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The subgenus *Phortica* SCHINER of the genus *Amiota* LOEW of Japan and the Oriental Region, with reference to anti-BURLA's rule (Diptera, Drosophilidae)

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Synopsis

Description of seven new species and a new subspecies and redescription of a species of the subgenus *Phortica* SCHINER from Japan, Formosa, and Thailand are made, with preparation of a key to Japanese and Oriental species. Finding of a case of anti-BURLA's rule in the wings of the *variegata* complex of Japan is reported, with reference to geographical and seasonal changes of wing length and body coloration.

In his study of Palaearctic species of *Amiota* subgenus *Phortica* SCHINER, MÁCA (1976) found that the Japanese form of *A.* (*P.*) *variegata* is a mixture of several species, all different from the type of *variegata* FALLÉN, and described two of them (*okadai* and *kappa*). I will taxonomically treat here Japanese and Oriental species of *Phortica*, including the *variegata* complex other than *okadai* and *kappa*, referring to the finding of anti-BURLA's rule among this complex.

I thank to Dr. J. MÁCA for a lot of informations about Palaearctic species of this subgenus. My thanks are also due to Drs. H. IKEDA of Ehime University, A. KANEKO of Ministry of Education, R. KANO and S. SHINONAGA of Tokyo Medical and Dental University, K. KANMIYA of Kurume University, H. KURAHASHI of National Institute of Health, T. SAIGUSA of Kyushu University, K. SUZUKI of Toyama University, H. TAKADA of Sapporo University, and K. WAKAHAMA of Shimane University, and Messrs. N. WATANABE and S. NISHIHARU, of Tokyo Metropolitan University, for their affording me with material.

The type specimens are deposited at the National Science Museum, Tokyo.

Description

Amiota (*Phortica*) conifera n. sp.
(Figs. 1A, 2A & 4B)

♂, ♀. Body about 4–4.5 mm in length. Antenna with 2nd joint black, 3rd brown. Arista with about 4 upper short and 2 lower fine subapical branches, without terminal fork. Palpus black. Ocellar triangle black. Periorbit milky white. Clypeus milky white, laterally black. Frons brownish black, orange brown laterally and anteriorly. Face black, whitish laterally and medially above. Cheek black. Anterior reclinate orbital 1/3 proclinate. 2nd oral weak, 1/3 vibrissa.

Mesoscutum greyish brown, with black patches. Scutellum black, apically yellow, basolaterally orange brown. Thoracic pleura mat greyish brown, with obscure black patches. Humeral one, strong. Anterior dorsocentral half posteriors, as long as prescutellars. Sterno-index about 0.6. Legs yellow, femora mostly black, tibiae with 3 black rings. Wing hyaline, crossveins slightly clouded. C-index 2.29±0.04, 4V-index 3.42±0.06, Ac-index 3.48±0.09 (in 20 ♂ samples). C3-fringe on basal 2/3. Abdominal tergites (Fig. 4B) yellowish brown, 1–2T laterally black, 3–5T with medially and laterally protruded caudal black bands.

Periphallic organs (Fig. 1A): surstylus relatively narrow and curved; decasternum quadrate, proximally with pubescent bar. Phallic organs (Fig. 2A): aedeagus curved dorsoventrally, slender and tapering; ventral process conical, thus the specific name, about 1/3 as long as aedeagus; anterior paramere apically trifid. Dorsal mantle rod-shaped.

Specimens examined. Akita Pref.: Tazawako, 1 ♂, 11 X 1966 (OKADA). Iwate Pref.: Kuzakai, 3 ♂, 5–6 VII 1956 (OKADA). Gumma Pref.: Tanigawa, 2 ♂, 30 V 1960 (incl. Holotype); 2 ♂, 12–14 VII 1961; 2 ♂, 16–18 VIII 1961 (OKADA); Kitakaruizawa, 2 ♂, 26 VII 1972 (OKADA); Yunokoya, 8 ♂, 16–17 VII 1960 (OKADA). Niigata Pref.: Takanosu, 1 ♂, 29 VIII 1963 (OKADA). Tokyo: Asakawa, 18 ♂, 1 ♀, IV–X 1974–1975 (NISHIHARU); Kumotoriyama, 3 ♂, 14–16 VII 1953 (OKADA); Kawanoriyama, 1 ♂, 28 V 1975 (OKADA). Nagano Pref.: Sugadaira, 1 ♂, 3–5 VIII 1960 (OKADA); Kisofukushima, 4 ♂, 21 VII 1952 (OKADA). Yamanashi Pref.: Masutomi, 2 ♂, 12 VIII 1961; 1 ♂, 21 VII 1961 (SAIGUSA); Kitadake, 3 ♂, 24–27 VII 1968 (OKADA). Toyama Pref.: Unazuki, 1 ♂, 16 X 1959 (OKADA). Ishikawa Pref.: Hatonoyu, 2 ♂, 10 VIII 1972 (SUZUKI). Tottori Pref.: Daisen, 3 ♂, 7 IX 1971 (OKADA).

Distribution. Japan (Honshu, Kyushu): mostly mountain areas.

Relationships. Resembling *A.* (*P.*) *kappa* MÁCA in general ornamentation, but different in having the dark area of frons broader, reaching anterior margin of frons, and basal process of aedeagus not globular.

Amiota (*Phortica*) *conifera takadai* n. subsp.
(Figs. 1B, 2B & 4D)

Amiota (*Phortica*) sp. like *variegata* (Fallén): TAKADA, 1960:190.

♂, ♀. Body about 4.5 mm in length. General features as described by Takada (1960). Distinguished from the nominate subspecies by much longer ventral conical process of aedeagus, more than half as long as aedeagus. C-index 2.33±0.03, 4V-index 3.55±0.08, Ac-index 3.39±0.12 (in 20 ♂ samples).

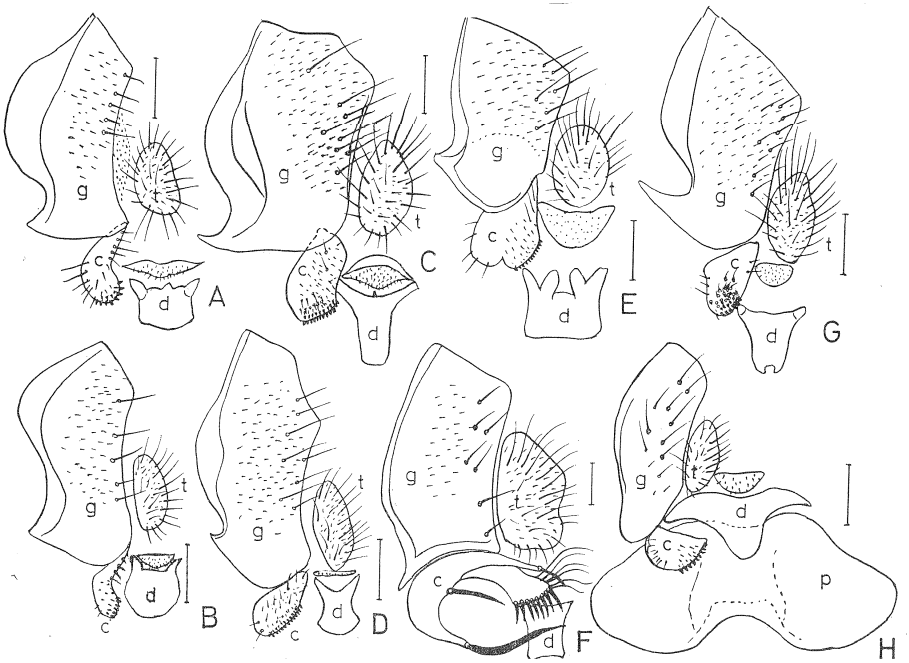

Fig. 1. Periphallic organs of *Amiota* (*Phortica*). A. *conifera* n. sp.; B. *c. takadai* n. subsp.; C. *orientalis* HENDEL; D. *omega* n. sp.; E. *eparmata* n. sp.; F. *gigas* n. sp.; G. *antheria* n. sp.; H. *cardua* n. sp. c, surstylus; d, decasternum; g, epandrium; p, dorsal mantle of aedeagus; t, cercus. Scale 0.1 mm.

Specimens examined. Akkeshi, 2 ♂, 3 ♀, 13 VIII 1951 (OKADA) (incl. holotype ♂); Tobetsu, 1 ♂, 17 VIII 1951 (OKADA); Nukabira, 10 ♂, 12–14 VIII 1966 (OKADA); 2 ♂, 10 VII–1 VIII 1961 (KANO); Iwaubetsu, 6 ♂, 16 VI 1963 (KANEKO); Nopporo, 4 ♂, 19 VIII 1966 (OKADA); Shioya, 1 ♂, 10 VII 1952 (TAKADA); Hiroo, 1 ♂, 1 ♀ VIII 1962 (WAKAHAMA). TAKADA recorded it from Mt. Toyoni, Hidaka.

Distribution. Japan (Hokkaido).

Amiota (*Phortica*) *orientalis* HENDEL

(Figs. 1C, 2C & 4E)

Amiota orientalis HENDEL, 1914. Supplta. Ent. 3: 116.

♂. Body about 3.5 mm in length. Antenna greyish brown. Arista with about 6 upper and 3 lower shorter branches, without terminal fork. Palpus orange

brown. Ocellar triangle black. Frons orange brown, only upper lateral corners black. Clypeus white, laterally black. Periorbit narrowly yellowish white. Anterior reclinate orbital half proclinate. Vibrissa long, other orals short.

Mesoscutum and scutellum orange brown, with brownish black patches. Thoracic pleura orange grey, with brown patches. Humeral one, strong. Acrostichal hairs in 8 rows. Anterior dorsocentrals half posteriors. Legs yellowish grey, fore femur medially black, tibiae with three black rings. Wing with posterior crossvein oblique and deeply clouded. C-index about 2.0, 4V-index 3.0, 5x-index 1.0, Ac-index 3.7. Abdominal tergites (Fig. 4E) yellow, 2T laterally black, 3–5T with medially and laterally protruded caudal black bands, succeeding tergites mostly black.

Periphallic organs (Fig. 1C): Epandrium and surstylus relatively large, decasternum elongate. Phallic organs (Fig. 2C): Aedeagus apically tripartite, basal process spiny, dorsal mantle fan-shaped.

Specimens examined. Hassenzan, 1 ♂, 29 V 1971 (KANMIYA), Wulai, 1 ♂, 28 VIII 1974 (WATANABE).

Distribution. Formosa.

= A (P.) orientalis Herdel 1910

5 *Amiota* (*Phortica*) *antheria* n. sp.

(Figs. 1G, 2D & 4G)

♂, ♀. Body about 3.5 mm in length. Antenna with 2nd joint pale brown, 3rd greyish brown. Arista with about 6 upper long and 3 lower long branches and a minute terminal fork. Palpus yellowish brown. Ocellar triangle black. Periorbit pale grey. Clypeus yellow, laterally black. Frons pale brown. Face greyish white. Anterior reclinate orbital shorter than others. 2nd oral about 1/3 vibrissa.

Mesoscutum and scutellum greyish yellow, with pale brown patches. Thoracic pleura paler. Humerals one long and 3 fine. Prescutellars slightly longer than anterior dorsocentrals. Acrostichal hairs in about 10 rows. Anterior dorsocentrals 3/4 posteriors. Legs yellowish white, femora fuscous subapically below, tibiae with 3 black rings. Wing with posterior crossvein sinuated, slightly clouded. C-index about 2.4, 4V-index 3.2, 5x-index 1.1, Ac-index 3.5. C3-fringe on basal 5/8. Haltere white. Abdominal tergites (Fig. 4G) yellow, 2T laterally black, 3–5T with anteriorly waving caudal black bands, succeeding tergites largely black, 2–4T, more over, with small median black spots.

Periphallic organs (Fig. 1G): Epandrium with ventro-anterior corner much pointed; surstylus and decasternum triangular. Phallic organs (Fig. 2D): Aedeagus slender, straight; basal process absent; dorsal mantle complicated flower-like, thus the specific name.

Specimens examined. Kôyô-Onsen near Mizuho, 2 ♂, 1 ♀, 22 VIII 1974 (WATANABE) (incl. holotype ♂).

Distribution. Formosa.

Relationships. Somewhat resembling *A.* (*P.*) *okadai* MÁCA in having relatively

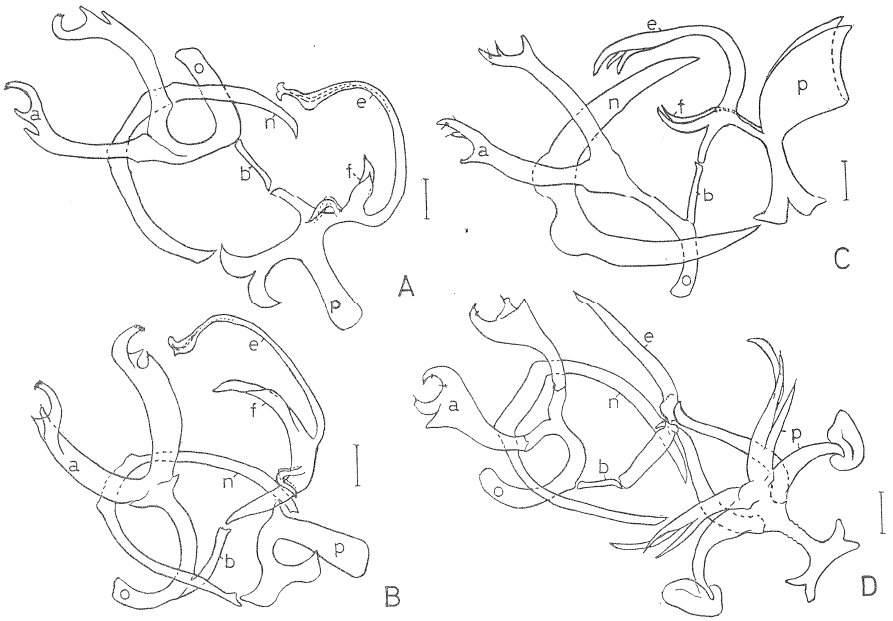

Fig. 2. Phallic organs of *Amiota* (*Phortica*). A. *conifera* n. sp.; B. *c. takadai* n. subsp.; C. *orientalis* HENDEL; D. *antheria* n. sp. a, anterior paramere; b, basal process of aedeagus; e, aedeagus; f, ventral process; n, novasternum; o, apodeme of aedeagus; p, dorsal mantle of aedeagus. Scales 0.1 mm.

small and pale body among the *variegata* complex, different, however, in having long branches of arista and complicated flower-like dorsal mantle of aedeagus.

Amiota (*Phortica*) *omega* n. sp.

(Figs. 1D, 3A & 4F)

♂, ♀. Body about 3 mm in length. Antenna with 2nd joint orange grey, 3rd grey. Arista with 6 upper long and 3 lower shorter branches, without terminal fork. Palpus yellowish grey, basally black. Ocellar triangle black. Periorbit white. Frons black, laterally and anteriorly yellowish orange. Clypeus white, laterally black. Face milky white. Anterior reclinate orbital 1/3 proclinate. 2nd oral fine.

Mesoscutum pollinose bluish grey, with black patches. Scutellum mat grey, caudomedially yellow. Thoracic pleura pale bluish grey with dark brownish spots. Humeral one, long. Acrostichal hairs in about 10 irregular rows. Sterno-index about 0.8. Legs yellow, femora basally black, tibiae with 3 black rings. Wing hyaline, crossvein clear, not much oblique. C-index about 2.2, 4V-index 3.0, 5x-index 1.0, Ac-index 3.0. C3-fringe on basal 2/3. Haltere white. Abdominal tergites (Fig. 4F) yellow, 2T laterally black, 3–6T with medially and laterally protruded broad black caudal bands, lower margins of 2–6T yellow.

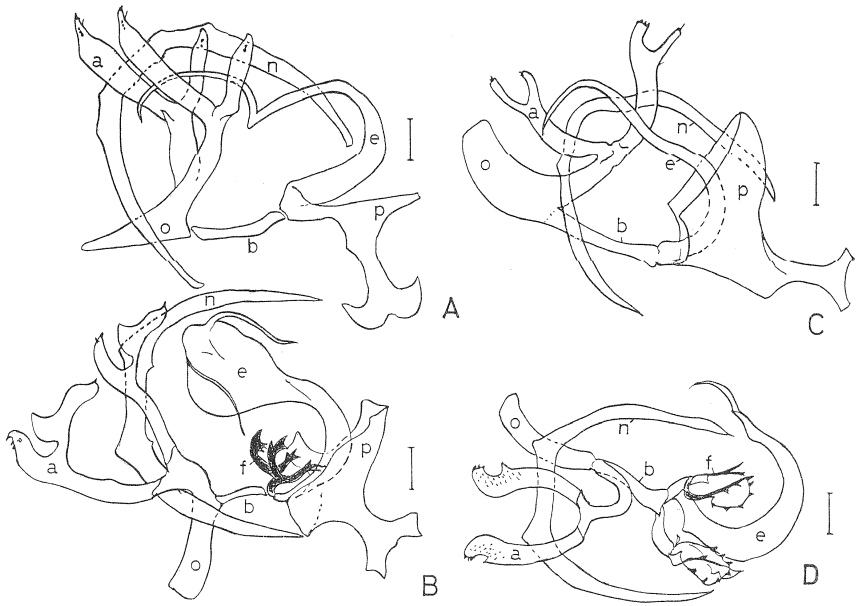

Fig. 3. Phallic organs of *Amiota* (*Phortica*). A. *omega* n. sp.; B. *eparmata* n. sp.; C. *gigas* n. sp.; D. *cardua* n. sp. Signs and scales as in Fig. 2.

Periphallic organs (Fig. 1D): Epandrium somewhat narrowing below; surstylus and decasternum quadrate. Phallic organs (Fig. 3A): Aedeagus slender, ω-shaped in lateral aspect, thus the specific name; basal process of aedeagus absent; dorsal mantle of aedeagus rod-shaped. Anterior paramere deeply bilobed.

Specimens examined. Doi Suthep, Chaing Mai, 2 ♂, 1 ♀, 20–21 XII 1975 (SHINONAGA) (incl. holotype ♂); 1 ♂, 22 IX 1975 (KURAHASHI).

Distribution. Thailand.

Relationships. Resembling *A.* (*P.*) *kappa* MÁCA in the coloration of frons, different, however, in smaller and paler body, ω-shaped aedeagus, and deeply bilobed anterior paramere.

Amiota (*Phortica*) *eparmata* n. sp.

(Figs. 1E, 3B & 4L)

♂. Body about 3.5 mm in length. Antenna with 2nd joint yellowish brown, 3rd grey. Arista with about 5 upper and one lower long branches and a large terminal fork, upper ast of fork very long. Palpus brown. Clypeus yellowish grey, laterally brown. Ocellar triangle brownish black. Periorbit grey, black at the insertion of posterior reclinate orbital. Frons dark brown, orange grey below. Face yellowish grey, darker above.

Mesoscutum and scutellum yellowish grey, with brownish black patches.

Humeral callus yellow. Thoracic pleura yellowish brown, with large black patches. Humerals four, one long and 3 short. Acrostichal hairs in 8 rows. Anterior dorsocentrals half posteriors. Sterno-index about 0.9. Legs yellow, fore femur medially brownish black, mid femur basally brownish black, hind femur brownish near both ends, tibiae with 3 black rings. Wing with posterior crossvein sinuated and slightly clouded. C-index 2.0, 4V-index 3.0, 5x-index 0.9, Ac-index 3.2. C3-fringe on basal 3/5. Haltere yellowish grey. Abdominal tergites (Fig. 4L) yellow, 2T laterally black, 3–5T mostly black, medially with yellowish incisions.

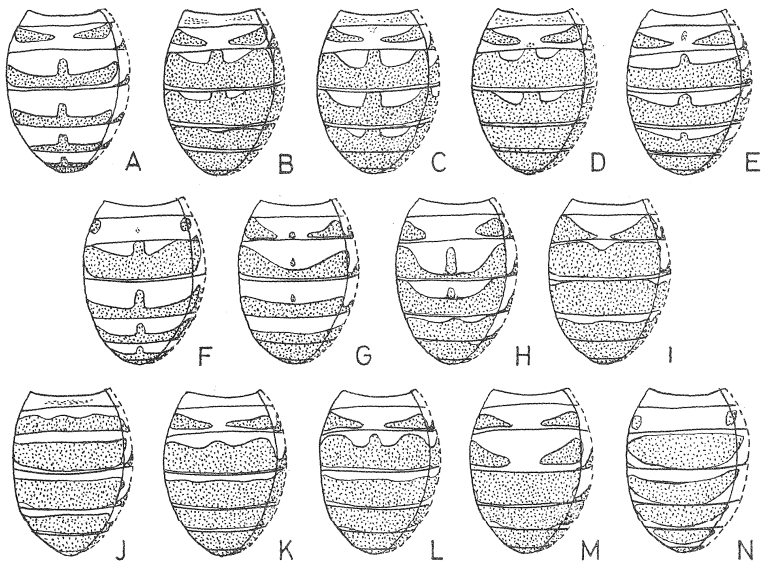

Fig. 4. Abdominal tergites of *Amiota* (*Phortica*). A. *okadai* MÁCA; B. *conifera* n. sp.; C. *kappa* MÁCA; D. *conifera takadai* n. subsp.; E. *orientalis* HENDEL; F. *omega* n. sp.; G. *antheria* n. sp.; H. *cardua* n. sp.; I. *subradiata* n. sp.; J. *magna* OKADA; K. *paramagna* OKADA; L. *eparmata* n. sp.; M. *gigas* n. sp.; N. *foliiseta* DUDA.

Periphallic organs (Fig. 1E): Epandrium rounded below; surstylus large, incised below and roundly expanded anteriorly, thus the specific name; decasternum quadrate. Phallic organs (Fig. 3B): Aedeagus globularly expanded at apical half, apically with a pair of long recurved filaments; basal process complicated, dendric; dorsal mantle rod-like, broad. Anterior paramere apically trilobed.

Specimens examined. Wulai, 3 ♂, 2 VIII 1974 (WATANABE) (incl. holotype).

Distribution. Formosa.

Relationships. Resembling *A.* (*P.*) *paramagna* OKADA in abdominal patterns, but different in having large fork of arista and paler body as well as in the shape of phallic organs.

Amiota (*Phortica*) *cardua* n. sp.
(Figs. 1H, 3D & 4H)

♂. Body about 3 mm in length. Antenna with 2nd joint brown, 3rd yellowish grey. Arista with about 6 upper long and 3 lower short branches, without terminal fork. Palpus yellowish brown. Ocellar triangle black. Periorbit orange. Clypeus yellowish orange, laterally black. Frons brown, marginally orange. Face mat greyish orange. Anterior reclinate orbital half others. 2nd oral half vibrissa, others fine.

Mesoscutum mat brownish black nearly uniformly, with faint paler clouds. Humeral callus yellowish orange. Scutellum mat but light yellow, apical corners black. Thoracic pleura mat black, orange yellow at wing base and around sutures. Humeral one, stout. Prescutellars longer than anterior dorsocentrals. Acrostichal hairs in 8 rows. Anterior dorsocentrals half posteriors. Sterno-index 0.8. Legs pale yellow, femora medially brownish black. Wing with posterior crossvein straight and clouded. C-index about 2.4, 4V-index 3.0, 5x-index 1.0, Ac-index 3.4. C3-fringe on basal 4/7. Haltere orange yellow. Abdominal tergites yellow, 2–3T laterally black, 4–5T with laterally protruded caudal black bands, 2-4T often with median longitudinal black spots (Fig. 4H).

Periphallic organs (Fig. 1H): Epandrium narrowing below; surstylus caudally pointed; decasternum broad triangular. Phallic organs (Fig. 3D): Aedeagus tapering distally; basal process thorn-like, thus the specific name; dorsal mantle huge, expanded laterally (Fig. 1H, p). Anterior paramere distally bifid.

Specimens examined. Wulai, 2 ♂, 2 VIII 1974 (WATANABE) (incl. holotype).

Distribution. Formosa.

Relationships. Seemingly related to *A.* (*P.*) *eparmata*, the foregoing species, in having thorn-like basal process of aedeagus, distinguished from it, however, in the shape of aedeagus and anterior paramere.

Amiota (*Phortica*) *subradiata* n. sp.
(Fig. 4I)

Amiota (*Phortica*) *orientalis*: OKADA, 1971. Kontyû, 39: 91 (not Hendel, misidentified).

♂. As described by Okada (1971, loc. cit.).

Specimens examined. Taroko, 1 ♂, 26 V 1971 (WAKAHAMA); Wulai, 2 ♂, 2 VIII 1974 (WATANABE) (including holotype).

Distribution. Formosa.

Relationships. Resembling *A.* (*P.*) *radiata* DUDA, 1926, from Sumatra (as var. of *maculiceps* DUDA), in having lower as well as upper branches of arista long, but differs in yellowish grey femora (black except apically in *radiata*).

Amiota (*Phortica*) *gigas* n. sp.

(Figs. 1F, 3C & 4M)

♂. Body about 3.5–4 mm in length, brownish black in general. Antenna with 2nd joint mat black, 3rd greyish brown. Arista with about 4 upper very short

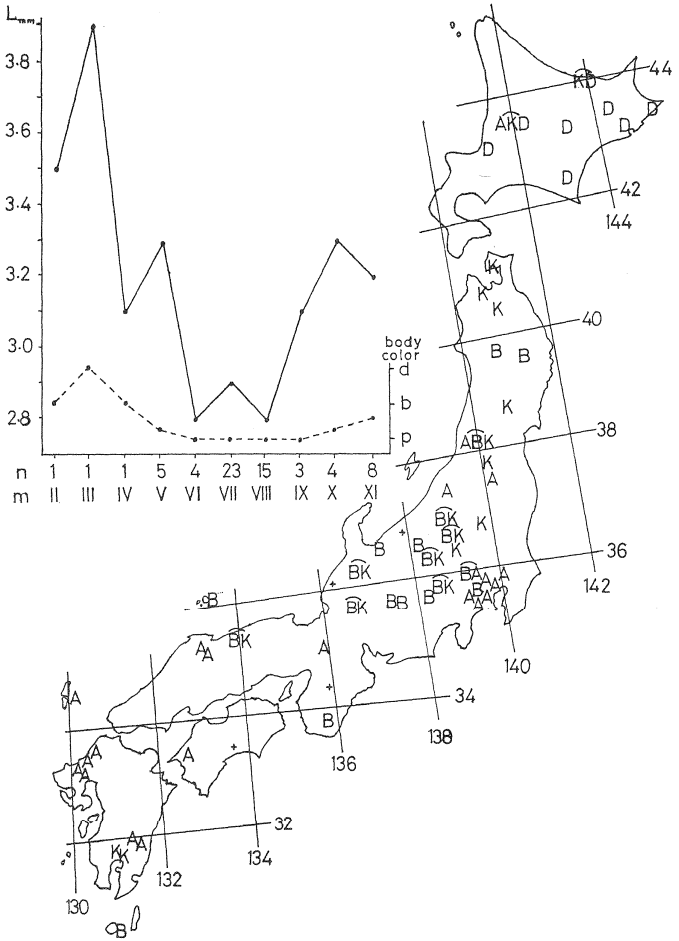

Fig. 5. Geographical distribution of the *variegata* complex in Japan. A. *okadai* MÁCA; B. *conifera* n. sp.; D. *c. takadai* n. subsp.; K. *kappa* MÁCA. Upper left: seasonal frequency of wing length (L: solid lines) and body coloration (p, pale brown; b. brown; d, dark brown: dotted lines) of *A. okadai* at Kinuta, Tokyo, in 1964. n, number of ♂ samples; m, month.

and 2 fine lower branches, without terminal fork. Palpus dark brown. Periorbit milky yellow, caudally black. Ocellar triangle mat black. Frons velvety black, deep orange brown laterally and anteriorly. Clypeus yellow, laterally deep black.

Face black, laterally white. Anterior reclinate orbital 2/3 proclinate, half posterior reclinate. 2nd oral half vibrissa.

Mesoscutum mat greyish black uniformly, humeral callus yellow. Scutellum mat black, yellow at anterior corners. Thoracic pleura mat greyish black, somewhat bluish. Humeral one, strong. Acrostichal hairs in 8 rows. Anterior dorsocentrals 1/3 posteriors. Sterno-index about 0.7. Legs dark yellow, femora and distal three tarsal joints black, tibiae with 3 black rings. Wing with posterior crossvein slightly clouded but straight. C-index about 2.3, 4V-index 2.5, 5x-index 0.9, C3-fringe on basal 2/5. Haltere orange yellow. Abdominal tergites (Fig. 4M) mat black, caudal margins narrowly yellow, 1–2T medially yellow, 2–3T laterally yellow.

Periphallic organs (Fig. 1F): Epandrium broadly truncate below; surstylus huge, deeply tripartite, with 3 large black spines and a row of long black teeth. Phallic organs (Fig. 3C): Aedeagus slender, gently curved dorsoventrally; basal process absent; dorsal mantle fan-shaped. Anterior paramere apically bifurcated.

Specimens examined. Alishan, 2 ♂, 9 VI 1965 (SAIGUSA); 26 ♂, 26 V 1971 (KANMIYA) (incl. holotype).

Distribution. Formosa.

Relationships. Resembling *A.* (*P.*) *magna* OKADA, in having velvety black frons and long black spines on surstylus, different, however, in having 3 spines on surstylus (one in *magna*) and anterior paramere deeply bifid (not bifid in *magna*).

Key to species of the subgenus *Phortica* of Japan and the Oriental Region

26–28. No change from OKADA (1971: 97).

29. Frons with prominent frontal hairs; tibiae without black rings; arista pulmose in ♀, bare and apically expanded in ♂ ..... 30.
— Frontal hairs absent; tibiae with black rings; arista with at least upper branches in both sexes. ..... 31.
30. Frons orange brown; palpus yellow..... *foliiseta* DUDA
— Frons velvety black; palpus black..*nigrifoliiseta* TAKADA, MOMMA, and SHIMA
31. Caudal black bands of 3–5T medially and laterally protruded ..... (*variegata* complex) ..... 32.
— Caudal black bands of 3–5T medially not protruded..... 39.
32. Arista with lower branches long..... *antheria* OKADA, n. sp.
— Arista with lower branches absent or fine..... 33.
33. Frons medially black or brownish black..... 34.
— Frons medially pale brown or orange brown..... 38.
34. Palpus yellow; black patch of frons not reaching anterior margin of frons ..... *omega* OKADA, n. sp.
— Palpus black or brown..... 35.
35. Black patch of frons not reaching anterior margin of frons..... 36.
— Black patch of frons reaching anterior margin of frons..... 37.
36. Mesoscutum brownish black; caudal black bands of 3–5T reaching lateral margins; aedeagus apically bifid, basal process globular..... *kappa* MÁCA
— Mesoscutum pale brown; caudal black bands of 3–5T not reaching lateral

margins; aedeagus apically not bifid, but with recurved plate, basal process absent. ..... *okadai* MÁCA

37. Basal process of aedeagus conical, about 1/3 as long as aedeagus. ..... *conifera conifera* OKADA, n. sp.

— Basal process of aedeagus conical, more than half as long as aedeagus. ..... *conifera takadai* OKADA, n. subsp.

38. Periorbit orange..... *cardua* OKADA, n. sp.

— Periorbit yellowish white. ..... *orientalis* HENDEL

39. Mesoscutum with four dark longitudinal stripes..... *varipes* DUDA

— Mesoscutum without four longitudinal stripes..... 40.

40. Arista with lower branches long..... 41.

— Arista with lower branches absent or fine..... 44.

41. Lower branch of arista only one..... 42.

— Lower branches of arista three or more..... 43.

42. Abdominal tergites mostly black; C-index about 2.0.. *eparmata* OKADA, n. sp.

— Abdominal tergites mostly brown; C-index about 2.5 ..... *gombakana* TAKADA and MOMMA

43. Mesopleura greyish brown with white longitudinal stripes.... *radiata* OKADA

— Mesopleura grey with black stripes and spots ..... *subradiata* OKADA, n. sp.

44. Arista without ventral branches..... *magna* OKADA

— Arista with fine ventral branches..... 45.

45. Femora entirely yellow..... *maculiceps* DUDA

— Femora at least partially black..... 46.

46. Palpus black; caudal black band of 3T not interrupted at middle. ..... *paramagna* OKADA

— Palpus yellowish brown; caudal black band of 3T medially interrupted. ..... *gigas* OKADA

Anti-BURLA's rule in relation to geographical and seasonal distribution.

BURLA's rule, primarily established for Drosophilidae (BURLA, OKADA, 1959) and later proved by some other insect groups (OKADA, 1960), refers to that the relative position of the wing veins of related species or the individuals of a species tends to shift more outwards in the forms with larger wings. The reverse relation between wing veins and wing membranes has, however, been recognized in the forms with relatively large and/or pointed wings such as Papilionidae and Lycaenidae (OKADA, 1960). I will report here the finding of another case of this anti-BURLA's rule among the Japanese members of the *variegata* complex.

The *variegata* complex (MÁCA, 1976), characteristic in having the black caudal bands on the 3rd to 5th abdominal tergites prominently protruded medially and laterally as shown in the key and in Fig. 4: A–F, G, comprises *variegata* FALLÉN, *semivirgo* MÁCA, *erinacea* MÁCA, *okadai* MÁCA, *kappa* MÁCA, *conifera* OKADA, n. sp., *conifera takadai* n. subsp., *cardua* OKADA, n. sp., and *orientalis* HENDEL, so far as the Palaearctic and Oriental forms are concerned. The species *okadai*, *kappa*, *conifera*, and the subspecies *c. takadai* are treated here together with two closely

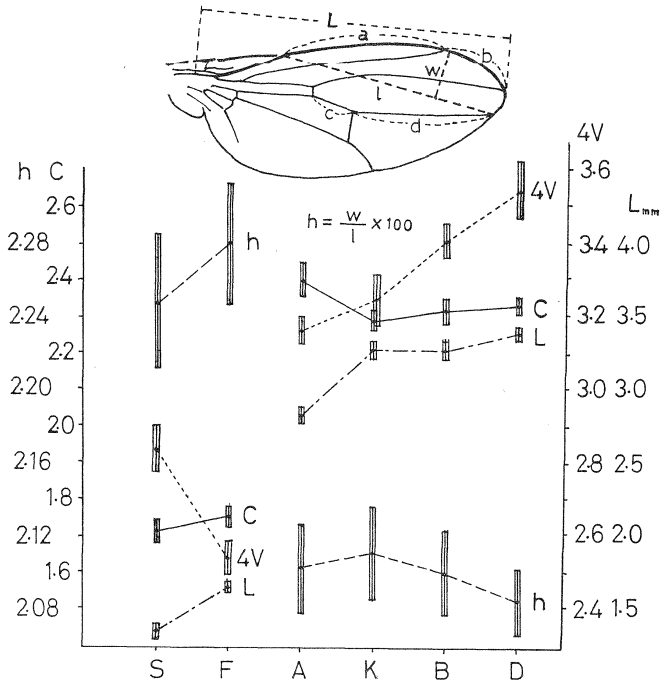

Fig. 6. Interspecific changes of C-index (C=a/b) and 4V-index (4V=d/c) in inverse relation (STURTEVANT's rule). The larger the wing length (L), the higher the C-index and lower the 4V-index in the *furcata* complex: *subfurcata* (S) and *furcata* (F) (BURLA's rule), while, the lower the C-index and higher the 4V-index in the *variegata* complex: *okadai* (A), *kappa* (K), *conifera* (B) and *c. takadai* (D) (anti-BURLA's rule). The value h(=w/1 × 100) is lower in the *variegata* complex than in the *furcata* complex, indicating the more pointed wings in the former group. Each point on the graph is a mean value of 20 male samples, vertical column: standard error of mean.

related species of *furcata* complex, *furcata* and *subfurcata*, of the subgenus *Amiota* for comparison. *A. furcata* OKADA has larger wing than in *A. subfurcata* OKADA and is distributed in the higher lands and more northwards in Japan than in the latter (OKADA, 1971_2). Similarly, among the *variegata* complex, *kappa*, *conifera* and *c. takadai* have larger wings than in *okadai* (Fig. 6) and are distributed in the higher lands and more northwards than in the latter. Moreover, the body coloration of *okadai* is paler than in others, but it becomes darker as well as the body becomes larger in the colder seasons, conforming to anti-GLOGER's rule and BERGMANN's rule (Fig. 5).

Measurement was made of wing length (L_{mm}), the length of the second costal section (a_{mm}), C-index and 4V-index for each 20 male samples of the six species and subspecies. It was resulted that 1) C-index and 4V-index show inversed relation among the species of each complex (STURTEVANT's rule: Sturtevant, 1942; Okada, 1959), 2) C-index becomes higher and 4V-index lower in the species with longer wing

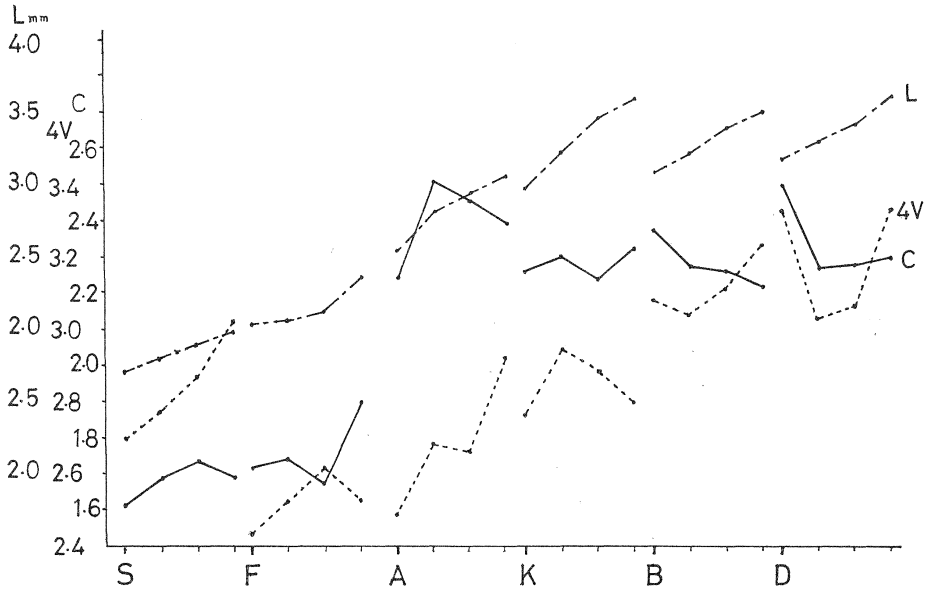

Fig. 7. Intraspecific changes of C-index (C) and 4V-index (4V) in relation to wing length (L) in the *variegata* complex——*okadai* (A), *kappa* (K), *conifera* (B) and *c. takadai* (D)—— to show anti-BURLA's rule, and in the *furcata* complex——*subfurcata* (S) and *furcata* (F) ——to show BURLA's rule. Each point on the graph is a mean value of 5 male samples.

in the *furcata* complex (BURLA's rule), and 3) C-index becomes lower and 4V-index higher in the species with longer wings in the *variegata*-complex (anti-BURLA's rule) (Fig. 6). It should be noticed that the species of the *variegata* complex have wings much longer (compare L in Fig. 6) and more pointed (compare h=w/l $\times$100 in Fig. 6) than in the *furcata* complex, similar as in the case of Papilionidae, for which anti-BURLA's rule was proved.

The same tendency of anti-BURLA's rule was also observed in the individual variations of wing length and wing indices of the species with longer wings, e. g., *conifera* and *c. takadai* (Fig. 7).

In view of allomorphosis between wing veins and wing membranes, which are represented by the length of the 2nd costal section (a) and wing length (L), respectively, allomorphic constant ($\propto$) was calculated by the method of least squares, applying values of a and L to the allometric formula, $a=bL^{\propto}$. The result shows that the phylogenetic constant, $\propto_1$, among the *variegata* complex is 1.23 (b=0.149), though still remaining tachymorphic ($\propto>1$). While, as shown in Fig. 8, the ontogenetic constant, $\propto_2$. is 1.50 (b=0.954), 1.21 (b=0.201), 0.68 (b=2.804), and 0.47 (b=7.628), in *okadai*, *kappa*, *conifera*, and *c. takadai*, respectively, in the *variegata* complex, and it is 1.83 (b=0.380) and 0.83 (b=1.233) in *subfurcata* and *furcata*, respectively, in the *furcata* complex. The values of $\propto_2$ decrease to indicate the change from tachymorphosis ($\propto>1$) to bradymorphosis ($\propto<1$) in both complexes,

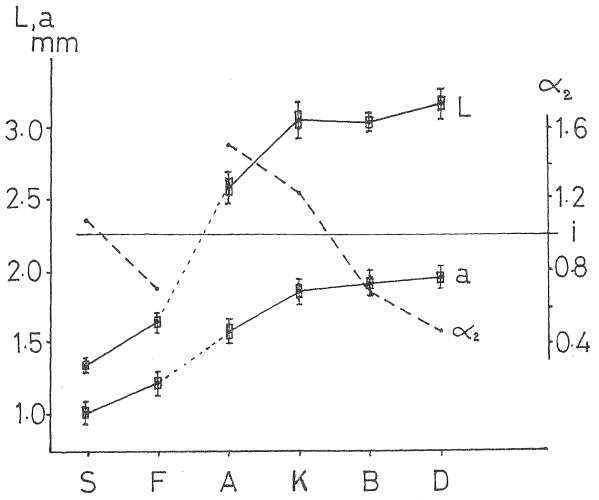

Fig. 8. Interspecific change of ontogenetic constant ($\propto_2$) in the allometric formula, $a = bL^{\propto}$, where "a" is the length of the second costal section and L is wing length (see Fig. 6), among the *variegata* complex (species A, K, B, and D), and the *furcata* complex (S and F). The value $\propto_2$ decreases from tachymorphosis ($\propto > 1$) to bradymorphosis ($\propto < 1$) in both groups. Species name as in Fig. 7. Each point on the graph is a mean value of 20 male samples, vertical column: standard error of mean, vertical line: 95% confidence limit of population mean, i: isomorphic line.

conforming to LAMEERE and SMITH's rule as proved in *Drosophila* and other insect groups (Okada, 1960). A case of bradymorphosis of wing veins (the length of discal cell) to wing length was already reported for Papilionidae and Lycaenidae, in which anti-BURLA's rule was also recognized. Therefore, it can be said that BURLA's rule in insect wings corresponds to tachymorphosis and anti-BURLA's rule to bradymorphosis.

Summary

Descriptions of six new species and a new subspecies of *Amiota* (*Phortica*) from Japan and the Oriental Region were made: *conifera* and *c. takadai* from Japan, *omega* from Thailand, and *antheria, cardua, subradiata* and *gigas* from Formosa. *A.* (*P.*) *orientalis* HENDEL from Formosa was redescribed. A revised key to *Phortica* of Japan and the Oriental Region was presented. Geographical and seasonal variations of wing length and body coloration of the *variegata* complex, especially *A. okadai*, in Japan were briefly discussed. Anti-BURLA's rule, which refers to that C-index is lower and 4V-index higher in the forms with longer wings, was recognized among the *variegata* complex, and this rule was analysed in view of allomorphosis.

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