

Resurrections and Redescriptions of *Caystrus marginiventris* (Stål), *C. trivalis* (Gerstaecker) and *C. pseudobrunnescens* Linnavuori (Hemiptera: Pentatomidae: Pentatominae), Key to This Complex and Their Cladistic Relationships*

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Abstract.- *Paramecus marginiventris* Stål, *Anarropa trivalis* Gerstaecker and *Caystrus pseudobrunnescens* Linnavuori are redescribed with special reference to their unknown characters *i.e.*, metathoracic scent auricle and male and female genitalia and these are compared with those of each other and with *Cimex nigriventris* Germar and *C. quadrimaculatus* Linnavuori. The latter was formerly described as subspecies of *C. marginiventris* by its author. Distant (1910) synonymised *marginiventris* with *nigriventris* and Linnavuori (1982) speculated that *trivalis* could be a race of *marginiventris*. In the light of present findings *marginiventris* and *trivalis* are resurrected and specific status of *quadrimaculatus* is confirmed. A key to the above species with their distributional ranges is given and their relationships within the genus *Caystrus* Stål is briefly discussed.

Key Words: Hemiptera, Pentatominae, Caystrini, *Caystrus marginiventris*, *Caystrus pseudobrunnescens*, *Caystrus trivalis*.

INTRODUCTION

Gerstaecker (1873) described *trivalis* under his monotypic genus *Anarropa* but the genus was synonymised with *Caystrus* Stål by Linnavuori (1972). Later Linnavuori (1982) also speculated that *C. trivalis* might only be a race of *Paramecus marginiventris* Stål (1858) transferred to *Caystrus* by Stål (1861). Distant (1910) transferred *Cimex nigriventris* Germar into *Caystrus* but synonymised *marginiventris* with it. Linnavuori (1972) described *quadrimaculatus* as subspecies of *C. marginiventris* but in 1974 raised it to an independent species considering it closely related to his *C. pseudobrunnescens*. Presently, therefore, *C. marginiventris*, *C. pseudobrunnescens* and *C. trivalis* are redescribed with special reference to their unknown metathoracic scent auricle and male genitalia including inflated aedeagus and female genitalia including spermatheca and in this light *C. marginiventris* and *C. trivalis* are resurrected.

Earlier Ahmad *et al.* (2005) and Zahid and Ahmad (2005) redescribed *nigriventris* and *quadrimaculatus*, respectively, confirming the specific status of the later. A key is given to all the above five species and their cladistic relationships are also briefly discussed.

MATERIALS AND METHODS

The authentically determined specimens of *C. marginiventris*, *C. pseudobrunnescens* and *C. trivalis* were borrowed by the courtesy of the authorities of Natural History Museum Stockholm, Sweden and the holotype of *C. nigriventris* was examined by the first author by the courtesy of Mr. Mick Webb, incharge Hemiptera Section Department of Entomology, Natural History Museum, London (pygophore was missing as also reported by Linnavuori (1972) and the holotype of *C. quadrimaculatus* was also examined by the first author by the courtesy of Dr. R Schuh Director Entomology, American Museum of Natural History New York, USA. For dissection of the male genitalia including inflation of the aedeagus the techniques of Ahmad (1986) and Ahmad and McPherson (1990, 1998) were followed. The components of genitalia

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after examination and illustration were placed in a microvial with a drop of glycerine, pinned with the insect. For studies of the female genitalia and for measurements and diagrams the conventional procedures, especially those used by Ahmad and Afzal (1979) were generally followed. The female abdomen after examination and illustration was dried on a filter paper and glued with the specimen, and spermatheca after illustration was placed in a microvial with glycerine and pinned with the specimen. All diagrams are to the given scales and all measurements are in millimeters.

RESULTS

C. marginiventris (Stål) (Fig. 1)

Paramecus marginiventris, Stål 1858: 435

Caystrus marginiventris, Stål 1861: 199.

Sciocoris marginiventris, Walker 1867: 177

Caystrus marginiventris Distant 1901: 26;
Linnavuori 1972: 400-401; Ahmad *et al.*
2005: 1-4.

Colouration and general shape

Body ochraceous with brownish punctures; except brownish black eyes; ocelli pale; membrane hyaline.

Head

Distinctly broader than long; anteocular distance about equal to remainder of head; paraclypei much broad and long but not enclosing clypeus, postero-lateral margin strongly concave, terminating anteriorly in front of eyes with sub round lobe; apex of head smoothly rounded; antennae with basal segment slightly shorter than head apex, 2nd segment shorter than 3rd, 5th longest, length of antennal segments I 0.6, II 1.1 (0.9-1.1), III 1.4 (1.4-1.45), IV 1.6 (1.6-1.85), V 1.8, antennal formula 1<2<3<4<5; labium just reaching hind coxae, 2nd segment longest, 4th shortest, length of segments I 1.1 (1.1-1.2), II 1.35 (1.35-1.45), III 1.2 (1.2-1.3), IV 0.8 (0.8-0.9), labial formula 4<1<3<2; anteocular distance 0.9 (0.9-1.0); remainder of head 0.95 (0.95-1.05); width of head 2.6; interocular distance 1.3(1.3-1.5); interocellar distance 0.8(0.8-0.9).

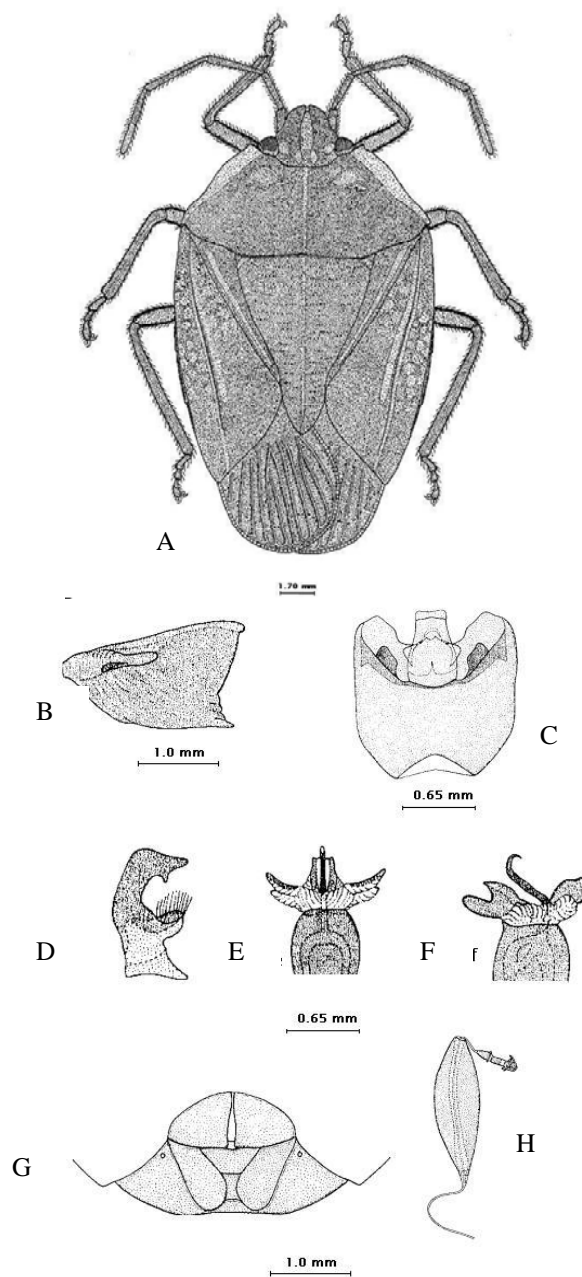


Fig. 1. *Caystrus marginiventris*: A, dorsal view; B, external scent gland, ventral view; C, pygophore, dorsal view; D, paramere, inner view; E, aedeagus, ventral view; F, aedeagus, lateral view; G, female terminalia, ventral view; H, spermatheca, dorsal view.

Thorax

Pronotum about 2.5x broader than long, anterior margin distinctly broader than head width

across the eyes, anterior angles toothed, humeral angles subacutely produced, lateral margins sinuate, length of pronotum 2.4(2.4-2.7), width 6.0 (6.0-6.3); scutellum with subrounded apex, length of scutellum 4.65 (4.65-5.0), width 3.9 (3.9-4.0); metathoracic scent auricles (Fig. 1) with peritreme finger-like reaching $\frac{1}{2}$ length of evaporatoria, apex round, anterior margin of peritreme slightly concave and posterior margin slightly convex, ostiole slit-like; distance base scutellum-apex clavus 3.6 (3.6-3.8); apex clavus-apex corium 2.2 (2.2-2.4); apex corium-apex abdomen including membrane 1.8 (1.8-2.0); apex scutellum-apex abdomen including membrane 3.25(3.25-3.6).

Abdomen

Convex beneath; connexiva slightly exposed at repose; posterior margin of 7th abdominal sternum concave, lateral margins slightly sinuate with acute angles; abdomen shorter than membrane of hemelytra. Total length 12.15 (12.15-13.35).

Male genitalia

Pygophore (Fig.1C) quadrangular, dorso-median surface slightly concave with a large plate-like process at inner lateral margins, lateral lobe narrowly produced, ventro-median surface bilobed; paramere (Fig. 1D) somewhat F-shaped, outer margin straight, humped near apex, apex of blade sharply truncate; aedeagus (Fig. 1E,F) with theca without thecal appendages, vesica large ventrally curved into sharply pointed apex, a pair of large ventro-lateral membranous conjunctival appendages, with sclerotized tip, dorso lateral membranous conjunctival appendages with large sclerotized bilobed plates.

Female genitalia

Female terminalia (Fig. 1G) with triangular, medium sized 1st gonocoxae, inner and posterior margins sinuate, medially wide apart; 9th paratergites flipper-like, large, not reaching beyond fused posterior margin of 8th paratergites, later with posterior margin medially concave, 2nd gonocoxae with posterior margin straight; posterior margin of proctiger concave; spermatheca (Fig. 1H) with balloon-like median dilation, proximally enclosed

by a ring, proximal spermathecal duct about 4x length of distal spermathecal duct, pump region tubular with sinuated lateral margins, bulb spherical with three finger-like processes.

Material examined

1male and 1 female Zair : Gandajika, Mayidi, leg Rev.P. Van.Eyen, J.Decelle, 1942, 3, 1959 "Coll. Mus. Tervuren", deposited at Nat. Hist. Mus. Stockholm, Sweden.

Comparative note

C. marginiventris is isolated in this complex in having body ochraceous with brownish punctures, apical lobe of scutellum remarkably elongate and pointed at apex, body at least 12.15mm long, (12.15-13.35mm.) and dorso-median surface of pygophore shallowly concave and sinuate.

C. pseudobrunnescens Linnavouri (Fig. 2)

Caystrus brunnescens Linnavouri 1972: 400, 413
(nec. *Agabotus brunnescens* Distant 1884)
Caystrus pseudobrunnescens Linnavouri 1974: 402,
408-409; 1975 : 35; 1982 : 76.

Colouration and general shape

Body pale with thick brown punctures; eyes brownish black, ocelli pinkish; membrane of hemelytra hyaline.

Head

Distinctly broader than long; antecular distance shorter than remainder of head; paraclypei broad, longer than clypeus not enclosing clypeus, lateral margins slightly sinuate, apex of paraclypei round; antennae with basal segment slightly shorter than head apex, 2nd segment shorter than 3rd, 5th longest, length of antennal segments I 0.5 (0.5-0.55), II 0.9, III 1.2 (1.15-1.2), IV 1.45 (1.35-1.45), V 1.5, antennal formula 1<2<3<4<5; labium just reaching hind coxae, 1st equal to 4th, 2nd longest, length of segments I 0.7 (0.7-0.8), II 1.1 (1.1-1.3), III 0.9 (0.9-1.0), IV 0.7, labial formula I=IV<III<II; antecular distance 0.75 (0.75-0.85); remainder of head 1.0; width of head 2.45; interocular distance 1.4 (1.30-1.40); interocellar distance 0.9.

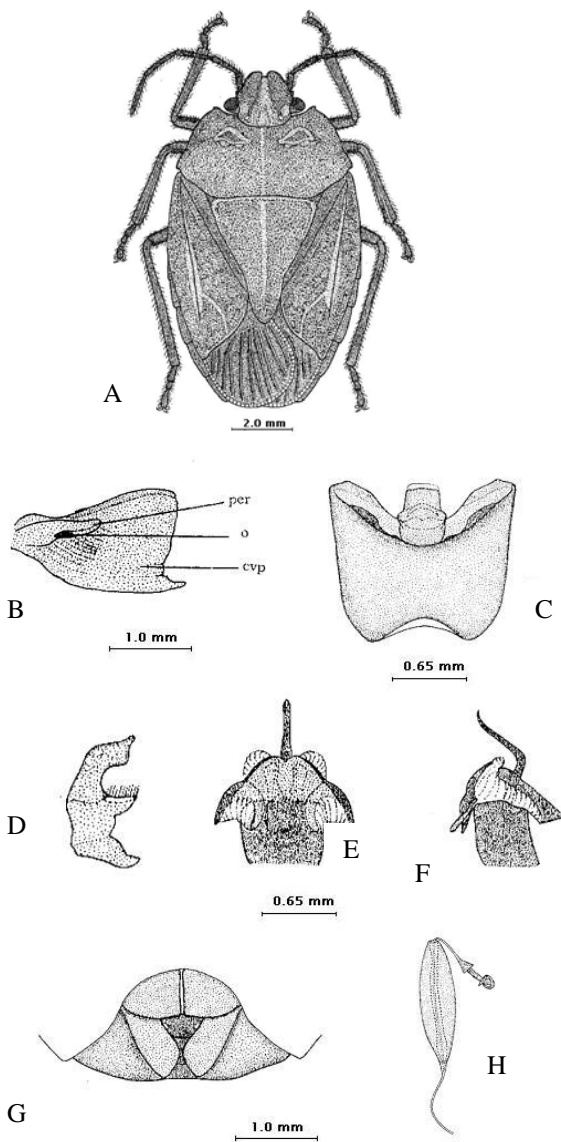


Fig. 2. *Caystrus pseudobrunnescens*: A, dorsal view; B, external scent gland, ventral view; C, pygophore, dorsal view; D, paramere, inner view; E, aedeagus, ventral view; F, aedeagus, lateral view; G, female terminalia, ventral view; H, spermatheca, dorsal view.

Thorax

Pronotum slightly less than 2.5x broader than its length, anterior margin distinctly broader than head width across the eyes, anterior angles toothed, humeral angles sub-acutely produced, lateral margins sinuate, length of pronotum 2.14 (2.15-

2.4), width 5.3 (5.3-5.6); scutellum with short apical subacute lobe, length of scutellum 4.15 (4.15-4.4), width 3.4 (3.4-3.5); metathoracic scent auricle (Fig. 2b) with peritreme lobe-like reaching $\frac{1}{2}$ distance of evaporatoria, apex round, anterior margin of peritreme concave, posterior margin convex, ostiole slit-like; base scutellum-apex clavus 3.0 (3.0-3.1); apex clavus-apex corium 2.1 (2.1-2.4); apex corium-apex abdomen including membrane 1.6 (1.6-1.9); apex scutellum-apex abdomen including membrane 2.65 (2.65-3.2).

Abdomen

Convex beneath; connexiva exposed at repose; posterior margin of 7th abdominal sternum medially concave, lateral margins slightly sinuate with acute angles, abdomen shorter than membrane of hemelytra. Total length 10.7 (10.7-11.85).

Male genitalia

Pygophore (Fig. 2C) rectangular, dorso-median surface concave with a large bilobed process at inner lateral margins, lateral lobe truncately produced, ventro-median surface bilobed; paramere (Fig. 2D) somewhat F-shaped, outer margin sinuate, apex truncate, a bunch of hairs present at inner lobe-like process; aedeagus (Fig. 2E,F) with theca with out thecal appendage, vesica large, curved, pair of largely membranous ventral conjunctival appendages, pair of thorn-like bilobed dorso-lateral conjunctival appendages.

Female genitalia

Female terminalia (Fig. 2G) with triangular moderate 1st gonocoxae, inner and posterior margins sinuate, slightly separated; 9th paratergites flipper-like, large, just reaching fused posterior margins of 8th paratergites; later sinuate; 2nd gonocoxae with posterior margin slightly concave; posterior margin of proctiger concave; spermatheca (Fig. 2H) with balloon-like median dilation, proximally encircled by a sclerotized ring, proximal spermathecal duct about 2x longer than distal spermathecal duct, pump region tubular with sinuated lateral margins, bulb spherical with two finger-like processes.

Material examined

1 male Zair: Ituri, Foret de Kawa, 15.4.1929

leg A. Collart; 1 female Zair: Ituri, Foret de Kawa, 13.4.1929, A. Collart NHM Tervuren, lodged at Nat. Hist. Mus. Stockholm, Sweden.

Comparative note

It is most closely related to *C. quadrimaculatus* in having body pale brown with thick brown punctures, of moderate size and dorso-median surface of pygophore deeply concave but it could easily be separated from *C. quadrimaculatus* by its scutellum with short apical sub-acute lobe, outer margin of paramere sinuate, curved near apex with round tip in contrast to scutellum with short, apically round lobe, outer margin of paramere roundly curvate, apex of blade sharply truncate but medially slightly concave and distally acutely spinously produced in *C. quadrimaculatus*

Caystrus trivalis (Gerstaecker)
(Figs. 3)

Anarropa trivalis Gerstaecker 1873: 398-399 p. 17 fig 1; Stål 1876: 70; Schouteden 1905: 13. *Caystrus trivalis*, Linnavuori 1972: 401, 405-6; figs. 5c-f; 1974: 402, 406; fig. 5d; 1982: 76, fig. 102 6b-d.

Colouration and general shape

Body light brown with thick brown punctures; eyes blackish brown; ocelli pinkish; membrane of hemelytra light brown.

Head

Distinctly broader than long; anteocular distance distinctly shorter than remainder of head ; paraclypei broad, longer than clypeus, separated at tips, apices pointed, lateral margins sinuate, a round lobe adjacent to eyes present; antennae with basal segment reaching head apex, 2nd segment shorter than 3rd, 5th longest, length of segments I 0.5 (0.5-0.6), II 1.1 (0.75-1.1), III 1.35 (0.9-1.4), IV 1.7 (1.1-1.7), V 1.85 (1.4-1.9), antennal formula I<2<3<4<5; labium just reaching hind coxae, 2nd and 3rd segments equal, length of segments I 0.75 (0.7-0.8), II 1.2 (1.0-1.4), III 1.2 (0.9-1.2), IV 0.9 (0.7-0.9), labial formula I<IV<2 = 3; anteocular distance 0.8 (0.8-0.9), remainder of head 1.1 (0.9-1.15); width of head 2.55 (2.25-2.6); interocular distance 1.4 (1.3-1.5); interocellar distance 0.8 (0.8-0.9).

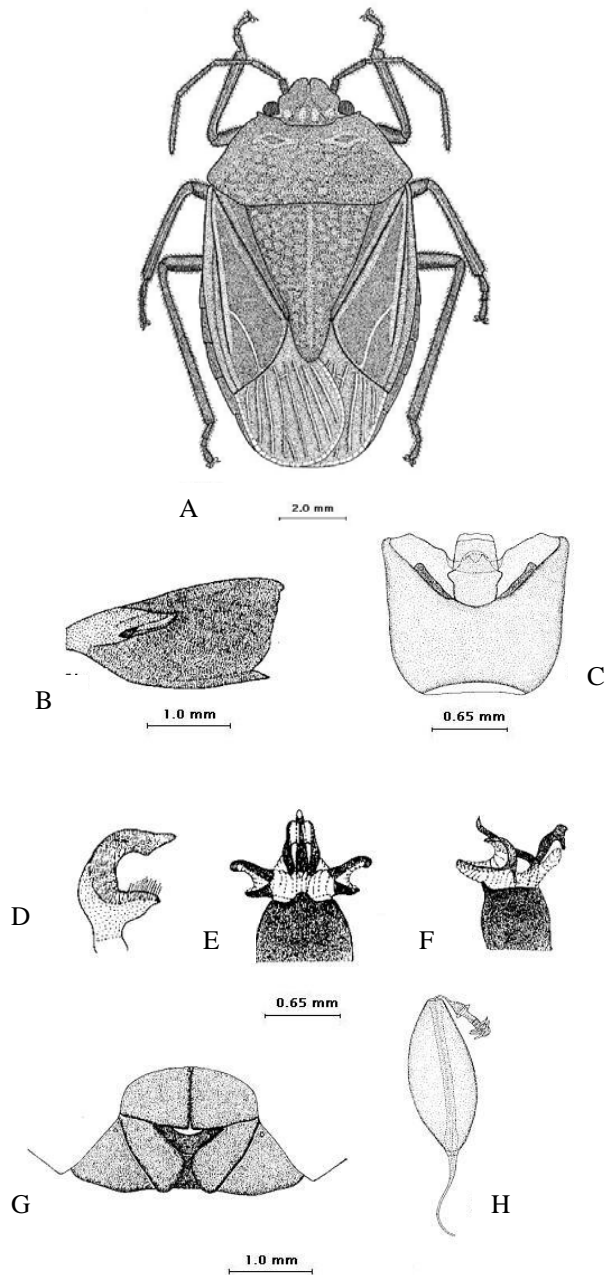


Fig. 3. *Caystrus trivalis*: A, dorsal view; B, external scent gland, ventral view; C, pygophore, dorsal view; D, paramere, inner view; E, aedeagus, ventral view; F, aedeagus, lateral view; G, female terminalia, ventral view; H, spermatheca, dorsal view.

Thorax

Pronotum slightly more than 2.25 X broader

than its length, anterior margin broader than head width across the eyes, anterior angles sharply toothed, humeral angles sub-acutely produced, lateral margins sinuate, length of pronotum 2.45 (2.2-2.55), width 5.8 (5.8-6.2); scutellum large with distinct apical lobe, apex narrowly rounded, length of scutellum 4.6 (4.1-4.95), width 3.75 (3.3-3.85); metathoracic scent auricle (Fig. 3) with peritreme lobe-like, not reaching to $\frac{1}{2}$ distance of evaporatoria, apex narrowly round, anterior margin concave, posterior margin convex, ostiole somewhat oval; length base scutellum-apex clavus 3.3 (3.1-3.8); apex clavus-apex corium 2.4 (2.2-2.6); apex corium-apex abdomen including membrane 1.7 (1.7-2.3); apex scutellum-apex abdomen including membrane 3.1 (2.75-3.6).

Abdomen

Convex beneath; connexiva moderately exposed at repose; posterior margin of 7th abdominal sternum medially concave, lateral margin slightly sinuate with acute angles. Total length 12.05 (10.75-13.05).

Male genitalia

Pygophore (Fig. 3C) quadrangular, dorsomedian surface concave with an elongate, large process at inner lateral margins, latero-posterior margin sinuate, lateral lobes narrowly rounded, ventro-median surface produced into a bifurcate lobe; paramere (Fig. 3D) somewhat F-shaped, outer margin convex, apex of blade transversely truncate, inner prong beset with bunch of hairs; aedeagus (Fig. 3E,F) with theca apically ventro-medially terminating into a prominent conical lobe, with pairs of bifurcated lateral appendages, later only medially membranous, dorsal membranous conjunctival appendages shorter than penial lobes, vesica longer than penial lobes.

Female genitalia

Female terminalia (Fig. 3G) with large somewhat quadrangular-shaped, 1st gonocoxae meeting to each other, posterior margins sinuate; 9th paratergites large, flipper-like, passing beyond posterior margins of fused 8th paratergites; later medially concave; 2nd gonocoxae with posterior margin convex; posterior margin of proctiger

concave; spermatheca (Fig. 3H) with balloon-shaped median dilation, proximally encircled by a sclerotized ring, proximal spermathecal duct more than 4 X the distal spermathecal duct, pump region tubular, medially slightly dilated, bulb spherical with three finger-like processes, third bifurcated.

Material examined

1 male Zair: Bambesa, leg J. Vrydagh 10,1937 determined as *C. trivalis* by R. Linnavuori No. 7855 deposited at NHM Tervuren. Belgium; 2 female Wambasa, leg Dr. Degotte, 1936; 1 female Equateur, Bokuma, leg R. Lootens, 4,1954; 2 female Kibali, Nioka, 11,1953, J. Hecq. determined as *C. trivalis* by R. Linnavuori No. 7855 deposited at NHM Tervuren. Belgium.

Comparative note

It is most closely related to *C. nigriventris* in having body pale brown or light brown with fine punctures, body of small or large sized, dorso-median surface of pygophore not deeply concave, but it could easily be separated from *C. nigriventris* in having body light brown with thick brown punctures, body moderate to large (10.75-13.05mm), labium just reaching hind coxae, apical lobe of scutellum of moderate size with subround apex in contrast to body pale brown with fine brown punctures, size remarkably short (10.5-11.0mm), labium short extending to middle coxae and apical lobe of scutellum short with acutely pointed apex in *C. nigriventris*.

DISCUSSION

Linnavuori (1982) in his Fig. 102 "h" of *trivalis* showed prominent difference in the shape of its paramere in comparison to that of *C. marginiventris* Fig. 102 "g" but commented that differing from the preceding species only in the shape of the style (Fig. 102 h) and possibly only a race of *marginiventris*. The two species however strikingly differ in the following characters: (1) Antocular distance distinctly shorter than remainder of head in *trivalis* but subequal to in *marginiventris*. (2) Paratype clearly divergent at the point of meeting clypeus in *trivalis* but almost convergent beyond clypeus in *marginiventris*. (3)

Outer margin of paraclypei only shallowly concave in the middle in *trivalis* but deeply so in *marginiventris*. (4) Basal antennal segment almost reaching to head apex in *trivalis* but distinctly short of head apex in *marginiventris*. (5) Apical labial segment slightly longer or equal to basal segment in *trivalis* but in *marginiventris* always distinctly shorter than basal segment. (6) Anterior angles of pronotum sharply acute and pointed laterad in *trivalis* but rounded and pointed anteriolaterad in *marginiventris*. (7) Humeral angles of pronotum round in *trivalis* but pointed in *marginiventris*. (8) Inner processes of pygophore broad and only a little exposed in *trivalis* but, narrowed and more exposed in *marginiventris*. (9) Pygophore with lateral margins at most parallel-sided in *trivalis* but in *marginiventris* proximal end much narrower than in the middle. (10) Paramere with outer margin of blade smoothly round and inner angle of the apex conical in *trivalis* but outer margin of blade hump-shaped in the middle and inner angle of the apex acute in *marginiventris*. (11) The penial plates are inwardly acutely projected in *trivalis* but inwardly round and blunt in *marginiventris*. (12) Ninth paratergites apically narrowly rounded and passing beyond fused posterior margin of eighth paratergites in *trivalis* but broadly rounded and not reaching to fused posterior margin of eighth paratergites in *marginiventris*. (13) Third finger-like process on the spermathecal bulb is branched or bifurcated in *trivalis* but not as above in *marginiventris*.

Caystrius trivalis is therefore presently regarded as an independent species, independent of *marginiventris* and is, therefore granted a new taxonomic status.

Linnavuori (1975) considered *trivalis* similar to but smaller than *deserticolus* his new species but the spermatheca which he illustrated for the latter species do not resemble that of *trivalis*. In fact *trivalis* appears more closely related to *marginiventris* in having three finger-like processes on the spermathecal bulb (two in *deserticolus*) but the third is branched or bifurcated in *trivalis*.

Distant (1910) considered *marginiventris* with which *trivalis* is most closely related a junior synonym of *nigriventris* (Germar) but as per key characters of Linnavuori (1972, 1974) *nigriventris* is only about 11 mm as compared to 12 to 13 mm

length in *marginiventris*. The scutellum in *nigriventris* is only 1.15 x as long as broad but in *marginiventris* it is about 1.2 to 1.25 x as long as broad. In *marginiventris* its apex is remarkably elongate but apex is much shorter in *nigriventris*.

The other species *i.e.*, *C. quadrimaculatus* which was earlier described as sub species of *C. marginiventris* by Linnavuori (1972) in fact is remarkably close to *C. pseudobrunnescens*, but it differs in the following characters from the later. Outer margin of paramere remarkably roundly curved, simply deeply concave dorso-median surface of pygophore and short and round apical lobe of scutellum in *C. quadrimaculatus* in contrast to outer margin of paramere curved near apex and apex of blade narrowly truncate having round tip, relatively short and narrow process at inner lateral margin on dorso-median surface of pygophore with its dentate process on either side of ventro-median surface and long and sub round apical lobe of scutellum in *C. pseudobrunnescens*. It is most closely related to *C. pseudobrunnescens* in having relatively short and narrow process at inner lateral margin on dorso-median surface of pygophore. Its dentate process on either side of ventro-median surface of pygophore and sinuate outer margin of paramere, curved near apex and apex of blade narrowly truncate having round tip, shows it more advanced than *C. quadrimaculatus*. *C. marginiventris* appears most advanced among these three species with remarkably sinuate lateral margin of pronotum, apical lobe of scutellum sub-acutely produced, prominent plate-like processes at inner lateral margin on dorso-median surface of pygophore and outer margin of paramere truncate, hump-like near apex, blade truncate curving laterad with unequal bilobed tips.

KEY TO THE INCLUDED SPECIES

1. Body ochraceous with brownish punctures, apical lobe of scutellum remarkably elongate and pointed at apex, body at least 12.15mm long, (12.15-13.35mm.), dorso-median surface of pygophore shallowly concave and sinuate*C. marginiventris*
- Body pale or pale brown or light brown with thick brown or fine punctures, apical lobe of scutellum not remarkably elongate and if elongate with round or subround apex 2

2. Body pale with thick brown punctures, of moderate size (10.7-11.85mm), dorso-median surface of pygophore deeply concave 3
- Body pale brown or light brown with fine punctures, of small or large size, dorso-median surface of pygophore not as above 4
3. Scutellum with short apical sub-acute lobe, outer margin of paramere sinuate, curved near apex with round tip *C. pseudobrunnescens*
- Scutellum with short, apically round lobe, outer margin of paramere roundly curvate, apex of blade sharply truncate but medially slightly concave, distally acutely spinously produced *C. quadrimaculatus*
4. Body pale brown with fine brown punctures, remarkably short (10.5-11.0mm), labium short extending to middle coxae, apical lobe of scutellum short but acutely pointed *C. nigriventris*
- Body light brown with thick brown punctures, body moderate to large (10.75-13.05), labium just reaching hind coxae, apical lobe of scutellum of moderate size with subround apex *C. trivalis*

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