

## New or Little Known Species of *Drosophila* (*Lordiphosa*) with Taximetical Analyses (Diptera, Drosophilidae)

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**Abstract** Six new species of the subgenus *Lordiphosa* of the genus *Drosophila* are described from Taiwan, Java and New Guinea. Eight drosophilid species of Japan, Korea and Nepal are transferred to this subgenus. Fundamental diagnosis of the subgenus is determined and taximetical analyses to find interspecific relationships are made.

The subgenus *Lordiphosa* BASDEN, 1961 of the genus *Drosophila* FALLÉN, 1823 includes 15 known species divided into 4 species groups: *fenestrarum*, *nigricolor* and *miki* by LAŠTOVKA and MÁČA (1978) and *tenuicauda* by TODA (1981). The present paper adds 6 new species and 8 species transferred to this subgenus. Thus the number of species of this subgenus attains 29.

### Descriptions of New Species

#### *Drosophila* (*Lordiphosa*) *antillaria* n. sp.

(Figs. 1-3)

♂, ♀. Body about 1.6 mm in length. Eye deep purple red, bare. Antenna grayish brown, arista with 6 upper and 5 lower branches and a small fork. Palpus black. Ocellar triangle brown. Periorbits and clypeus yellowish gray. Frons mat yellowish gray, nearly quadrate, anteriorly much broader than median length. Face yellowish gray, carina short. Cheek yellowish white, 1/5 as broad as the greatest diameter of eye, with a black line along insertion of orals. Anterior reclinate orbital minute, outside and close to proclinate, posterior reclinate twice as long as proclinate. Second oral nearly as long as or 2/3 as long as vibrissa. Mesoscutum and scutellum subshining pale yellowish brown. Thoracic pleura paler, with dark brown patches medially and on humerus. Dorsocentrals 2 pairs, anterior half as long as posteriors. Humeral 2, lower longer. Acrostichal hairs in 6 rows. Lateral scutellars divergent, apicals 2/3 as long as laterals and nearer to each other than to laterals. Sterno-index 0.5. Legs yellowish white. Fore metatarsus as long as 3 succeeding tarsal joints, mid and hind as long as the rest of tarsal joints. Wing hyaline,  $R_{2+3}$  slightly curved to costa apically,  $R_{4+5}$  and M parallel. C-index 2.2; 4V-index 1.7; 4C-index 1.0; 5x-index 2.5; Ac-index 2.5; C1-bristles 2; C3-fringe 1/3 or 1/4. Halter yellowish white. Abdominal tergites glossy brownish black, 1T orange. Cerci of ♂ and ♀ white.

Periphallic organs (Fig. 1) with epandrium black, surstylus with about 11 teeth.

Phallic organs (Fig. 2) brown; anterior paramere elongate, curved, subapically branched, thus the specific name. Ovipositor (Fig. 3) dark brown, pointed.

Holotype ♂, Chitau, Nantow, 16–17. VIII. 1967 (OKADA). Paratypes: 21 ♂, 13 ♀, collected together with holotype; 1 ♀, Alishan, Chiayi, 14–15. VIII. 1967 (OKADA). Types in National Science Museum, Tokyo (NSMT).

*Distribution.* Taiwan.

*Relationships.* This species belongs to *nigricolor* species group. It resembles *D. (L.) coei* OKADA from Nepal in general structures and male genitalia, but differs in having anterior paramere not hairy.

***Drosophila (Lordiphosa) subantillaria* n. sp.**

(Fig. 4)

♂, ♀. Body about 1.5 mm in length. Antenna with 2nd joint yellowish gray; arista with 4 upper and 2 lower branches. Palpus brown. Ocellar triangle black. Frons glossy grayish brown, anteriorly yellow. Face pale yellow. Cheek 1/7 as broad as the greatest diameter of eye, pale yellow. Anterior reclinate orbital fine. Second oral half as long as vibrissa. Mesoscutum and scutellum glossy orange gray. Thoracic pleura with a large dark patch. Humeral 2, upper shorter. Acrostichal hairs in 6 rows. Anterior dorsocentrals half posteriors, no supernumerous dorsocentrals. Lateral scutellars slightly divergent, longer than apicals, which are nearer to each other than to laterals. Sterno-index about 0.5. Legs yellowish gray. Fore and hind metatarsi as long as succeeding 3 tarsal joints, mid metatarsus as long as the rest of tarsal joints. Wing hyaline. C-index 2.5; 4V-index 1.9; 4C-index 1.0; 5x-index 1.2; Ac-index 3.0; C3-fringe 1/7. Halter yellowish gray. Abdominal tergites glossy black, anterior half of each tergite obscurely pale.

Periphallallic organs black; surstylus with about 12 teeth. Phallic organs (Fig. 4) black; anterior paramere elongate, submedially branched. Ovipositor brown, apically pointed.

Holotype ♂, Tugu, 27–29. VII. 1971 (OKADA). Paratypes: 2 ♀, collected together with holotype, 1 ♂, Tjibodas, 28. VII. 1971 (IKEDA). Types in NSMT.

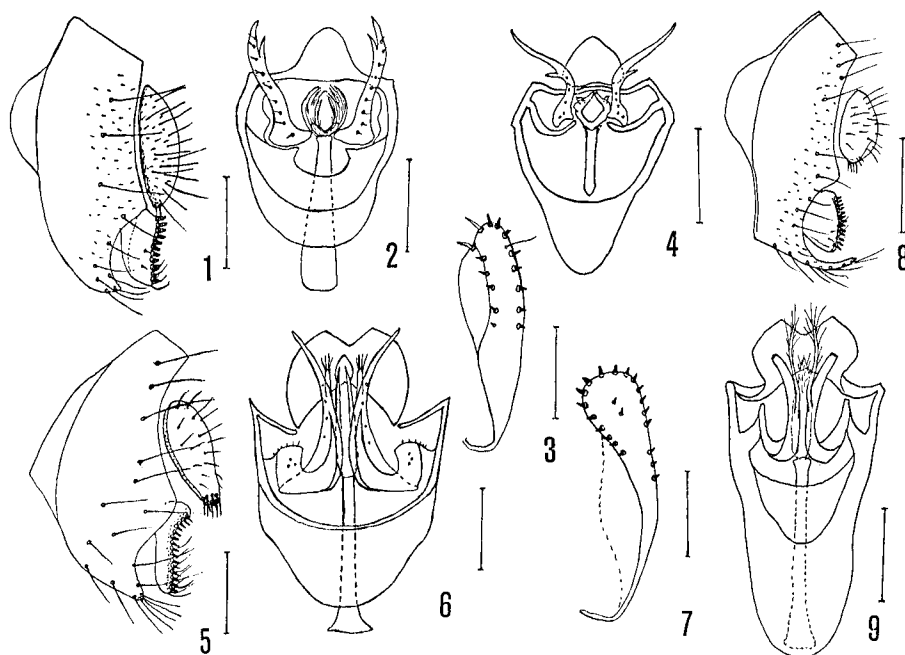
*Distribution.* Java.

*Relationships.* This species belongs to *nigricolor* species group. It closely resembles the foregoing species, different in having abdominal tergites obscurely banded and anterior paramere submedially branched (subapically branched in the related species).

***Drosophila (Lordiphosa) penicula* n. sp.**

(Figs. 5–7)

♂, ♀. Body about 2 mm in length. Eye red, bare. Antenna brown; arista with 7 upper and 3 lower branches and a small fork. Palpus brown. Ocellar tri-



Figs. 1-3. *Drosophila (Lordiphosa) antillaria*; 4, *D. (L.) subantillaria*; 5-7, *D. (L.) penicula*; 8-9, *D. (L.) aurantifrons*. — 1, 5, 8, periphallallic organs; 2, 4, 6, 9, phallic organs; 3, 7, ovipositor. Scales 0.1 mm.

angle small, black. Periorbits glossy brown, broad. Postverticals long, as long as ocellars. Frons brown, anteriorly orange, one and half times as broad as median length. Face grayish brown, buccal margin convexed. Cheek yellowish brown,  $1/8$  as broad as the greatest diameter of eye, with a black line along insertions of orals. Clypeus brown. Anterior reclinate orbitals fine, outside proclinate, which is half as long as posterior reclinate. Second oral thin, slightly shorter than vibrissa. Mesoscutum glossy orange brown, caudally darker. Scutellum darker, pruinose. Thoracic pleura paler, whitish below. Humerals 2, upper shorter. Acrostichal hairs in 6 rows. Dorsocentrals 2 pairs, anteriors  $2/3$  as long as posteriors. Sterno-index 0.5. Lateral scutellars divergent, as long as apicals, which are slightly nearer to each other than to laterals. Legs yellow. Metatarsi as long as the rest of tarsal joints. Wing hyaline,  $R_{2+3}$  gently curved to costa apically,  $R_{4+5}$  and M parallel, both slightly curved anteriorly at middle. C-index 2.0; 4V-index 2.0; 4C-index 1.5; 5x-index 1.5; C3-fringe  $1/5$ . Halter yellowish brown. Abdominal tergites glossy black.

Periphallallic organs (Fig. 5) black; surstylus with about 15 pointed teeth. Phallic organs (Fig. 6) black; anterior paramere subapically and basally branched, subapical branch with apical hair tufts, thus the specific name. Ovipositor (Fig. 7) black, apically truncate.

Holotype ♂, Mt Kaindi, 1900 m, PNG, 30. XI. 1977 (CARSON, by *Alocasia*

*macrorrhiza* plant. Paratypes: 1 ♂, 1 ♀, collected together with holotype, 3 ♂, 1 ♀, Wau, 1300 m, PNG, 4. IX–11. X. 1977 (OKADA). Types in Bishop Museum, some paratypes in NSMT.

*Distribution.* New Guinea.

*Relationships.* This species belongs to *nigricolor* species group. It is unique in having subapical branch of anterior paramere apically hairy.

***Drosophila (Lordiphosa) aurantifrons* n. sp.**

(Figs. 8–9)

♂. Body about 2 mm in length. Eye dark red, with fine pile. Antenna with 2nd joint orange, dark above, 3rd gray, apically dark. Arista with 5 upper and 2 lower branches and a large fork. Palpus black. Ocellar triangle and periorbits glossy black. Clypeus gray. Postverticals very long, parallel. Frons shining golden gray, anteriorly orange, broader than median length. Face yellowish gray, subshining. Carina short. Cheek yellowish gray, 1/5 as broad as the greatest diameter of eye, with a black line along insertions of orals. Anterior reclinate orbitals minute, just behind and inside proclinae, which is half as long as posterior reclinate. Second oral 2/3 as long as vibrissa. Thorax entirely glossy black, somewhat pruinose. Humeral 1, very long. Acrostichal hairs in 6 rows. Dorsocentrals 2 pairs. Lateral scutellars divergent, 2/3 as long as apicals, which are equally apart from each other and from laterals. Sterno-index 0.45. Legs pale yellow. Fore and mid metatarsi as long as succeeding 3 tarsal joints, hind longer than rest of tarsal joints. Wing hyaline,  $R_{2+3}$  strongly curved to costa,  $R_{4+5}$  and M parallel. C-index 2.7; 4V-index 1.7; 4C-index 0.9; 5x-index 2.0; Ac-index 2.8; Cl-bristles 2, C3-fringe 1/4. Halter yellow. Abdominal tergites glossy black.

Periphallalic organs (Fig. 8) black; epandrium elongate caudally below; surstylus with about 10 strong teeth; cercus pale, oval, ventrally with several strong setae. Phallic organs (Fig. 9) black; anterior paramere long, apically truncate, subapically with a slender branch, which is distally hairy.

Holotype ♂, Chitau, Nantow, 16–17. VIII. 1967 (THROCKMORTON).

*Distribution.* Taiwan.

*Relationships.* This species belongs to *nigricolor* species group. It resembles the foregoing species in having hairy subapical branches of anterior paramere, but the branch is much longer than in the related species.

***Drosophila (Lordiphosa) chaolipinga* n. sp.**

(Figs. 10–12)

♂, ♀. Body about 2 mm in length. Eye dark red, with pile. Antenna dark brown; arista with 3 upper and 1 lower branches. Palpus orange yellow. Ocellar triangle and periorbit glossy dark gray. Frons orange brown, anteriorly half as

broad as head width. Face gray, clypeus pale brown. Cheek orange,  $1/5$  as broad as the greatest diameter of eye. Anterior reclinate orbital fine, close to proclinate. Second oral half as long as vibrissa. Mesoscutum mat orange, scutellum same color but paler marginally. Thoracic pleura fuscous. Acrostichal hairs in 6 rows. Dorsocentrals 2 pairs, anteriors  $3/5$  as long as posteriors. Lateral scutellars longer than apicals. Sterno-index 0.5. Legs yellow; metatarsi nearly as long as succeeding 3 tarsal joints. Wing hyaline, crossveins somewhat clouded. C-index 3.1; 4V-index 1.9; 4C-index 0.9; 5x-index 1.7; Ac-index 2.0; C1-bristles 2, C3-fringe  $1/4$ . Halter orange. Abdominal tergites glossy black, cercus white, ♂ 1T yellowish orange.

Periphallallic organs (Fig. 10) black; epandrium narrowly pointed below; surstylus quadrate, with about 10 teeth. Phallic organs (Fig. 11) black; anterior paramere yellow, elongate, distally hairy, with median and basal short branches. Aedeagus serrated laterally. Ovipositor (Fig. 12) black, somewhat pointed.

Holotype ♂, Fenchihu, Chiayi, 1400 m, 12. IV. 1965 (SAIGUSA), Paratypes, 1 ♀, collected together with holotype, 1 ♂, Chiaoliping, Chiayi, 1400 m, 12. IV. 1965 (SAIGUSA). Types in NSMT.

*Distribution.* Taiwan.

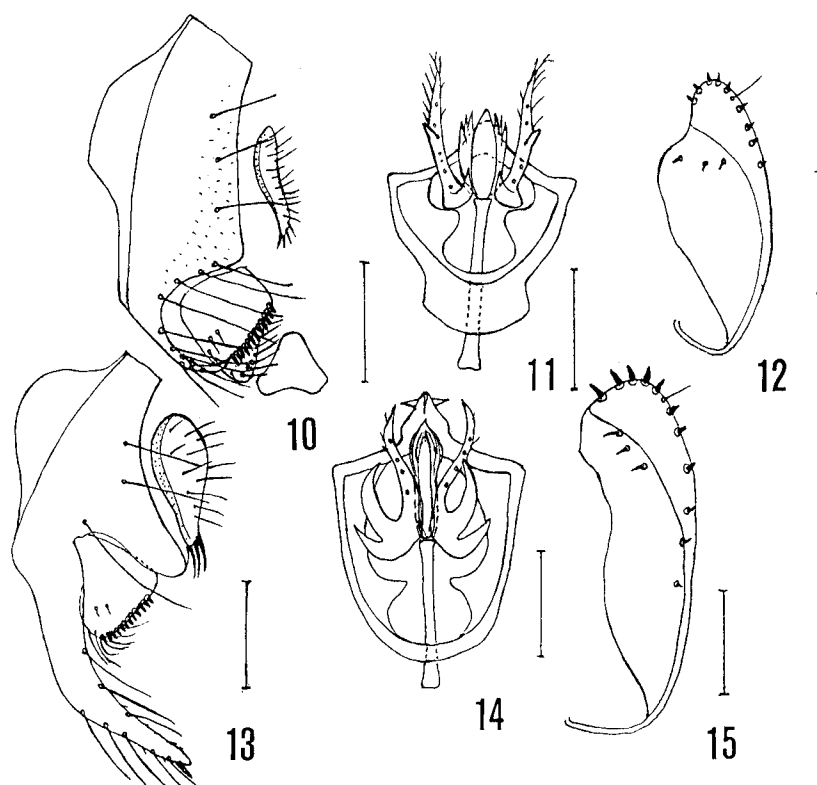
*Relationships.* This species belongs to *nigricolor* species group. It resembles *D. (L.) coei* in having anterior paramere hairy and aedeagus serrated, but differs in ventrally much narrowing epandrium.

### *Drosophila (Lordiphosa) porrecta* n. sp.

(Figs. 13-15)

♂, ♀. Body about 2 mm in length. Eye dark red, with fine pile. Antenna grayish brown; arista with 5 or 6 upper and 2 or 3 lower branches. Palpus brown. Ocellar triangle black. Periorbits gray, pruinose. Clypeus brown. Frons glossy brown, anteriorly orange and broader than median length. Face gray. Cheek yellowish gray,  $1/6$  as broad as the greatest diameter of eye. Anterior reclinate orbital minute, outside proclinate, which is half as long as posterior reclinate. Second oral slightly shorter than or half as long as vibrissa. Mesoscutum subshiny gray brown; humerus dark above. Scutellum mat grayish brown. Thoracic pleura dark brown, paler above. Humeral 2, upper shorter. Acrostichal hairs in 6 rows. Anterior dorsocentrals slightly shorter than posteriors, no supernumerous dorsocentrals. Lateral scutellars divergent, apicals longer than laterals and nearer to each other than to laterals. Sterno-index 0.5. Legs yellow. Metatarsi as long as succeeding 3 tarsal joints. Wing hyaline, posterior crossvein somewhat clouded. C-index 2.2; 4V-index 2.0; 4C-index 1.2; 5x-index 1.5; C1-bristles 2, lower longer; C3-fringe  $1/3$  to  $1/4$ . Halter white. Abdominal tergites black, 1T usually yellowish orange.

Periphallallic organs (Fig. 13) black; epandrium ventrally much elongated, thus the specific name, subapically with a strong tooth. Phallic organs (Fig. 14) black, Anterior paramere elongate, subapically hairy, basally with a long branch.



Figs. 10–12, *Drosophila (Lordiphosa) chaolipinga*; 13–15, *D. (L.) porrecta*. — 10, 13, peripheral phallic organs; 11, 14, phallic organs; 12, 15, ovipositor. Scales 0.1 mm.

Ovipositor (Fig. 15) black, apically somewhat truncate.

Holotype ♂, Chitau, Nantow, 16–17. VIII. 1967 (OKADA, THROCKMORTON). Paratypes. 2 ♂, 8 ♀, collected together with holotype; 2 ♂, 4 ♀, Alishan, Chiayi, 14. VIII. 1967 (OKADA, THROCKMORTON). Types in NSMT.

*Distribution.* Taiwan.

*Relationships.* This species belongs to *nigricolor* species group. It resembles *D. (L.) antillaria* in general body coloration, but differs in having epandrium much more elongate below.

#### The Species Newly Transferred to the Subgenus *Lordiphosa*

The *nipponica* species subgroup of the *melanogaster* species group is found to be synonymous with the *miki* species group. Thus:

*Drosophila (Lordiphosa) nipponica* KIKKAWA et PENG **n. status**

*D. (Sophophora) nipponica* KIKKAWA et PENG, 1938. Jap. J. Zool., 7: 531.

*D. (Lordiphosa) magnipectinata* OKADA **n. status**

*D. (Sophophora) magnipectinata* OKADA, 1956. *Systematic study of Drosophilidae of Japan*: 113.

*D. (Lordiphosa) clarofinis* LEE **n. status**

*D. (Sophophora) clarofinis* LEE, 1959. Kor. J. Zool., 4: 43.

The *momma* species group of the subgenus *Sophophora* is discarded because *D. mommai* TAKADA et OKADA was already transferred to the *nigricolor* species group by LAŠTOVKA and MÁČA (1978). The following two Nepalese species of "mommai" group are also transferred to the latter species group.

*D. (Lordiphosa) zonaria* OKADA n. status

*D. (Sophophora) zonaria* OKADA, 1966. Bull. Brit. Mus. (NH), Ent. Suppl., (6): 83.

*D. (Lordiphosa) serriflabella* OKADA n. status

*D. (Sophophora) serriflabella* OKADA, 1966. Bull. Brit. Mus. (NH), Ent. Suppl., (6): 84.

Concerning the *grandis* species group of the subgenus *Drosophila*, *D. grandis* KIKKAWA et PENG itself was transferred to the genus *Zapriouns* by OKADA and CARSON (1983), and *D. tenuicauda* OKADA to the *tenuicauda* species group by TODA (1983). The following two species are also transferred to the latter species group.

*D. (Lordiphosa) acutissima* OKADA n. status

*D. (D.) acutissima* OKADA, 1956. Systematic study of Drosophilidae of Japan: 139.

*D. (Lordiphosa) flexicauda* OKADA n. status

*D. (D.) flexicauda* OKADA, 1966. Bull. Brit. Mus. (NH), Ent. Suppl. (6): 101.

Having large penis envelope (posterior parameres), branched anterior paramere, and ventrally pointed male cercus, the following species should be placed in the *nigricolor* species group.

*D. (Lordiphosa) ripa* (OKADA) n. comb.

*Diathoneura ripa* OKADA, 1966. Bull. Brit. Mus. (NH), Ent. Suppl., (6): 65.

### Fundamental Diagnosis of the Subgenus *Lordiphosa*

Detailed diagnosis of the subgenus *Lordiphosa* concerning external morphology was given by BASDEN (1961) and LAŠTOVKA and MÁČA (1978). BASDEN (1961) gave more fundamental diagnosis of 1. seminal receptacle (=ventral receptacle) long, narrow, and loosely looped and 2. egg with two short filaments, basing on a single example of *D. (L.) andulsiaca* STROBL. The character 1 has been proved by myself also for *collinella*, *momma*, *nipponica*, *magnipectinata* and *tenuicauda*, and the character 2 for *antillaria*, *subantillaria*, *collinella*, *momma* and after LEE (1959) also for *clarofinis*. In subdividing the genus *Drosophila*, Sturtevant (1921) put importance upon these two characters together with 3. posterior Malpighian tubules, whether they are ending free, apically closely apposed, or apically fused with each other. They are proved to be closely apposed for *collinella*, *momma*, *nipponica* and *magnipectinata* by TAKADA and OKADA (1960). The *tenuicauda* species group is found to be remotely related to the other species groups (TODA, 1983) also in view of internal anatomy and egg; *acutissima*, *tenuicauda* and *pseudotenuicauda* have posterior Malpighian tubules apically fused and egg filaments four and long, although they

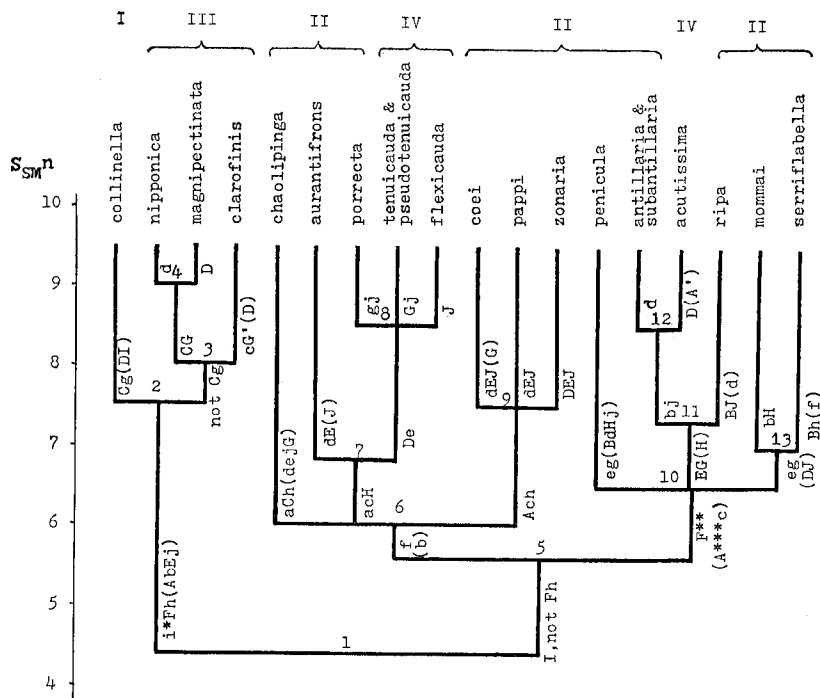


Fig. 16. A dendrogram to show relationships of the species of *Drosophila* (*Lordiphosa*), based on  $S_{SM}$  proximity analysis and UPGMA cluster analysis. Alphabetical figures are character states, numerical figures on the branching points of dendrogram are couplets in the key derived from the dendrogram. Roman numerals indicate species groups: I. *fenestrarum*, II. *nigricolor*, III. *miki*, IV. *tenuicauda*. \* Excluding *collinella*, \*\* excl. *serriflabella*, \*\*\* excl. *acutissima*.

have long and loosely looped ventral receptacle.

Confirmed (1, 2) and additional (3) fundamental subgeneric diagnosis: 1. ventral receptacle long and loosely looped, 2. egg with 2 short filaments, 3. posterior Malpighian tubules apically closely apposed (2, 3. except for *tenuicauda* species group).

### Taximetical Analyses

Taximetical analyses using  $S_{SM}$  proximity analysis and UPGMA cluster analysis are made on 20 *Lordiphosa* species around Japan over the following 10 diagnostic characters coded in two states (0, 1) with intermediate state (0.5) if necessary.

- “A” Epandrium obtuse (A=0) or elongate below (a=1) or intermediate (A'=0.5).
- “B” Surstylus linear (B=0) or quadrate (b=1).
- “C” Male cercus linear (C=0) or oval (c=1).
- “D” Anterior paramere without (D=0) or with (d=1) subapical branch.
- “E” Anterior paramere without (E=0) or with (e=1) basal branch.



- “F” Anterior paramere not hairy (F=0) or hairy (f=1).  
 “G” Ovipositor apically pointed (G=0) or truncate (g=1) or intermediate (G'=0.5).  
 “H” Aedeagus not pectinate (H=0) or pectinate (h=1).  
 “I” Male fore leg without (I=0) or with (i=1) sex combs.  
 “J” Mesoscutum blackish (J=0) or yellowish (j=1).

The resulted dendrogram is shown in Fig. 16. The *miki* species group is clustered together with the *fenestrarum* species group and the *tenuicauda* species group is not separated from the *nigricolor* species group.

From this dendrogram a sequential key and simultaneous key (including items in brackets) are automatically produced. Some supplementary characters are incorporated in couplets 8', 9 and 12'.

### Sequential and Simultaneous Keys to Species

1. Male fore leg with sex-combs (i) (excl. *collinella*), anterior paramere not hairy (F), aedeagus pectinate (h); [epandrium obtuse below (A), surstylus quadrate (b), anterior paramere without basal branch (E), mesoscutum yellowish (j)]... 2.  
 — Male fore leg without sex-combs (I), not simultaneously anterior paramere not hairy (F) and aedeagus pectinate (h)..... 5.
2. Male cercus linear (C), ovipositor apically truncate (g); [anterior paramere without subapical branch (D), male fore leg without sex-combs (I)]... *collinella*  
 — Not simultaneously male cercus linear (C) and ovipositor apically truncate (g).  
 ..... 3.
3. Male cercus oval (c), ovipositor apically rounded (G'); [anterior paramere without subapical branch (D)]..... *clarofinis*  
 — Male cercus linear (C), ovipositor apically pointed (G)..... 4.
4. Anterior paramere with subapical branch (d) ..... *nipponica*  
 — Anterior paramere without subapical branch (D)..... *magnipectinata*
5. Anterior paramere hairy (f); [surstylus quadrate (b)] ..... 6.  
 — Anterior paramere not hairy (F) (excl. *serriflabella*); [epandrium obtuse below (A) (excl. *acutissima*), male cercus oval (c)]..... 10.
6. Epandrium elongate below (a), male cercus linear (C), aedeagus pectinate (h); [anterior paramere with subapical branch (d), anterior paramere with basal branch (e), mesoscutum yellowish (j), ovipositor apically pointed (G)].....  
 ..... *chaolipinga*  
 — Epandrium elongate below (a), male cercus oval (c), aedeagus not pectinate (H). ..... 7.  
 — Epandrium obtuse below (A), male cercus oval (c), aedeagus pectinate (h)... 9.
7. Anterior paramere with subapical branch (d), anterior paramere without basal branch (E); [mesoscutum blackish (J)]..... *aurantifrons*  
 — Anterior paramere without subapical branch (D), anterior paramere with basal

- branch (e).....8.
8. Ovipositor apically truncate (g), mesoscutum yellowish (j).....*porrecta*  
 — Ovipositor apically pointed (G), mesoscutum yellowish (j).....8'  
 — Mesoscutum blackish (J). ....*flexicauda*
- 8'. Caudal black bands of abdominal tergites interrupted at middle, surstylus teeth  
 8-9, outer lobe of anterior paramere asymmetrical, male cerus elongate below.  
 .....*tenuicauda*  
 — Caudal black bands of abdominal tergites contiguous at middle, surstylus teeth  
 about 12, outer lobe of anterior paramere symmetrical, male cercus not elongate  
 below.....*pseudotenuicauda*
9. Anterior paramere with subapical branch (d), anterior paramere without basal  
 branch (E), mesoscutum blackish (J), frons pale; [ovipositor apically pointed  
 (G)]. ....*coei*  
 — Anterior paramere with subapical branch (d), anterior paramere without basal  
 branch (E), mesoscutum blackish (J), frons black. ....*pappi*  
 — Anterior paramere without subapical branch (D), anterior paramere without  
 basal branch (E), mesoscutum blackish (J). ....*zonaria*
10. Anterior paramere with basal branch (e), ovipositor apically truncate (g); [sur-  
 stylus linear (B), anterior paramere with subapical branch (d), aedeagus not  
 pectinate (H), mesoscutum yellowish (j)].....*penicula*  
 — Anterior paramere without basal branch (E), ovipositor apically pointed (G);  
 [aedeagus not pectinate (H)]. ....11.  
 — Anterior paramere with basal branch (e), ovipositor apically truncate (g);  
 [anterior paramere without subapical branch (D), mesoscutum blackish (J)]. .13.
11. Surstylus linear (B), mesoscutum blackish (J); [anterior paramere with subapical  
 banch (d)].....*ripa*  
 — Surstylus quadrate (b), mesoscutum yellowish (j).....12.
12. Anterior paramere without subapical branch (D); [epandrium truncate below  
 (A')].....*acutissima*  
 — Anterior paramere with subapical branch (d).....12'
- 12'. Lateral lobe of aedeagus serrated, anterior paramere subapically serrated.....  
 .....*antillaria*  
 — Lateral lobe of aedeagus not serrated, anterior paramere submedially branched.  
 .....*subantillaria*
13. Surstylus quadrate (b), aedeagus not pectinate (H).....*mommai*  
 — Surstylus linear (B), aedeagus pectinate (h); [anterior paramere hairy (f)]. ....  
 .....*serriflabella*

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