Kontyû, Tokyo, **51** (3): 412–425. September 25, 1983

A Systematic Study on the Genus *Polemochartus* SCHULZ (Hymenoptera, Braconidae), Parasitic on the Genus *Lipara* MEIGEN (Diptera, Chloropidae)*

Kaoru MAETÔ**

Entomological Laboratory, Faculty of Agriculture,
Kyushu University, Fukuoka, 812 Japan

Synopsis The braconid genus *Polemochartus* SCHULZ, which is parasitic on the genus *Lipara* MEIGEN (Diptera, Chloropidae), is revised. It is inferred that *Polemochartus* is a monophyletic group and its sister group is the *Coelinius* Complex (*Coelinius* NEES + *Coelinidea* VIERECK + *Sarops* NIXON). *Polemochartus* can be divided into two monophyletic species groups, the *melas* group (*P. melas* (GIRAUD) from Europe and Japan) and the *liparae* group (*P. liparae* (GIRAUD) from Europe, and *P. nipponensis* sp. nov. and *P. kanmiyai* sp. nov. from Japan). All these four species are described. A key to the species of *Polemochartus* is given.

Introduction

The braconid genus *Polemochartus* is a small group of the subfamily Alysiinae, and has been known to include only two European species, *P. liparae* (GIRAUD, 1863) and *P. melas* (GIRAUD, 1863). This genus was erected by GIRAUD (1863) as *Polemon*, but SCHULZ (1911) gave a new name, *Polemochartus*, to this genus, because *Polemon* GIRAUD, 1863 is a junior homonym of *Polemon* JAN, 1858.

In the present study, I attempt to revise this genus with descriptions of all species including two new Japanese ones.

In constructing the classification of *Polemochartus*, I have tried to follow the principles of phylogenetic systematics proposed by HENNIG (1966). In deciding the relative apo- (derived) or plesiomorphic (ancestral) character state, I adopted the out-group comparison method (e.g. ROSS, 1974, as ex-group comparison; DE JONG, 1980, as argument of out-group occurrence; WATROUS & WHEELER, 1981). In principle, if one of two or more character states in one group (in-group) occurs in other closely related groups (out-group), this character state is assumed to be plesiomorphic.

RICHARDS (1977) and VAN ACHTERBERG (1975, 1979) were consulted with for morphological terms. The letters OD stand for the greatest diameter of a posterior ocellus.

The holotypes of the new species described in this paper are deposited in the

* Contribution from the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka (Ser. 3, No. 129).

** Present address: Forestry and Forest Products Research Institute, P.O. Box 16, Tsukuba Norin Kenkyu Danchi, Ibaraki, 305 Japan.

Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, 812 Japan.

Subfamily Alysiinae
Tribe Dacnusini

Genus *Polemochartus* SCHULZ

Polemon GIRAUD, 1863, Verh. zool. -bot. Ges. Wien **13**: 1267 (nec *Polemon* JAN, 1858); DALLA TORRE, 1898, Cat. Hym. **4**: 18; MARSHALL, 1899, Trans. R. ent. Soc. Lond. 1899: 8.
Dacnusa (*Polemon*): THOMSON, 1895, Opusc. ent. **20**: 2330.
Polemochartus SCHULZ, 1911, Zool. Ann. **4**: 61 (n. n. pro *Polemon* GIRAUD, 1863, nec JAN, 1858); NIXON, 1942, Ent. mon. Mag. **78**: 133; NIXON, 1943, *Ibid.* **79**: 28; TOBIAS, 1971, Tr. Vsesoyuzn. ent. Obshch. **54**: 191; SHENEFELT, 1974, Hym. Cat. **11**: 1106 (literature).
Coelinius (*Polemochartus*): GRIFFITHS, 1964, Beitr. Ent. **12**: 857.

Type-species: *Polemon liparae* GIRAUD, 1863.

Length of body 4.5–11.5, of fore wing 3.5–7.5 mm.

Head.—Width of head 1.3–1.8 times its length, 1.30–1.45 times width of mesoscutum; head wider behind eyes than across them; OOL/OD=3.0–5.0; POL/OD=1.0–2.0; frons deeply concave with some rugae; vertex, temple, face and clypeus punctate; gena more strongly punctate; eye bare; anterior tentorial pit deep and small; epistomal sulcus present; malar sulcus absent; clypeus projecting anteriorly as a thickened lamella; ventral lamella of clypeus absent or only vestigial; mandible in exodont condition, tridentate, dominated by large pointed 2nd tooth, 2nd tooth with a basal lobe antero-dorsally (Fig. 7); median length of mandible 2.0–3.0 times its apical width; antennal segments 43–65 (♀), 48–80 (♂); maxillary and labial palpi with 6 and 4 segments, respectively.

Mesosoma.—Length of mesosoma 1.5–1.9 times its height; side of pronotum punctate, with a more or less crenulate median depression; precoxal sulcus completely developed and crenulate; metapleuron rugose, its hairs tending downwards toward the hind coxa; metapleural flange small; pronope deep and round; notauli present; mesoscutal lobes punctate; mesoscutum with a median longitudinal groove on the posterior half; propodeum rugose entirely.

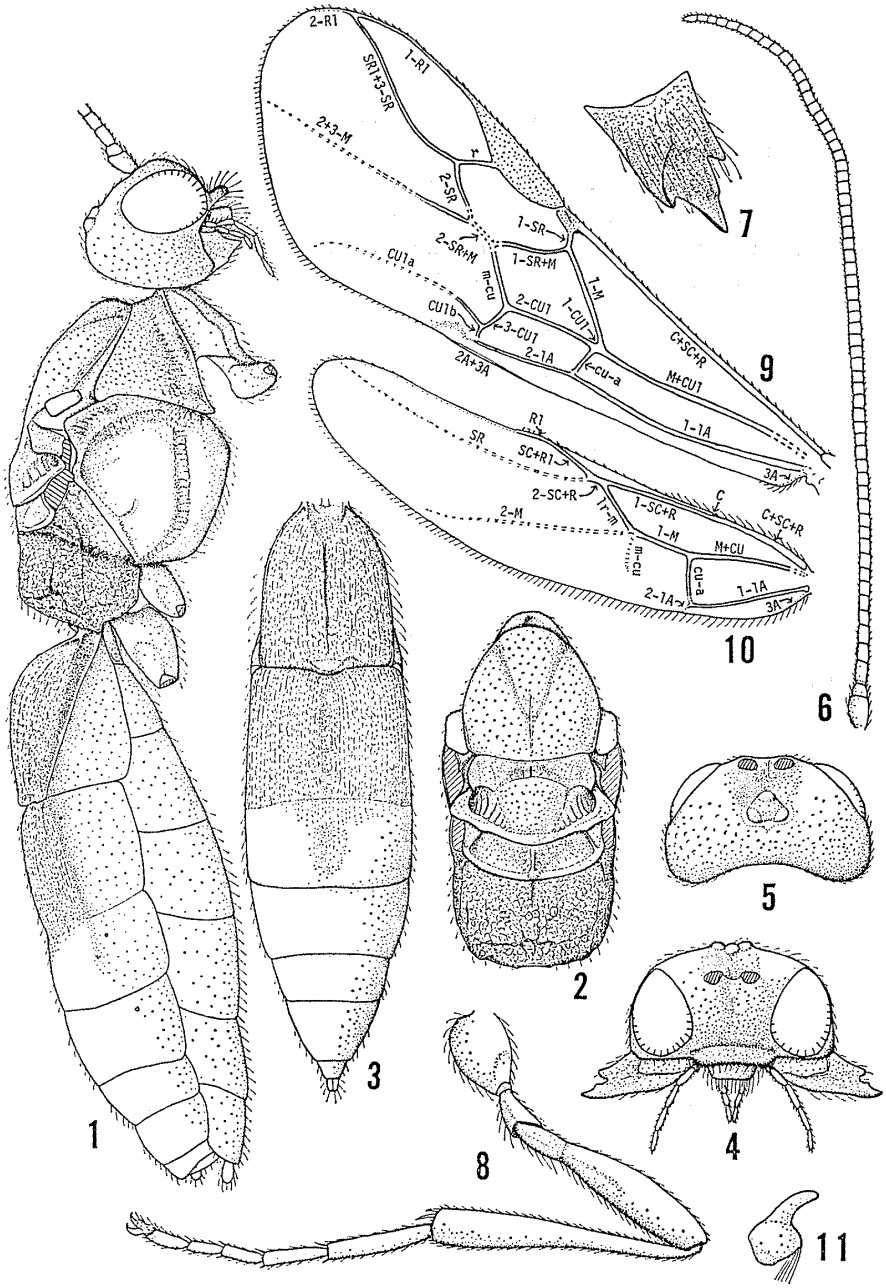
Wings.—Fore wing: r-m absent; pterostigma short and wide, its length 4–5 times its width; r emerging from middle of pterostigma; 1-SR+M and CU1b present; 2-1A complete; SR1+3-SR more or less sinuate; m-cu antefurcal to 2-SR. Hind wing: m-cu present, at least vestigial. Wing membrane slightly infuscated.

Legs.—Tarsal claws spatulate (Figs. 26–28); length of hind coxa ca. 0.45 times length of 1st metasomal tergite; length of hind tibia 1.5–1.6 times length of hind femur.

Metasoma.—Metasoma of ♀ compressed laterally only at the apex; dorsope and laterope of 1st tergite well developed; basal portion of 1st tergite strongly elevated in lateral aspect; length of 1st tergite 1.1–1.5 times its apical width; 1st and 2nd tergites longitudinally rugose, and often so on anterior area of 3rd one;

all tergites covered with more than one row of hairs; 3rd–7th terga of ♀ without notches on the posterior margin; length of ovipositor sheath ca. 1/20 times length of fore wing.

Cephalic structures of the final instar larva.—All structures except mandible



Figs. 1–11. *Polemochartus nipponensis* sp. nov., ♀. —— 1, Body, lateral aspect; 2, mesosoma, dorsal aspect; 3, metasoma, dorsal aspect; 4, head, frontal aspect; 5, head, dorsal aspect; 6, antenna; 7, mandible; 8, hind leg; 9, fore wing; 10, hind wing; 11, mandible of final instar larva.

and palpi desclerotized; mandible simple and smooth (Fig. 11). I have examined the cephalic structures of *P. melas*, *P. nipponensis* and *P. kanmiyai*, and SHORT (1952) reported on *P. liparae*.

Diagnostic combination. *Polemochartus* can be easily separated from any other genus of the Alysiinae by possession of the following combination of character states: Vein r-m of fore wing absent; mandible tridentate, dominated by large pointed 2nd tooth (Fig. 7); 2nd tergite of metasoma longitudinally rugose (Fig. 3); all metasomal tergites covered with more than one row of hairs; eye bare; ventral lamella of clypeus almost absent (Figs. 4, 21–22); 1st tergite of metasoma stout, 1.1–1.5 times as long as wide apically; tarsal claws spatulate (Figs. 26–28); body large, 4.5–11.5 mm in length; metasoma of ♀ compressed laterally only at apex (Fig. 3); vertex and temple punctate (Fig. 5); and head wider behind eyes than across them (Figs. 5, 14–16).

Biology. Solitary, egg-larval parasites of the genus *Lipara* MEIGEN (Diptera, Chloropidae), larvae of which cause more or less distinct galls on stems of the Common Reed (*Phragmites communis* TRIN.) (GIRAUD, 1863; MOOK, 1961; CHVÁLA *et al.*, 1974; KANMIYA, pers. com.). Univoltine, and adults appear from May to July in Japan.

Distribution. Europe and Japan.

Systematic position. *Polemochartus* belongs to the subfamily Alysiinae, which is deemed to be monophyletic on account of its members having the unique, exodont mandibles in common (Fig. 4). This subfamily is closely related to the subfamily Opiinae (VAN ACHTERBERG, 1976). The Alysiinae are composed of two tribes, Alysiini and Dacnusini, and *Polemochartus* belongs to the latter tribe. The tribe Dacnusini may be monophyletic because of the absence of the vein r-m in the fore wing.

Monophyly. The following character states may be regarded as autapomorphic for *Polemochartus*:

P(1). Apically spatulate tarsal claws (Figs. 26–28)—As far as I know, this is a unique character state of *Polemochartus*. In the Opiinae and any other genus of the Alysiinae, the tarsal claws are slender and simple.

P(2). Being parasitic on the genus *Lipara*—All the *Polemochartus* species are parasitic on the genus *Lipara* MEIGEN (Chloropidae), and no other braconid endoparasites have been known from *Lipara*.

The anteriorly projecting clypeus of *Polemochartus* may also be unique, though similar condition is observed in some species of *Coelinius* NEES.

Sister group relationship (Fig. 32). The sister group of *Polemochartus* is thought to be the *Coelinius* complex (*Coelinius* NEES = *Chaenon* CURTIS + *Coelinidea* VIERECK + *Sarops* NIXON). It is characterized by the following apomorphs:

C(1). Compression of female metasoma after the 3rd segment, thus the metasoma is shaped like the blade of a knife (Figs. 1, 7 in MAETÔ, 1983)—In the Opiinae and most genera of the Alysinnae, the metasoma of female is rather de-

pressed or only weakly compressed laterally.

C(2). Presence of a pair of notches on the posterior margins of the 3rd to 7th terga of female metasoma (Fig. 7 in MAETÔ, 1983)—This character state is unique and observed only in the *Coelinius* complex.

The following character states may be regarded as synapomorphic for *Polemochartus* and the *Coelinius* complex:

P-C(1). Desclerotization of all cephalic structures of the final instar larva, except mandible and palpi—This condition can be assumed to be apomorphic, because the usual cephalic structures of the larvae of Braconidae are too complex to be regained after once obliterated. The similar condition would have occurred independently in some genera of the subfamily Opiinae and the genus *Oenonogastra* ASHMEAD of the tribe Alysiini (ČAPEK, 1970). In the tribe Dacnusini, however, this condition is observed only in the *Coelinius* complex and *Polemochartus* (SHORT 1952; ČAPEK, 1970; MAETÔ, 1983). In other genera of the Dacnusini (*Synelix* FOERSTER=*Ectilis* NIXON, *Dacnusa* HALIDAY, *Pachysema* FOERSTER, *Chorebus* HALIDAY, *Laotris* NIXON, *Symphya* FOERSTER, *Antrusa* NIXON, *Priapis* NIXON and *Toxelea* NIXON), the cephalic structures are not so much reduced (ČAPEK, 1970).

P-C(2). Retirement of ventral lamella of clypeus (Figs. 4, 21–22; Fig. 2 in MAETÔ, 1983)—In most genera of the Opiinae and Alysiinae, the clypeus has a well developed ventral lamella (Fig. 13 in MAETÔ, 1983).

P-C(3). Elevation of the basal portion of the 1st metasomal tergite in lateral aspect (Fig. 1; Fig. 1 in MAETÔ, 1983)—In most genera of the Opiinae and Alysiinae, the basal portion of the 1st tergite is only slightly elevated (Fig. 12 in MAETÔ, 1983).

P-C(4). Small hind coxa, which is less than half as long as 1st metasomal tergite (Fig. 1)—As far as I know, the hind coxa is nearly always more than half as long as the 1st tergite in the Opiinae and Alysiinae.

P-C(5). Dominance of the 2nd tooth of mandible (Fig. 7; Fig. 4 in MAETÔ, 1983)—Such a developed 2nd tooth is rare in the Alysiinae.

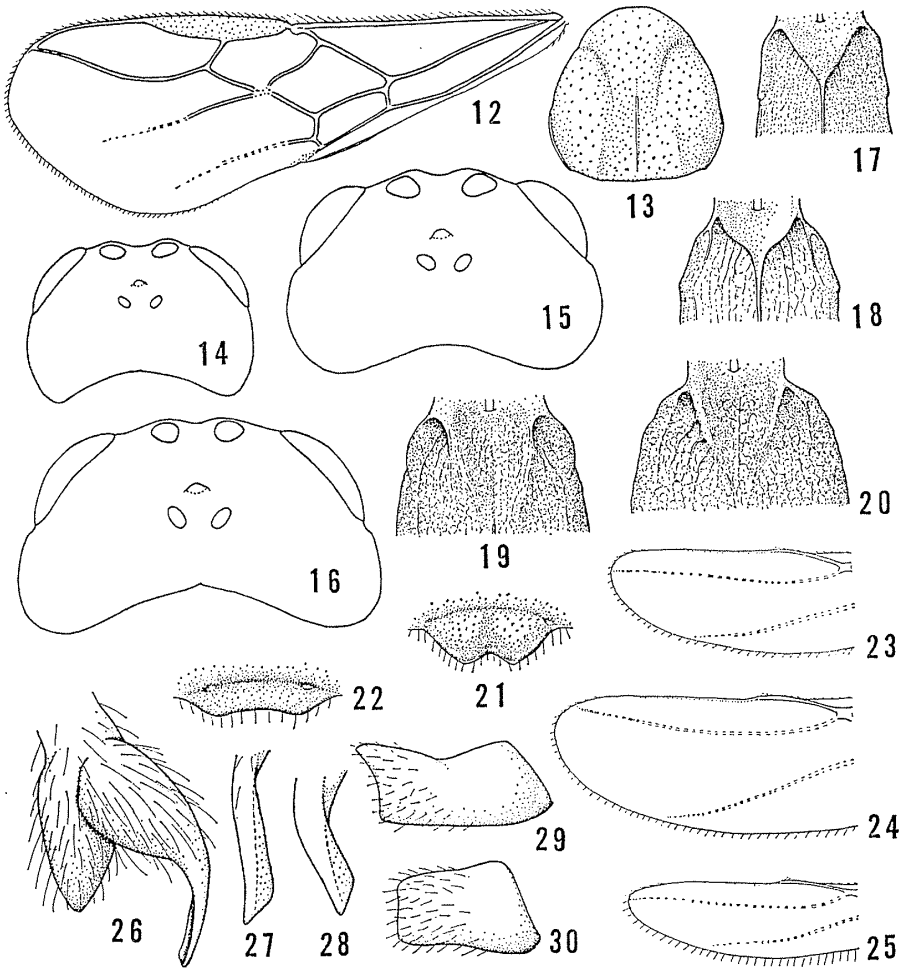
P-C(6). Being parasitic on the family Chloropidae—According to GRIFFITHS (1964), excluding doubtful records, all the Dacnusini parasitic on the Chloropidae belong to his genus *Coelinius* (=*Coelinius*+*Coelinidea*+*Polemochartus*). The genus *Sarops* is also parasitic on the Chloropidae (MAETÔ, 1983). In the Opiinae only one species is recorded as a parasite of the Chloropidae (FISCHER, 1971), and as far as I know the Alysiini are hardly parasitic on the Chloropidae. Agromyzid species are the most common hosts of the Opiinae and Alysiinae. GRIFFITHS (1964) concluded, after he studied the phylogeny and host association of the Dacnusini, that the earliest hosts of the Dacnusini were leaf-mining Agromyzidae.

P-C(7). Being egg-larval parasites (=depositing an egg on the egg of host)—The genera *Coelinidea* and *Polemochartus* are known as egg-larval parasites (e.g. CLAUSEN, 1940; MOOK, 1961; WATANABE, 1963), and this habit is unique in the Alysiinae. Only another genus, *Symphya* FOERSTER, is known as an egg-larval parasite (CLAUSEN, 1940).

Key to Species of *Polemochartus*

1. Vein m-cu of fore wing only slightly antefurcal to vein 2-SR, 2-SR+M/1-SR+M=0.1–0.2 (Fig. 12); width of head 1.3–1.5 times its length (Figs. 14, 31); notauli vanishing posteriorly (Fig. 13); paramere of male with a strong expansion dorso-distally (Fig. 29); vein SR of hind wing directed toward the wing apex (Fig. 23); small species, length of fore wing 3.5–5.0 mm (*melas* group)..... *melas* (GIRAUD)

— Vein m-cu of fore wing far antefurcal to vein 2-SR, 2-SR+M/1-SR+M=0.3–0.5 (Fig. 9); width of head 1.5–1.8 times its length (Figs. 5, 15–16, 31); notauli complete (Fig. 2); paramere of male truncate distally (Fig. 30); vein SR of



Figs. 12–30. —— 12–14, 17, 21, 23, 28–29, *Polemochartus melas*; 15, 18, 22, 24, *P. liparae*; 19, 26–27, 30, *P. nipponensis*; 16, 20, *P. kanmiyai*; 25, *Coelinius* sp. —— 12, Fore wing; 13, mesonotum; 14–16, head, dorsal aspect; 17–20, basal portion of 1st tergite, dorsal aspect; 21–22, clypeus, frontal aspect; 23–25, apical portion of hind wing; 26, hind pretarsus, lateral aspect; 27–28, apical portion of tarsal claw, dorsal aspect; 29–30, male paramere, lateral aspect.

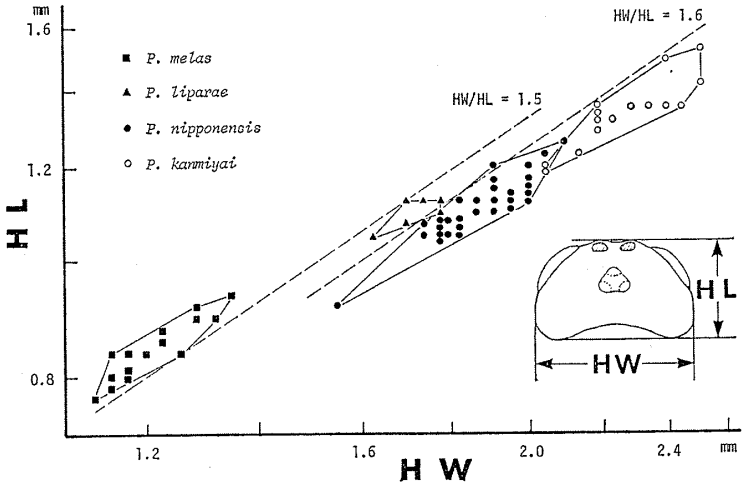


Fig. 31. Relation between head width (HW) and its length (HL) among *Polemochartus* species in males.

hind wing not directed toward the wing apex (Figs. 10, 24); large species, length of fore wing 5.0–7.5 mm (*liparae* group).....2

2. Dorsal carinae of 1st tergite well developed basally; basal triangular area of 1st tergite surrounded by the dorsal carinae almost smooth (Fig. 18); eye strongly convex in dorsal aspect (Fig. 15); width of head 1.5–1.6 times its length (Figs. 15, 31); vein cu-a of fore wing far postfurcal, 1-CU1/2-CU1=0.1–0.2; parasite of *Lipara lucens*; Europe.....*liparae* (GIRAUD)

— Dorsal carinae of 1st tergite reduced basally (Figs. 19–20); basal area of 1st tergite more or less longitudinally rugose (Figs. 19–20); eye weakly convex in dorsal aspect (Figs. 5, 16); width of head 1.6–1.8 times its length (Figs. 5, 16, 31); vein cu-a of fore wing interstitial or slightly postfurcal, 1-CU1/2-CU1 at most 0.15; Japan.....3

3. Hind coxa black, if reddish-brown, then 2nd and 3rd metasomal tergites almost always reddish-brown; rather small species, length of fore wing 5.0–6.5 mm (cf. Fig. 31); vein m-cu of hind wing usually interstitial, sometimes antefurcal or postfurcal, to vein 1r-m; in hind wing 1r-m/1 M=0.7–1.0; parasite of *Lipara japonica*.....*nipponensis* sp. nov.

— Hind coxa reddish-brown and 2nd and 3rd metasomal tergites black; rather large species, length of fore wing 6.0–7.5 mm (cf. Fig. 31); vein m-cu of hind wing usually postfurcal, rarely interstitial, to vein 1r-m; in hind wing 1r-m/1M=1.0–1.2; parasite of *Lipara brevipilosa*.....*kanmiyai* sp. nov.

The *melas* group

Width of head 1.3–1.5 times its length (Figs. 14, 31); clypeus rather broad (Fig. 21); length of 4th and penultimate segments of antenna both 1.5–2.0 times their width; notauli vanishing posteriorly (Fig. 13); in fore wing, m-cu slightly ante-

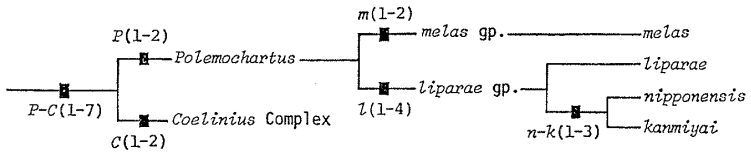


Fig. 32. Proposed phylogenetic relationships for *Polemochartus* and its probably nearest relative. Symbols refer to apomorphic character states in the text.

furcal to 2-SR, 2-SR+M/1-SR+M=0.1–0.2 (Fig. 12); length of pterostigma ca. 5 times its width; SR of hind wing directed toward the wing apex (Fig. 23); length of hind femur 4.0–5.5 times its width; paramere of ♂ with a strong expansion dorso-distally (Fig. 29).

This group is composed of a single, small species from Europe and Japan. This group may be a sister group to the *liparae* group and is characterized by the following apomorphs:

m(1). A strong dorso-distal expansion on the male paramere (Fig. 29)—In the *liparae* group and the *Coelinius* complex, the male paramere is truncate apically (Fig. 30).

m(2). Vanishing of the posterior portion of notauli (Fig. 13)—A tendency to lose the notauli is observed in many groups of the Braconidae, while in many species of the *Coelinius* complex and all of the *liparae* group the notauli are completely retained.

Polemochartus melas (GIRAUD)

(Figs. 12–14, 17, 21, 23, 28–29, 31)

Polemon melas GIRAUD, 1863, Verh. zool.-bot. Ges. Wien **13**: 1269 (Austria); DALLA TORRE, 1898, Cat. Hym. **4**: 18; GOIDANICH, 1936, Boll. Inst. Ent. Univ. Bologna, **8**: 213 (redescription); CHVÁLA *et al.*, 1974, Tijdschr. Ent. **117**: 21 (host).

Polemochartus melas: SHENEFELT, 1974, Hym. Cat. **11**: 1107 (literature).

Length of body 4.5–6.5, of fore wing 3.5–5.0 mm.

Head.—Eye weakly convex in dorsal aspect (Fig. 14); length of eye 0.7–0.9 times length of temple; width of face 0.8–1.0 (♀), 1.0–1.2 (♂) times height of eye; antennal segments 43–54 (♀), 48–59 (♂).

Mesosoma.—Length of mesosoma 1.7–1.9 times its height; epicnemial area usually rugulose.

Wings.—Fore wing (Fig. 12): 2-SR/r=1.5–2.5; 2-SR+M/r=0.3–0.6; 1-SR+M/m-cu=1.4–1.7; 1-M/m-cu=1.3–1.7; cu-a postfurcal; 1-CU1/2-CU1=0.05–0.20. Hind wing: m-cu usually postfurcal to 1r-m; 1r-m/1-M=0.6–0.9.

Metasoma.—Dorsal carinae of 1st tergite well developed basally (Fig. 17); basal triangular area of 1st tergite coriaceous.

Colour.—Black; palpi yellowish-brown; legs reddish-brown, hind coxa infuscated, hind tibia except for basal extreme and 1st–3rd tarsal segments blackish;

pterostigma dark brown.

Hosts. In Japan, *Lipara rufitarsis* LOEW, *L. vallicola* KANMIYA and *L. frigida* KANMIYA. In Europe, *L. rufitarsis* L. (CHVÁLA *et al.*, 1974). Records of *L. lucens* MEIGEN need to be confirmed.

Distribution. Europe and Japan (Hokkaido, Honshu, Kyushu).

Specimens examined. From Europe—Frankfurt am Main, W. Germany, 1 ♂, ex *Lipara* galls, undated (H. WOLF), determined by VAN ACHTERBERG (1982) as *Polemochartus melas* (GIRAUD). From Japan—[HOKKAIDO] Kabutonuma, Toyotomi-machi, 4 ♀♀, 12. vii. 1980 (K. MAETÔ); Ashorobuto, Ashoro-machi, 4 ♀♀, 27. vi. 1980 (K. MAETÔ), 2 ♂♂, 27. vi. 1980 (H. TAKEMOTO); Churui, Tokachi, 1 ♀[1], em. on 1. iv. 1975; Kushiro, 1 ♂[2], em. on 25. v. 1977; Koshimizu, Abashiri, 1 ♀[2], em. on 12. v. 1977. [HONSHU] Sasaguchihama, Nakajô-machi, Niigata Pref., 1 ♀, 6. vi. 1980 (K. MAETÔ); Ohtawara, Tochigi Pref., 1 ♀[3], em. on 10. v. 1977; Nikko, Tochigi Pref., 1 ♂[3], em. on 31. v. 1975; Ushikunuma, Ibaraki Pref., 1 ♀[3], gall col. on 30. vii. 1973; Sawara, Chiba Pref., 2 ♀♀[3], galls col. on 29. vii. 1973; Tagonoura, Shizuoka Pref., 3 ♂♂[3], em. on 2. v. 1976; Kisofukushima, Nagano Pref., 2 ♀♀ 1 ♂[1], em. on 8. v. 1977, 2 ♀♀ 2 ♂♂[1], em. on 30. v. 1977; Biwako, Shiga Pref., 3 ♂♂[3], em. on 2. v. 1977; Ogôri, Yamaguchi Pref., 1 ♀ 1 ♂[3], em. on 4. v. 1976. [KYUSHU] Koga, Fukuoka Pref., 7 ♀♀ 3 ♂♂, 13. v. 1981 (K. MAETÔ); Suegawa, Fukuoka City, 2 ♀♀ 1 ♂, 13. v. 1981 (K. MAETÔ); Hakozaki, Fukuoka Pref., 6 ♀♀ 3 ♂♂[3], galls col. on 20. viii. 1973; Ongagawa, Fukuoka Pref., 3 ♀♀ 1 ♂[3], em. on 4. v. 1975, 2 ♀♀ 3 ♂♂[3], em. on 26. iv. 1976; Chôjabaru, Kujû, Oita Pref., 3 ♀♀[3], em. on 4. v. 1976; Hikawa, Kumamoto Pref., 1 ♀ 3 ♂♂[3], em. on 20. v. 1977; Kuchinotsu, Nagasaki Pref., 6 ♀♀ 1 ♂[3], em. on 10. v. 1976; Hitotsusegawa, Miyazaki Pref., 1 ♀[3], em. on 6. iv. 1975; Shigetomi, Kagoshima Pref., 2 ♀♀ 1 ♂[3], em. in iv. 1975.

Remarks. The Japanese specimens examined agree well with the European one and the redescription by GOIDANICH (1936).

The *liparae* group

Width of head 1.5–1.8 times its length (Figs. 5, 15–16, 31); clypeus rather narrow and transverse (Fig. 22); length of 4th and penultimate segments of antenna both 1.0–1.5 times their width (Fig. 6); notauli complete (Fig. 2); in fore wing, m-cu far antefurcal to 2-SR, 2-SR+M/1-SR+M=0.3–0.5 (Fig. 9); length of pterostigma ca. 4 times its width; SR of hind wing not directed toward the wing apex (Figs. 10, 24); length of hind femur 3.5–4.5 times its width (Fig. 8); paramere of ♂ truncate distally (Fig. 30).

This group is composed of three, large species from Europe and Japan. This

1) Reared from galls of *L. vallicola* on *Phragmites communis* and collected by K. KANMIYA.
2) Reared from galls of *L. frigida* on *P. communis* and collected by K. KANMIYA.
3) Reared from galls of *L. rufitarsis* on *P. communis* and collected by K. KANMIYA.

group is parasitic on the *Lipara* species belonging to the *lucens* group (KANMIYA, pers. com.).

Monophyly. The monophyly of this group is based on the following four apomorphs:

l(1). Displacement of the apical portion of the vein SR of hind wing toward the base (Figs. 10, 24)—In *P. melas* and many species of the related genera, the vein SR of the hind wing is directed toward the wing apex (Figs. 23, 25).

l(2). Large body size: body length 6.5–11.5 mm—The species of the *liparae* group may be the largest of the Alysiine species. According to GRIFFITHS (1964), the plesiomorphic size range for the Dacnusini is 2–3 mm.

l(3). Presence of two colour forms: dark-form and reddish-from—As far as I know, this type of dimorphism is observed only in two species, *P. liparae* and *P. nipponensis*, of the *liparae* group in the tribe Dacnusini.

l(4). Being parasitic on the *lucens* group of the genus *Lipara*—The hosts of the *liparae* group seem to be restricted to the *lucens* group of *Lipara*. The species of the *lucens* group (*L. lucens* MEIGEN, *L. baltica* KARPS, *L. japonica* KANMIYA and *L. brevipilosa* NARTSHUK) are very closely related to one another (KANMIYA, pers. com.).

Inter-specific relationships (Fig. 32). *P. nipponensis* sp. nov. and *P. kanmiyai* sp. nov. seem to form a sister group to *P. liparae* (GIRAUD), being characterized by the following apomorphs:

n-k(1). Reduction of the basal portion of dorsal carinae of the 1st metasomal tergite (Figs. 19–20)—In *P. melas*, *P. liparae* and many species of the *Coelinius* complex, the dorsal carinae are well developed basally.

n-k(2). Broad head, being 1.6–1.8 times as broad as long—For each species the range of the ratio (head width at temple/its length) is given as follows: the *Coelinius* complex (1.3–1.5), *P. melas* (1.3–1.5), *P. liparae* (1.5–1.6), and *P. nipponensis* and *P. kanmiyai* (1.6–1.8) (Fig. 31).

n-k(3). Displacement of the vein cu-a of fore wing toward the base: vein cu-a interstitial or slightly postfurcal—In *P. melas*, *P. liparae* and many species of the Dacnusini, the vein cu-a is distinctly postfurcal.

Polemochartus liparae (GIRAUD)

(Figs. 15, 18, 22, 24, 31)

Polemon liparae GIRAUD, 1863, Verh. zool.-bot. Ges. Wien **13**: 1268 (Austria); DALLA TORRE, 1898, Cat. Hym. **4**: 18; MARSHALL, 1899, Trans. R. ent. Soc. Lond. 1899: 9; D'ROZARIO, 1942, Trans. R. ent. Soc. Lond. **92**: 367, 390 (development of the genitalia); MOOK, 1961, Archs. néerl. Zool. **14**: 423 (oviposition behaviour); CHVÁLA *et al.*, 1974, Tijdschr. Ent. **117**: 21 (host).

Polemochartus liparae: NIXON, 1942, Ent. mon. Mag. **78**: 133; SHORT, 1952, Trans. R. ent. Soc. Lond. **103**: 80 (final instar larva); ČAPEK, 1970, Can. Ent. **102**: 859 (final instar larva); SHENEFELT, 1974, Hym. Cat. **11**: 1107 (literature); EDSON & VINSON, 1979, Can. Ent. **111**: 1015 (venom apparatus).

Length of body 7.5–8.5, of fore wing 5.0–6.0 mm.

Head.—Width of head 1.5–1.6 times its length; eye strongly convex in dorsal aspect (Figs. 15, 31); length of eye 0.6–0.7 times length of temple; width of face 1.1–1.2 (♀), 1.2–1.5 (♂) times height of eye; antennal segments 55 (♀), 65–74 (♂).

Mesosoma.—Length of mesosoma 1.6–1.8 times its height; epicnemial area crenulate or rugulose.

Wings.—Fore wing: 2-SR/r=ca. 1.5; 2-SR+M/r=0.6–0.9; 1-SR+M/m-cu=1.3–1.4; 1-M/m-cu=1.5–1.8; cu-a postfurcal; 1-CU1/2-CU1=0.10–0.20. Hind wing: m-cu usually postfurcal to 1r-m; 1r-m/1-M=0.9–1.4.

Metasoma.—Dorsal carinae of 1st tergite well developed basally (Fig. 18); basal triangular area of 1st tergite almost smooth (Fig. 18).

Colour.—Black; palpi brown; legs reddish-brown, hind tarsus and apical portion of hind tibia infuscated; pterostigma dark brown. Reddish-form: 2nd and 3rd tergites of metasoma reddish-brown, sometimes 1st tergite also reddish-brown posteriorly. Dark-form: 2nd and 3rd tergites dark brown.

Host. Lipara lucens MEIGEN (MOOK, 1961; CHVÁLA *et al.*, 1974). Records of *L. similis* SCHINER need to be confirmed.

Distribution. Europe.

Specimens examined. [HOLLAND] All determined by VAN ACHTERBERG (1980) as *Polemochartus liparae* (GIRAUD). Overveen, 1 ♀, 1–20. vi. 1974 (C. J. ZWAKHALS); Asperen, 1 ♂, 24. v. 1972, 1 ♂, 3. vi. 1972 (C. J. ZWAKHALS). [U.S.S.R] Latvia, 1 ♀ 4 ♂♂, em. on 12. v. 1980 (A. KARPS & K. KANMIYA).

Polemochartus nipponensis sp. nov.

(Figs. 1–11, 19, 26–27, 30–31)

Length of body 6.5–9.5, of fore wing 5.0–6.5 mm.

Head.—Width of head 1.6–1.8 times its length (Figs. 5, 31); eye weakly convex in dorsal aspect (Fig. 5); length of eye 0.6–0.9 times length of temple; width of face 1.0–1.1 (♀), 1.1–1.4 (♂) times height of eye; antennal segments 52–64 (♀), 61–80 (♂).

Mesosoma.—Length of mesosoma 1.5–1.7 times its height; epicnemial area usually crenulate.

Wing.—Fore wing (Fig. 9): 2-SR/r=1.5–2.0; 2-SR+M/r=0.7–1.2; 1-SR+M/m-cu=1.2–1.4; 1-M/m-cu=1.4–1.7; cu-a interstitial or slightly postfurcal; 1-CU1/2-CU1 at most 0.15. Hind wing (Fig. 10): m-cu usually interstitial, sometimes antefurcal or postfurcal, to 1r-m; 1r-m/1-M=0.7–1.0.

Metasoma.—Basal portion of dorsal carinae of 1st tergite reduced (Fig. 19); basal area of 1st tergite more or less longitudinally rugose (Fig. 19).

Colour.—Black; palpi yellowish-brown; pterostigma dark brown. Dark-form: 2nd and 3rd tergites of metasoma dark brown or black; legs almost always black or dark brown, fore and middle tarsi yellowish-brown. Reddish-form: 2nd

and 3rd tergites and legs reddish-brown, hind tarsus and apical portion of hind tibia infuscated, fore and middle tarsi yellowish-brown.

Host. *Lipara japonica* KANMIYA.

Distribution. Japan (Hokkaido, Honshu, Shikoku, Kyushu).

Holotype ♀ (Type No. 2395, Kyushu Univ.), Hakozaki, Fukuoka Pref., Kyushu, reared from a gall of *L. japonica* on *Phragmites communis*, 20. iii. 1975 (K. KANMIYA).

Paratypes. Kabutonuma, Toyotomi-machi, Hokkaido, 2 ♀♀, 12. vii. 1980 (K. MAETÔ); Nishitoyotomi, Toyotomi-machi, Hokkaido, 2 ♀♀, 11. vii. 1980 (K. MAETÔ); Koga, Fukuoka Pref., Kyushu, 1 ♂, 13. v. 1981 (K. MAETÔ). The following paratypes were all reared from galls of *L. japonica* on *Phragmites communis* and collected by K. KANMIYA. [HOKKAIDO] Kabutonuma, Soya, 2 ♀♀, em. on 13–15. v. 1977; Abashiriko, Abashiri, 2 ♀♀ 2 ♂♂, em. on 10–12. v. 1977; Shadai, Tomakomai, 1 ♀ 1 ♂, em. on 2. iv. 1975. [HONSHU] Shariki, Aomori Pref., 3 ♀♀ 3 ♂♂, em. on 13–15. v. 1977; Kogawara, Aomori Pref., 1 ♀ 1 ♂, em. on 31. v. 1975; Jyusanko, Aomori Pref. 1 ♀ 1 ♂, em. on 13. v. 1977; Naganuma, Miyagi Pref., 5 ♀♀ 3 ♂♂, em. on 4. v. 1976; Ohnuma, Tochigi Pref., 7 ♀♀ 4 ♂♂, em. on 20. iv. 1973; Ohtawara, Tochigi Pref., 2 ♀♀ 1 ♂, em. on 10. v. 1976; Akamanuma, Tochigi Pref., 2 ♀♀ 1 ♂, em. on 17. v. 1976; Nikko, Tochigi Pref., 3 ♀♀ 2 ♂♂, em. on 12. vi. 1974; Kamimaki, Gunma Pref., 9 ♀♀ 12 ♂♂, em. on 1–18. iv. 1974; Koga, Ibaraki Pref., 1 ♀ 4 ♂♂, em. on 25–27. iv. 1977; Kasukabe, Saitama Pref., 2 ♀♀ 1 ♂, em. on 1–18. iv. 1977; Mt. Togakushi, Nagano Pref., 1 ♀ 2 ♂♂, em. on 27. iv. 1977; Ogôri, Yamaguchi Pref., 2 ♂♂, em. on 25. iv. 1976. [SHIKOKU] Mononobegawa, Kochi Pref., 1 ♂, 15. vii. 1973. [KYUSHU] Same locality as holotype, 2 ♀♀ 2 ♂♂, galls col. on 20. vii. 1973, 1 ♀, 22. iii. 1975; Shikanoshima, Fukuoka Pref., 4 ♀♀ 2 ♂♂, em. on 25. iv. 1975; Ongagawa, Fukuoka Pref., 1 ♀ 2 ♂♂, em. on 4. v. 1975; Chôjabaru, Kujû, Oita Pref., 5 ♀♀ 6 ♂♂, em. on 17. v. 1976, 6 ♀♀ 3 ♂♂, em. on 25. v. 1976; Hikawa, Kumamoto Pref., 5 ♀♀ 1 ♂, em. on 10. v. 1976; Yafusogawa, Kagoshima Pref., 2 ♀♀ 2 ♂♂, em. on 10–15. v. 1977.

Remarks. This species is very similar to *P. kanmiyai* sp. nov., but is smaller, and the colouration of the hind coxa and the ratio 1r-m/1-M in the hind wing are different as stated in the key.

Polemochartus kanmiyai sp. nov.

(Figs. 16, 20, 31)

Length of body 8.0–11.5, of fore wing 6.0–7.5 mm.

Head.—Width of head 1.6–1.8 times its length (Figs. 16, 31); eye weakly convex in dorsal aspect (Fig. 16); length of eye 0.7–0.9 times length of temple; width of face 1.0–1.1 (♀), 1.2–1.5 (♂) times height of eye; antennal segments 58–65 (♀), 68–78 (♂).

Mesosoma.—Length of mesosoma 1.5–1.7 times its height; epicnemial area crenulate.

Wings.—Fore wing: 2-SR/r=1.4–1.6; 2-SR+M/r=0.8–1.0; 1-SR+M/m-cu=1.2–1.4; 1-M/m-cu=1.4–1.7; cu-a interstitial or slightly postfurcal; 1-CU1/2-CU1 at most 0.10. Hind wing: m-cu usually postfurcal, rarely interstitial, to 1r-m; 1r-m/1-M=1.0–1.2.

Metasoma.—Basal portion of dorsal carinae of 1st tergite reduced (Fig. 20); basal area of 1st tergite longitudinally rugose (Fig. 20).

Colour.—Black; palpi yellowish-brown; legs reddish-brown, hind tarsus and apical portion of hind tibia infuscated; pterostigma dark brown.

Host. *Lipara brevipilosa* NARTSHUK.

Distribution. Japan (Honshu: Tochigi and Ibaraki Prefs.).

Holotype ♀ (Type No. 2396, Kyushu Univ.), Ohtawara, Tochigi Pref., Honshu, reared from a gall of *L. brevipilosa* on *Phragmites communis*, em. on 16. v. 1976 (K. KANMIYA).

Paratypes. All reared from galls of *L. brevipilosa* on *Phragmites communis* and collected by K. KANMIYA. [HONSHU] Same locality as holotype, 1 ♀ 4 ♂♂, em. on 10. v. 1976, 2 ♀♀ 2 ♂♂, em. on 17. v. 1976; Ushikunuma, Ibaraki Pref., 1 ♀ 1 ♂, em. on 12. iv. 1975, 4 ♂♂, em. on 17. iv. 1975, 1 ♀ 1 ♂, em. on 24. v. 1975, 4 ♀♀, em. on 22. v. 1976, 3 ♀♀ 4 ♂♂, em. on 29. iv. 1977, 2 ♂♂, em. on 1–5. v. 1977; Tsuwanuma, Ibaraki Pref., 2 ♂♂, em. on 5. v. 1976, 2 ♀♀ 3 ♂♂, em. on 16. v. 1976, 2 ♀♀, em. on 28. v. 1976, 3 ♀♀ 2 ♂♂, em. on 8. vi. 1976; Hinuma, Ibaraki Pref., 1 ♂, em. on 19–20. v. 1977.

Remarks. This species is very similar to *P. nipponensis* sp. nov., but is larger, and the colouration of the hind coxa and the ratio 1r-m/1-M in the hind wing are different as stated in the key.

Acknowledgements I wish to express my gratitude to Prof. Y. HIRASHIMA and Assoc. Prof. K. MORIMOTO of the Entomological Laboratory, Kyushu University, for their constant guidances. I am deeply indepted to Dr. K. KANMIYA of Kurume University, for his kind advices and for the gift of valuable specimens, and to Dr. C. VAN ACHTERBERG of Rijksmuseum van Natuurlijke Historie, Leiden, for his helpful suggestions and for sending me European materials for comparison. My cordial thanks are also due to Dr. C. WATANABE of Sapporo, for his critical reading of the manuscript.

References

ACHTERBERG, C. VAN, 1975. A revision of the tribus Blacini (Hym., Braconidae, Helconinae). *Tijdschr. Ent.*, **118**: 159–322.

———— 1976. A preliminary key to the subfamilies of the Braconidae (Hym.). *Ibid.*, **119**: 33–78.

———— 1979. A revision of the subfamily Zelinae auct. (Hymenoptera, Braconidae). *Ibid.*, **122**: 241–479.

ČAPEK, M., 1970. A new classification of the Braconidae (Hymenoptera) based on the cephalic structures of the final instar larva and biological evidence. *Can. Ent.*, **102**: 846–875.

CHVÁLA, M., J. DOSKOČIL, J. H. MOOK, & V. POKORNÝ, 1974. The genus *Lipara* MEIGEN (Diptera, Chloropidae), systematics, morphology, behaviour, and ecology. *Tijdschr. Ent.*, **117**: 1–25.

CLAUSEN, C. P., 1940. Entomophagous Insects. 688 pp. McGraw-Hill, New York and London.

FISCHER, M., 1971. Index of Entomophagous Insects. 5. World Opiinae (Hym. Braconidae). 189 pp. Le François, Paris.

GIRAUD, J., 1863. Mémoire sur les Insectes qui vivent sur le Roseau commun, *Phragmites communis* TRIN. (*Arundo phragmites* L.) et plus spécialement sur ceux de l'ordre des Hyménoptères. *Verh. zool.-bot. Ges. Wien*, **13**: 1251–1288.

GRIFFITHS, G. C. D., 1964. The Alysiinae (Hym., Braconidae) parasites of the Agromyzidae (Dip.). 1. General questions of taxonomy, biology, and evolution. *Beitr. Ent.*, **12**: 823–914.

HENNIG, W., 1966. Phylogenetic Systematics. Translated by D. D. DAVIS and R. ZANGERL. 263 pp. Univ. Ill. Press, Urbana.

JONG, R. DE, 1980. Some tools for evolutionary and phylogenetic studies. *Z. zool. Syst. Evolut.-forsch.*, **18**: 1–23.

MAETÔ, K., 1983. Discovery of two genera, *Sarops* NIXON and *Protodacnusa* GRIFFITHS, from Japan (Hymenoptera, Braconidae). *Kontyû, Tokyo*, **51**: 247–253.

MOOK, J. H., 1961. Observation on the oviposition behaviour of *Polemon liparae* GIR. (Hym., Braconidae). *Archs. néerl. Zool.*, **14**: 423–430.

RICHARDS, O. W., 1977. Hymenoptera. Introduction and key to families. *Handb. Ident. Brit. Insects*, **6** (1), 2nd ed.: 1–100.

ROSS, H. H., 1974. Biological Systematics. 345 pp. Addison-Wesley, Reading, Mass.

SCHULZ, W. A., 1911. Zweihundert alte Hymenopteren. *Zool. Ann.*, **4**: 1–220.

SHENEFELT, R. D., 1974. Family Braconidae 7. *In* VAN DER VECHT & SHENEFELT (eds.), *Hymenopterorum Catalogus* 11: 937–1113. Junk.

SHORT, J. R. T., 1952. The morphology of the head of larval Hymenoptera with special reference to the head of the Ichneumonoidea, including a classification of the final instar larvae of the Braconidae. *Trans. R. ent. Soc. London*, **103**: 27–84.

WATANABE, C., 1963. Two new species of the genus *Coelinidea* VIERECK, parasites of stem flies of economic importance, occurring in Japan (Hymenoptera: Braconidae). *Mushi, Fukuoka*, **37**: 13–17.

WATROUS, L. E., & Q. D. WHEELER, 1981. The out-group comparison method of character analysis. *Syst. Zool.*, **30**: 1–11.