing, lateral view; 13, head, frontal view; 14, ♀ pronotum, dorsal view.

rent but obsolete anteriorly, metopidium with anterior portion black, supra-ocular callosities rather inconspicuous, black and impunctate, humeral angles subacute, suprahumeral horns usually absent, sometimes represented only by raised area on pronotum, posterior process tricarinate, robust, abruptly sloping towards apex, tip black, stout and never reaching internal angles of tegmina, scutellum narrowly exposed, punctate and pubescent, tegmina pale, subhyaline, veins brown, base ferruginous and finely punctate, sparingly pubescent, 5 apical and 2 discoidal cells, hind wings with 3 apical cells, legs with apices of femora black, sides of thorax black and without white spots or pubescence. Undersurface of body and abdomen black.

Length from front of head to tips of tegmina, 3.6 mm; width between humeral angles, 1.9 mm.

Genitalia. Subgenital plates moderately elongated, gradually narrowing at apex, latter ⅓ of basal width, basal margin medially slightly convex or somewhat truncated, lateral angles prominent and subacute, outer margins concave at base and convex at apex (FIG. 7), parameres elongated with curved portion rounded, head somewhat abruptly tapering with tip acute, inner margin of distal portion concave but of proximal portion straight or convex, median lobe rather short and subrounded (FIG. 9), aedeagus not or only slightly recurved at base and usually not turned upward, tip subrounded, inner transverse projection with a median rounded lobe near base, transverse outer line sinuate, dentines on inner margin rather inconspicuous, transverse portion distinctly shorter than curved portion (FIG. 8).

Material examined. Lectotype ♀ (designated by P. S. Broomfield in 1971), with labels, "Type/Distant Coll, 1911-383/Darjiling/*Tricentrus bifurcus* type Dist." (BMNH). New records: 1 ♀ (det. P. S. Broomfield (1972), BANGLADESH: Sylhet, on grass, 9.III.1969, Farid Ahmad (NHMUK). Other material: 6 ♂, 17 ♀: BANGLADESH: Jessore, Sylhet, Pablakhali, Sreemangal, Kaptai, Marysha, Bagerhat, Kararhat, Sissok, Chittagong, Okhiya, Rangamati, Cox's Bazar, Dohazari, on *Ceriops roxburghiana, Aca-*

cia nilotica, Oxytenanthera nigrociliata, Rubia cordifolia, Arisaema jacquemontii, Mikania scandens, Eupatorium odoratum, Rumex hastatus, 17,20.XII.1964, 9,15,17.I.1965, 12.III.1965, 14,15,21.V.1965, 25.VI.1965, 13.I.1969, 2,3,9.III.1969, 27.III.1970, 28.IV.1971, Farid Ahmad, M. U. Shadab, I. Ahmad, Z. Khan, N. Zaman, Ghulamullah (NHMUK, ZMUH, PFI, BISHOP); 1 ♂, PAKISTAN: NWFP: Balakot, on *Rumex hastatus,* 28.IV.1971, Azhar A. Khan (NHMUK); 1 ♂, AZAD KASHMIR: Chikar, on *Rumex hastatus,* 26.VI.1970, I. Ahmad (NHMUK).

Variation and sexual dimorphism. Males vary in size (3.35–3.6 mm × 1.75–1.9 mm), head usually entirely black and may be 2× as wide as long, sometimes with lower margins of vertex and frontoclypeus ferruginous, frontoclypeus may be as long as wide and may extend less than ½ or even more than ½ its length below lower margins of vertex; usually hornless but sometimes showing raised area on pronotum above humeral angles; pronotum usually ferruginous, sometimes area below humeral angles blackish. Females differ from males in being larger in size (4.0–4.68 mm × 2.1–2.8 mm), usually uniformly ferruginous brown. Head sometimes dark ferruginous with upper margin of vertex brownish black or entirely black, ¾ again or about 2× as wide as long, frontoclypeus dark brown or black with apex ferruginous or dark ferruginous, with sides darker in color, or basal ½ of frontoclypeus blackish, usually wider than long but sometimes as long as wide, extending less than ½ or distinctly ½ its length below lower margins of vertex, with apex rounded or oval and only sometimes inwardly curved; suprahumeral horns always well developed, stout, broad at base with front and posterior margins and apices black, extending obliquely upward and outward beyond humeral angles, ranging from more than ½ to greater than their intervening space, tips subacute and rarely projecting forward, posterior process short, attenuated or robust, straight with tip depressed or strongly raised just after base and abruptly sloping toward apex with tip black and subacute, legs with femora except apices black, the latter, tibiae and tarsi ferruginous with claws black.

Remarks. Two males from Balakot, northern region of Pakistan and from Chikar (Azad Kashmir) agree with *T. bifurcus* in coloration of head, metopidium and pronotum and in length of posterior process, falling short of internal angles of tegmina; these differ in being larger in size (4.1 mm) and only 1 male showing well developed suprahumeral horns, extending onto humeral angles and measuring more than ½ the length of their intervening space. Because of the small series at hand, these are included presently as variations of *T. bifurcus* and further material is awaited to ascertain their taxonomic status.

This species is most closely related to *T. projectus* but can easily be separated by the absence of pale sericeous spots at basal angles of scutellum and by suprahumeral horns never as developed and never projecting forward as in *T. projectus.*

Tricentrus gibbiformis Ahmad & Yasmeen, **new species** FIG. 12–14

♀. Generally ferruginous brown.

Head vertical, vertex dark brown, distinctly ¾ again as wide as long, finely punctate with dense pubescence, upper margin slightly darker in color, convex and sinuate, lower margins oblique, not sinuate,

slightly ridged and extended on frontoclypeus, eyes large, pale brown, ocelli conspicuous, unicolorous, and nearer to the eyes than from each other, situated above centro-ocular line, frontoclypeus black with apical area ferruginous brown, wider than long, extending for about ½ its length below lower margin of vertex, lateral lobes entirely fused with median lobe, their suture impunctate, tip rounded and very slightly curved inwardly. Pronotum finely punctate, with short golden pilosity, median carina percurrent but slightly fainting anteriorly, metopidium unicolorous, supraocular callosities concolorous with body, rather inconspicuous, impunctate, humeral angles subacute, suprahumeral horns oblique, stout, extending upward and outward beyond humeral angles, greater than their intervening space, front margins black and rounded, hind margins black, straight with apices broadly subacute, posterior process with lateral and median carinae and tip black, tricarinate, with strong gibba at the base and then sloping towards apex, tip subacute and distinctly reaching internal angles of tegmina, scutellum brownish black, narrowly exposed, punctate, and covered with golden pilosity, tegmina pale, subhyaline, veins pale brown, base dark ferruginous and finely punctate, sparingly pubescent, 5 apical and 2 discoidal cells, hind wings with 3 apical cells, sides of thorax dark brown and covered with white pubescence, legs concolorous with pronotum. Undersurface of body and abdomen black.

Length from front of head to tips of tegmina 4.4 mm; width between tips of suprahumeral horns 2.8 mm.

♂. Unknown.

Holotype ♀ (NHMUK), BANGLADESH: Bagherhat, on *Oxytenanthera nigrociliata*; 21.V.1965, N. Zaman.

Remarks. This species is most closely related to *T. aeneus* Distant of its subgroup but can easily be separated from the same in having gibba at the base of the posterior process and in other characters as noted in the description.

Tricentrus kashmirensis Ahmad & Yasmeen, **new species** FIG. 15–18

♀. Generally dark ferruginous brown.

Head vertical, vertex black, distinctly ¾ again as wide as long, finely punctate with golden pubescence, upper margin arcuate, very feebly sinuate, lower margins oblique, strongly ridged, sinuate and extended on frontoclypeus, eyes large, brown, mottled with dark shades, ocelli conspicuous, glassy in appearance, nearer to the eyes than from each other and situated above centro-ocular line, frontoclypeus black, a little wider than long, longly pilose, extending for distinctly ½ its length below lower margins of vertex, lateral lobes entirely fused with median lobe, their sutures conspicuous, impunctate, tip rounded, pilose and feebly inwardly curved. Pronotum finely punctate and densely covered with fine golden pubescence, median carina percurrent but fainting anteriorly near upper margin of vertex, metopidium with anterior portion black, supraocular callosities conspicuous, black, impunctate, suprahumeral horns well developed, extending obliquely upward and outward beyond humeral angles, measuring more than ½ in length as their intervening space, front margins subrounded, slightly black, posterior margins concave, apices subacute, posterior process tricarinate, robust, convex, abruptly sloping toward apex, tip black, subacute and passing well beyond internal angles of tegmina, scutellum narrowly exposed, punctate, pubescent, tegmina pale brown, subhyaline, veins brown and sparingly pubescent, base brownish black and finely punctate with short golden hairs, 5 apical and 2 discoidal cells, hind wings with 3 apical cells, sides of thorax black and without white pubescence, legs with femora except apices black, the latter tibiae and tarsi ferruginous. Undersurface of body and abdomen black.

Length from front of head to tips of tegmina, 4.9 mm; width between tips of suprahumeral horns, 3.0 mm.

Holotype ♀ (NHMUK), AZAD KASHMIR: Bagh, on *Rumex hastatus,* 15.VII.1974, I. Ahmad. Paratypes: 4 ♀, same data as holotype (NHMUK, USNM, ZMUH, BISHOP), 1 ♀, PAKISTAN: NWFP: Balakot, on *Rumex hastatus,* 14.VII.1973, I. Ahmad (NHMUK).

Other material examined. 30 ♀: AZAD KASHMIR: Bagh, Muzafferabad, PAKI-

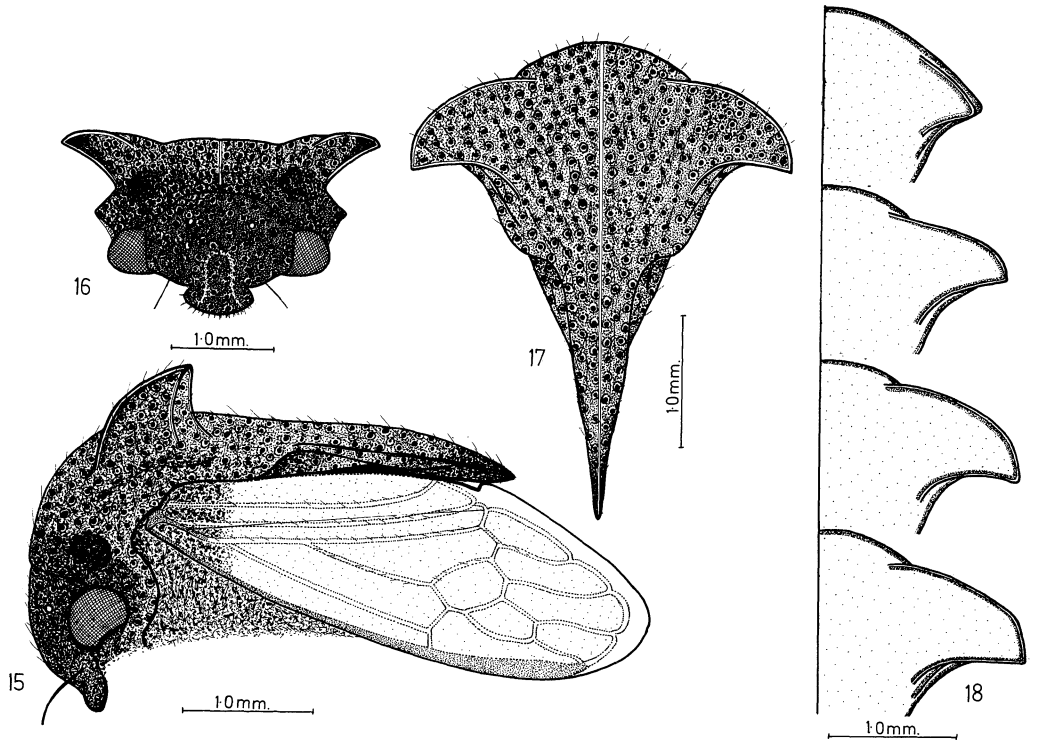

FIG. 15–18. *Tricentrus kashmirensis*: 15, head, pronotum and wing, lateral view; 16, head, frontal view; 17, ♀ pronotum, dorsal view; 18, ♀ pronotum, dorsal view, showing variations of suprahumeral horns.

STAN: NWFP: Balakot, Abbotabad, Kaghan, on *Rumex hastatus*, on light, on wild bush, 17.VIII.1963, 25.VI.1969, 30.VI.1970, 28.IV.1971, 15.VII.1974, I. Ahmad, F. Ahmad, M. Ismail, Azhar A. Khan (NHMUK, ZMUH, PFI, NIM, AC).

Variation. The females other than the holotype range in size from 4.7–5.05 mm × 2.4–3.5 mm; the head may be slightly more than ½ or more than ¾ again as wide as long, and frontoclypeus sometimes extends less than ½ its length below lower margins of vertex, color of pronotum varies from bright ferruginous to dark brown; suprahumeral horns pale ferruginous, sometimes with anterior and posterior margins or apical ½ of the horns black, ranging for less than ½ in length to as long as their intervening space.

Remarks. This species appears isolated among the species of its subgroup because of its long posterior process which passes well beyond internal angles of tegmina and in other characters, as noted in the description.

Tricentrus nigra Ahmad & Yasmeen, **new species** FIG. 19–21

♀. Generally black.

Head vertical, vertex slightly more than ¾ again as wide as long, deeply punctate and sparingly pubes-

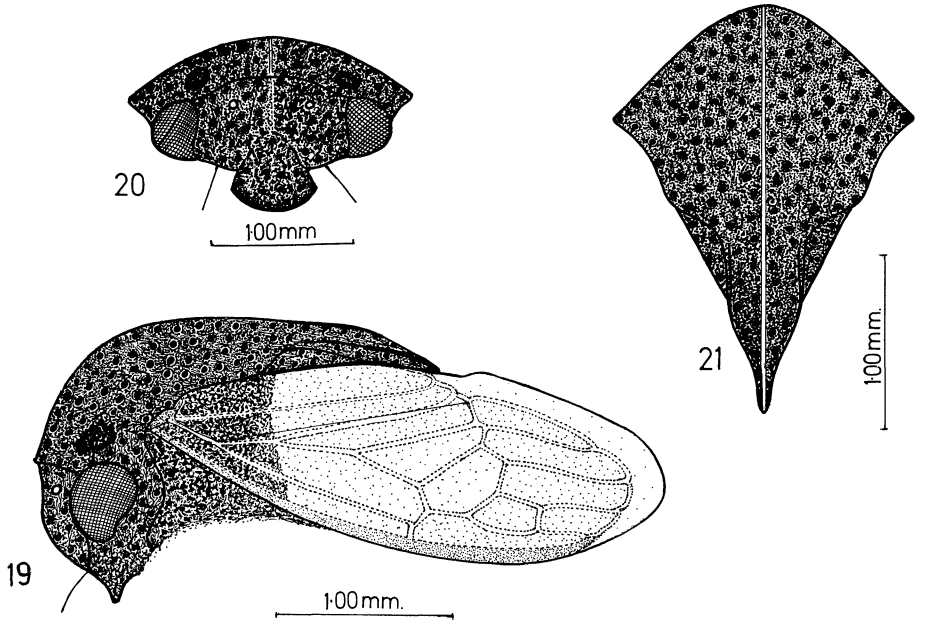

FIG. 19–21. *Tricentrus nigra*: 19, head, pronotum and wing, lateral view; 20, head, frontal view; 21, ♀ pronotum, dorsal view.

cent, upper margin convex and smooth, lower margin oblique, strongly ridged, weakly sinuate and slightly extended on frontoclypeus, eyes large, brown, with yellow markings, ocelli pale, placed much wider apart from each other than from the eyes and situated well above centro-ocular line, frontoclypeus almost as wide as long, much deflexed downward, extending for distinctly ½ its length below lower margins of vertex, lateral lobes entirely fused with the median lobe, their sutures impunctate, tip subrounded. Pronotum finely punctate and very irregularly pubescent, median carina percurrent but almost obsolete on metopidium, latter much sloping, supraocular callosities impunctate, humeral angles prominent, subacute, suprahumeral horns entirely absent, posterior process tricarinate, short, robust, somewhat flat at base, then abruptly narrowing and sloping toward apex, tip subacute, rather depressed and distinctly not reaching internal angles of tegmina, scutellum narrowly exposed, punctate and pubescent, tegmina pale brown, subhyaline, veins ferruginous brown, basal area broad, darkly punctate, 5 apical and 2 discoidal cells, hind wings with 3 apical cells, legs with apices of femora and tibiae except apices brown.

Length from front of head to tips of tegmina, 3.5 mm; width between tips of humeral angles, 1.9 mm.

♂. Unknown.

Holotype ♀ (NHMUK), BANGLADESH: Rangamati, on grass, 24.III.1970, I. Ahmad.

Remarks. This species appears most closely related to *T. concavus* Funk., but can easily be separated by its rather straight posterior process at base and by the absence of white tomentose hairs at the sides of thorax.

Tricentrus projectus Distant FIG. 22–24

Tricentrus projectus Distant, 1908, Fauna India, Rhyn. **4:** 55, fig. 8.—Schmidt, 1926, Wien. Entomol. Ztg **43:** 189.—Funkhouser, 1927b, Gen. Cat. Hemipt. **1**(1): 502;

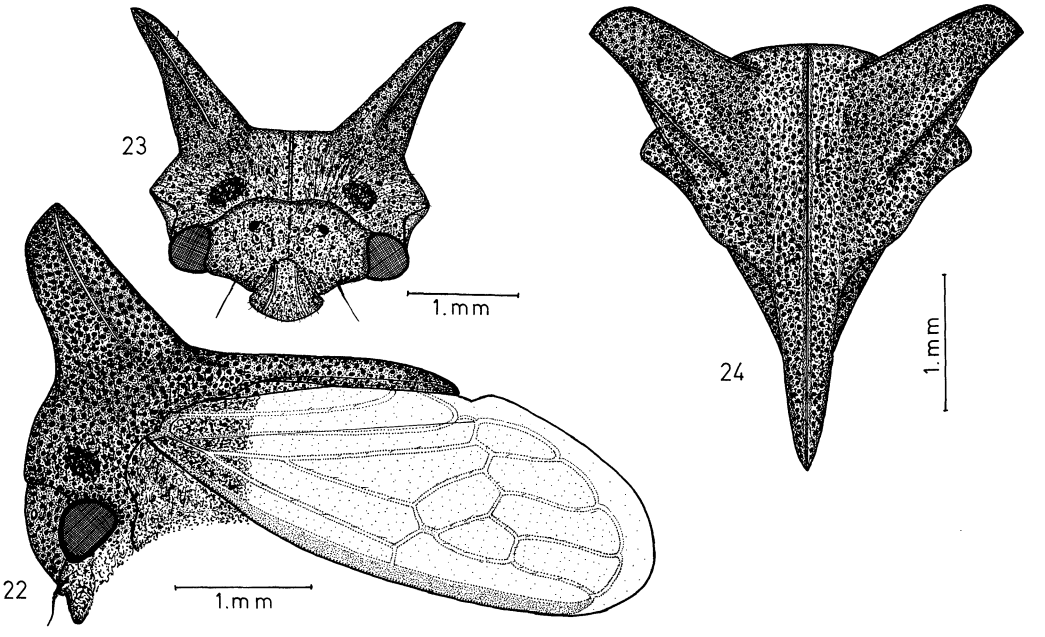

FIG. 22–24. *Tricentrus projectus*: 22, head, pronotum and wing, lateral view; 23, head, frontal view; 24, ♀ pronotum, dorsal view.

1929, Philipp. J. Sci. **40:** 118; 1951, Gen. Insect. **208:** 211.—Goding, 1939, J. N. Y. Entomol. Soc. **47:** 315–23.—Jacobi, 1944, Munchen Entomol. Ges. Mitt. **34:** 32.—Mathur, 1953, Indian For. Leafl. (Entomol.) **121**(3): 157.—Metcalf & Wade, Gen. Cat. Homopt. **1**(1): 406.

♀. Generally castaneous brown.

Head vertical, vertex about 2× as wide as long, finely punctate and densely pilose with golden hairs, upper margin convex and feebly sinuate, lower margins oblique, slightly ridged, not sinuate or extended on frontoclypeus, eyes large and pale, ocelli conspicuous, unicolorous and nearer to the eyes than from each other, situated slightly above centro-ocular line, frontoclypeus wider than long, extending for ½ its length below lower margins of vertex, lateral lobes entirely fused with median lobe, their sutures impunctate, tip rounded and slightly recurved. Pronotum strongly punctate with suberect golden pubescence, median carina percurrent but obsolete anteriorly, metopidium unicolorous, supraocular callosities dark brown, impunctate, humeral angles subacute, suprahumeral horns obliquely porrect, projecting forward, front margins rounded and black, hind margins black, centrally ridged with apices subacute, 2× as their intervening space, posterior process somewhat straight, short, robust, strongly centrally raised and carinate, apex black, depressed and never reaching internal angles of tegmina, scutellum punctate, pubescent and narrowly exposed, tegmina smoky hyaline, pale, veins brown, base piceous and punctate, 5 apical and 2 discoidal cells, hind wing with 3 apical cells, legs with femora except apices black, the latter and tibiae castaneous, tarsi ochraceous and claws black, sides of thorax black and without white pubescence. Undersurface of body and abdomen black.

Length from front of head to tips of tegmina 4.68 mm; width between tips of suprahumeral horns 2.87 mm.

Material examined. Holotype ♀ (BMNH) with labels, "Type/Distant Coll.; 1911–

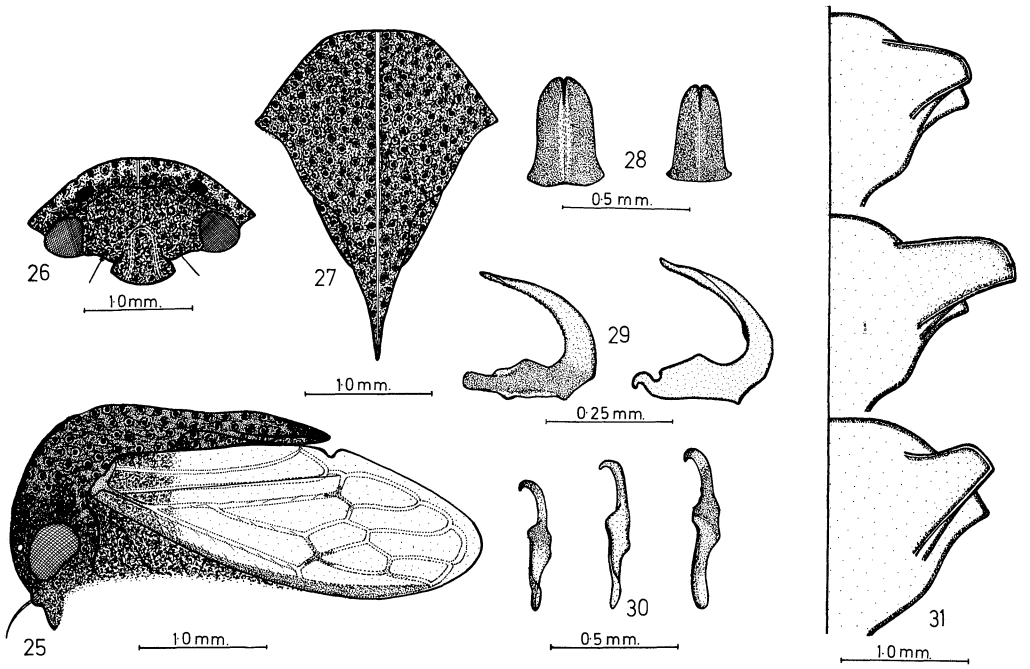

FIG. 25–31. *Tricentrus pseudobifurcus*: 25, head, pronotum and wing, lateral view; 26, head, frontal view; 27, ♂ pronotum, dorsal view; 28, subgenital plate, ventral view; 29, aedeagus, lateral view; 30, paramere, lateral view; 31, ♂ pronotum, showing variations of suprahumeral horns.

383/Tenass Vall; Myitta (Doherty)/*projectus*; type Dist." New records: 1 ♀ (det. P. S. Broomfield 1972), BANGLADESH: Sylhet, on forest plant, 9.III.1969, Farid Ahmad (NHMUK). Other material: 1 ♀, BANGLADESH: Sreemangal, on *Mikania scandens*, 27.III.1969, I. Ahmad (NHMUK).

Remarks. This species is closely related to *T. bifurcus*, but can easily be separated from the same by its well developed and forward projecting suprahumeral horns being greater than their intervening space and in having small pale sericeous spots at each basal angle of scutellum.

Tricentrus pseudobifurcus Ahmad & Yasmeen, **new species** FIG. 25–31

♂. Generally black.

Head vertical, vertex about 2× as wide as long, finely punctate with coppery golden erect pilosity, upper margin arcuate, sinuate, lower margins oblique, strongly ridged, weakly sinuate and extended on frontoclypeus, eyes large and pale brown, ocelli unicolorous, nearer to the eyes than from each other and situated above centro-ocular line, frontoclypeus slightly wider than long, extended for distinctly less than ½ its length below lower margins of vertex, lateral lobes entirely fused with median lobe, their sutures impunctate and rather obscure, tip subrounded. Pronotum deeply punctate and covered with short golden hairs, median carina percurrent but fainting anteriorly near upper margin of vertex, metopidium with anterior portion ferruginous, supraocular callosities irregular and impunctate, humeral angles subacute, suprahumeral horns entirely absent, posterior process tricarinate, somewhat robust, slightly convex in

shape and sloping toward apex, tip subacute and distinctly reaching internal angles of tegmina, scutellum ferruginous with anterior portion rather blackish, narrowly exposed, punctate and densely pubescent, tegmina pale, subhyaline, veins light brown, base ferruginous and finely punctate with short hairs, 5 apical and 2 discoidal cells, hind wings with 3 apical cells, legs with apices of femora, tibiae, tarsi and claws pale brown, sides of thorax without white pubescence.

Length from front of head to tips of tegmina, 3.72 mm; width between humeral angles, 1.88 mm.

Genitalia. Subgenital plate moderately elongated, only slightly tapering at apex, latter more than ½ of basal width, basal margin medially slightly notched or truncated, lateral angles prominent and subacute, outer margin usually concave at basal portion and then roundly curving at apex (FIG. 28), parameres somewhat shorter with curved portion, usually rounded, head sometimes slightly oblique with tips acute or blunt, inner margin of distal portion smoothly concave but of proximal portion usually sinuate or convex, median lobe usually smaller, rounded or subtruncated (FIG. 30), aedeagus not or only slightly recurved at base and not turned upward, tip narrowly or broadly rounded, inner transverse projection usually medially slightly emarginate, transverse outer line sinuate, dentines on inner margin small but visible, transverse portion distinctly shorter than curved portion (FIG. 29).

Holotype ♂ (NHMUK) BANGLADESH: Rangamati, on grass, 25.III.1970, I. Ahmad; paratypes: 1 ♂, 1♀, Rangamati, on grass, 24,25.III.1970, I. Ahmad (BISHOP, USNM).

Other material examined. 12 ♂, 5 ♀: BANGLADESH: Herbang, Chittagong, Marysha, Bagherhat, Jessore, Kaptai, Khulna, Sreemangal, Sylhet, Cox's Bazar, Pablakhali, PAKISTAN (NWFP): Balakot; on *Grewia microcos, Eupatorium odoratum, Tectona grandis, Kandelia rheedii, Lagerstoomia speciosa, Oxytenanthera nigrociliata,* grass, *Rumex hastatus,* 25.XI.1964, 15,22.I.1965, 26–27.II.1965, 5,9.III.1969, 21,22.III.1970, I. Ahmad, S. Ali, N. Zaman, F. Ahmad, Q. A. Abbasi, Azhar A. Khan (NHMUK, NIM, PFI).

Variation and sexual dimorphism. The size of ♂ ranges from 3.35–4.0 mm × 1.8–2.0 mm; frontoclypeus sometimes extending for distinctly ½ its length below lower margins of vertex, pronotum sometimes dark ferruginous with black shades, lateral carinae of posterior process black, sometimes veins of subbasal area of tegmina dark brown. Females differ from males in being larger in size (measuring 3.9–4.5 mm × 2.2–3.0 mm), usually uniformly ferruginous or brown with margins of suprahumeral horns, and tip and margins of posterior process always black, head always about 2× wide as long, sometimes dark ferruginous or black except a small area above ocelli ferruginous, basal portion of frontoclypeus sometimes black, suprahumeral horns always developed, obliquely extending upward and outward beyond humeral angles, ranging from about ½ in length to as long as their intervening space.

Remarks. This species appears rather isolated in its subgroup, as noted below, but can easily be separated by its relatively reduced median frontoclypeal lobe, elongated subgenital plate and by other characters as noted in the description.

Tricentrus russellae Ahmad & Yasmeen, **new species** FIG. 32–39

♂. Generally black.

Head vertical, vertex, about 2× as wide as long, finely punctate and densely covered with short depressed golden hairs, upper margin arcuate and feebly sinuate, lower margins oblique, strongly ridged, distinctly sinuate and extended on frontoclypeus, eyes large and ferruginous brown, ocelli conspicuous, nearer to

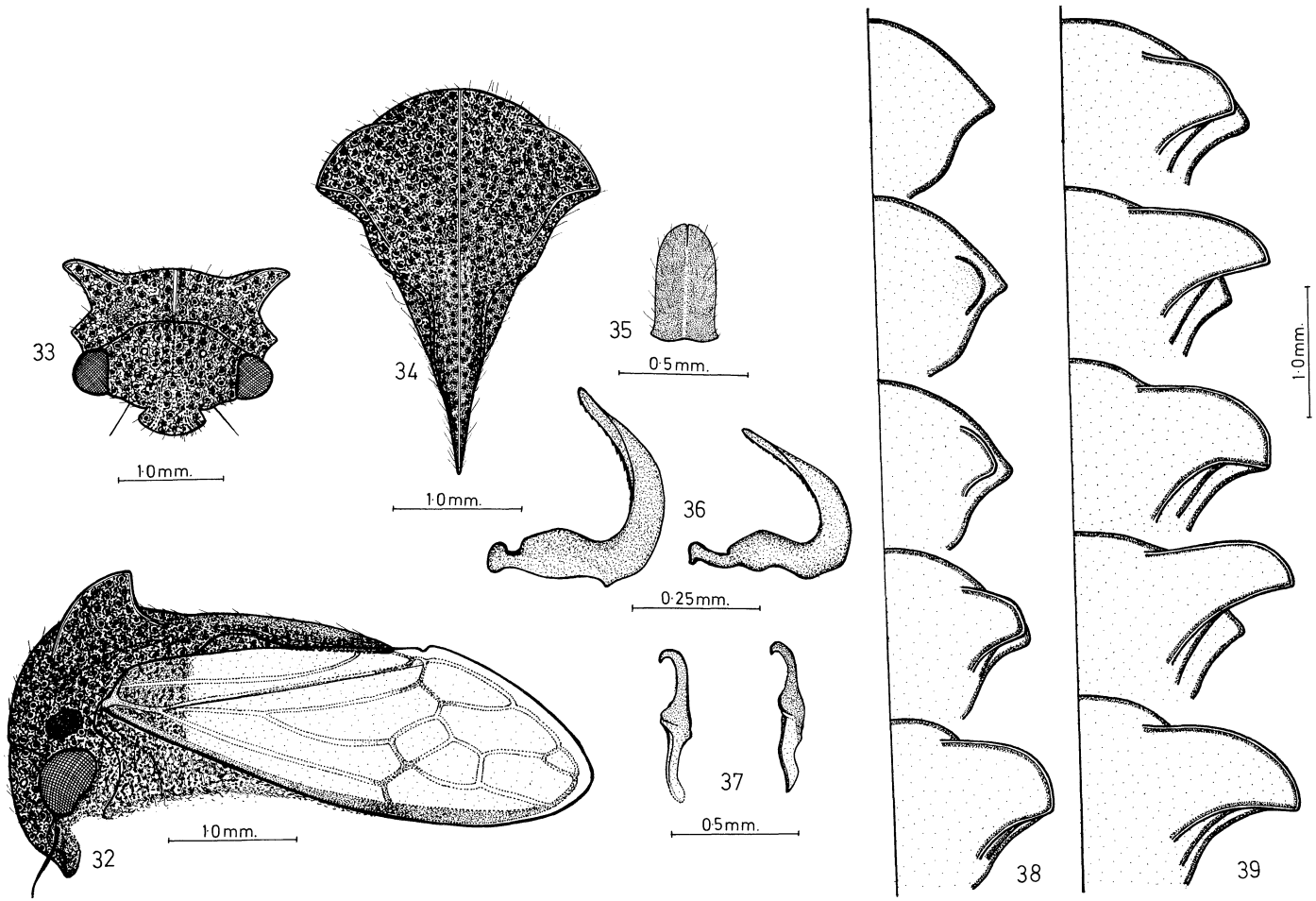

FIG. 32–39. *Tricentrus russellae*: 32, head, pronotum and wing, lateral view; 33, head, frontal view; 34, ♂ pronotum, dorsal view; 35, subgenital plate, ventral view; 36, aedeagus, lateral view; 37, paramere, lateral view; 38, ♂ pronotum and 39, ♀ pronotum, dorsal view, showing variations of suprahumeral horns found in both sexes.

the eyes than from each other and situated above centro-ocular line, frontoclypeus as long as wide, extending for less than ½ its length below lower margins of vertex, lateral lobes entirely fused with median lobe, their sutures conspicuous, impunctate, tip rounded, pilose and inwardly curved. Pronotum finely punctate with very short depressed golden hairs, median carina ferruginous and percurrent but obsolete anteriorly near upper margin of vertex, metopidium unicolorous, supraocular callosities conspicuous, impunctate, humeral angles subacute, suprahumeral horns with anterior margins ferruginous, short, extending obliquely upward and only reaching onto humeral angles measuring about ½ in length as their intervening space with apices subacute, posterior process with median carina ferruginous, tricarinate, robust, straight, centrally ridged, tip depressed, rather subacute, and never reaching internal angles of tegmina, scutellum narrowly exposed, punctate and sparingly pubescent, tegmina pale brown, subhyaline, veins brown, base dark brownish black and finely punctate with golden pubescence, 5 apical and 2 discoidal cells, 3rd apical cell of 1 side comparatively very small, hind wing with 3 apical cells, legs with apices of femora, tibiae and tarsi ferruginous, sides of thorax without white pubescence.

Length from front of head to tips of tegmina, 4.5 mm; width between tips of suprahumeral horns, 2.2 mm.

Genitalia. Subgenital plate moderately elongated, not at all tapering at apex, latter almost equal to basal width, basal margin medially distinctly emarginate, lateral angles somewhat prominent but acute, outer margins concave only near base but throughout markedly convex (FIG. 35), parameres elongated with curved portion rounded, head usually at least slightly obliquely tapering with tip acute, inner margin of distal portion concave but of proximal portion convex or sinuate, median lobe very small, subrounded (FIG. 37); aedeagus sometimes slightly recurved at base and never turned upward, tip rounded, inner transverse projection truncated, transverse outer line sinuate, dentines on inner margin rather distinct, transverse portion distinctly shorter than curved portion (FIG. 36).

Holotype ♂ (NHMUK), PAKISTAN: NWFP: Balakot, on *Rumex hastatus,* 1.V.1971, I. Ahmad; paratypes: 1 ♂, same data as holotype except Azhar A. Khan (NHMUK); 3 ♀, Abbotabad, on *Rumex hastatus*, 29.VI.1971, 2.V.1971, Azhar A. Khan, I. Ahmad (NHMUK); AZAD KASHMIR: 4 ♂, 1 ♀, Chikar, on *Rumex hastatus,* 26.VI.1970, 27,29.IV.1970, Azhar A. Khan, I. Ahmad (NHMUK); 1 ♀, Muzafferabad, on *Rumex hastatus,* 28.IV.1971, I. Ahmad (BISHOP).

Other material examined. 72 ♂, 29 ♀: PAKISTAN: Punjab: Murree, NWFP: Balakot, Abbotabad, Gari Habibullah, AZAD KASHMIR: Muzafferabad, Chikar, Chunari, Bagh, BANGLADESH: Rangamati, on *Rumex hastatus,* grass, 26.VIII.1970, 28.VI.1970, I.VII.1970, 25,30.VI.1971, 1,2.V.1971, 14.VII.1973, 15.VII.1974, I. Ahmad, Azhar A. Khan (NHMUK, ZMUH).

Variations and sexual dimorphism. Males vary in size from 3.95–4.5 mm × 1.9–2.2 mm; head, metopidium and pronotum may be entirely black and eyes and ocelli dark brown, former sometimes only ½ again as wide as long; suprahumeral horns may be entirely absent, but when present, exhibit diversity of form, vary showing from slight carinae on pronotum to quite developed horns measuring as long as their intervening space, posterior process sometimes convex in shape with subacute tip. Females differ from males in being larger in size (4.4–5.2 mm × 2.5–3.5 mm), usually lighter in color with pronotum usually pale ferruginous, brown or dark brown with head, anterior portion of metopidium and tip of posterior process black; head usually distinctly 2× as wide as long but sometimes only ⅔ again as wide as long, frontoclypeus usually wider than long but sometimes as long as wide and always extending for less than ½ or sometimes distinctly ½ its length below lower margins of vertex; suprahumeral horns always well developed, stout, usually as long as but sometimes greater,

i.e., even exceeding their intervening space with apices subacute and sometimes directed backward, posterior process short, robust, usually smoothly convex in shape but sometimes with a depression at the base, then elevated in the middle and sloping towards blunt tip.

Remarks. This species is most closely related to *T. nigra,* n. sp., but can easily be separated from the same by short median frontoclypeal lobe extended for less than ½ its length below lower margins of vertex and in other characters as noted in the description.

Tricentrus variabilis Ahmad & Yasmeen, **new species** FIG. 40–47

♂. Generally black.

Head vertical, vertex black about 2× as wide as long, finely punctate with short golden hairs, upper margin arcuate, not sinuate, lower margins oblique, not ridged, weakly sinuate, slightly extended on frontoclypeus, eyes large, pale brown, ocelli conspicuous, unicolorous and nearer to the eyes than from each other, situated on centro-ocular line, frontoclypeus wider than long, extending for less than ½ its length below lower margins of vertex, lateral lobes entirely fused with median lobe, their sutures conspicuous, impunctate, tip subrounded. Pronotum finely punctate, densely covered with short golden hairs, median carina percurrent but fading anteriorly near upper margin of vertex, metopidium unicolorous, supraocular callosities impunctate, humeral angles subacute, suprahumeral horns ferruginous, short, obliquely extending upward but not extending beyond humeral angles, more than ½ in length as their intervening space, front margins rounded, posterior margins rather straight with tips subacute, posterior process with median carina ferruginous, tricarinate, more or less robust, straight but slightly sloping towards apex, tip subacute and distinctly reaching internal angles of tegmina, scutellum well exposed, strongly punctate with dense golden pilosity, tegmina light pale, hyaline, veins light brown, sparingly pubescent, base brownish black, punctate, sparingly pubescent 5 apical and 2 discoidal cells, hind wings with 3 apical cells, legs with apices of femora, tibiae, tarsi and claws ferruginous, sides of thorax without white pubescence.

Length from front of head to tips of tegmina, 4.5 mm; width between tips of humeral angles, 2.3 mm.

Genitalia. Subgenital plate rather stubbed or less elongated, very slightly tapering at apex, latter more than ½ of basal width, margin distinctly medially emarginate, lateral angles prominent but subrounded or subacute, outer margins only concave near base and roundly curving near apex (FIG. 43), parameres rather elongated with curved portion very shallowly rounded, head usually abruptly curved with tip acute or subacute, inner margin of distal portion smoothly concave, but of proximal portion more or less convex, median lobe usually very small, subrounded (FIG. 45), aedeagus at least slightly recurved at base and never turned prominently upward, tip usually rounded, inner transverse projection markedly truncated or slightly concave in the middle, transverse outer line nearly straight or sinuate, dentines on inner margins usually prominent, transverse portion distinctly shorter than curved portion (FIG. 44).

Holotype ♂ (NHMUK), PAKISTAN: NWFP: Abbotabad, on *Dalbergia sissoo,* 2.V.1971, I. Ahmad; paratypes: 2 ♂, 2♀, Abbotabad, on *Dalbergia sissoo, Rumex hastatus,* 27,28.IV.1971, Farid Ahmad, Azhar A. Khan (NHMUK, USNM); 2 ♂, 4 ♀, Balakot, on *Rumex hastatus,* 19.VII.1968, Azhar A. Khan (NHMUK, BISHOP); Punjab: 3 ♀, Murree, on *Rumex hastatus,* 27.IV.1970, 12.VII.1973, I. Ahmad (NHMUK); AZAD KASHMIR: 2 ♀, Chikar, on *Rumex hastatus,* 26,30.VI.1970, 27–29.IV.1971, Azhar A. Khan, I. Ahmad (NHMUK, ZMUH).

Other material examined. 237 ♂, 460 ♀: PAKISTAN: Punjab: Murree, NWFP: Balakot, Abbotabad, Gari-Habibullah, Bahrain, Madyan, Kalakot, AZAD KASHMIR: Bagh, Chikar, Chunari, Muzafferabad, BANGLADESH: Khulna, Sreemangal, Ran-

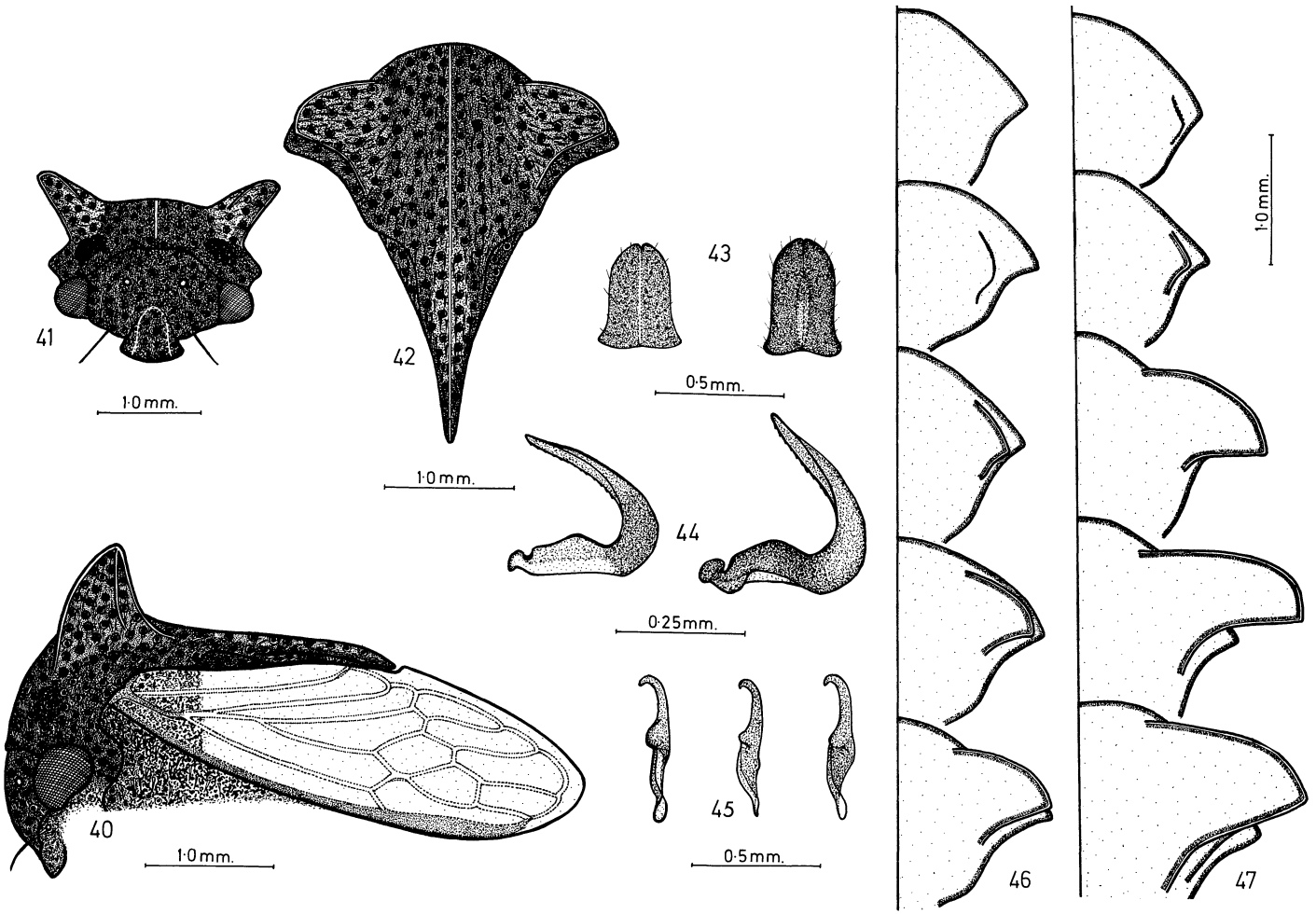

FIG. 40–47. *Tricentrus variabilis*: 40, head, pronotum and wing, lateral view; 41, head, frontal view; 42, ♂ pronotum, dorsal view; 43, subgenital plate, ventral view; 44, aedeagus, lateral view; 45, paramere, lateral view; 46, ♂ pronotum and 47, ♀ pronotum, dorsal view, showing variations of suprahumeral horns found in both sexes.

gamati, Hazarikhel, Marysha, on *Rumex hastatus, Dalbergia sissoo, Acasia arabica, Indigofera oblongifolia, Mikania scandens,* grass, wild plant, on wing, 26.III.1964, 18.V.1965, 29.VII.1967, 3.VII.1968, 17,19.VIII.1968, 21.VI.1969, 21,25,27.III.1970, 20,26,27,28,30.VI.1970, 1.VII.1970, 10,20,26–30.IV.1971, 1–2.V.1971, 8.V.1973, 12,14.VII.1973, I. Ahmad, Azhar A. Khan, N. Ahmad, F. Ahmad, M. Nasrullah (NHMUK, ZMUH, PFI, AC).

Variation and sexual dimorphism. The size of males ranges from 3.8–4.5 mm × 2.15–2.3 mm, head, metopidium and pronotum may be entirely black, frontoclypeus sometimes as long as wide, tegmina dark brown with veins darker in color; suprahumeral horns exhibiting wide range of sexual dimorphism, being entirely absent to quite developed, measuring about as long as their intervening space. Females differ from males in being larger in size (measuring 4.3–5.3 mm × 2.2–3.5 mm), usually ferruginous with head, anterior portion of metopidium, supraocular callosities and tip of posterior process black but very rarely entirely black, lower margins of vertex and apex of frontoclypeus sometimes ferruginous; head may be only ¼ again or about ½ again or distinctly ¾ again or 2× as wide as long; suprahumeral horns always present, ranging from less than ½ to even greater than their intervening space.

Remarks. This species is closely related to *T. gibbiformis,* n. sp., *T. pseudobifurcus,* n. sp., and *T. aeneus,* but appears isolated with less wide median frontoclypeal lobe and more stubbed subgenital plate.

Tricentrus concavus (Funkhouser), **new combination**

Centrotoscelus concavus Funkhouser, 1918, Philipp. J. Sci. **13:** 31, 38; pl. 1, figs. 11, 12; 1927, Entomol. Suppl. **15:** 9; 1927, Gen. Cat. Hemipt. **1**(1): 357; 1929, Fed. Malay States Mus. J. **14:** 476; 1951, Ann. Entomol. Soc. Am. **44:** 486.—Goding, 1934, J. N. Y. Entomol. Soc. **42:** 458–59.—Allen, 1951, Ann. Entomol. Soc. Am. **44:** 486.—Metcalf & Wade, 1965, Gen. Cat. Homopt. **1**(1): 363.

Remarks. Funkhouser (1918) in the original description of this species under the genus *Centrotescelus* noted, "trochanters strongly spined." Funkhouser (1914) while describing the genus stated, "The genus *Centrotoscelus* is peculiar in having no suprahumeral horns and yet having strong teeth on the posterior trochanter." Later work of Kato (1960), Capener (1962, 1968) and Ahmad & Yasmeen (1974) revealed that the only character, "absence of suprahumeral horns," in which *Centrotoscelus* differed from *Tricentrus* was not to be relied upon, for the absence or presence of these horns in many cases reflected sexual dimorphism. The hornless condition of the above species described under *Centrotoscelus* resembles the presently described *T. nigra,* in which the unique female is hornless. Therefore it is more than probable that the male holotype of this species will show male genitalia similar to the type species of *Tricentrus* Stål.

Ahmad & Yasmeen (1974) have already synonymized *Centrotoscelus* Funkhouser with *Tricentrus* Stål after studying the type species of both genera, *C. typus* Funkhouser and *T. fairmairei* Stål.

Tricentrus pseudocornis (Funkhouser), **new combination**

Centrotoscelus pseudocornis Funkhouser, 1920, J. Br. Asiatic Soc. **82:** 217, Fig. 13, 14; 1927, Gen. Cat. Hemipt. **1**(1): 358.

Xanthosticta pseudocornis: Goding, 1934, J. N. Y. Entomol. Soc. **42:** 474–75—Allen, 1951, Ann. Entomol. Soc. Am. **44:** 486.—Funkhouser, 1951, Gen. Insect. **208:** 267; pl. xiii, Fig. 230.—Metcalf & Wade, 1965, Gen. Cat. Homopt. **1**(1): 369–70.

Remarks. Funkhouser (1920), describing this species with remarks "hind trochanters armed on inner surface with strong teeth," placed it under the genus *Centrotoscelus,* but Goding (1934), perhaps being unaware of this peculiar character, erroneously transferred it to the genus *Xanthosticta* Buckton. While commenting upon this species, Funkhouser (1920) himself stated: "This species is most interesting in that it shows a tendency to a transition towards the genus *Tricentrus.* It very closely approaches *Tricentrus brevicornis* (described above No. 26) and might be placed in the same genus as the latter species if the suprahumeral ridges were somewhat more prominent." It is more than probable from a lateral view diagram (Funk. 1920, Fig. 13, 14) of this species that the basal plate and the parameres would show tricentrine characters.

In light of the above, *X. pseudocornis* (Funk.) is hereby transferred to the genus *Tricentrus* Stål as *T. pseudocornis* (Funkhouser) (new combination).

DISCUSSION

The 9 species treated herein, together with 10 of Funkhouser's species described from other areas, namely *T. aiyuri, T. orientalis, T. pseudocornis, T. brevicornis, T. kriegeli, T. depressicornis, T. nigris, T. nitidus, T. nigroapicalis* and *T. concavus* are included in the *T. projectus* group; this probably represents the largest species group within *Tricentrus* Stål. Additional named species are expected to be included in the group after their types are studied. These species probably have evolved by fusion of lateral frontoclypeal lobes with the median lobe. With the inclusion of the above extralimital species, the distributional range of the species group extends into Indonesia and SE China. Unlike other species groups within *Tricentrus* Stål (Yasmeen & Ahmad 1975, 1976; Ahmad & Yasmeen 1976), these species usually do not invade the economically important host plants of the family Leguminosae, but live generally on weedy plants such as *Mikania scandens* Willd. of the family Compositae in Bangladesh and usually on *Rumex hastatus* D. Don. of the family Polygonaceae in the hilly areas NW of Pakistan and Azad Kashmir.

Within the *T. projectus* group the following subgroups are recognized.

1. *kashmirensis subgroup*

T. kashmirensis n. sp., *T. nigris* Funk., *T. nigroapicalis* Funk., *T. depressicornis* Funk., *T. nitidus* Funk. and *T. kriegeli* Funk. appear to represent the most primitive subgroup. These have a long posterior process passing distinctly beyond internal

angles of tegmina; both sexes usually have greater development of suprahumeral horns, usually as long as their intervening space and they are large species (length 5.0 mm–7.0 mm).

The first 4 species appear closer to each other with longer posterior process passing far beyond internal angles of tegmina, but *T. depressicornis* from China stands apart by having the frontoclypeus extending for more than ½ its length below lower margins of vertex, and by having sharp subacute tip and sides of thorax with silvery hairs. *T. nigris* from Borneo (Sabah: Sandakan) and *T. nigroapicalis* from Sumatra, Doerian Island, Riouw Island and Java share more or less similar pigmentation of the body and more prominently flattened suprahumeral horns in both sexes extending outward and upward and at least slightly backward. However, *T. nigroapicalis* is more specialized in having posterior process with elevated tip, white spots and pubescence at the base of tegmina and comparatively broader and more rounded median lobe of frontoclypeus. The latter feature is also shared by *T. kashmirensis,* n. sp., an endemic species from various areas of Azad Kashmir having dark ferruginous body.

On the other hand, *T. nitidus* and *T. kriegeli* appear closer to each other in having comparatively short posterior process, passing only just beyond internal angles of tegmina, shorter suprahumeral horns and rounded median lobe of frontoclypeus. But *T. nitidus* from Sumatra has white tomentose spot at the base of each tegmen and in *T. kriegeli* from Borneo, these spots are missing.

2. *variabilis subgroup*

The species of the 2nd subgroup include *T. variabilis,* n. sp., *T. pseudobifurcus,* n. sp., *T. gibbiformis,* n. sp., *T. aeneus* Distant, *T. aiyuri* Funk., *T. pseudocornis* (Funk.), *T. brevicornis* Funk. and *T. orientalis* Funk. These share a posterior process which distinctly reaches internal angles of tegmina.

The previously described species and *T. gibbiformis,* n. sp., are known by unique specimens; therefore, the grades of the development of horns in these are unknown. On the other hand, *T. pseudobifurcus,* n. sp. and *T. variabilis,* n. sp. are represented by various populations in present collections and appear to have greater horn variations in both sexes, ranging from hornless males to those having suprahumeral horns as long as their intervening space and females having smaller horns, less than ½ to much longer than their intervening space. *T. aiyuri* and *T. orientalis* appear more primitive in having longer median lobe of frontoclypeus extending for 2/3 its length below lower margins of vertex. However, *T. aiyuri* from South India appears more specialized in having heavy and smooth posterior process (in the lateral view diagram, Funk. 1933, pl. 1, Fig. 4, a shorter posterior process has been shown which is distinctly not reaching beyond internal margins of tegmina) and with smaller suprahumeral horns. *T. pseudocornis* and *T. brevicornis* from Malaysia and Indonesia, respectively, appear closely related, as concluded by Funkhouser (1920), in having the median lobe of the frontoclypeus extending for ½ its length below lower margins of vertex and in the absence of tomentose spots at the sides of thorax. However, *T.*

brevicornis appears more specialized in having tip of posterior process slightly upraised. Both the species are to date represented only by unique male specimens. It is quite probable that collection of additional specimens of both sexes will reveal a greater range of horn development similar to that in *T. variabilis,* n. sp. and *T. pseudobifurcus,* n. sp., as noted above.

T. variabilis, n. sp. has a wide distributional range in Pakistan, Azad Kashmir and Bangladesh and appears isolated in the subgroup, with less wide median lobe of frontoclypeus. It is represented by patterned or black females, as well as black males. Its subgenital plate is also more stubbed. Both *T. aeneus* and *T. gibbiformis,* n. sp. are represented by only a few females and appear to be most closely related by having the widest median lobes of frontoclypeus. The former species is distributed in Himalayas, Bengal, Assam, Darjeeling, United Province in India, Burma and Malaysia and the latter species is probably restricted to Bangladesh. Both species are represented by unique or only a few specimens. *T. gibbiformis,* n. sp. is probably endemic and is more specialized, having gibba at the base of the posterior process. On the other hand, *T. pseudobifurcus,* n. sp. appears most advanced in the group, with relatively reduced median lobe of frontoclypeus and elongated subgenital plate. It is also widely distributed in western Pakistan and Bangladesh.

3. *russellae subgroup*

The included species, viz *T. russellae,* n. sp., *T. nigra,* n. sp., *T. projectus* Distant, *T. bifurcus* Distant and *T. concavus* (Funk.) share a very short posterior process barely or not at all reaching internal angles of tegmina.

This is the only subgroup, which includes the species *T. nigra,* n. sp. known from Bangladesh and *T. concavus* from Sumatra and Borneo and Luzon in the Philippines, which has entirely hornless females. The former species is represented by a unique female and the latter by a unique male and 3 females. However, *T. nigra* also appears somewhat related in having posterior process barely reaching internal angles of tegmina and median lobe of frontoclypeus extending far below, at least slightly more than ½ its length below lower margins of vertex. But *T. concavus* appears somewhat more specialized in having a posterior process markedly curved at base and prominent white tomentose hairs at the sides of thorax.

On the other hand, in *T. bifurcus* and *T. projectus* the median lobe of frontoclypeus is extended for ½ its length below lower margins of vertex and is also comparatively wider in the latter species. These are light-colored species with patterned males and ferruginous to castaneous brown females. *T. projectus* is, to date, known from only females, in which the suprahumeral horns are greatly developed, projecting forward and are greater than their intervening space. In *T. bifurcus,* both hornless and horned males are known. The females also vary, from having shorter suprahumeral horns only ½ or as long as their intervening space, to having prominent, longer suprahumeral horns distinctly greater than their intervening space. *T. projectus* appears somewhat more specialized in having a small pale sericeous spot at each basal angle of

scutellum. Both species appear widely distributed, with *T. bifurcus* extending into the areas of NW Pakistan and Azad Kashmir and also into Bangladesh and *T. projectus* distributed in Bengal, United Province and Madras in India and also in Burma and Luzon.

T. russellae, n. sp. known from northwestern Pakistan, Azad Kashmir and Bangladesh, appears most specialized in having a short median lobe of frontoclypeus distinctly extended less than ½ of its length below lower margins of vertex, having prominent heads of parameres and a posterior process which is strongly ridged and convex from above.

Acknowledgments. We wish to express our sincere thanks to Mr P. S. Broomfield of the British Museum (Nat. Hist.) for confirming our identifications and for comparing these with holotypes or with the specimens from the type series lodged at his museum. Our special thanks are also due to Dr J. L. Gressitt of Bishop Museum, Honolulu, Hawaii, for the loan of determined *Tricentrus* species. Mr Naseer Ahmad Khan R.O. of the present USDA Research Project is also sincerely acknowledged for some technical help.

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