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Eight Species of the Subgenus *Drosophila* (Diptera: Drosophilidae) from Guangdong Province, Southern China

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ABSTRACT—Six new and two known species of the subgenus *Drosophila* are reported from Guangdong, China. A new species-group, the *Drosophila quadrisetata* species-group, is established by one known and two new species.

INTRODUCTION

Up to the present, no drosophilid species has been reported from Guangdong Province, China. In order to fill the lack of knowledge on its drosophilid fauna, we have been making a faunal survey since 1985. As the first report this paper deals with six new and two known species of the subgenus *Drosophila*. The information on other known species will be reported elsewhere.

All the holotypes and a part of paratypes are deposited in the Guangdong Institute of Entomology, Guangzhou, China, and the remaining paratypes in the Entomological Institute, Hokkaido University, Sapporo, Japan.

D. polychaeta Species-group

D. polychaeta species-group, Sturtevant, 1942, Univ. Texas Publ., **4213**: 31.

Diagnosis. Reddish brown species (*D. asper* Lin et Tseng, 1971 blackish brown) with 3 pairs of postsutural dorsocentral bristles and without prominent acrostichal bristles between dorsocentral lines. C-index *ca.* 1.8 to 2.1 (*ca.* 3.1 in *D. kashimirensis* Kumar et Gupta, 1985) and 4V-index *ca.* 2.0 to 2.3. Aedeagus usually T-shaped in lateral view. Surstylus dorsally with more or less

pubescent flap. The last two characters were confirmed in *D. polychaeta* Patterson et Wheeler, 1942, *D. daruma* Okada, 1956, *D. bivibrissae* Toda, 1988 and *D. latifshahi* Gupta et Ray-Chaudhuri, 1970.

Drosophila (Drosophila) latifshahi Gupta et Ray-Chaudhuri (Figs. 1–4)

Drosophila (Scaptodrosophila) latifshahi Gupta et Ray-Chaudhuri, 1970 [1]: 67.

Diagnosis. ♂ fore tarsus anteriorly with long recurved hairs. Epandrium caudo-subapically with acute projection (Fig. 1). Surstylus with small, slightly pubescent flap on dorsal margin (Fig. 1). Ovipositor with *ca.* 3 long bristle-like discal teeth and longest ultimate marginal tooth (Fig. 4).

♂, ♀. Body length, ♂ *ca.* 2.3 mm (range: 2.17–2.52), ♀ *ca.* 3.0 mm (2.89–3.29). Thorax length (including scutellum), ♂ *ca.* 1.0 mm (0.96–1.12), ♀ *ca.* 1.2 mm (1.12–1.28).

Head: Eye brownish red with thick pile. Antenna dark brown. Arista with *ca.* 5 (5–6) upper and *ca.* 2 (2–3) lower long branches in addition to large terminal fork. Frons slightly narrower than 1/2 of head width (mean=0.48, 0.46–0.49, measured at level of anterior ocellus), dark brown, anteriorly with frontal hairs; inside margins of ocelli darker; periorbit paler. Anterior reclinate orbital *ca.* 3/7 (0.43, 0.36–0.53) length of

posterior reclinate; proclinate *ca.* 2/3 (0.67, 0.62–0.75) length of posterior reclinate. Face dark brown; carina broad. Clypeus dark brown. Cheek dark brown, *ca.* 1/5 (0.21, 0.17–0.23) as broad as maximum diameter of eye. Second oral *ca.* 7/10 (0.70, 0.53–0.80) length of vibrissa. Palpus dark brown, club-shaped, with several long setae.

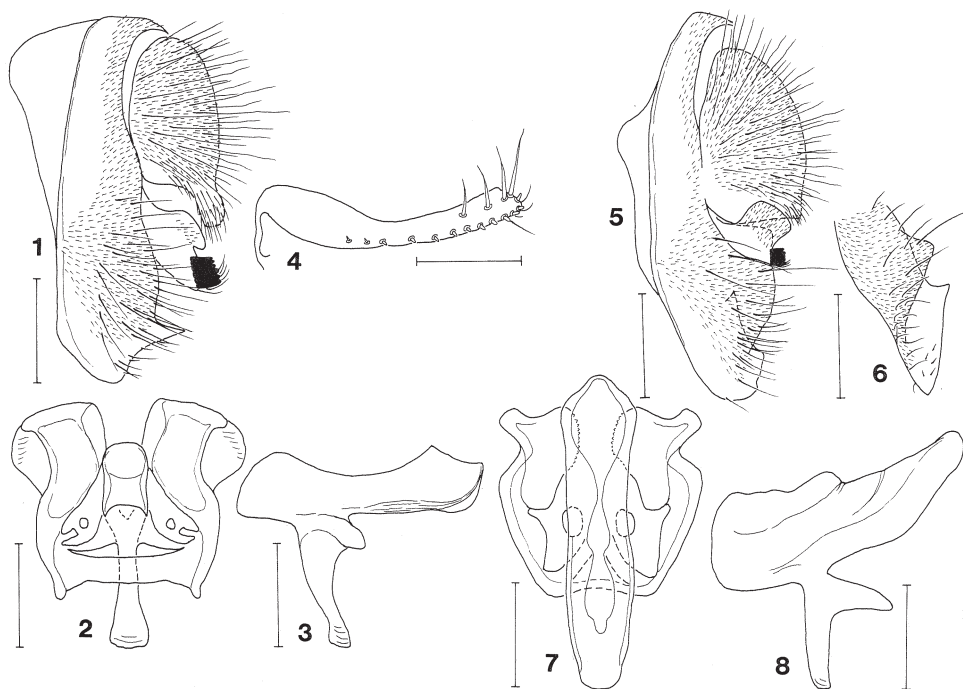
Thorax brown; episternum darker. Humerals 2, subequal. One extra pair of dorsocentrals present in front of usual anteriors. Several bristles in row of dorsocentrals and in 1st row lateral to dorsocentrals somewhat longer than other acrostichal hairs. First dorsocentral *ca.* 2/5 (0.40, 0.32–0.49), 2nd *ca.* 7/10 (0.69, 0.61–0.77) length of 3rd; length distance from 1st to 2nd *ca.* 1/3 (0.32, 0.25–0.41), distance from 2nd to 3rd *ca.* 1/2 (0.48, 0.41–0.54) cross distance between 2nds. Prescutellars absent. Acrostichal hairs in 6 rows. Anterior scutellar *ca.* 9/10 (0.91, 0.80–0.99) length of posterior; posteriors nearer to each other than to anterior. Stern-index *ca.* 0.8 (0.68–0.95).

Legs brown. Preapicals on all tibiae; apicals on fore and mid tibiae. Fore metatarsus as long as 3 succeeding tarsal joints together; mid and hind metatarsi as long as rest together.

Wing hyaline, somewhat fuscous. Veins dark brown; cross veins clear. R_{2+3} slightly curved to costa at tip; R_{4+5} and M nearly parallel. C1-bristles 2, subequal. Wing indices: C *ca.* 1.9 (1.79–2.06), 4V *ca.* 2.3 (2.03–2.45), 4C *ca.* 1.4 (1.30–1.50), 5x *ca.* 1.6 (1.23–2.00), Ac *ca.* 2.7 (2.46–2.87), C3-fringe *ca.* 0.9 (0.79–0.90). Haltere dark grayish brown.

Abdomen: Tergites dark brown; 1st and antero-medial part of 2nd and 3rd yellowish. Sternites pale brown, quadrate, broader than long; ♂ 3rd to 5th large.

Periphallic organs (Fig. 1): Epandrium pubescent except ventral and anterior portions, with *ca.* 34 bristles in lower part and several small setae on lower margin. Surstylus narrow, triangular, with *ca.* 6 long, slightly curved primary teeth on distal



FIGS. 1–4. *Drosophila (Drosophila) latifshahi* Gupta et Ray-Chaudhuri, 1970. 1: Periphallic organs. 2: Phallic organs. 3: Aedeagus (lateral view). 4: Ovipositor. (Scale-line=0.1 mm.)

FIGS. 5–8. *Drosophila (Drosophila) daruma* Okada, 1956. 5: Periphallic organs. 6: Lower part of epandrium (caudal view). 7: Phallic organs. 8: Aedeagus (lateral view). (Scale-line=0.1 mm.)

margin and several recurved spines at caudoventral corner. Cercus separate from epandrium, oval, elongate below, pubescent except ventral portion, with *ca.* 66 bristles and tuft of short setae on lower elongation.

Phallic organs (Figs. 2, 3): Aedeagal apodeme *ca.* 1/2 as long as aedeagus. Anterior paramere tiny, circular, without sensilla. Posterior paramere absent. Novasternum quadrate, without submedian spines; hypandrium large, somewhat quadrate, laterally with flap.

♀ reproductive organs: Ovipositor (Fig. 4) slender, proximally broader, with *ca.* 13 small marginal teeth, *ca.* 3 short terminal and 1 long subterminal hairs; basal ithmus narrow, *ca.* 1/5 as long as ovipositor. Spermatheca unsclerotized.

Specimens examined. China: 18 ♂, 41 ♀, Nankunshan, Guangdong Province, 27, 28. VIII. 1987, ex trap (K. Beppu).

Distribution. India, Bangladesh; China (n. loc. rec.): Guangdong.

Relationship. Gupta and Ray-Chaudhuri [1] described this species as a member of the subgenus *Scaptodrosophila*. However, this species should belong to the *polychaeta* species-group of the subgenus *Drosophila* in having 3 pairs of dorsocentral bristles and ♂ genitalia characteristic to this species-group. This species is clearly distinguishable from other members of the *polychaeta* species-group by the diagnostic characters.

Drosophila (Drosophila) daruma Okada (Figs. 5–8)

Drosophila (Drosophila) daruma Okada, 1956, Syst. Study: 155.

Diagnosis. Caudal margin of lower epandrial part expanding triangularly; toe not pointed, but with acute corner on inner side (Figs. 5, 6). Surstylus triangular, dorsally with large, quadrate, pubescent flap, and with 5 primary teeth in straight row on lower distal margin (Fig. 5). Cercus narrowly fused to epandrium at middle (Fig. 5).

♂. Body length *ca.* 2.8 mm. Thorax length *ca.* 1.2 mm (1.20–1.23).

Head: Arista with 5 upper and 2 lower long branches in addition to large terminal fork. Frons slightly narrower than 1/2 of head width (0.47,

0.45–0.48), dark brown; inside margins of ocelli darker; periorbit paler. Anterior reclinate orbital *ca.* 4/9 (0.44, 0.43–0.45) length of posterior reclinate; proclinate *ca.* 5/7 (0.72, 0.71–0.72) length of posterior reclinate. Face dark brown; carina broad. Cheek dark brown, *ca.* 1/5 (0.21, 0.20–0.21) as broad as maximum diameter of eye. Second oral *ca.* 5/6 (0.82, 0.81–0.83) length of vibrissa.

Thorax: Humerals 2, subequal. One extra pair of dorsocentrals present in front of usual anteriors. Several bristles in row of dorsocentrals and in 1st row lateral to dorsocentrals somewhat longer than other acrostichal hairs. First dorsocentral *ca.* 2/5 (0.40, 0.38–0.41), 2nd *ca.* 5/7 (0.73) length of 3rd; length distance from 1st to 2nd *ca.* 1/4 (0.25), distance from 2nd to 3rd *ca.* 3/7 (0.43, 0.42–0.43) cross distance between 2nds. Acrostichal hairs in 8 rows. Anterior scutellar *ca.* 9/10 (0.90, 0.88–0.92) length of posterior; posteriors nearer to each other than to anterior. Sterno-index *ca.* 0.8 (0.77–0.83).

Leg: Fore metatarsus as long as 3 succeeding tarsal joints together; mid and hind metatarsi as long as rest together.

Wing: Veins brown. R_{2+3} nearly straight; R_{4+5} and M nearly parallel. C1-bristles 2, subequal. Wing indices: C *ca.* 2.1 (2.05–2.12), 4V *ca.* 2.0 (1.97–2.01), 4C *ca.* 1.2 (1.21–1.26), 5x *ca.* 1.4 (1.30–1.52), Ac *ca.* 2.7 (2.58–2.85), C3-fringe *ca.* 0.8 (0.82–0.86). Haltere dark grayish brown.

Abdomen: Sternites quadrate, broader than long.

Periphallic organs (Figs. 5, 6): Epandrium pubescent except ventral and anterior portions, with *ca.* 23 bristles in lower part, narrow in submedian to upper part. Surstylus with several recurved setae at caudoventral corner. Cercus oval, pubescent except ventral portion.

Phallic organs (Figs. 7, 8): Aedeagus T-shaped in lateral view, dorsally broad, ventrally somewhat flat; apodeme *ca.* 1/3 as long as aedeagus. Novasternum somewhat quadrate; hypandrium slightly serrate on inner margin.

Specimens examined. China: 2 ♂, Dinghushan, Guangdong Province, 21. VIII. 1987, ex trap (K. Beppu).

Distribution. Korea, Japan, Bonin Is., Ryukyu Is., Malaya, Borneo, India; China: Taiwan,

Guangdong (n. loc. rec.).

Relationship. This species is somewhat related to *D. bivibrissae* in having surstylus dorsally with large, quadrate, pubescent flap, but clearly distinguishable from the latter by the other diagnostic characters.

D. quadrisetata Species-group

Diagnosis. Dull brown species with 4 pairs of dorsocentral bristles and prominent acrostichal bristles between dorsocentral lines. C-index *ca.* 2.4 to 3.6 and 4V-index *ca.* 1.7 to 1.8. Cercus separate from epandrium. Aedeagus large, curved ventrad.

This newly established species-group consists of *D. quadrisetata* Takada, Beppu et Toda, 1979 and the following two new species. *D. quadrisetata* was previously included in the *polychaeta* species-group [2], because of having extra pairs of dorsocentrals. However, this species and the following two new species resemble the *D. robusta* species-group, especially *D. neokadai* Kaneko et Takada, 1966 and *D. okadai* Takada, 1959, rather than the *polychaeta* species-group in the body color, the morphology of aedeagus and the larger values of C-index, although clearly distinguished from the *robusta* species-group by the presence of extra dorsocentrals and cercus separate from epandrium. Therefore, these three species are considered to form a separate species-group probably intermediate between the *polychaeta* and the *robusta* species-group.

Drosophila (Drosophila) beppui sp. nov.

(Figs. 9–14)

Diagnosis. ♂ palpus modified, apically much broadened and with flat undersurface (Fig. 9). Epandrium moderate in width, slightly broader below; toe round (Fig. 10). Ovipositor subapically much broad, with *ca.* 22 black, stout teeth in irregular rows and 1 short subterminal hair (Fig. 13).

♂, ♀. Body length, ♂ *ca.* 2.4 mm (2.19–2.70), ♀ *ca.* 2.6 mm (2.38–2.98). Thorax length, ♂ *ca.* 0.9 mm (0.88–1.07), ♀ *ca.* 1.0 mm (0.84–1.07).

Head: Eye brownish red, with thick pile.

Antenna dark grayish brown. Arista with *ca.* 4 (2–5) upper and *ca.* 1 (1–2) lower small branches in addition to terminal fork. Frons *ca.* 1/2 (0.51, 0.49–0.54) as wide as head, grayish brown, anteriorly with a few frontal hairs; ocellar triangle and its surrounding area darker. Anterior reclinate orbital *ca.* 2/5 (0.39, 0.31–0.52) length of posterior reclinate; proclinate *ca.* 3/5 (0.61, 0.49–0.85) length of posterior reclinate. Face pale brown; carina broad. Clypeus dark brown. Cheek pale brown, *ca.* 1/4 (0.25, 0.21–0.27) as broad as maximum diameter of eye. Second oral minute. Palpus pale brown, with numerous setae.

Thorax pale brown; median line and posteromedian portion of mesoscutum and scutellum darker. Humerals 2; upper one longer. Two extra pairs of dorsocentrals present in front of usual ones; 1st pair located before transverse suture, 2nd slightly posterior to suture. Two pairs of acrostichal bristles present between dorsocentral lines, arranged somewhat irregularly. Relative lengths of dorsocentrals and acrostichal bristles to 4th dorsocentral: 1st dorsocentral *ca.* 3/5 (0.59, 0.53–0.65), 2nd *ca.* 1/2 (0.50, 0.33–0.64), 3rd *ca.* 7/10 (0.69, 0.61–0.76), anterior acrostichal bristle *ca.* 2/5 (0.41, 0.33–0.48), posterior *ca.* 4/9 (0.45, 0.38–0.57). Length distance from 1st dorsocentral to 2nd *ca.* 4/7 (0.57, 0.43–0.64), distance from 2nd to 3rd *ca.* 4/9 (0.47, 0.34–0.67), distance from 3rd to 4th *ca.* 1/2 (0.50, 0.44–0.57) cross distance between 3rds. Acrostichal hairs sparse, in *ca.* 4 irregular rows. Anterior scutellar *ca.* 9/10 (0.90, 0.82–0.97) length of posterior; posteriors nearer to each other than to anterior. Sterno-index *ca.* 0.6 (0.45–0.75).

Legs pale brown. Preapicals on all tibiae; apicals on fore and mid tibiae. Fore metatarsus as long as rest of tarsal joints together; mid and hind metatarsi longer than rest together.

Wing hyaline, slightly fuscous. Veins grayish brown; cross veins clear. R_{2+3} nearly straight; R_{4+5} and M nearly parallel. C1-bristles 2, subequal. Wing indices: C *ca.* 2.7 (2.38–2.92), 4V *ca.* 1.8 (1.69–2.05), 4C *ca.* 0.9 (0.88–1.01), 5x *ca.* 1.3 (1.05–1.62), Ac *ca.* 2.4 (2.12–2.79), C3-fringe *ca.* 0.8 (0.71–0.81). Haltere pale brown; stalk anteriorly darker.

Abdomen: Tergites nearly entirely dark

brown. Sternites pale gray, quadrate, broader than long; ♂ 3rd to 5th large.

Periphallic organs (Fig. 10): Epandrium pubescent on middle to upper caudal half, with *ca.* 1 bristle in middle part and *ca.* 6 in lower part. Surstylus quadrate, broad, distally narrowing, with *ca.* 9 primary teeth in straight row on distal margin, *ca.* 3 spines on lower outer surface and several small bristles at caudoventral corner. Cercus oval, entirely pubescent, with *ca.* 32 long bristles and tuft of several short bristles on caudoventral apex.

Phallic organs (Figs. 11, 12): Aedeagus basally bilobed and expanded anteriorly, with 1 pair of dark-colored dorsal ridges and vertical rod; apodeme short, *ca.* 1/3 as long as aedeagus. Anterior and posterior parameres absent. Novasternum without submedian spines; ventral fragma arc-shaped; hypandrium large, quadrate, with sharp ridge starting from lateral corner.

♀ reproductive organs: Basal ithmus of ovipositor narrow, sinuate, *ca.* 1/2 as long as ovipositor (Fig. 13). Spermatheca (Fig. 14) elongate, conical, apically slightly indented, basally horizontally wrinkled; introvert deep.

Holotype ♂, China: Nankunshan, Guangdong Province, 28. VIII. 1987, ex trap (K. Beppu).

Paratypes, China: 1 ♂, 2 ♀, same data as holotype; 4 ♂, 4 ♀, same data except 27. VIII. 1987.

Distribution. China: Guangdong.

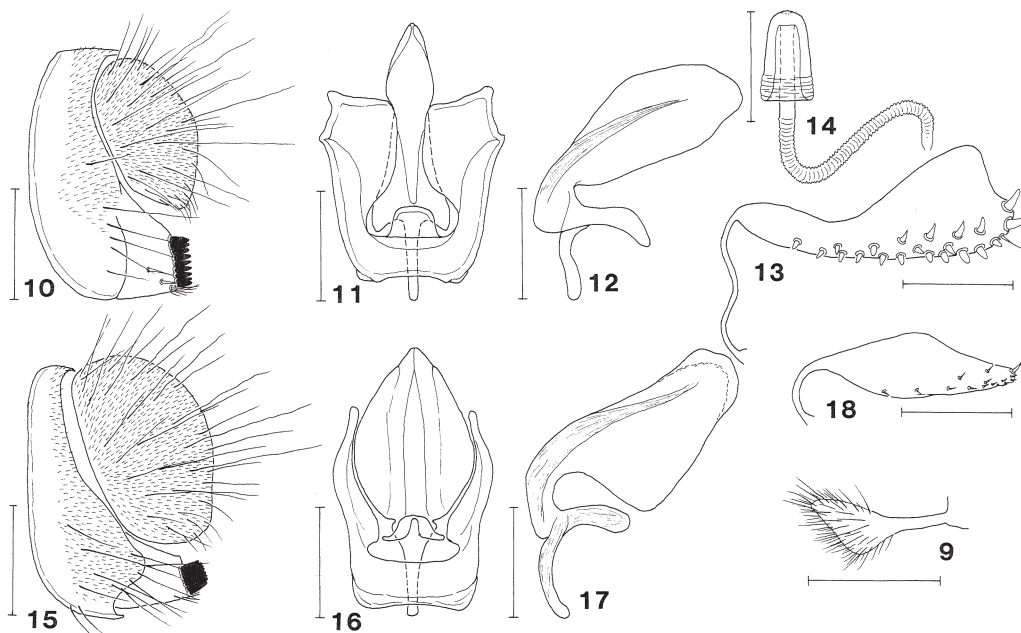
Relationship. This species is somewhat close to *D. quadrisetata*, but easily distinguishable from the latter by the diagnostic characters.

Remarks. This species is named in honor of our colleague, Dr. K. Beppu, Shinshu University, who provided us with the material.

Drosophila (Drosophila) potamophila sp. nov.
(Figs. 15–18)

Diagnosis. Epandrium narrow in submedian to upper part, broad below; caudal margin of lower part sigmoidal; toe pointed (Fig. 15). Ovipositor slender, apically somewhat truncate, with 1 stout apical tooth, *ca.* 12 minute marginall teeth in somewhat irregular rows and *ca.* 2 small discal teeth (Fig. 18). Spermatheca unsclerotized.

The characters such as eye, antenna, frons, clypeus, acrostichal hairs and so on are same as in



Figs. 9–14. *Drosophila (Drosophila) beppui* sp. nov. 9: ♂ palpus. 10: Periphallic organs. 11: Phallic organs. 12: Aedeagus (lateral view). 13: Ovipositor. 14: Spermatheca. (Scale-line=0.1 mm.)

Figs. 15–18. *Drosophila (Drosophila) potamophila* sp. nov. 15: Periphallic organs. 16: Phallic organs. 17: Aedeagus (lateral view). 18: Ovipositor. (Scale-line=0.1 mm.)

the foregoing species, *D. beppui*, and not referred to in the following description.

♂, ♀. Body length, ♂ *ca.* 2.4 mm (2.22–2.49), ♀ *ca.* 2.5 mm (2.21–2.94). Thorax length, ♂ *ca.* 1.0 mm (0.89–1.08), ♀ *ca.* 1.0 mm (0.90–1.10).

Head: Arista with *ca.* 4 (3–5) upper and 2 lower small branches. Periorbit darker than frons. Anterior reclinate orbital *ca.* 4/9 (0.46, 0.39–0.53) length of posterior reclinate; proclinate *ca.* 5/9 (0.53, 0.47–0.57) length of posterior reclinate. Face grayish brown. Cheek grayish brown, *ca.* 2/7 (0.27, 0.23–0.32) as broad as maximum diameter of eye. Palpus dark gray, club-shaped, with several long and numerous small setae.

Thorax grayish brown. Humeral 2, subequal. Second pair of dorsocentrals located beside suture. One or 2 pairs of acrostichal bristles present; anterior pair between 1st dorsocentrals, posterior pair (if present) between 2nd dorsocentrals. Relative lengths of dorsocentrals and acrostichal bristles to 4th dorsocentral: 1st dorsocentral *ca.* 5/8 (0.62, 0.57–0.68), 2nd *ca.* 5/8 (0.63, 0.49–0.68), 3rd *ca.* 3/4 (0.74, 0.67–0.81), anterior acrostichal bristle *ca.* 1/2 (0.51, 0.43–0.60), posterior (if present) *ca.* 1/2 (0.50, 0.38–0.64). Length distance from 1st dorsocentral to 2nd *ca.* 1/2 (0.52, 0.48–0.61), distance from 2nd to 3rd *ca.* 3/5 (0.59, 0.52–0.65), distance from 3rd to 4th *ca.* 1/2 (0.52, 0.46–0.58) cross distance between 3rds. Anterior scutellar *ca.* 9/10 (0.92, 0.74–1.06) length of posterior. Sterno-index *ca.* 0.7 (0.56–0.91).

Legs grayish brown.

Wing fuscous. Veins dark brown. R_{2+3} slightly curved to costa at tip. Wing indices: C *ca.* 2.4 (2.14–2.77), 4V *ca.* 1.8 (1.59–2.05), 4C *ca.* 1.0 (0.88–1.16), 5x *ca.* 1.4 (1.26–1.60), Ac *ca.* 2.2 (1.96–2.45), C3-fringe *ca.* 0.9 (0.82–0.95). Haltere grayish brown.

Abdomen: Tergites nearly entirely dark grayish brown. Sternites grayish brown.

Periphallic organs (Fig. 15): Epandrium pubescent except anterior margin, with *ca.* 12 bristles in lower part. Surstylus quadrate, distally narrowing, with *ca.* 8 primary teeth in straight row on distal margin and several small bristles at caudoventral corner. Cercus with *ca.* 42 bristles.

Phallic organs (Figs. 16, 17): Aedeagus broad in both ventral and lateral views. Ventral fragma

quadrate; hypandrium large, triangular.

♀ reproductive organs: Basal ithmus of ovipositor *ca.* 1/4 as long as ovipositor (Fig. 18).

Holotype ♂, China: Dinghushan, Guangdong Province, 3. IX. 1987, ex trap (K. Beppu).

Paratypes, China: 1 ♂, 1 ♀, same data as holotype; 1 ♂, 2 ♀, same data except 21. VIII. 1987, 2 ♂, 6 ♀, Nankunshan, Guangdong Province, 27, 28. VIII. 1987, ex trap (K. Beppu).

Distribution. China: Guangdong.

Relationship. This species is somewhat similar to the foregoing species, *D. beppui*, but clearly distinguishable from the latter by the diagnostic characters.

D. histrio Species-group

D. histrio species-group, Okada, 1966, Bull. Brit. Mus. (Nat. Hist.) Ent. Suppl., 6: 99.

Drosophila (Drosophila) liae sp. nov.

(Figs. 19–24)

Diagnosis. Thoracic pleura dark brown; episternum paler below. Aedeagus apically with 1 pair of small, acute, thorn-like projections (Figs. 20, 21). Anterior paramere absent (Fig. 20). Hypandrial process elongate, distally expanded triangularly, somewhat irregularly serrate on margin (Fig. 22).

♂, ♀. Body length, ♀ *ca.* 2.2 mm. Thorax length *ca.* 1.0 mm.

Head: Eye orange red, with pile. Antenna with 2nd joint dark brown and 3rd grayish. Arista with 6 or 7 upper and 3 lower branches in addition to terminal fork. Frons *ca.* 4/9 (0.45, 0.43–0.46) as wide as head, orange brown, anteriorly with a few frontal hairs; periorbit and ocellar triangle darker, especially on inside margins of ocelli. Anterior reclinate orbital *ca.* 3/8 (0.39, 0.36–0.41) length of posterior reclinate; proclinate *ca.* 4/7 (0.57, 0.52–0.62) length of posterior reclinate. Face brown; carina high, narrow. Clypeus dark brown. Cheek yellowish brown, narrower than 1/10 of maximum diameter of eye (0.09, 0.08–0.09). Second oral *ca.* 5/6 (0.83, 0.67–0.98) length of vibrissa. Palpus pale brown, club-shaped, with several prominent setae on apical to lateral margin, in ♂ with numer-

ous small setae on ventral surface.

Thorax: Mesoscutum orange brown; scutellum yellowish brown. Humerals 2, subequal. Acrostichal hairs in 6 rows. Anterior dorsocentral *ca.* 5/9 (0.55) length of posterior; length distance of dorsocentrals *ca.* 1/2 (0.50, 0.46–0.53) cross distance. Posterior scutellars equidistant to each other and to anterior. Sterno-index *ca.* 0.5 (0.52–0.55); mid sternopleural *ca.* 1.3 (1.31–1.32) times longer than anterior.

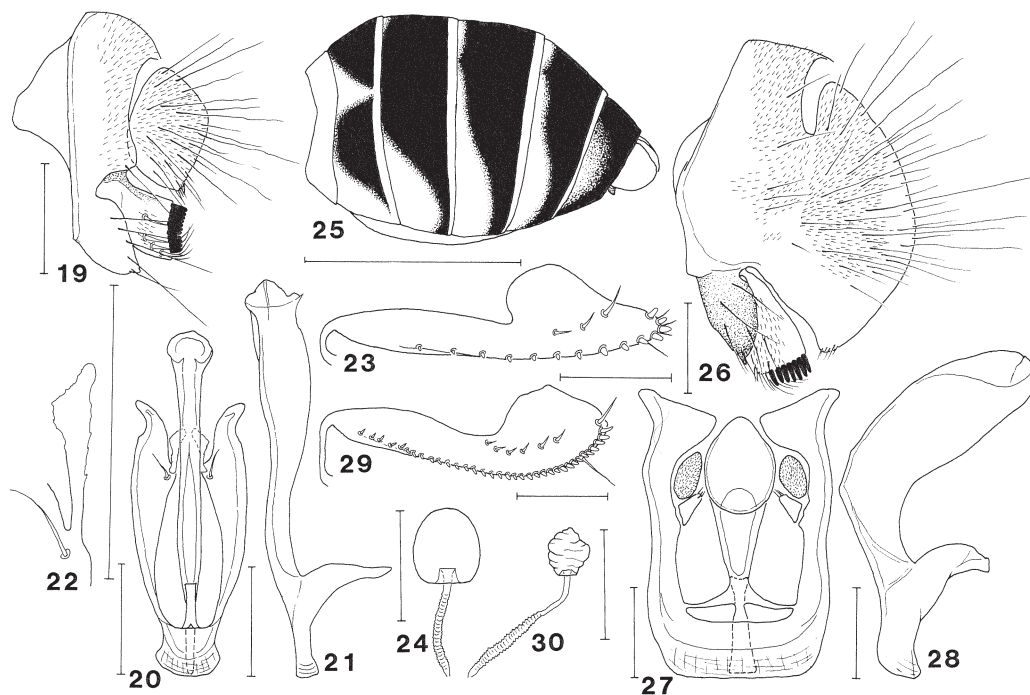
Legs pale brown. Preapicals on all tibiae; apicals on fore and mid tibiae. Fore metatarsus slightly longer than 2 succeeding tarsal joints together; mid and hind metatarsi slightly longer than 3 succeeding together.

Wing hyaline, slightly fuscous. Veins brown; anterior cross vein clear; posterior clouded. R_{2+3} slightly curved to costa at tip; R_{4+5} and M nearly parallel. C1-bristles 2; ventral one somewhat weak. Wing indices: C *ca.* 3.3 (3.22–3.31), 4V *ca.*

1.6 (1.51–1.68), 4C *ca.* 0.7 (0.67–0.73), 5x *ca.* 1.3 (1.31–1.35), Ac *ca.* 2.4 (2.37–2.44), C3-fringe *ca.* 0.5 (0.51–0.57). Haltere white; stalk anteriorly dark gray.

Abdomen: Tergites yellow; 2nd to 5th each with medially interrupted, laterally forward extending, dark brown, caudal band. Sternites pale yellow.

Periphallic organs (Fig. 19): Epandrium pubescent mediocaudally to dorsally, constricted deeply at base of surstylus, with 1 bristle in middle part and 5 in lower part; heel present; toe somewhat pointed. Surstylus quadrate, broad, medially slightly pubescent, with 11 primary teeth in slightly concave row on distal margin, 4 spines on outer surface and many curved setae on inner surface. Cercus oval, pubescent except ventral portion, separate from epandrium, with *ca.* 28 bristles and tuft of a few short bristles at caudoventral, somewhat pointed corner.



FIGS. 19–24. *Drosophila (Drosophila) liae* sp. nov. 19: Periphallic organs. 20: Phallic organs. 21: Aedeagus (lateral view). 22: Hypandrial process and submedian spine. 23: Ovipositor. 24: Spermatheca. (Scale-line=0.1 mm.)
FIGS. 25–30. *Drosophila (Drosophila) fluvialis* sp. nov. 25: ♂ abdomen. 26: Periphallic organs. 27: Phallic organs. 28: Aedeagus (lateral view). 29: Ovipositor. 30: Spermatheca. (Scale-line=1 mm in 25, 0.1 mm in 26–30.)

Phallic organs (Figs. 20–22): Aedeagus slender, basally with vertical rod; apodeme short, *ca.* 1/3 as long as aedeagus. Posterior paramere absent. Novasternum narrow, long, with 1 pair of submedian spines at bases of hypandrial processes; median notch deep, wide.

♀ reproductive organs: Ovipositor (Fig. 23) dorso-submedially expanded, apically round, with 3 bristle-like discal, *ca.* 14 apically round, marginal teeth, 3 short terminal and 1 subterminal hairs; basal ithmus narrow, short. Spermatheca (Fig. 24) ellipsoidal; introvert shallow, *ca.* 1/5 height of outer capsule; duct distally expanded.

Holotype ♂, China: Conghua, Guangdong Province, 27. I. 1987, by sweeping on forest floor (M. J. Toda).

Paratype, China: 1 ♀, Dinghushan, Guangdong Province, 24. I. 1987, by sweeping on forest floor (M. J. Toda).

Distribution. China: Guangdong.

Relationship. This species is closely related to *D. trisetosa* Okada, 1966, but readily distinguishable from the latter by the diagnostic characters.

Remarks. This species is named in honor of Dr. Li Ying Li, the director of the Guangdong Institute of Entomology, who understood and promoted this study.

Ungrouped Species

Drosophila (Drosophila) fluvialis sp. nov.

(Figs. 25–30)

Diagnosis. Third to 6th abdominal tergites each with medially uninterrupted and broad, laterally narrowing blackish brown, caudal band (Fig. 25). Cercus fused broadly to epandrium (Fig. 26). Aedeagus large, curved ventrad, with vertical rod (Fig. 28). Anterior paramere narrowly separate from novasternum, triangular, apically with *ca.* 3 sensilla (Fig. 27). Finely pubescent, oval hypandrial plate present posteriorly to anterior paramere, separate from novasternum (Fig. 27).

♂, ♀. Body length, ♀ *ca.* 3.1 mm (2.70–3.36), ♀ *ca.* 3.2 mm (3.01–3.36). Thorax length, ♂ *ca.* 1.4 mm (1.27–1.57), ♀ *ca.* 1.5 mm (1.34–1.55).

Head: Eye brownish red, with thick pile. Second joint of antenna dark grayish brown; 3rd

dark gray. Arista with 3 upper and 1 or 2 lower branches in addition to terminal fork. Frons *ca.* 1/2 (0.49, 0.47–0.51) as wide as head, brown, anteriorly with frontal hairs; ocellar triangle darker. Anterior reclinate orbital *ca.* 1/3 (0.35, 0.25–0.46) length of posterior reclinate; proclinate *ca.* 6/7 (0.86, 0.75–0.94) length of posterior reclinate. Face brownish yellow, medially whitish; carina high, broad. Clypeus brown. Cheek brownish yellow, dark gray below eye and on anteroventral margin, *ca.* 1/4 (0.25, 0.21–0.26) as broad as maximum diameter of eye. Second oral *ca.* 2/5 (0.40, 0.29–0.52) length of vibrissa. Palpus grayish yellow, with several long setae.

Thorax: Mesoscutum grayish brown, medially darker; scutellum dark grayish brown; thoracic pleura grayish yellow. Humerals 2; upper one longer. Acrostichal hairs in 6 somewhat irregular rows. Anterior dorsocentral *ca.* 2/3 (0.65, 0.59–0.67) length of posterior; length distance of dorsocentrals *ca.* 3/8 (0.38, 0.34–0.42) cross distance. Anterior scutellar *ca.* 8/9 (0.89, 0.83–0.95) length of posterior; posteriors nearer to each other than to anterior. Sterno-index *ca.* 0.7 (0.63–0.77).

Legs grayish yellow; fore tibia and tarsus blackish. Preapicals on all tibiae; apicals on fore and mid tibiae. All metatarsi much longer than rest of tarsal joints together. ♂ fore tarsus anteriorly with many erected hairs.

Wing hyaline. Veins dark brown; cross veins clear. R_{2+3} slightly curved to costa at tip; R_{4+5} and M nearly parallel. C1-bristle 1. Wing indices: C *ca.* 3.0 (2.74–3.62), 4V *ca.* 1.9 (1.77–2.06), 4C *ca.* 0.9 (0.71–0.94), 5x *ca.* 1.3 (1.06–1.35), Ac *ca.* 2.1 (1.97–2.35), C3-fringe *ca.* 0.9 (0.83–0.93). Haltere pale grayish brown; anterior side of stalk darker.

Abdomen (Fig. 25): Tergites yellow; 2nd with 1 pair of large, triangular, blackish brown patches. Sternites pale yellow, quadrate; ♂ 5th longer than broad, concave on caudal margin.

Periphallallic organs (Fig. 26): Epandrium yellow, broad, pubescent caudally and dorsally, with *ca.* 5 bristles in middle to upper part; lower blackish, narrow, apically pointed, with *ca.* 6 bristles. Surstylus quadrate, pubescent on medial to ventral outer surface, with 7 primary teeth in straight row on distal margin, 2 straight spines on

outer surface and numerous recurved spines at caudoventral corner and on inner surface. Cercus large, oval, pubescent medially to dorsally, with *ca.* 40 bristles; ventral part bare except for tuft of short bristles on caudoventral apex.

Phallic organs (Figs. 27, 28): Aedeagal apodeme *ca.* 1/4 as long as aedeagus. Posterior paramere absent. Novasternum quadrate, longer than broad, without submedian spines.

♀ reproductive organs: Ovipositor (Fig. 29) subapically broad, with *ca.* 6 discal, *ca.* 36 marginal teeth and subterminal hair; ultimate marginal tooth long, bristle-like; basal ithmus narrow, *ca.* 1/5 as long as ovipositor. Spermatheca (Fig. 30) small, less sclerotized, irregularly wrinkled and shaped; introvert very shallow.

Holotype ♂, China: Nankunshan, Guangdong Province, 28. VIII. 1987, ex trap (K. Beppu).

Paratypes, China: 9♂, 25♀, same data as holotype; 1♂, 1♀, same data except 27. VIII. 1987.

Distribution. China: Guangdong.

Relationship. The large, ventrad curved aedeagus and the cercus fused to epandrium suggest the relationship to the *robusta* species-group. However, the abdominal color pattern, the morphology of anterior paramere, the presence of characteristic hypandrial plate and the small, less sclerotized spermatheca are inconsistent with the characters of the latter group.

Drosophila (Drosophila) wakahamai sp. nov.
(Figs. 31–36)

Diagnosis. Arista with 3 upper and 1 lower long branches in addition to large terminal fork. Longest axis of eye oblique to body axis. Wing entirely brownish fuscous. Epandrial toe truncate, with *ca.* 6 short bristles (Fig. 31). Decasternum triangular and with lateral short arms (Fig. 32). Aedeagus bilobed but with apical fusion (Fig. 33). Ventral fragma triangular, basally tapering and with narrow elongation, distally overlapping with hypandrium (Fig. 33).

♂, ♀. Body length, ♂ *ca.* 2.9 mm (2.43–3.50), ♀ *ca.* 3.0 mm (2.84–3.24). Thorax length, ♂ *ca.* 1.2 mm (1.00–1.34), ♀ *ca.* 1.2 mm (1.16–1.33).

Head: Eye dark brownish red, with thick pile. Second joint of antenna dark brown; 3rd gray. Frons slightly wider than 1/2 of head width (0.51, 0.50–0.51), dark brown, anteriorly with frontal hairs; ocellar triangle and periorbit darker. Anterior reclinate orbital *ca.* 3/10 (0.31, 0.25–0.35) length of posterior reclinate; proclinate *ca.* 2/3 (0.68, 0.62–0.72) length of posterior reclinate. Face dark brown, paler below; carina high, broad. Clypeus dark brown. Cheek dark brown, *ca.* 1/4 (0.27, 0.23–0.30) as broad as maximum diameter of eye. Second oral small. Palpus grayish brown, with a few prominent setae.

Thorax: Mesoscutum dark brown, with 1 pair of broad, darker bands between dorsocentrals; scutellum blackish brown, anteromedially paler; thoracic pleura dark brown, with diffuse, darker patch on episternum. Humerals 2, subequal. Acrostichal hairs in 6 rows. Anterior dorsocentral *ca.* 2/3 (0.65, 0.59–0.72) length of posterior; length distance of dorsocentrals *ca.* 1/2 (0.48, 0.40–0.56) cross distance. Anterior scutellar as long as posterior (1.00, 0.93–1.06); posteriors nearer to each other than to anterior. Sterno-index *ca.* 0.7 (0.60–0.85).

Legs brown. Preapicals on all tibiae; apicals on fore and mid tibiae. Fore metatarsus as long as rest of tarsal joints together; mid and hind metatarsi slightly longer than rest together.

Wing apically somewhat pointed. Veins dark brown; cross veins clear. R_{2+3} slightly curved to costa at tip; R_{4+5} and M nearly parallel. C1-bristles 2; lower one thin. Wing indices: C *ca.* 3.7 (3.53–3.79), 4V *ca.* 1.5 (1.41–1.56), 4C *ca.* 0.7 (0.64–0.71), 5x *ca.* 1.3 (1.05–1.50), Ac *ca.* 1.7 (1.59–1.91), C3-fringe *ca.* 0.4 (0.32–0.45). Haltere dark grayish brown.

Abdomen: Tergites nearly entirely blackish brown, each anterolaterally somewhat paler. Sternites pale grayish brown, longer than broad.

Periphallallic organs (Figs. 31, 32): Epandrium pubescent caudally and dorsally, broad medially, narrow below, with *ca.* 1 (0–2) bristle in upper part and *ca.* 2 in middle part; heel prominent. Surstylus blackish brown, narrow proximally, broad distally, with *ca.* 8 primary teeth in concave row on distal margin and several setae at caudoventral corner and on inner surface. Cercus oval, fused to

epandrium, pubescent medially to dorsally, with ca. 42 (33–47) bristles.

Phallic organs (Figs. 33, 34): Aedeagal apodeme as long as aedeagus. Anterior paramere attached to aedeagus, ventrally pubescent, with a few small warts on apical inner surface. Posterior paramere absent. Novasternum without submedian spines; hypandrium somewhat quadrate.

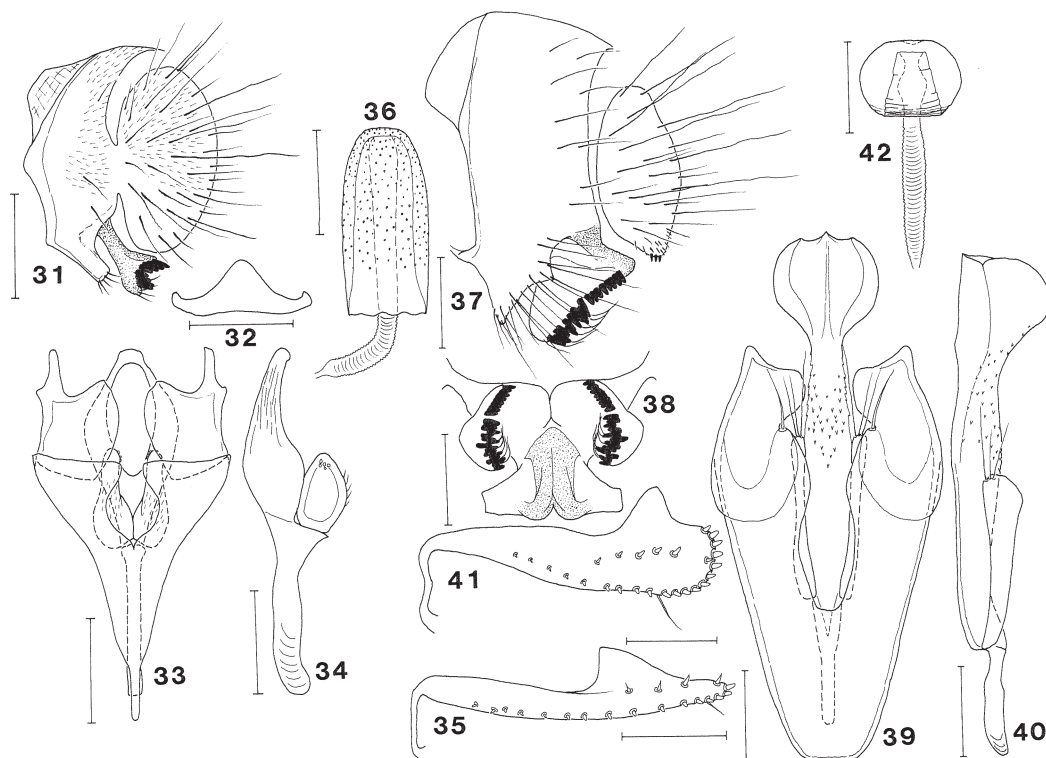
♀ reproductive organs: Ovipositor (Fig. 35) narrow, dorso-subapically expanded triangularly, with ca. 3 apically pointed discal, ca. 17 marginal teeth and subterminal hair; ultimate marginal tooth only apically pointed, other marginals apically round; basal ithmus narrow, ca. 1/5 as long as ovipositor. Spermatheca (Fig. 36) large, long, sinuate on basal margin, with numerous small warts on upper 3/4 outer capsule; introvert wide and deep.

Holotype ♂, China: Nankunshan, Guangdong Province, 28. VIII. 1987, ex trap (K. Beppu).

Paratypes, China: 1 ♂, same data as holotype; 3 ♂, 3 ♀, Dinghushan, Guangdong Province, 22. VIII, 3, 4. IX. 1987, ex traps (K. Beppu).

Distribution. China: Guangdong.

Relationship. This species is conspecific or very close to *Drosophila* (*Drosophila*) sp. a reported by Takada and Wakahama [3]. According to their description, though not referring to the phallic organs, there are slight differences only in the number of bristles on epandrium and the morphology of decasternum between the two forms. Although Takada and Wakahama [3] thought that their form "probably belongs to the *robusta* group", the present species is quite unique in the subgenus *Drosophila*, having the diagnostic characters different from any species-groups of this



FIGS. 31–36. *Drosophila* (*Drosophila*) *wakahamai* sp. nov. 31: Periphallal organs. 32: Decasternum. 33: Phallic organs. 34: Aedeagus and anterior paramere (lateral view). 35: Ovipositor. 36: Spermatheca. (Scale-line=0.1 mm.)

FIGS. 37–42. *Drosophila* (*Drosophila*) *guangdongensis* sp. nov. 37: Periphallal organs. 38: Surstylus and decasternum. 39: Phallic organs. 40: Aedeagus and anterior paramere (lateral view). 41: Ovipositor. 42: Spermatheca. (Scale-line=0.1 mm.)

subgenus. However, the cercus fused to epandrium and the absence of submedian spines on novasternum indicate at least the relationship to the *virilis-repleta* Radiation [4].

Remarks. This species is named in honor of Dr. K. Wakahama, Shimane University.

***Drosophila (Drosophila) guangdongensis* sp. nov.**
(Figs. 37–42).

Diagnosis. Eye bare. Cross veins clear. ♂ abdominal tergites entirely black except for 1st and anterior part of 2nd. ♀ tergites yellow; 2nd with medially interrupted, narrow, dark brown, caudal band; 3rd to 6th each with medially uninterrupted, narrow, caudal band. Surstylus with *ca.* 8 moderate teeth in straight row on upper half distal margin, *ca.* 15 larger teeth in irregular rows on lower half (Fig. 37). Aedeagus long, distally bilobed and swollen (Figs. 39, 40). Anterior paramere long, slender, apically with 3 long bristles, basally attached to aedeagus (Fig. 40).

♂, ♀. Body length, ♂ *ca.* 3.0 mm (2.63–3.19), ♀ *ca.* 3.2 mm (3.01–3.33). Thorax length, ♂ *ca.* 1.4 mm (1.25–1.46), ♀ *ca.* 1.6 mm (1.57–1.79).

Head: Eye orange red. Antenna grayish yellow. Arista with *ca.* 5 (4–6) upper and 3 lower branches in addition to terminal fork. Frons slightly narrower than 1/2 of head width (0.48, 0.47–0.50), orange yellow, anteriorly with frontal hairs; inside margins of ocelli darker; periorbit paler. Anterior reclinate orbital *ca.* 3/7 (0.43, 0.34–0.55) length of posterior reclinate; proclinate *ca.* 7/9 (0.77, 0.72–0.87) length of posterior reclinate. Face orange yellow; carina pale, high, narrow. Clypeus brownish yellow. Cheek orange yellow, *ca.* 1/5 (0.19, 0.16–0.21) as broad as maximum diameter of eye. Second oral small. Palpus grayish yellow, with a few prominent setae.

Thorax brownish yellow. Humeral 2, subequal. Acrostichal hairs in *ca.* 10 irregular rows. Anterior dorsocentral *ca.* 5/9 (0.54, 0.50–0.65) length of posterior; length distance of dorsocentrals *ca.* 3/10 (0.30, 0.24–0.37) cross distance. Anterior scutellar *ca.* 8/9 (0.89, 0.81–0.93) length of posterior; posteriors nearer to each other than to anterior. Sterno-index *ca.* 0.7 (0.63–0.76).

Legs yellow. Preapicals small, but present on

all tibiae; apicals on fore and mid tibiae. Fore metatarsus as long as 2 succeeding tarsal joints together; mid as long as 3 succeeding together; hind as long as rest together.

Wing hyaline. Veins yellow. R_{2+3} slightly curved to costa at tip; R_{4+5} and M slightly convergent distally. C1-bristle 1. Wing indices: C *ca.* 3.1 (2.96–3.35), 4V *ca.* 1.7 (1.56–1.73), 4C *ca.* 0.8 (0.73–0.82), 5x *ca.* 1.4 (1.21–1.65), Ac *ca.* 2.4 (2.13–2.59), C3-fringe *ca.* 0.7 (0.62–0.73). Haltere grayish pale yellow.

Abdomen: Sternites grayish pale yellow; ♂ 5th broader than long.

Periphallic organs (Figs. 37, 38): Epandrium broad, with *ca.* 8 bristles in upper to middle part and *ca.* 23 in lower part; lower part triangular, curved inward, apically pointed, with rectangular corner on caudal margin; heel prominent, pointed. Surstylus broad, with several curved spines on ventral inner surface; upper part fused basally to epandrium, distally to decasternum. Decasternum composed of dark median plate and lateral broad arms. Cercus somewhat narrow, with *ca.* 26 bristles; caudoventral corner somewhat pointed, with 3 stout short spines and several small spines.

Phallic organs (Figs. 39, 40): Aedeagus with numerous spinules on submedian ventral to lateral surface; apodeme short, *ca.* 3/10 as long as aedeagus. Posterior paramere absent. Novasternum long, basally narrowing, with 1 pair of submedian spines at apices of U-shaped hypandrial plates; median notch deep, narrow.

♀ reproductive organs: Ovipositor (Fig. 41) apically quadrate, dorso-subapically expanded triangularly, with *ca.* 5 discal, *ca.* 21 marginal teeth and subterminal hair; basal isthmus narrow, somewhat sinuate, *ca.* 1/4 as long as ovipositor. Spermatheca (Fig. 42) spherical, apically shallowly indented, basally slightly wrinkled; introvert deep, distally narrowing, basally wrinkled; duct expanded medially and distally in introvert.

Holotype ♂, China: Dinghushan, Guangdong Province, 20–28. V. 1986, ex trap (T. X. Peng).

Paratypes, China: 38 ♂, 39 ♀, same data as holotype.

Distribution. China: Guangdong.

Relationship. This species seems to have some affinities to the *D. quinaria* species-group in the

arrangement of teeth on surstylus and the morphology of phallic organs, but clearly differs from the latter group in having the clear cross veins, the bare eye and the neither spotted nor medially interrupted caudal bands on 3rd to 6th abdominal tergites.

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