

**A REVISION OF THE GENUS *EOSTEGANA*
(DIPTERA: DROSOPHILIDAE), WITH DESCRIPTIONS
OF FIVE NEW SPECIES¹**

Toyohi Okada²

Abstract. The genus *Eostegana* of the family Drosophilidae is reviewed with descriptions of 5 new species from the Bishop Museum collection from the Philippines, New Guinea, Bismarck Archipelago and Solomon Is. Division of the genus into 2 species groups is proposed. The wing patterns are taximetrically analyzed to illustrate relationships of the species. A key to species-groups and species is automatically constructed from the resulting dendrogram.

The genus *Eostegana* Hendel has been distinguished from the genus *Stegana* Meigen by having R_{4+5} and M distally divergent. Although this character breaks down by the finding in this study of exceptional cases in which R_{4+5} and M are slightly convergent distally, in known species the Ac-index, a ratio of length of the 3rd and 4th costal sections, is lower than 4.0 in *Eostegana* but higher than 8.0 in *Stegana*. *Stegana bakeri* Sturtevant was transferred to *Eostegana* (Okada 1977), but this species is better included in *Amiota* (*Amiota*) because it has clear wings.

The type specimens of the new species and all remaining specimens treated here belong to the Bishop Museum, Honolulu, Hawaii (BISHOP).

Genus ***Eostegana*** Hendel, 1913

Eostegana Hendel, 1913, Entomol. Mitt. **2**: 390. Type-species: *Eostegana biroi* Hendel.

Stegophortica Duda, 1923, Ann. Hist.-Nat. Mus. Natl. Hung. **20**: 33. Type-species: *Stegophortica striatipennis*

Duda. Syn. by Duda, 1926, Ann. Hist.-Nat. Mus. Natl. Hung. **23**: 245.

Orthostegana (*Eostegana*): Duda, 1927, Arch. Naturgesch. **91A**(11): 26.

Division of this genus into 2 species-groups is attempted here: I. *biroi* species-group, in which R_{4+5} and M are distally divergent and white patches of wing are few and roughly in 3 groups; II. *tessellata* species-group, in which R_{4+5} and M are distally somewhat convergent and white patches of wing are numerous and scattered.

I. The ***biroi*** species-group

Eostegana punctipennis Okada, new species

Fig. 1A, 2E-F

♂, ♀. Body 3-5 mm in length, generally brownish black. Eye dark red. Antenna with 2nd joint brown, 3rd dark brown. Arista with about 12 upper and 7 lower branches and a small

1. Materials examined are partial results of fieldwork supported by grants to Bishop Museum from the U.S. National Science Foundation (G-4114, G-10734, GB-518, GB-3245, GB-7330), the U.S. National Institutes of Health (AI-01723), and the U.S. Army Medical Research & Development Command (DA-MD-49-193-62-647 & G-65).

2. Gôtokuji 2-30-18, Setagaya-ku, Tokyo 154, Japan.

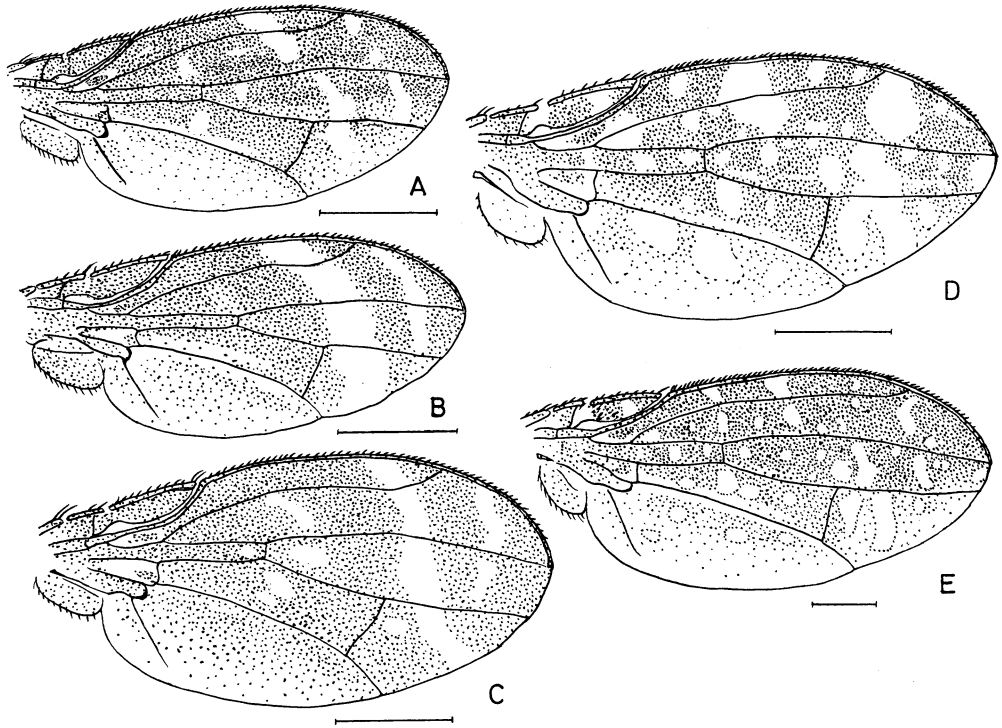


FIG. 1. Wings: A, *Eostegana punctipennis*; B, *E. argentea*; C, *E. inclinata*; D, *E. tessellata*; E, *E. maculosa*. Scales = 1.0 mm.

fork. Palpus black. Frons quadrate. Cheek very narrow. Anterior reclinate orbital nearly as long as proclinate, outside and just behind it. Vibrissa strong, other orals fine. Mesoscutum subshining brown, gray pruinose. Scutellum darker, flat and caudally rounded. Thoracic pleura darker than mesoscutum. Humerals 2, lower one $2\times$ as long as upper. Anterior dorsocentrals $\frac{2}{3}$ as long as posteriors; length distance of dorsocentrals $\frac{3}{8}$ cross distance. Acrostichal hairs in about 20 rows. Apical scutellars $\frac{4}{5}$ as long as laterals, equally apart from each other and from laterals. Sterno-index 0.8. Legs black, tarsi yellow; mid tibia with a row of about 15 bristles above; fore and hind metatarsi as long as other tarsal joints; mid metatarsus $2\times$ as long as other tarsal joints. Wing (Fig. 1A) black, paler along caudal margin, with 3 white bands; inner band composed of 3 small spots around anterior crossvein; median band interrupted by R_{4+5} ; outer band parallel to median band, divided into 3 spots. C-index 1.5; 4V-index 1.0; 4C-index 1.2; 5x-index 0.6; Ac-index 2.5; C3-fringe $\frac{4}{9}$. Halteres yellow. Abdominal tergites matte brownish black, narrowly yellow at caudal margins. Periphallallic organs (Fig. 2E) with epandrium broad, dorsally not narrowing; cercus small; surstylus without teeth. Phallic organs (Fig. 2F) with aedeagus large, ellipsoidal; apodeme short.

Holotype ♂ (BISHOP 11,912), IRIAN: NEW GUINEA (NW): Nabire, S Geelvink Bay, 1920 m, 5.V.1962, Gressitt; allotype ♀ (BISHOP), PNG: NEW GUINEA (NE): Mt Kaindi, Nami Crk, 1700 m, 13.VIII.1968, Sedlacek. Paratypes. IRIAN: NEW GUINEA (SW): 1♂, 1♀, Bomberi, Vogelkop, 100–900 m, 4–7.VI.1959, Maa; NEW GUINEA (NW): 1♀, W Sentani, Cyclops Mts,

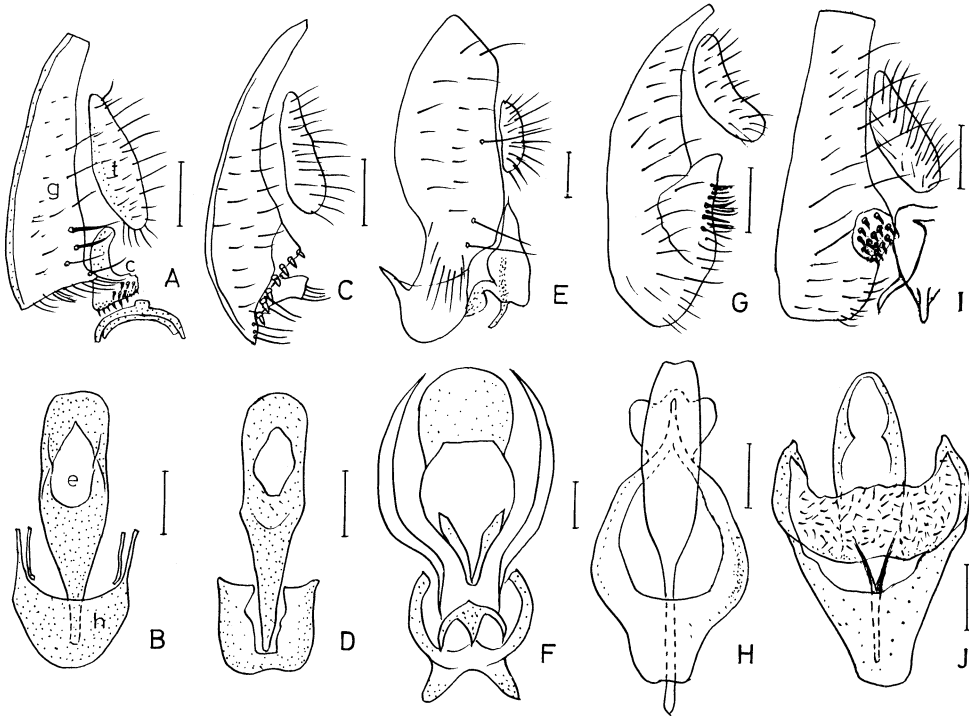


FIG. 2.Periphallal organs (A, C, E, G, I) and phallic organs (B, D, F, H, J). A-B, *Eostegana argentea*; C-D, *E. inclinata*; E-F, *E. punctipennis*; G-H, *E. tessellata*; I-J, *E. maculosa*. c = surstylus; e = aedeagus; g = epandrium; h = hypandrium; t = cercus. Scales = 0.1 mm.

Hollandia area, 150-250 m, 23.VI.1959, Maa. PNG: NEW GUINEA (NE): 1♂, Karimui, S of Goroka, 1080 m, 14.VII.1963, Sedlacek; 1♂, Moife, 15 km NW of Okapa, 2100 m, 11-13.X.1959, Maa. PNG: BISMARCK ARCH.: NEW IRELAND: 1♂, Gilingil Plantation, 2 m, 6.VII.1956, Gressitt; 1♂, ridge above "Camp Bishop," 15 km up Kait Riv, 250-750 m, 14.VII.1956, Gressitt.

Distribution. New Guinea, New Ireland.

This species resembles *D. striatipennis* Duda in general wing patching and yellow halteres, but differs from the latter in having the outer white band of the wing divided into 3 spots.

Eostegana argentea Okada, new species

Fig. 1B, 2A-B

♂, ♀. Body about 3-5 mm in length. Eye dark red. Antenna black, 3rd joint gray pruinose. Arista with 9 upper and 6 lower branches and a fine fork. Frons shining brownish black, anterior margin yellow. Periorbits and ocellar triangle not well demarcated. Face grayish white, silvery shining between antennae. Anterior reclinate orbital much nearer to proclinate than to posterior reclinate. Vibrissa strong, other orals fine. Mesoscutum and scutellum shiny black; humeral callus yellowish. Thoracic pleura matte black. Acrostichal hairs in about 12 rows.

Anterior dorsocentrals $\frac{1}{3}$ as long as posteriors; length distance of dorsocentrals $\frac{1}{3}$ cross distance. Sterno-index 1.5. Scutellars subequal in length and in distance; lateral scutellars divergent. Legs yellow; femora and mid and hind tibiae except bases black; fore and hind metatarsi as long as other tarsal joints; mid metatarsus $2\times$ as long as other tarsal joints. Wing (Fig. 1B) black, with 3 white bands; median band very broad and long, not interrupted; outer band narrow, not interrupted, parallel to median one; inner band obscure, often missing. C-index 1.5; 4V-index 2.2; 4C-index 1.3; 5x-index 0.9; Ac-index 2.4; C3-fringe $\frac{9}{10}$. Halteres yellow. Abdominal tergites matte brownish black, caudal margins of 2nd to 4th tergites yellow. Periphallalic organs (Fig. 2A) black, epandrium truncate below, dorsally narrowing; surstylus with about 6 small teeth; cercus large. Phallic organs (Fig. 2B) black; aedeagus ellipsoidal.

Holotype ♂ (BISHOP 11,914), PNG: NEW GUINEA (SE): Kiunga, Fly Riv, 8–10.VIII.1957, Brandt; allotype ♀ (BISHOP), IRIAN: NEW GUINEA (NW), Waris, S of Hollandia, 450–500 m, 1–7.VIII.1959, Maa. Paratypes, 1♂, PNG: BISMARCK ARCH.: Admiralty Is: Manus I: Momote, 24.XII.1959, Maa; 1♀, same data as allotype except 8–15.VII.1959; 1♂, 1♀, same data as allotype except 1–2.VIII.1959.

Distribution. New Guinea, Manus Island.

This species resembles *E. biroi* Hendel in having the median white band of the wing not interrupted and parallel to the outer band, but it differs from the latter in having the inner white band of the wing obscure and the halteres yellow.

***Eostegana inclinata* Okada, new species**

Fig. 1C, 2C–D

♂, ♀. Body about 4–5 mm in length. Antenna brownish black. Arista with 9 upper and 3 lower branches and a small fork. Palpus slender, yellowish orange, basal $\frac{1}{2}$ black, with a few weak setae. Frons quadrate, dark brown, gray pruinose, anterior margin yellow. Periorbit brown, broad. Face brownish black, much broadened below; ventral $\frac{1}{2}$ silvery pruinose. Cheek $\frac{1}{6}$ as broad as greatest diameter of eye. Anterior reclinate orbital nearer to proclinate than to posterior reclinate. Vibrissa strong, other orals fine. Mesoscutum matte brown, gray pruinose. Scutellum velvety dark brown. Thoracic pleura pruinose brownish black. Humeral 1, with 3 additional small bristles. Acrostichal hairs in about 16 irregular rows. Anterior dorsocentrals $\frac{5}{9}$ as long as posteriors; length distance of dorsocentrals $\frac{1}{3}$ cross distance. Sterno-index 0.7. Lateral scutellars parallel, longer than apicals, which are as long as scutellum itself. Legs black except proximal 3 tarsal joints, which are yellowish white; fore and hind metatarsi slightly longer than other tarsal joints; mid metatarsus much longer than other tarsal joints. Wing (Fig. 1C) black, with 3 white crossbands; median and outer bands convergent caudally (thus the specific name); median band sinuated, not interrupted; outer band interrupted by R_{4+5} ; inner band composed of 4 small spots around anterior crossvein. R_{2+3} sinuated; R_{4+5} and M nearly parallel. C-index 1.7; 4V-index 1.1; 4C-index 1.1; 5x-index 0.7; Ac-index 2.8; C3-fringe $\frac{5}{7}$. Halteres yellow. Abdominal tergites yellowish brown, caudal margins pale. Periphallalic organs (Fig. 2C) black; epandrium narrow, pointed below; surstylus broad but short, distally with about 7 large teeth. Phallic organs (Fig. 2D) black; aedeagus oblong, tapering basally; hypandrium quadrate.

Holotype ♂ (BISHOP 11,913), PNG: NEW GUINEA (NE): Wau, Mt Missim, 1400–1600 m, 28.XII.1964, L. & M. Gressitt; allotype ♀ (BISHOP), Wau, 1200 m, 17.VI.1961, Gressitt. Paratypes. 1♂, same data as allotype; 1♀, same locality as allotype, 14.XI.1965, malaise trap, Shanahan; 1♀, same locality, 1250 m, 4.V.1965, Sedlacek; 1♀, Chimbu Val, 1900 m, 16.V.1963, Sedlacek. IRIAN: NEW GUINEA (NW): 1♂, Swart Val, Karubaka, 1350 m, 18.XI.1958, Gressitt.

Distribution. New Guinea.

This species resembles *E. biroi* Hendel in having a noninterrupted median band on the wing and a divided outer band, but it differs from the latter in having median and outer bands caudally convergent, R_{4+5} and M nearly parallel, and the halteres not black.

***Eostegana biroi* Hendel, 1913**

Fig. 3A

Eostegana biroi Hendel, 1913, Entomol. Mitt. **2**: 390.—Duda, 1924, Arch. Naturgesch. **90A** (3): 183.

Body about 4 mm in length. Arista with 8 upper and 3 lower branches. Face broad, with silvery crossband. Wing (Fig. 3A) with 3 white bands; outer band interrupted in 2 patches; median band not interrupted; inner band composed of 3 small spots. Halteres black.

Distribution. New Guinea.

I. R. Bock has sent me his sketch of a wing of a specimen labelled *E. biroi*, which is preserved in the Deutsches Entomologische Museum, Berlin. It shows the outer band of the wing divided, the median band complete, and the inner band composed of 3 spots, as described above. Although distinctions between *E. biroi* and the 3 following species, *striatipennis* (Duda), *ortalidoides* (Walker) and *ortalioides* (Walker), are not yet clear, each is tentatively recognized as a separate species.

***Eostegana striatipennis* (Duda), 1923**

Fig. 3B

Stegophortica striatipennis Duda, 1923, Ann. Hist.-Nat. Mus. Natl. Hung. **20**: 33 (♂), type-locality: New Guinea.—Duda, 1926, op. cit. **23**: 245 (synonymized with *E. biroi*).

Eostegana (Stegophortica) striatipennis: Duda, 1929, Treubia **7**: 419 (Buru; conspecificity with *biroi* not yet certain).

Body about 3.5 mm in length, black. Arista with about 10 upper and 5 lower branches. Frons brownish black. Face silvery below. Cheek black, linear. Mesoscutum subshining brownish black, thickly and finely bristled. Scutellum brownish black, with thick pubescence. Wing (Fig. 3B) black, with white patches, which are slightly different from those of *biroi*. C-index 1.6; 4V-index 3.0; 5x-index 0.5; Ac-index more than 2. Halteres yellow.

Distribution. New Guinea.

***Eostegana ortalidoides* (Walker), 1864**

Fig. 3D

Notiphila ortalidoides Walker, 1864, J. Proc. Linn. Soc. London (Zool.) **7**: 222 (♀). Type-locality: Misool I.

Body dull black, about 5 mm in length. Head silvery in front. Thorax posteriad and abdomen with slight cinereous tomentum. Wing (Fig. 3B) black, with 2 outer white interrupted crossbands and 3 inner white spots. Halteres pale. 5x-index less than 1.0.

Distribution. Misool I.

***Eostegana ortalioides* (Walker), 1865**

Fig. 3C

Notiphila ortalioides Walker, 1865, J. Proc. Linn. Soc. London (Zool.) **8**: 136 (♂). Type-locality: Salwatty I.

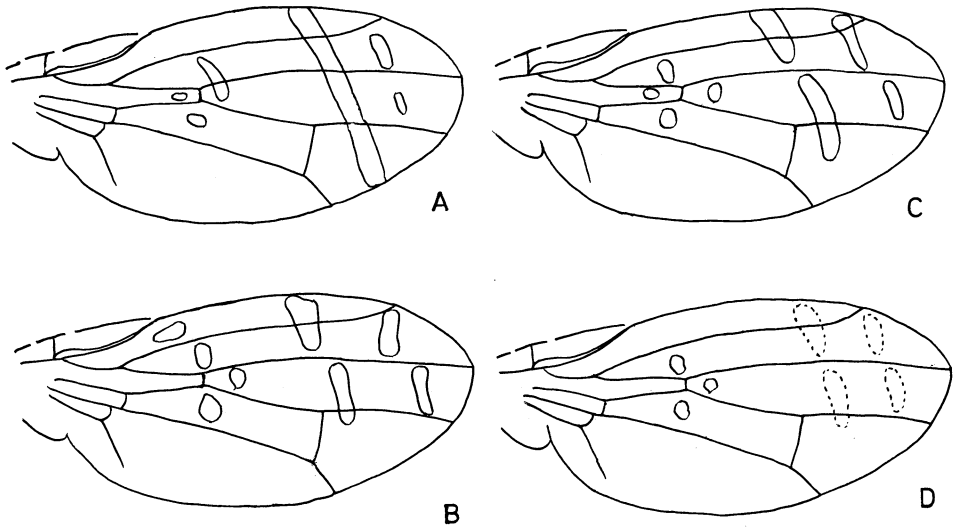


FIG. 3. Schematic expressions of white wing patches. **A**, *Eostegana biroi*, after Bock's (in litt.) information; **B**, *E. striatipennis*, after Duda's figure; **C**, *E. ortalioides*, after Cogan's (in litt.) information; **D**, *E. ortalioides*, after original description.

Body black, about 3.5 mm in length. Thorax with piceous tomentosus. Wing (Fig. 3C) black with 8 white marks; 4 marks minute, near base; 4 exterior larger, transverse. 5x-index 0.5.

Distribution. Salwatty I.

In a letter to D. E. Hardy in 1975, B. H. Cogan suggested that *Notiphila ortalioides* Walker should be a *Stegophortica*. Cogan wrote to M. R. Wheeler in 1977, "There are two separate descriptions, both could apply to the same genus if not species; such was the way that Walker wrote." Cogan showed me in 1979 a wing picture of the type of *ortalioides* preserved in the British Museum, which shows the median and outer white bands of wing well fit to that of *striatipennis*.

II. The *tessellata* species-group

Eostegana tessellata Okada, new species

Fig. 1D, 2G-H

♂. Body about 5-6 mm in length, matte brown in general coloration. Antenna with 2nd joint dark brown; 3rd gray, basally pale. Arista with about 9 upper and 5 lower long branches and a fine fork. Palpus yellowish orange, basally dark. Frons quadrate, orange-brown, anterior ½ grayish, with scattered frontal hairs. Face silvery white, medially with a small brownish spot. Clypeus silvery white. Anterior reclinate orbital close to proclinate, slightly longer than proclinate and slightly shorter than posterior reclinate. Mesoscutum matte brown, gray pruinose, with scattered obscure dark patches. Scutellum darker especially laterally, with many long discal hairs. Thoracic pleura brownish black. Humeral 1, long. Acrostichal hairs in about 16 irregular rows. Anterior dorsocentrals about 2/5 as long as posteriors; length distance of dor-

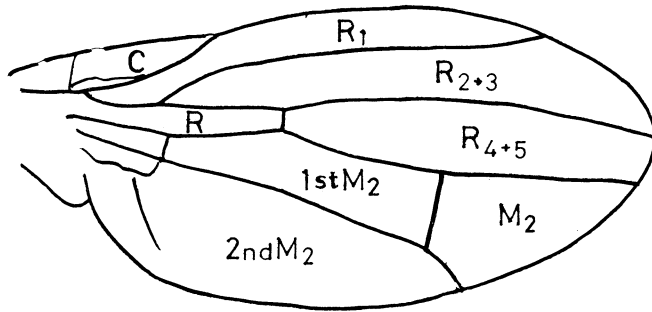


FIG. 4. A schematic wing of *Eostegana* to show wing cells.

socentrals $\frac{1}{5}$ cross distance. Sterno-index 0.8. Legs black, tarsi yellow; fore metatarsus as long as other tarsal joints; mid and hind metatarsi slightly longer than other tarsal joints; mid tibia with a row of about 14 bristles above. Wing (Fig. 1D) black with a score of scattered white spots, medioanterior spot and caudal interrupted crossband especially large. C-index 1.7; 4V-index 1.0; 4C-index 1.0; 5x-index 0.7; Ac-index 3.5; C3-fringe $\frac{3}{4}$. Halteres yellow. Abdominal tergites matte brown, caudal margins of 2nd to 4th tergites yellowish gray. Periphallallic organs (Fig. 2G) with epandrium black, rounded below, narrowing above; cercus yellowish brown; surstylus large, partly fused to epandrium, distally with about 10 black, long, pointed teeth. Phallic organs (Fig. 2H) black; aedeagus slender, with long apodeme; hypandrium quadrate, lateral arm long.

Holotype ♂ (BISHOP 11,916) SOLOMON IS: NW of Malaita, Dala, 19.VI.1964, malaise trap, Straatman. Paratypes. 1♂, same data as holotype; 1 ex, same data except 3.VII.1964.

Distribution. Solomon Is.

This species differs from other known members of the genus in having numerous white spots on wings and a densely haired scutellum.

Eostegana maculosa Okada, new species

Fig. 1E, 2I–J

♂, ♀. Body about 4–5 mm in length, grayish black in general coloration. Antenna brown; 3rd joint elongate, apically dark. Arista with about 9 upper and 7 lower branches and a small fork. Palpus yellowish white, with short setae below. Frons quadrate, black with bluish pruinosity, caudally brown. Periorbits broad, dark brown. Face pruinose yellowish gray, medially with a black transverse band. Cheek narrow, grayish brown. Clypeus protruded, grayish white. Anterior reclinate orbital near proclinate, slightly shorter than posterior reclinate, slightly longer than proclinate. Mesoscutum and scutellum matte grayish black, the former with thick microtrichia and obscure paler patches. Distal margin of scutellum narrowly pale. Humeral 1, long. Acrostichal hairs in about 14 irregular rows. Anterior dorsocentrals $\frac{1}{2}$ as long as posteriors; length distance of dorsocentrals $\frac{1}{2}$ of cross distance. Sterno-index 0.8. Lateral scutellars weakly divergent, slightly longer than apicals, which are equally apart from each other and from laterals. Legs black; tarsi yellow; mid tibia with about 12 stout bristles above; mid metatarsus much longer than other tarsal joints; hind metatarsus slightly longer than other tarsal joints. Wing (Fig. 1E) black with about 30 scattered small white spots. R_{2+3} weakly curved to C. C-index 2.0; 4V-index 1.2; 4C-index 1.0; 5x-index 0.7; Ac-index 3.5; C3-fringe $\frac{5}{7}$. Halteres yellowish white. Abdominal tergites mostly matte brownish black, gray pruinose. Periphallallic

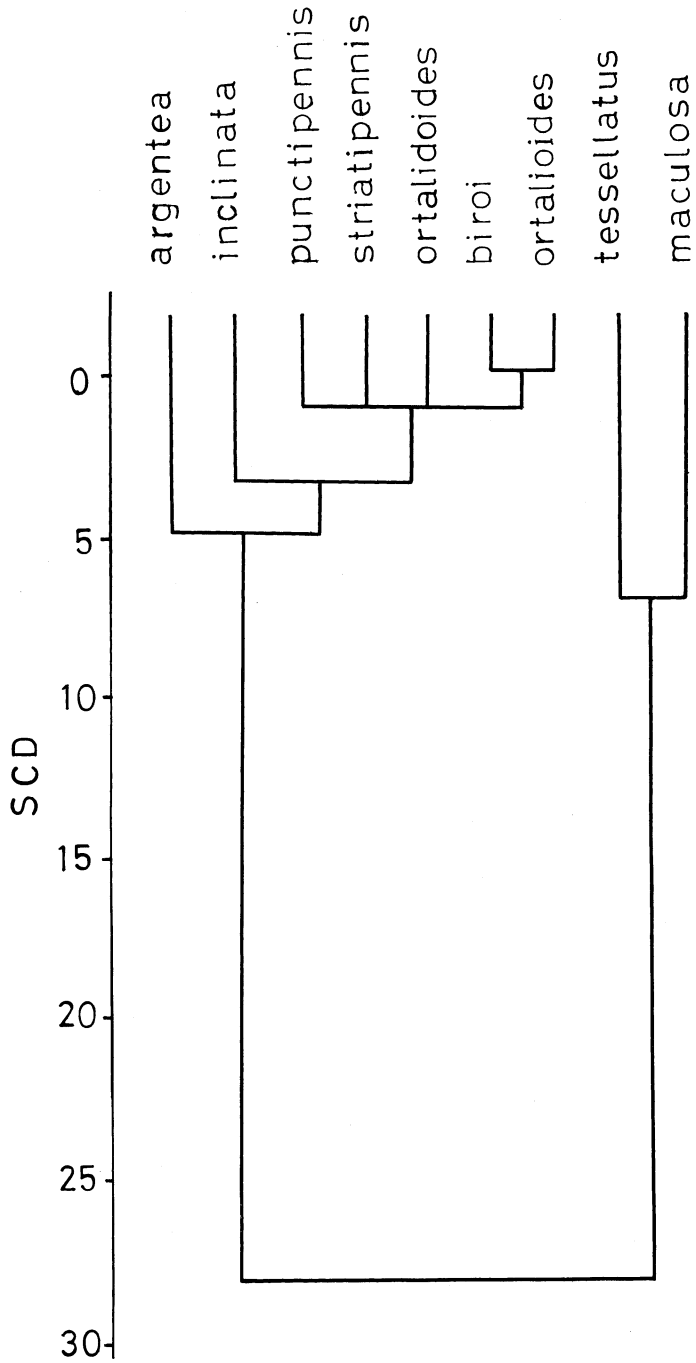


FIG. 5. A dendrogram of 9 species of *Eostegana* based on wing patterns, resulting from SCD proximity analysis and WPGA cluster analysis.

TABLE 1. Characters ($n = 8$) \times taxa ($t = 9$) matrix for 9 species of *Eostegana*.

<i>t</i>	CHARACTERS (n)*							
	C	R ₁	R ₂₊₃	R	R ₄₊₅	1st M ₂	M ₂	2nd M ₂
<i>punctipennis</i>	0	1	4	0	3	1	1	0
<i>argentea</i>	0	1	2	0	2	0	1	0
<i>inclinata</i>	0	1	3	1	3	2	2	0
<i>striatipennis</i>	0	2	3	0	3	1	1	0
<i>biroi</i>	0	1	3	1	3	1	1	0
<i>ortalidoides</i>	0	1	3	0	3	1	1	0
<i>ortalioides</i>	0	1	3	1	3	1	1	0
<i>tessellata</i>	2	5	7	3	9	3	3	4
<i>maculosa</i>	2	3	10	2	9	4	3	4

* Figures in body of table refer to numbers of distinct white patches on specified wing cells.

organs (Fig. 2I) brownish black; epandrium broadly truncate below, not narrowing above; surstylus small, with scattered black pointed teeth. Phallic organs (Fig. 2J) black; aedeagus elliptical; hypandrium setigerous.

Holotype ♂ (BISHOP 11,915), IRIAN: NEW GUINEA: Waris, S of Hollandia, 450–500 m, 16–23.VIII.1959, Maa; allotype ♀ (BISHOP), same data as holotype except 3–15.VII.1959. Paratypes. 2♂, same data as holotype; 1♂, Biak I, Kampong Lanabouw, 30 km NE of air strip, 46 m, 17.VII.1957, Hardy. PNG: NEW GUINEA (NE): 1♂, Brown Riv, 5 m, 23.X.1960, Gressitt; 1♂, Wau, 1200 m, 14.XI.1965, malaise trap, Shanahan; 1♂, Daradae Plain, 80 km N of Port Moresby, 500 m, 5.IX.1959, Maa. PHILIPPINE IS: Luzon: 1♂, Nueva Vizcaya, 6 km W of Imugan, 11.IV.1968, Hardy.

Distribution. New Guinea, Philippines.

This species is allied to *E. tessellata*, but it differs from the latter in having more numerous small white spots on the wing and yellowish gray, not silvery, face.

A TAXIMETRICAL ANALYSIS OF WING PATTERNS AND A KEY TO SPECIES

The number of distinct white patches on 8 wing cells: C, R₁, R₂₊₃, R, R₄₊₅, 1st M₂, M₂ and 2nd M₂ (Fig. 4) were counted for each of 9 species of the genus *Eostegana*. From this characters (n) \times taxa (t) matrix (Table 1), a dendrogram (Fig. 4) was produced by means of SCD (sum of character differences) proximity analysis and WPGA (weighted pair-group) cluster analysis. A key to species was automatically constructed from the dendrogram, as below. *E. ortalioides* and *E. biroi* share the same character states for all 8 characters, and they are distinguished by another character (couplet 7).

KEY TO THE SPECIES OF *Eostegana*

1. C=0; R \leq 1; R₁ \leq 2; 1st M₂ \leq 2; M₂=0 2
- C=2; R \geq 2; R₁ \geq 3; 1st M₂ \geq 3; M₂=3; 2nd M₂=4 8

2.	$R_{2+3}=2$; $R_{4+5}=2$; 1st $M_2=0$; $R_1=1$	argentea
	$R_{2+3} \geq 3$; $R_{4+5}=3$; 1st $M_2=1$	3
3.	1st $M_2=2$; $M_2=2$; $R=1$; $R_1=1$	inclinata
	1st $M_2=1$; $M_2=1$	4
4.	$R_1=2$; $R_{2+3}=3$; $R=0$	striatipennis
	$R_1=1$	5
5.	$R_{2+3}=4$; $R=0$	punctipennis
	$R_{2+3}=3$	6
6.	$R=0$	ortalidoides
	$R=1$	7
7.	Median band interrupted	ortalioides
	Median band not interrupted	biroi
8.	$R_1=5$; $R_{4+5}=7$	tessellata
	$R_1=3$; $R_{4+5}=10$	maculosa

Acknowledgments. I am much indebted to Drs J. L. Gressitt, F. J. Radovsky and W. A. Steffan, who kindly allowed me free access to the Bishop Museum collection. Many thanks are due to Drs I. R. Bock of La Trobe University, Victoria, B. H. Cogan of British Museum, Natural History, D. E. Hardy of the University of Hawaii, and M. R. Wheeler of the University of Texas, Austin, for their valuable comments, and also to various persons who collected materials, whose names are mentioned in the collection data of each species. This work was partly aided by a fund from the Japan-U.S. Cooperative Science Program, JSPS 5R 102.

LITERATURE CITED

- Okada, T.** 1977. Family Drosophilidae. In: Delfinado, M. D. & D. E. Hardy, eds. *A catalog of the Diptera of the Oriental Region*. Vol. 3. Univ. Press of Hawaii, Honolulu. 854 pp.