Zool. J. Linn. Soc., *53*: 65-79. With 7 figures

August 1973

On the taxonomy of some forms of *Ibalia* Latreille (Hymenoptera: Cynipoidea) associated with conifers

G. J. KERRICH

Commonwealth Institute of Entomology, British Museum (Natural History), London SW7

Accepted for publication March 1973

In order to ensure correct identification of species of *Ibalia* used in the control of woodwasps of the genus *Sirex* a study is made of the taxonomy of those forms associated with conifers. A key is included.

CONTENTS

INTRODUCTION

In connection with the campaign for the control of *Sirex* woodwasps in Australia and New Zealand, material of *Ibalia* Latreille has been reared in Europe and neighbouring countries, North America and Japan.

Two species, having different flight periods, have been recognized as concerned in Europe, namely *leucospoides* Hochenwarth and *drewseni* Borries, while North American material was placed as *ensiger* Norton and Japanese as *suprunenkoi* Jacobson. I had suspected that *ensiger* was a form of *leucospoides*, as has been noted by Spradbery (1970), and provisional study of Japanese material supplied led me to think that *suprunenkoi* was a form of the same species. The opportunity has now been taken of making a more critical study of the available material. Among that from North America, three specimens were found to belong to another species, running best in the key of

Weld (1952) to *rufipes* Cresson, though having mainly black hind femora, and agreeing in structural features with *drewseni* Borries, but without date of rearing. Dr B. D. Burks very kindly, at my request, sent on loan determined specimens of *ensiger* and *rufipes*, adding another North American conifer-associated species namely *montana* Cresson. The locality of the Mexican species *ruficollis* Cameron suggested a conifer association; the unique type was studied, and was found to be very close to *leucospoides*.

I. leucospoides Hochenwarth has been recognized as widely distributed in Europe, and, previously regarded as a great rarity, has been well known in Britain since it was studied by Chrystal (1930).

I. ensiger Norton (1862) was stated by Weld (1952) to be one of the three most common species in the United States. A mass flight of this form was observed by Wickman (1964) on 27 September 1962 in California. Yoshimoto (1970), when redescribing this form as a new species, was deceived by making comparison with misdetermined small specimens of *rufipes* Cresson having blackish hind femora.

The far eastern form was first recorded by Jacobson (1899) who gave a good description of it as a new species, *I. suprunenkoi*, based on a single female specimen from the island of Sakhalin. Yasumatsu (1937) recorded it as *I. picea* Matsumura 1912, also from Sakhalin, which was Japanese territory at that period. Maa (1949), in revising the Asiatic Ibaliinae, established the synonymy of *picea* with *suprunenkoi*. The series of specimens first submitted to me for study were reared by Dr K. Kanamitsu from the Tokyo University Forest on Honshu.

I. drewseni Borries was reared in Britain by Spradbery (1970), who studied the biology and gave a modification of my provisional unpublished key for its separation from *leucospoides* (Hochenwarth). It was recorded from Sakhalin, but not more widely in the Far East, by Yasumatsu (1937) and by Maa (1949). It has an early summer flight period in Europe and, according to Yasumatsu's record, in the Far East, while the dates of capture of specimens received of *rufipes* Cresson indicate an early summer flight period for that form also.

Hearing that this study was being made, Mr K. L. Taylor wrote from the Tasmanian Regional Laboratory to ask whether I would examine their reared material. He sent the following, mostly reared in 1971 or 1972: a good series of *I. montana* Cresson, already well known in the United States, a good series of *I. ruficollis* Cameron from south-westerly U.S.A., earlier known only from the unique type from Mexico, a large series mostly correctly attributed to *rufipes* Cresson, a large series mostly correctly attributed to *ensiger* Norton, and a large series of a very distinct species from Japan, reared by Dr J. P. Spradbery in April 1972. He also sent series of *leucospoides-ensiger* crosses made by Mr J. L. Varley.

The main series of specimens of each species studied will be deposited in the British Museum (Natural History), but other specimens will be distributed widely, in particular to the Tasmanian Regional Laboratory, the Australian and Canadian National Collections, Museum d'Histoire Naturelle, Geneva, Zoologisches Museum der Universität, Berlin, Naturhistoriska Riksmuseum, Stockholm, Zoological Institute of the Academy of Sciences, Leningrad, and the United States National Museum. Representatives of North American forms will be deposited in the Academy of Natural Sciences of Philadelphia, and of

Japanese forms in the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, Japan.

Family IBALIIDAE

Ibaliidae Thomson 1862: 397, 405.
Ibaliinae Ashmead 1886: 60.
Ibalina Cameron 1890: 156.
Ibaliinae Ashmead 1903: 7, 143, 214-5.
Ibaliinae Dalla Torre & Kieffer 1910: 16, 19.
Ibaliidae Imms 1934: 581.
Ibaliinae Thomson: Maa 1949: 263.
Ibaliidae Weld 1952: 83, 85-6, 148.
Ibaliidae Eady & Quinlan 1963: 7.

The above are selected references.

The characters of the family are given by Maa (1949: 163) and by Weld (1952: 83-4, 148).

Genus *Ibalia* Latreille

Type species *Ophion cultellator* Fabricius 1798, syn. = *Ichneumon leucospoides* Hochenwarth 1785.

Ibalia Latreille 1802: 306-7.
Ibalia Latreille; Thomson 1862: 405.
Ibalia Latreille; Cameron 1890: 260-1.
Ibalia Latreille; Dalla Torre & Kieffer 1910: 19-20.
Ibalia Latreille; Maa 1949: 269-70.
Ibalia Latreille; Weld 1952: 86, 148-50.

The above are selected references.

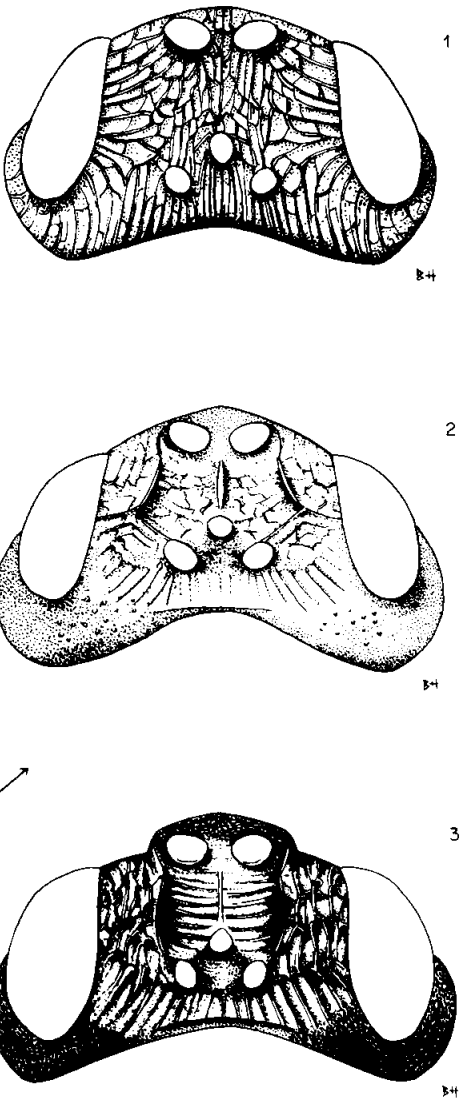
Weld (1952: 148) stated that the family Ibaliidae contained a single subfamily and within this a single genus, apart from a described fossil, but Maa (1949: 268-70) had described a new genus *Myrmoibalia*, tabulating and illustrating differences from *Ibalia* Latreille.

For structural features, reference may be made to Hedicke & Kerrich (1940).

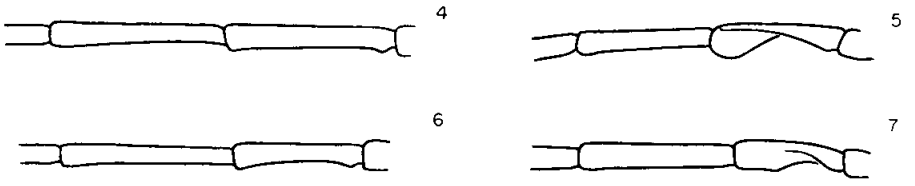
***Ibalia aprilina* sp. nov.**

Head, thorax and propodeum much more densely, strongly and outstandingly pilose than in the other species studied, though not nearly so densely as in the genus *Myrmoibalia* Maa.

Head above (Fig. 1) having rugosity only moderately strong and much less coarse than in the other species studied, with such keels as run back from outer margins of toruli in those species (cf. Figs 2 and 3) either relatively weak and incomplete, hardly stronger than the surrounding rugosity, or completely absent, the median area before the ocelli being indicated by a change of sculpture from generally longitudinal in to generally transverse beside it: behind median ocellus having longitudinal striae, which are much more



Figures 1 to 3. Head of female, seen from above: 1, *I. aprilina* sp. nov.; 2, *I. rufipes drewseni* Borries; 3, *I. leucospoides* (Hochenwarth). Drawn by Mr Brian Hargreaves on outlines drawn by the author. As indicated by the arrow the direction of illumination was, at the artist's suggestion, from half left behind, in order that the sculpture behind the ocelli could be made out most clearly.



Figures 4 to 7. Left antenna in sinistro-lateral view: apex of pedicellus, first, second, and base of third flagellar segments: 4, *I. montana* Cresson, female, 5, *I. montana* Cresson, male; 6, *I. aprilina* sp. nov., female; 7, *I. aprilina* sp. nov., male.

numerous than in the other species, which are of comparable strength to the anterior sculpture, and which run to the longitudinally striate occiput. Outer orbits finely shagreened, beset with moderate piliferous punctures. Lower face striate-reticulate, the sculpture not coarser than on upper face, the genae markedly more coarsely striate towards the mandibles. Tentorial pits very deep: clypeus margined at sides by obscure furrows, weakly but distinctly finely reticulate and bearing some obvious punctures.

Female first flagellar segment markedly emarginate beneath (Fig. 6), relatively short, only about three-quarters length of second, the third about equal to second or slightly shorter, the fourth distinctly shorter: male first flagellar segment relatively short (Fig. 7), about three-quarters length of second.

Pronotum finely punctate on neck, rather more coarsely so near the elevated hind margin, its sides entirely coarsely rugose, without any smooth area, transversely striate with some interspersed punctures above, longitudinally striate to reticulate below. Mesoscutum having transverse ridges only moderately sharp, weaker and generally more numerous than in the other species studied; having a rather shallow median furrow, deeper notauli and distinct parapsidal furrows or ridges. Scutellum having the pair of apical lobes sharply, and usually strongly, upstanding. Mesopleura having a shining, rather finely piliferous-punctate band below the speculum, rather strongly longitudinally striate, or sometimes more reticulate, before it and below, the speculum very finely longitudinally striate in more than upper half: mesosternum moderately and closely transversely striate. Metapleura reticulate, the sculpture much finer than in well-developed specimens of the other species studied. Propodeum having teeth above bases of hind coxae strong and sharp to only moderately so, the keels bounding the median area relatively weak, occasionally very weak.

Female gaster about one and a third to, usually, about one and a half times combined length of head, thorax and propodeum. First large tergite generally about twice length of second along dorsal margin (but considerable variation in this), the fifth (true seventh) tergite nearly always markedly longer than the three preceding combined. Male gaster about one-tenth to one-half longer than combined length of head, thorax and propodeum, the higher proportion mostly in smaller specimens. First large tergite about or nearly twice length of second, the fifth (true seventh) tergite about one and a third times length of fourth.

Prolongation of second hind tarsal segment occasionally only just reaching but generally extending slightly beyond apex of third.

Head, thorax and propodeum wholly black, only the tegulae dull castaneous in part. Antennae of female pale to dull castaneous, blackened towards apex, the scape and pedicellus black except at apex, and the basal flagellar segment largely blackened; of male as described for female or mainly blackish. Female gaster blackish, with an isolated translucent patch on the fifth (true seventh) tergite, and a translucent area on the following tergite below, which extends on to the ovipositor sheaths. The isolated patch is generally very conspicuous, but occasionally rather small or, in two specimens seen, absent or hardly traceable. Male gaster blackish, without any translucent area. Legs black, the tarsi very often paler, the hind metatarsi often conspicuously pale.

Holotype ♀. JAPAN, Honshu, 1971, J. P. Spradbery. Holotype in British Museum (Natural History), catalogue Hym. 7-116.

Paratypes. JAPAN, 34 ♀♀ 46 ♂♂, 1971, J. P. Spradbery. All female specimens south Honshu, Totsugawa, from *Pinus densiflora* or east Honshu, Takane, from *Abies firma*; males the same except one from Hokkaido from *Abies sacchalinensis* and four from Kyushu from *Cryptomeria japonica.*

Ibalia montana Cresson

Ibalia montana Cresson 1879: Proc. xvii. Holotype ♀ U.S.A., Colorado (Academy of Natural Sciences of Philadelphia) [examined].
Ibalia montana Cresson; Dalla Torre & Kieffer 1910: 20-21, 25.
Ibalia montana Cresson; Weld 1952: 149-50.

Head above having a pair of strong keels running back from outer margins of toruli, slightly divergent then curved inward to lateral ocelli: median area between these strong keels having a median keel that is much weaker but complete, dull in greater part but often with a little rugosity: beside these keels strongly reticulate-rugose, behind them rather dull, with a few fine, generally diagonal striae and some small punctures. Occiput longitudinally striate. Outer orbits very finely shagreened, rather sparsely beset with fine, shallow piliferous punctures. Lower face and genae striate, though markedly less coarsely so than in *rufipes* Cresson. Tentorial pits distinct though sometimes rather obscure: clypeus with raised margins at sides but not at base.

Female first and second flagellar segments about equal in length, the third slightly, the fourth markedly shorter: male second flagellar segment about equal to or a little shorter than first (Figs 4 and 5).

Pronotum finely punctate anteriorly and in greatest part at sides, which have a narrow band of transverse ridges above, these almost meeting medially, and some irregular rugosity on lower part. Mesoscutum having moderately sharp transverse ridges, rather shallow median furrow, deeper notauli, and distinct parapsidal furrows. Scutellum having the pair of apical lobes sharply but not very strongly upstanding. Mesopleura usually having a rather indefinite, shining, finely piliferous-punctate band below the speculum, finely to moderately longitudinally striate below; mesosternum finely and indefinitely to moderately transversely striate at sides, more finely so in middle. Metapleura more strongly rugose than is general in *rufipes* Cresson, less strongly so than in *leucospoides* (Hochenwarth). Propodeum having the pair of teeth above bases of hind coxae sometimes strong and sharp but usually only moderately so.

Female gaster elongate, about or nearly twice the combined length of head, thorax and propodeum. First large tergite about one and one-third to nearly twice length of second along dorsal margin, the fifth (true seventh) tergite much longer than the three preceding combined, sometimes over one and a half times their combined length. Male gaster about one and a half times combined length of head, thorax and propodeum. First large tergite one and a quarter times length of second, the fifth (true seventh) tergite up to one and a quarter times length of fourth. There is considerable variation in the relative length of the middle tergites.

Prolongation of second hind tarsal segment extending beyond apex of third.

Female: head pale to dull castaneous, often with some blackening especially on upper face, clypeus and mandibles. Antennae black, slightly paler towards apex, and with the basal segments narrowly pale at apex. Thorax and propodeum black, with the following pale to dull castaneous: upper part of pronotum at sides and of propleura, a pair of broad anterior marks on mesoscutum continuous with percurrent longitudinal stripes, or occasionally the mesoscutum mainly castaneous, and mesopleura above anteriorly and on smooth hinder part. Gaster castaneous in about basal third or more, and more narrowly near apex, blackened above usually in greater part, and with an elongate translucent area below. Legs mainly dull castaneous, with only slight blackening. There is likely to have been some decomposition of melanin in the type specimen which is almost a century old. *Male*: blackening only slight except on mandibles and clypeus at apex. Antennae pale brown, somewhat darkened above. Mesoscutum rather more broadly pale, and scutellum and propodeum blackish-brown. Gaster castaneous, with only slight infuscation, and with the translucent area usually less well defined than in female.

Redescribed from the following: U.S.A., Colorado, 1 ♀, H. K. Morrison (unique type), Nevada, Glenbrook, 16 ♀♀ 6 ♂♂ viii. 1970 *ex Abies* sp., D. C. Lloyd; Arizona, 9 ♂♂ 1971, A. A. Kirk; ♂ "W.T." det. Cresson, obtained by U.S. Nat. Mus. by exchange with American Entomological Society (no further data).

Ibalia rufipes Cresson

Ibalia rufipes Cresson 1879: Proc. xvii. Holotype ♀ U.S.A., Nevada (Academy of Natural Sciences of Philadelphia), [examined].
Ibalia rufipes Cresson; Dalla Torre & Kieffer 1910: 20, 24.
Ibalia rufipes Cresson; Weld 1952: 149-50.
Ibalia ensiger Norton; Yoshimoto 1970: 1196-8 (misdetermination).
Ibalia drewseni Borries 1891: 57, here considered as sub-species, **stat. nov.**
Ibalia drewseni Borries: Dalla Torre & Kieffer 1910: 20-1.
Ibalia shirmeri Kieffer; Bischoff 1953: 539 (syn. of *drewseni*).
Ibalia drewseni Borries: Yasumatsu 1937: 14-5, pl. I, figs 9-10.
Ibalia drewseni Borries; Maa 1949: 264-5.
Ibalia drewseni Borries; Spradbery 1970: 104-13 + pl. I.

Head above (Fig. 2) having a pair of keels running back from outer margins of toruli, relatively weaker than in *leucospoides* (Hochenwarth) and strongly divergent: median area between them irregularly striate-rugose and having a median keel that is little weaker than these, and area beside them striate to reticulate-rugose. Head behind level of lateral ocelli almost smooth, bearing only very weak diagonal striae and small obscure punctures. Occiput longitudinally striate. Outer orbits very finely shagreened, sparsely beset with fine piliferous punctures. Lower face and genae coarsely striate. Tentorial pits usually very sharp and obvious: clypeus with raised basal margin often complete or almost so, or with a tubercle.

Female second flagellar segment generally distinctly longer than first, the third intermediate to fourth which is equal to or shorter than first: male second flagellar segment almost always a little longer than first.

Pronotum finely piliferous-punctate before the elevated hind margin and in large part at sides, which have a narrow band of transverse ridges above, sometimes broader behind in nearctic material, and some much weaker rugosity on lower part. Mesoscutum having sharp transverse ridges, moderately strong median furrow and notauli, which generally are not obviously broadened to hind margin, and indications of parapsidal furrows. Scutellum having the pair of apical lobes generally less strongly and sharply upstanding than in *leucospoides* (Hochenwarth). Mesopleura rugose before the speculum, having a rather indefinite, shining and finely piliferous-punctate band below it, comparatively weakly longitudinally striate below, the striae often turning mesad anteriorly: mesosternum shining, very finely piliferous-punctate. Metapleura much less strongly rugose than in *leucospoides* (Hochenwarth). Propodeum having a pair of weak, blunt teeth above bases of hind coxae.

Female gaster about or less, very often much less, than one and a half times combined length of head, thorax and propodeum. First large tergite about twice to (exceptionally) four times length of second along dorsal margin, the fifth (true seventh) tergite generally about equal in length to the three preceding combined. Male gaster about or somewhat less than one and a half times combined length of head, thorax and propodeum. First large tergite about one and a half times to twice length of second, the fifth (true seventh) tergite about one and a quarter to one and a half times length of fourth.

Prolongation of second hind tarsal segment generally just about reaching apex of third (Yasumatsu, 1937: fig. 10; Yoshimoto, 1970: fig. 4, Spradbery, 1970: fig. 4b), though sometimes a little short of that point and sometimes extending distinctly beyond it.

Head black, mandibles in about half or more and palpi castaneous. Antennae black, sometimes paler towards apex, and with the basal segments very narrowly paler at apex. Thorax black, the tegulae more or less castaneous, sometimes only very slightly so marked. Gaster in European and, according to Yasumatsu (1937), in far eastern material, castaneous anteriorly, blackish above in about hinder two-thirds, and with a large translucent area below (Yasumatsu, 1937: fig. 9, Spradbery, 1970: pl. I, fig. 4a, d): in nearctic material generally pale to medium castaneous, with no distinct blackening or translucent patch, though sometimes with some weak infuscation or with the translucent patch more or less extensively developed. Legs generally having coxae, trochanters, hind tibiae and tarsi mainly black, with some infusion of dull castaneous, otherwise pale to dull castaneous or rufous, the hind femora conspicuously rufous; but sometimes the hind tarsi are mainly dull castaneous, or the legs may be much more extensively infuscate, with the hind femora mainly black or blackish.

Redescribed from the following: nearctic material: U.S.A., Nevada, 1 ♀, H. K. Morrison (unique type); Nevada, Glenbrook, 16 ♀♀ 13 ♂♂ vi. 1970, *ex Abies*, D. C. Lloyd; Colorado, Grand Canyon, ♂ 8.vii.1969, ? captor; Arizona, Apache National Forest, 5 ♂♂ 1971, Arizona or New Mexico, 19 ♀♀ 16 ♂♂ 1972, A. A. Kirk: CANADA, Nova Scotia, 1 ♂ (19th century), Redman; New Brunswick, 5 ♀♀ 1 ♂ 1968, "emerged from logs", D. C. Lloyd; Province Quebec, Laniel, "cage 62", ♂ 15.vi, ♀ 18.vi.1934, *ex Sirex cyaneus* Fabr., ? captor: altogether 41 ♀♀ 38 ♂♂ examined.

Palaearctic material: Scotland, Finglass; France, Le Boreon and S.E. France;

Switzerland, Ablandschen, Lucelle, Chatillon and unlocalized; Germany, Fallingbostel; Czechoslovakia, Hodrusa; Hungary, Eger and Sopron; Turkey, Bursa and Trabzon: altogether 8 ♀♀ 17 ♂♂, 15.v.-24.vii., F. Wilson and J. P. Spradbery (see Spradbery, 1970).

Spradbery records *drewseni* also from England, Norway, Sweden and Yugoslavia.

In all European material seen, the gaster has in both sexes a large translucent patch and is largely blackish above. In North American, the gaster is generally pale to medium castaneous, with no distinct blackening or translucent patch, yet some specimens have some weak infuscation or the translucent patch more or less extensively developed. The original description, based on the unique female type from Nevada, reads for the gaster "fulvo-ferrugineous, semi-transparent, upper edge dusky, sides varied with yellow". In this type specimen, the gaster at this date is pale castaneous; and although it is broadly paler below, there is no defined translucent patch such as is found in European female *drewseni* and as occurs in *montana* which the author described in the same way on the same page. Any duskiness on the upper edge of the gaster has since completely faded, and the hind tibiae are now deep castaneous; but since the specimen is almost a century old, there is likely to have been some decomposition of the melanin.

Mr K. L. Taylor writes that material of European origin has been liberated in Australia.

Ibalia leucospoides (Hochenwarth)

Ichneumon leucospoides Hochenwarth 1785: 345, pl. 8, figs 5-6.
Ichneumon cultellator Fabricius 1793: 167.
Ophion cultellator (Fabricius); Fabricus 1798: 239 (=*leucospoides* Hochenwarth).
Ibalia cultellator (Latreille); Cameron 1890: 261, pl. XIV, figs 7, 11.
Ibalia cultellator (Fabricius); Borries 1891: 53-7.
Ibalia leucospoides (Hochenwarth); Dalla Torre & Kieffer 1910: 20, 23.
Ibalia leucospoides Hochenwarth; Chrystal 1930.
Ibalia suprunenkoi Jacobson 1891: 289-90, **syn. nov.**
Ibalia suprunenkoi Jacobson; Dalla Torre & Kieffer 1910, 20-22.
Ibalia suprunenkoi Jacobson; Maa 1949: 264-9.
Ibalia ensiger Norton 1862: 200, here considered as sub-species, **stat. nov.**
Ibalia ensigera Norton; Dalla Torre & Kieffer 1910: 20, 24.
Ibalia ensiger Norton; Weld 1952: 149-50.
Ibalia ensiger Norton; Wickman 1964: 19-20.
Ibalia gigantea Yoshimoto 1970: 1196-8, **syn. nov.**

Head above (Fig. 3) having a pair of strong keels running back from outer margins of toruli up to or near level of ocelli, a little curved outward but not strongly divergent; median area between these strong keels having a much weaker, sometimes incomplete, median keel and striae running rather diagonally towards it: beside these keels strongly reticulate-rugose and behind them with strong diagonal striae which run to the longitudinally striate occiput, these generally strong but at least almost always moderately strong. Outer

orbits very finely shagreened, beset with moderate piliferous punctures. Lower face coarsely reticulate-rugose, or very often more striate: genae coarsely striate towards clypeus and mandibles. Tentorial pits set in a transverse impression and often not very obvious: clypeus with raised margins at sides but very seldom at base.

Antennae as described for *rufipes* Cresson, except that the female third flagellar segment is often about equal in length to the second.

Pronotum having fine transverse rugosity and punctures before the elevated hind margin, its sides having a broad band of transverse ridges above, which sometimes is confluent anteriorly with the weaker but not very weak rugosity on lower part, between the rugose areas with a finely piliferous-punctate area which sometimes is very reduced or even occasionally absent. Mesoscutum having sharp transverse ridges, strong median furrow and notauli, which are obviously broadened to hind margin, and distinct parapsidal furrows. Scutellum (Maa, 1949: fig. 14) having the pair of apical lobes strongly and sharply upstanding. Mesopleura usually having a rather indefinite, shining and rather finely piliferous-punctate band below the speculum, rather strongly longitudinally striate before it and below: mesosternum strongly transversely striate at sides, more weakly in the occasional small specimen, much more weakly so in middle. Metapleura strongly and coarsely rugose. Propodeum having a pair of strong, sharp teeth above bases of hind coxae.

Female gaster less, generally much less, than one and a half times combined length of head, thorax and propodeum. First large tergite about one and two-thirds to three times length of the second along dorsal margin, the fifth (true seventh) tergite generally about equal in length to the three preceding combined. Male gaster markedly less than one and a half, generally about one and a quarter, times combined length of head, thorax and propodeum. First large tergite about one and a half times to twice length of the second along dorsal margin, the fifth (true seventh) tergite generally about one and a quarter times length of fourth.

Prolongation of second hind tarsal segment normally extending distinctly beyond apex of third (Yoshimoto, 1970: fig. 2), but occasionally not so.

Head black, often with a dull castaneous patch on lower genae, the mandibles more or less broadly though often only obscurely castaneous at base. Antennae black, sometimes paler towards apex. Thorax and propodeum black, the tegulae often somewhat paler. Gaster in North American form pale to medium castaneous, in western palaearctic deep castaneous to almost black, in Japanese almost black. Legs black, sometimes varying in part to brown, especially the fore and mid tarsi and often the fore tibiae of the male.

Redescribed from the following: western palaearctic material: England, Devon to north-east Yorks.; France, St Isidore, Le Boreon and Turini; Corsica, L'Ospedale and Forêt d'Aitone; Portugal, S. Montejunto and Cobilha; Spain, Sierra de Guaderrama, Castro Urdiales and Monte Raso; Switzerland, Zürich; Italy, Bibbiena, Camaldoli, Arezzo, Umbria, Lama and Cambarie; Hungary, Sopron and Eger; Turkey, Trabzon, Kastamonu, Bucak, Edremit and Karsanti; Cyprus: altogether 53 ♀♀ 65 ♂♂. The English records include the following: Beds., Leighton Buzzard, 6 ♀♀ 6 ♂♂ "descendents of individuals bred in 1904 from *Sirex gigas*", G. A. Crawshay; Hants., Romsey, ♀ em. 27.vi.-7.vii., ♀ em. 16-26.vii.1965, *ex Sirex cyaneus* Fabr. from dead trunk of *Larix* infested with

Armillaria mellea, C. R. Vardy. Apart from the last-mentioned record, dates range from 25.vii. (France) to 13.xi. (Spain).

Material of European origin reared in insectary, Tasmania, 1 ♂ xii.1962, 7 ♀♀ 7 ♂♂ ii.1963.

Japanese material: Honshu, Tokyo University Forest, 4 ♀♀ 5 ♂♂ em. 1968, K. Kanamitsu; 7 ♂♂ em. 1969 in insectary, Cambridge, Tasmania; Hokkaido, *ex Abies* and *Picea* logs, 5.vii.-9.viii., Honshu and Shikoku, *ex Pinus densiflora* and *P. thunbergii,* 13.ix.-8.xi.1971, J. P. Spradbery.

Nearctic material: U.S.A., California, Forest Hill, 3 ♀♀ x.1963, E. A. Cameron, unlocalized, 16 ♀♀ 19 ♂♂ reared in insectary, Tasmania, 1966-70, Santa Cruz, 16 ♀♀ 13 ♂♂ 1971, A. A. Kirk; Arizona or New Mexico, 10 ♀♀ 6 ♂♂ em. 1971-72, A. A. Kirk; Florida, Gainesville, 1 ♀ 1.x.1956, ? captor; Minnesota, Ely, Kawishiwi Field Lab., ♂ 12.x.1960, L. F. Wilson: CANADA, B.C., Vancouver, ♀ ♂ 18.ix.1939, *ex Tsuga heterophylla,* W. G. Mathers, Forest Insect Survey, 1 ♀ received 1.x.1938; Alberta, Ribbon Creek, Forest Insect Survey, ♀ em. 10.v.1965 (!), these four specimens being paratypes of *gigantea* Yoshimoto; New Brunswick, ♀ 1968, "emerged from logs", D. C. Lloyd; Nova Scotia, 1 ♀ (19th century), Redman; unlocalized, 4 ♀♀ em. 1969 in insectary, Tasmania: altogether 51 ♀♀ 48 ♂♂. The specimens from the Canadian Forest Insect Survey, reared early in the year (see also Yoshimoto, 1970), were presumably forced.

Dalla Torre & Kieffer (1910) record the European form from "all Europe to Asia Minor"; Muesebeck *et al.* (1952) the North American as "trans-continental".

J. L. Varley in Tasmania obtained fertile matings in both directions between material of European (*leucospoides*) and North American (*ensiger*) origin. The *ensiger* ♀ × *leucospoides* ♂ crossing gave rise to female progeny with gaster colour intermediate between that which is typical in the two forms respectively, while the reverse crossing gave rise to female progeny mostly with darker gaster. Back crosses were also made, giving rise mostly to small specimens.

Ibalia ruficollis Cameron

Ibalia ruficollis Cameron 1884: 448.
Ibalia ruficollis Cameron; Weld 1952: 150.

Very closely related to *leucospoides* (Hochenwarth), being found to differ as follows: head having median keel no stronger than the striae which run diagonally towards it: tentorial pits very deep; clypeus margined laterally by obscure impressions: metapleura less coarsely rugose: gaster having the fifth (true seventh) tergite somewhat, often considerably, longer than the three preceding combined: pronotum largely, and propodeum of female with a pair of lateral stripes pale castaneous, and of male sometimes with a trace of such: mesopleura with an anterior mark dull castaneous: gaster wholly castaneous. The female second flagellar segment is very distinctly longer than the first in all specimens seen.

Redescribed from the following: MEXICO, Chihuahua, Pinos Altos, unique female holotype, Buchan-Hepburn: U.S.A., Arizona, 18 ♀♀ 18 ♂♂ of which 3 ♀♀ 3 ♂♂ recorded from Apache National Forest, 1971, A. A. Kirk.

KEY TO THE FORMS OF *IBALIA* LATREILLE INCLUDED IN THE PRESENT STUDY

1. Head above (Fig. 1) having rugosity only moderately strong and much less coarse than in the other species studied, with such keels as run back from outer margins of toruli in those species (Figs 2 and 3) either relatively weak and incomplete, hardly stronger than the surrounding rugosity or completely absent, the median area before the ocelli being indicated by a change of sculpture, behind median ocellus having longitudinal striae which are much more numerous than in those species: first flagellar segment only about three-quarters length of second in both sexes, in female markedly emarginate beneath (Figs 6 and 7): pronotum having sides entirely coarsely rugose, without any smooth area: mesopleura having speculum very finely striate in more than upper half: female gaster almost always having an isolated translucent patch on the fifth (true seventh) tergite: head, thorax and propodeum much more densely, strongly and outstandingly pilose than in the following species: Japan . . ***aprilina*** **sp. nov.**

   Head above (Figs 2 and 3) having rugosity coarse at least in part, having keels running back from outer margins of toruli very distinct and strong, markedly stronger than the surrounding rugosity and enclosing a very distinct area, not with such numerous striae behind median ocellus: first flagellar segment not so short relatively, in female not markedly emarginate beneath (e.g. Figs 4 and 5): sides of pronotum almost always with at least a patch in middle more or less smooth and shining: mesopleura having speculum quite smooth: if the female gaster is, on the fifth (true seventh) tergite partly translucent, this area is not an isolated patch: head, thorax and propodeum normally pilose for the genus . . 2

2. Head and thorax very largely pale to dull castaneous: legs mainly dull castaneous, with only slight blackening: ♀ gaster more elongate, about or nearly twice the combined length of head, thorax and propodeum, with fifth large (true seventh) tergite much longer than the three preceding combined: ♀ first and second flagellar segments about equal in length, the fourth markedly shorter: ♂ second flagellar segment about equal to or a little shorter than first: nearctic, gaster having a translucent area, large and conspicuous in ♀: [head behind lateral ocelli bearing a few, rather weak, diagonal striae and some small punctures] . . . . . *montana* Cresson

   Head and thorax almost entirely black except that in a form from Mexico and south-westerly U.S.A. the pronotum is largely castaneous: legs having at least coxae, trochanters and hind tibiae mainly black: ♀ gaster less elongate, about or less, generally much less, than 1½ times combined length of head, thorax and propodeum, the fifth large (true seventh) tergite generally about equal in length to the three preceding combined: ♀ second flagellar segment generally distinctly longer than first, the fourth equal to or shorter than first: ♂ second flagellar segment almost always a little longer than first: in nearctic forms, gaster usually having no distinct translucent area beneath 3

3. Head having keels running back from outer margins of toruli relatively weaker, strongly divergent, behind them bearing only weak diagonal striae and small obscure punctures (Fig. 2): mesosternum shining, very finely piliferous-punctate: propodeum having a pair of weak, blunt teeth above bases of hind coxae: [pronotum at sides generally having a narrow band of transverse ridges above, though sometimes in nearctic material this is broader behind: prolongation of second hind tarsal segment usually about reaching apex of third: hind femora usually conspicuously rufous though sometimes mainly blackish] : on the wing in the earlier part of the summer 4

Head having strong keels running back from outer margins of toruli not strongly divergent, behind them bearing strong diagonal striae (Fig. 3): mesosternum strongly transversely striate at sides, much more weakly so in middle: propodeum having a pair of strong, sharp teeth above bases of hind coxae: [pronotum at sides having a broad band of transverse ridges above: prolongation of second hind tarsal segment normally extending beyond apex of third: hind femora black] : on the wing in the latter part of the summer to autumn but some overlap occurs 5

4. Palaearctic: gaster blackish above in about hinder two-thirds, and with a large translucent area below . . . . . *rufipes drewseni* Borries

Nearctic: gaster generally pale to medium castaneous, with no distinct blackening or translucent patch, though sometimes with some weak infuscation or with the translucent patch more or less extensively developed . . . . . *rufipes rufipes* Cresson

5. Mexico and south-westerly U.S.A.: pronotum largely and propodeum of female with a pair of lateral stripes pale castaneous: mesopleura sometimes with an anterior mark dull castaneous: tentorial pits very deep: clypeus margined laterally by obscure impressions; gaster (♀) having the fifth (true seventh) tergite somewhat longer than the three preceding combined . . . . . *ruficollis* Cameron

Holarctic: thorax and propodeum without such pale marks; tentorial pits set in a transverse impression and often not very obvious: clypeus having raised lateral margins: gaster (♀) having the fifth (true seventh) tergite about equal in length to the three preceding combined 6

6. Palaearctic: gaster deep castaneous to almost black . . . . . *leucospoides leucospoides* (Hochenwarth)

Nearctic: gaster pale to medium castaneous . *leucospoides ensiger* Norton

FURTHER SPECIFIC DIFFERENTIATION

Modification has had to be made to the separation of the species as previously proposed. The pigmentation of the gaster in the different forms

studied is described above and included in the key. The extent of prolongation of the second hind tarsal segment is less reliable as a key character than had been thought, and there is such intra-specific variation in the form of the third antennal segment of the male that no reliable specific difference has been found.

The second key couplet above is less satisfying than the author had hoped to achieve, for *I. montana* Cresson is in some respects intermediate between *leucospoides* (Hochenwarth) and *rufipes* Cresson. Thus, the mesosternum is finely to moderately striate at sides (more strongly so in *leucospoides*, shining and very finely piliferous-punctate in *rufipes*); the metapleura are less strongly rugose than in *leucospoides*, more strongly than is general in *rufipes*; and the teeth on the propodeum above the hind coxae are moderately strong and sharp (strong and sharp in *leucospoides*, weak and blunt in *rufipes*).

I. montana agrees with *leucospoides* in having the keels running back from the outer margins of the toruli not or hardly divergent (Fig. 3), but with *rufipes* in having the striae between these keels weaker and less definite, the head behind the lateral ocelli with only weak striae and small punctures, the pronotum with a narrow band of transverse ridges above, and the mesopleura finely longitudinally striate below.

ADDENDUM

Ibalia scalpellator Westwood

Ibalia scalpellator Westwood 1837: Cl. IX, pl. 179: 2 (separate pagination). Holotype ♂ in Zoological Museum of the University, Berlin.
Ibalia maculipennis Haldeman 1846: 127, **syn. nov.**

I have studied a good series of specimens determined by L. H. Weld and a pair determined by B. D. Burks as *maculipennis* Haldeman. It was stated in Muesebeck *et al.* (1951) that *scalpellator* was a probable synonym of *maculipennis*. Through the courtesy of Dr E. Königsmann I have been able to compare Westwood's unique type from Georgia with Weld's series. I feel confident that it is conspecific and that the senior synonym should be adopted as the valid name for the species.

The outer orbits have coarse punctures, the genae are very coarsely, sparsely and irregularly striate, and the propodeum bears a pair of raised crests above the hind coxae. There is a good deal of intra-specific variation, but the colour and sculpture appear to be comformable to a species pattern. The legs are relatively stouter than in the conifer-associated species.

Westwood's fig. 2 is wrongly cited in Dalla Torre & Kieffer (1910) and Muesebeck *et al.* (1951) as illustrating this species whereas it applies to *Liopteron nigrum* (Westwood) (see Hedicke & Kerrich, 1940: 206). The species is not treated here in greater detail since it is associated with broad-leaved trees.

REFERENCES

ASHMEAD, W. H., 1886. Synopsis of the North American sub-families and genera of Cynipidae. *Trans. Am. ent. Soc., 13:* 59-64.

ASHMEAD, W. H., 1903. Classification of the Gall-wasps and the parasitic Cynipoids, or the superfamily Cynipoidea. *Psyche, 10:* 7-13, 59-73, 140-55, 210-6.

BISCHOFF, H., 1953. *Ibalia jakolewi* Jacobs., ein neuer deutscher Siriciden-Parasit, sowie Bemerkungen über die weiteren deutschen Ibaliiden (Hymenoptera: Cynipoidea: Ibaliidae). *Beitr. Ent., 3:* 536-40.

BORRIES, H., 1891. Om slaegten Ibalia Latr. *Ent. Meddr, 3:* 53-7.

CAMERON, P., 1884. Descriptions of new species of Tenthredinidae and Cynipidae from Mexico. *Trans. ent. Soc. Lond., 1884:* 481-8.

CAMERON, P., 1890. *A monograph of the British phytophagous Hymenoptera, 3:* 1-274 + pl. I-XVII. London: Ray Society.

CHRYSTAL, R. N., 1930. Studies of the Sirex parasites. The biology and post-embryonic development of *Ibalia leucospoides* Hochenw. (Hymenoptera-Cynipoidea). *Oxf. For. Mem., 11:* 1-63 + 10 pl.

CRESSON, E. T., 1879. Ibalia rufipes. Ibalia montana. *Trans. Am. ent. Soc., 7:* Proc. xvii.

DALLA TORRE, K. W. & KIEFFER, J. J., 1910. Cynipidae. *Tierreich, 24:* xxxv +891 pp. Berlin: Friedländer & Sohn.

EADY, R. D. & QUINLAN, J., 1963. Hymenoptera Cynipoidea. Key to families and subfamilies, and Cynipinae (including galls). *Handb. Ident. Brit. Ins., 8*(1a): 1-81. London: Royal Entomological Society.

FABRICIUS, J. C., 1793. *Entomologia Systematica emendata et aucta, 2:* i-viii + 1-519. Hafniae.

FABRICIUS, J. C., 1798. *Supplementum Entomologiae Systematicae,* pp. i-ii + 1-572. Hafniae.

HALDEMAN, S. S., 1846. On several new genera and species of insects. *Proc. Acad. nat. Sci. Philad., 3:* 124-8.

HEDICKE, H. & KERRICH, G. J., 1940. A revision of the family Liopteridae (Hymenopt., Cynipoidea). *Trans. R. ent. Soc. Lond., 90:* 177-225.

HOCHENWARTH, S. von, 1785. Beiträge zur Insectengeschichte. *Schr. berlin. Ges. naturf. Freunde, 6:* 334-60.

IMMS, A. D., 1934. *A general textbook of entomology, including the anatomy, physiology, development and classification of insects,* 3rd ed., pp. i-xii + 1-727. London: Methuen.

JACOBSON, G., 1899. Duae Ibaliae novae (Hymenoptera, Cynipidae). *Ezheg. zool. Muz., 4:* 288-91. [*Annls Mus. zool. St Petersb.*].

LATREILLE, P. A., 1801-02. *Histoire Naturelle generale et particuliere des Crustaces et des Insectes, 3:* 1-386. Paris: F. Dufart.

MAA, T.-C., 1949. A revision of the Asiatic Ibaliinae (Hym., Cynipidae). *Treubia, 20*(2): 263-74.

MUESEBECK, C. F. W. *et al.,* 1951. Hymenoptera of America north of Mexico—synoptic Catalog. *U.S. Dept. Agric., Agriculture Monogr., 2:* 1-1420.

NORTON, E., 1862. A description of several new Hymenoptera. *Proc. ent. Soc. Philad., 1:* 198-200.

SPRADBERY, J. P., 1970. The biology of *Ibalia drewseni* Borries (Hymenoptera: Ibaliidae), a parasite of siricid woodwasps. *Proc. R. ent. Soc. Lond. (A), 45:* 104-13.

TAYLOR, K. L., 1967. The introduction, culture, liberation and recovery of parasites of *Sirex noctilio* in Tasmania, 1962-67. *C.S.I.R.O. Australian Divn. Ent. Tech. Paper, 8:* 1-19.

THOMSON, C. G., 1862. Försök till uppställning och beskrifning av Sveriges Figiter. *Öfvers. k. Vet.-Akad. Förh., 18:* 395-420.

WELD, L. H., 1952. *Cynipoidea (Hym.) 1905-1950,* 351 pp. Ann Arbor Michigan (privately printed).

WESTWOOD, J. O., 1837. Insectorum nonnullorum exoticorum e familia Cynipidarum descriptiones. *Guerin's Mag. Zool., 7:* Cl. IX, pl. 179: 1-2 (separate pagination).

WICKMAN, B. E., 1964. Observations on the Siricid parasite *Ibalia ensiger* (Hymenoptera, Ibaliidae). *Pan-Pacif. Ent., 40:* 19-20.

YASUMATSU, K., 1937. Ibalinae of Nippon (Hym., Cynipidae). *Insecta matsum., 12:* 13-8.

YOSHIMOTO, C. M., 1970. A new Ibaliid wasp from North America (Hymenoptera: Cynipoidea, Ibaliidae). *Can. Ent., 102:* 1196-8.