

**BIOSYSTEMATIC STUDIES ON THE APHIDIIDAE OF ISRAEL (HYMENOPTERA:
ICHNEUMONOIDEA). 3. THE GENERA *ADIALYTUS* AND *LYSIPHLEBUS***

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ABSTRACT

The authors present descriptions, records and biological data for the species of the genera *Adialytus* and *Lysiphlebus*. *Lysiphlebus marismortui* n. sp. is described.

KEY WORDS: Hymenoptera, Aphidiidae, *Adialytus*, *Lysiphlebus*, Israel.

INTRODUCTION

This article, third in a series of five, continues the presentation of a revision of the species of aphidiidae found in Israel. It deals with the two genera, *Adialytus* and *Lysiphlebus*, and includes several new host records (marked *).

Genus *Adialytus* Foerster 1862

Adialytus Foerster, 1862, Verh. Naturh. Ver. Preuss. Rheinl., 19: 249-250.

Head: transverse, maxillary palpi 3-segmented, labial palpi 1-segmented. Antenna 10-12 flagellar segments. *Thorax*: Mesonotum with notaulices present on anterolateral aspect only. Forewing with only pterostigma, metacarp and radial vein developed distad of basal vein. *Abdomen*: Propodeum smooth, with or without 2 divergent carinae near posterior apex. Petiole elongate, slightly dilating posteriorly, spiracles on raised tubercles. Ovipositor sheaths roundly pointed.

While generally similar to the well-known *Lysiphlebus*, *Adialytus* differs from it in its more reduced forewing venation: distad of the basal vein, the small segment of the median and the 2nd intermedian veins are absent (Fig. 1). It also has a more elongate abdominal petiole. The known host aphids of this genus belong to the families Callipteridae (subfamily Chaitophorinae, tribes Chaetophorini and Siphini) and Thelaxidae (subfamily Thelaxinae, tribe Thelaxini).

Although both Stary (1975) and Tremblay and Eady (1978) treated *Adialytus* as a subgenus of *Lysiphlebus*, we feel that classifying this taxon as an independent genus (Mackauer, 1968a,b; Marsh, 1971; Tremblay, 1979) is justified because of the significant morphological and host-range differences.

KEY TO THE SPECIES OF *ADIALYTUS* FOERSTER OCCURRING IN ISRAEL (FEMALES)

1. Antennal setae mostly semi-erect (Fig. 2); propodeum smooth, acarinate (Fig. 3); petiole anteriorly parallel-sided, narrow, posteriorly rounded, dorsum with strongly raised central tubercle (Fig. 3); dorsum of ovipositor sheaths slightly concave. Coloration predominantly brown. Parasite of Siphini *A. ambiguus* (Haliday)
— Antennal setae mostly erect (Fig. 7); propodeum with short carinae diverging anteriorly

from posterior apex (Fig. 8); petiole narrowing towards spiracular tubercles, widening posteriorly, dorsum roundly raised with posterior central depression (Fig. 8); dorsum of ovipositor sheaths straight. Coloration predominantly black. Parasite of Thelaxidae

..... *A. thelaxis* Starý

Adialytus ambiguus (Haliday 1834)

(Figs. 1–4)

Aphidius (*Adialytus*) *ambiguus* Haliday, 1834, Entomol. Mag. 2: 104–105.

Lysiphlebus (*Adialytus*) *arvicola* Starý, 1961, Polskie Pismo Entomol. 31: 98–100.

Lysiphlebus mackaueri Starý, 1961, Sb. Faun. Praci Entomol. Odd. Nar. Mus. Praze, 7: 141.

Lysiphlebus crocinus Mackauer, 1962, Mitt. Dt. Entomol. Gesell. 21: 12–13.

Female

Head: Dorsal view, transversely oval, wider than thorax at tegulae, smooth, shiny, with sparse setae of moderate length. Eyes moderately protuberant, transverse diameter about equal to width of temple. Occiput margined by an almost circular, slightly raised carina. Ocellar triangle right-angled. In anterior view, eyes oval, slightly convergent towards clypeus, vertical diameter about 3 times width of gena. Face smooth, shiny, with sparsely scattered long setae. Clypeus slightly protuberant, with about 4 long setae. Maxillary palpi 3-segmented, labial palpi 1-segmented. Tentorial index about 0.5. Antenna (Fig. 2) 10 flagellar segments; F1 about 2.5 times longer than width at middle, equal to or slightly longer than F2; most antennal setae semi-erect. Occipital foramen almost square above tentorial bridge.

Thorax: Prothorax faintly punctate. Mesothorax smooth, shiny, notaulices present on anterolateral ascendent aspect of mesoscutum only; sparse long setae follow path of the erased notaulices dorsally. Central line of mesoscutum smooth, narrow elongate area on each side shallowly punctate. Forewing (Fig. 1): pterostigma elongately triangular, about 3.5 times longer than wide, more or less equal to metacarp; radius about 2.5 times width of pterostigma.

Abdomen: Propodeum (Fig. 3) smooth, with 2 long setae above and one long seta below each spiracle. Petiole almost 3 times longer than width at spiracles, which are located on raised tubercles slightly anterior to middle of segment; dorsum distinctly raised, narrowing sharply anterad of spiracles, becoming almost parallel-sided, narrowing slightly posterior of spiracles, then widening gradually, becoming slightly rounded apically. Gaster lanceolate. Ovipositor sheaths (Fig. 4) elongate, bluntly pointed, dorsum very slightly concave, long setae present on apex.

Coloration predominantly brown to dark brown. Head dark brown, eyes black, face brown, clypeus and mandibles lighter except for dark apices, palpi brownish. Antennal scape and pedicel light brown, F1 light brown to brown, remainder of flagellum gradually merging to dark brown at apex. Prothorax light brown, mesothorax brown with scattered lighter areas. Wings brownish, venation brown. Legs yellowish-brown, coxae and trochanters lighter. Propodeum brown. Petiole yellow-brown. Gaster light brown. Ovipositor sheaths dark brown to black.

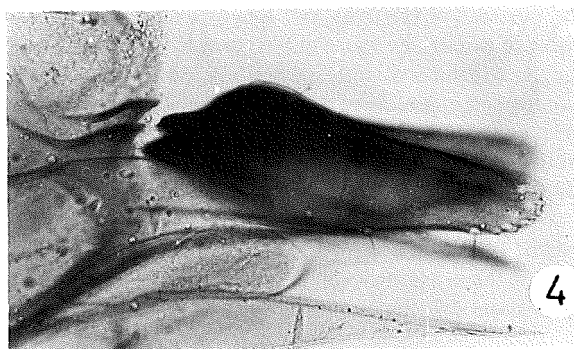
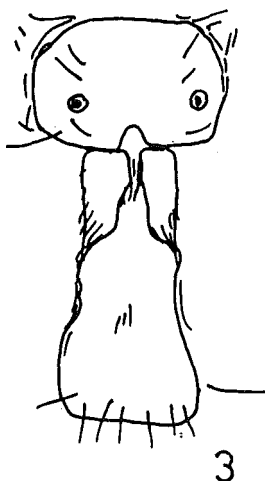
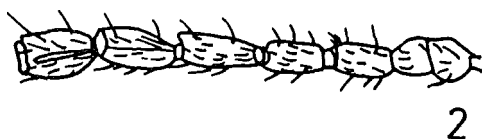
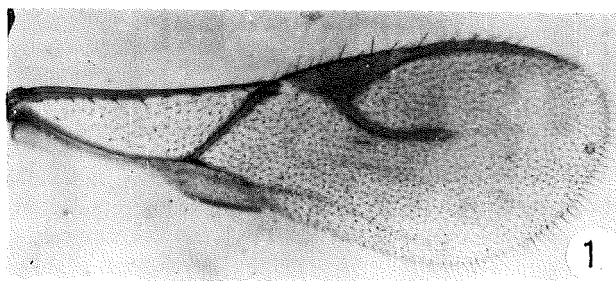
Length: 1.4 mm.

Male

Similar to female with the following notable differences: coloration darker; antenna 12 flagellar segments; length 1.2 mm.

HOST RECORDS: From *Sipha maydis* Passerini on *Arundo donax* (Bustan haGalil, 6/75) and on *Sorghum halepense* (Bet Rabban, 5/85).

NOTES: Review by Tremblay and Eady (1978) of Haliday's type material deposited in the British Museum (Natural History) has shown that the species theretofore called *Lysiphlebus* (*A.*) *arvicola* Starý is *A. ambiguus* (Haliday). The species incorrectly carrying the name *ambiguus* has been



Figs. 1–4. *Adialytus ambiguus* Haliday ♀. 1. Forewing. 2. Antenna: scape, pedicel and part of flagellum. 3. Propodeum and petiole. 4. Ovipositor mechanism.

renamed *L. confusus* Tremblay and Eady, and the name given by Starý has become a junior synonym.

In the past, *Sipha maidis* had been reported as very common in Israel, and had no known parasites (Harpaz, 1953; Bodenheimer and Swirski, 1957). Harpaz (1953) assumed this to be a result of the protection afforded to it from parasites and predators by its dense covering of stiff setae. During the course of this study, this aphid was first collected when its scattered mummies were found on leaves of *Arundo donax*. Even when sought after on its known graminaceous hosts, *Sipha maidis* was encountered only very few times.

A. ambiguus is of holarctic distribution. The previously recorded southern limits of its range have been Spain, S. France, Italy, Sicily and Bulgaria.

Adialytus thelaxis Starý 1961
(Figs. 5–9)

Lysiphlebus thelaxis Starý, 1961, Polskie Pismo Entomol. 31: 100–102.

Female

Head: Dorsal view, transverse, distinctly wider than thorax at tegulae, laterally rounded, smooth, shiny, with sparse moderately long setae. Eyes slightly protuberant, transverse diameter about equal to width of temple. Occiput margined by a narrow, circular, slightly raised carina. Ocellar triangle right-angled. In anterior view (Fig. 6), eyes oval, slightly convergent towards clypeus, vertical diameter about 2.5 times width of gena. Face smooth, shiny, moderately covered with medium-length setae. Clypeus slightly protuberant, with about 7 long setae. Labrum bluntly triangular usually with 6 long setae. Maxillary palpi 3-segmented, labial palpi 1-segmented. Tentorial index 0.6–0.7. Occipital foramen widens above tentorial bridge, upper corners pointed. Antenna (Fig. 7) 10 flagellar segments (rarely 11), F1 parallel-sided, slightly more than twice as long as wide, about 1.2 times longer than F2, antennal setae mostly erect.

Thorax: Pronotum faintly punctate to smooth. Mesoscutum smooth, shiny, notaulices shallowly defined anterolaterally, sparsely setose, a few long setae more or less following the path of the erased notaulices dorsally. Forewing (Fig. 5): pterostigma elongately triangular, about 3 times longer than wide, about equal to metacarp; radius shorter, about twice width of pterostigma.

Abdomen: Propodeum (Fig. 8) smooth, with 2–3 long setae on anterior areolae, anterad of spiracles; posterad of spiracles, 0–1 seta on each areola; two short shallow divergent carinae arise near center of posterior edge. Petiole elongate, smooth, narrowing slightly anterad and posterad of spiracles, widening slightly posteriorly; length slightly more than twice width at spiracles, which are located in middle of segment; dorsum slightly raised; sparse long setae near apex. Gaster lanceolate. Ovipositor sheaths (Fig. 9) pointed, of moderate length, dorsum without any concavity, venter rounded, apex blunt.

Coloration predominantly dark-brown to black. Head very dark brown, eyes black. Face dark brown, clypeus and mouthparts somewhat lighter, antenna dark brown. Thorax and propodeum dark brown. Wings pale brown, venation brown. Legs yellowish-brown. Petiole and following abdominal segment yellow-brown, remainder of gaster dark brown.

Length: about 1.2 mm.

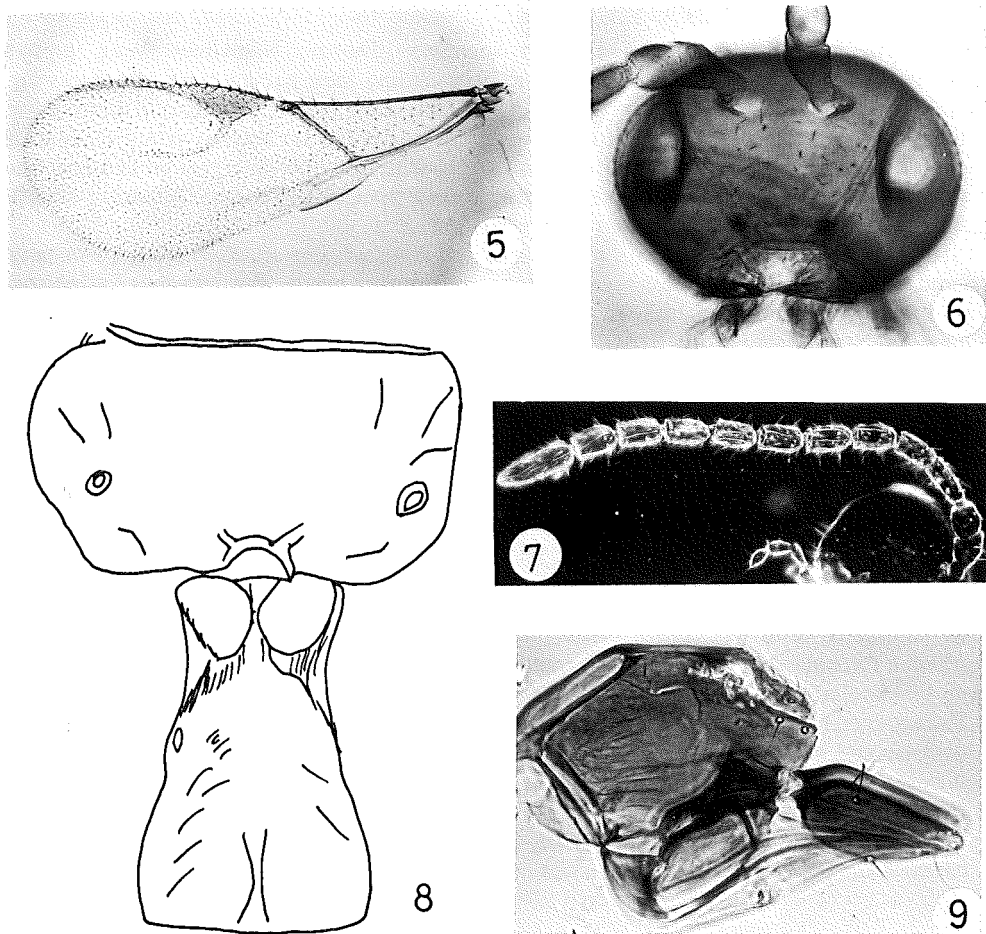
Male

Similar to female with the following notable differences: coloration darker; antenna 11 flagellar segments (rarely 12-segmented).

HOST RECORDS: From *Thelaxes confertae* Börner on *Quercus calliprinos* (Qal'at Nimrud, 10/74, 9/75; Mt. Meron, 8/75; Massada, 9/75; Shores, 8/76).

NOTES: *Thelaxes confertae* is reported by Bodenheimer and Swirski (1957) to be present in Israel during the spring and summer. Collections made on various species of oak during this study showed this aphid to be present during the fall and winter, too. Whereas oaks are relatively common forest-trees in northern and central Israel, and these aphids were found wherever they grow, *A. thelaxis* was recorded during summer and fall only. Despite the widespread occurrence of the host aphid, wasp collections have been restricted to mountainous regions, above 600 m elevation.

While attended by honeydew-seeking ants, *Thelaxes confertae* occasionally develops quite heavy populations between the scales and around the rim of the acorn cupules. This recessed position apparently affords some protection from larger natural enemies, but still leaves the aphids exposed to attack by smaller coccinellid and cecidomycid species which are quite commonly found in association with them. *Adialytus thelaxis* is one of the less common natural enemies of this aphid.



Figs. 5–9. *Adialytusthelaxis* Starý ♀. 5. Forewing. 6. Head, anterior view. 7. Antenna. 8. Propodeum and petiole. 9. Ovipositor mechanism.

The Israeli material stands in general agreement with Starý's (1961) description. However, there are a few consistent discrepancies. Most notably, female flagella are almost always 10-segmented, only rarely 11-segmented as in the original description; male flagella have 11–12 segments and none have 13 segments as in Starý's description. However, the Israeli specimens are also consistently shorter (about 1.2 mm, not 1.7 mm), presumably due to the small size of the local host.

Genus *Lysiphlebus* Foerster 1862

Lysiphlebus Foerster, 1862, Verh. Naturh. Ver. Preuss. Rheinl., 19: 248, 250.

Aphidaria Provancher, 1888, Add. Faun. Canad. Hym., 396.

Head: transverse, as wide as or wider than thorax at tegulae. Eyes hairless, medium-sized to small. Occiput weakly margined. Maxillary palpi 3-segmented, labial palpi 1-segmented. Tentorial index

0.5–0.6. Antenna filiform, 11–16 flagellar segments. *Thorax*: Notaulices weak, present anterolaterally only, erased on dorsum, sparse hairs outline their paths posteriorly. Forewing: Pterostigma elongately triangular; radial vein with 2 abscissae; 2nd interrarial vein more or less distinct between radial vein and short median vein; neither radial nor median vein reaches wing apex. *Abdomen*: Propodeum convex, entirely smooth or with 2 shallow divergent impressions near midline of posterior apex. Petiole elongately or widely triangular, smooth. Ovipositor sheaths slightly pointed or angular apically. Ovipositor straight.

Stary (1975) subdivided the genus *Lysiphlebus* into three subgenera: *Adialytus*, *Lysiphlebus* s. str. and *Phlebus*. *Adialytus* is here regarded as an independent genus. The subgenus *Lysiphlebus* s. str. has not been found in Israel. All recorded species of *Lysiphlebus* found in Israel, therefore, belong to the subgenus *Phlebus* Stary.

Lysiphlebus was first reported in Israel by Bodenheimer and Swirski (1957), without species determination, ex *Rhopalosiphum padi* (L.). Mackauer (1960) listed *Lysiphlebus ambiguus* [now correctly known as *Lysiphlebus confusus* Tremblay and Eady (1978)], ex *A. ruborum* (Börner), from material collected by Harpaz. Rosen (1966, 1967, 1969) expanded the list of *Lysiphlebus* species in Israel to include *L. fabarum* (Marshall), added *Toxoptera aurantii* Boyer de Fonscolombe to the host records for both species, and provided information about their geographical distribution, efficacy and thelytokous mode of reproduction in Israel. However, whereas Rosen (1967) found *L. confusus* to be the dominant of the two species in citrus groves, in this study *L. fabarum* was encountered more frequently. On the other hand, whereas Rosen did not obtain *L. confusus* from citrus in the northern coastal plain, both species have now been found to be equally distributed throughout the country, their populations very frequently being mixed together in the same aphid colonies.

Rosen noted the complete absence of males from the local populations of both *L. confusus* and *L. fabarum* and suggested that the Israeli *Lysiphlebus* were local biological strains, distinct from the biparental strains known elsewhere. Our observations on field-collected material from hundreds of samples and many thousands of specimens corroborate these findings, for in no case was a male *Lysiphlebus* of either species collected at any time of the year. However, a laboratory culture of *L. confusus* did produce normal males under certain conditions (see Notes under *L. confusus*).

KEY TO THE SUBGENERA OF *LYSIPHLEBUS* FOERSTER

1. Antenna 14–15 flagellar segments (except apical) almost quadrate
 *Lysiphlebus* Foerster s. str.
- Antenna 10–13 flagellar segments distinctly longer than wide *Phlebus* Stary

KEY TO THE SPECIES OF *LYSIPHLEBUS* (*PHLEBUS*) OCCURRING IN ISRAEL (FEMALES)

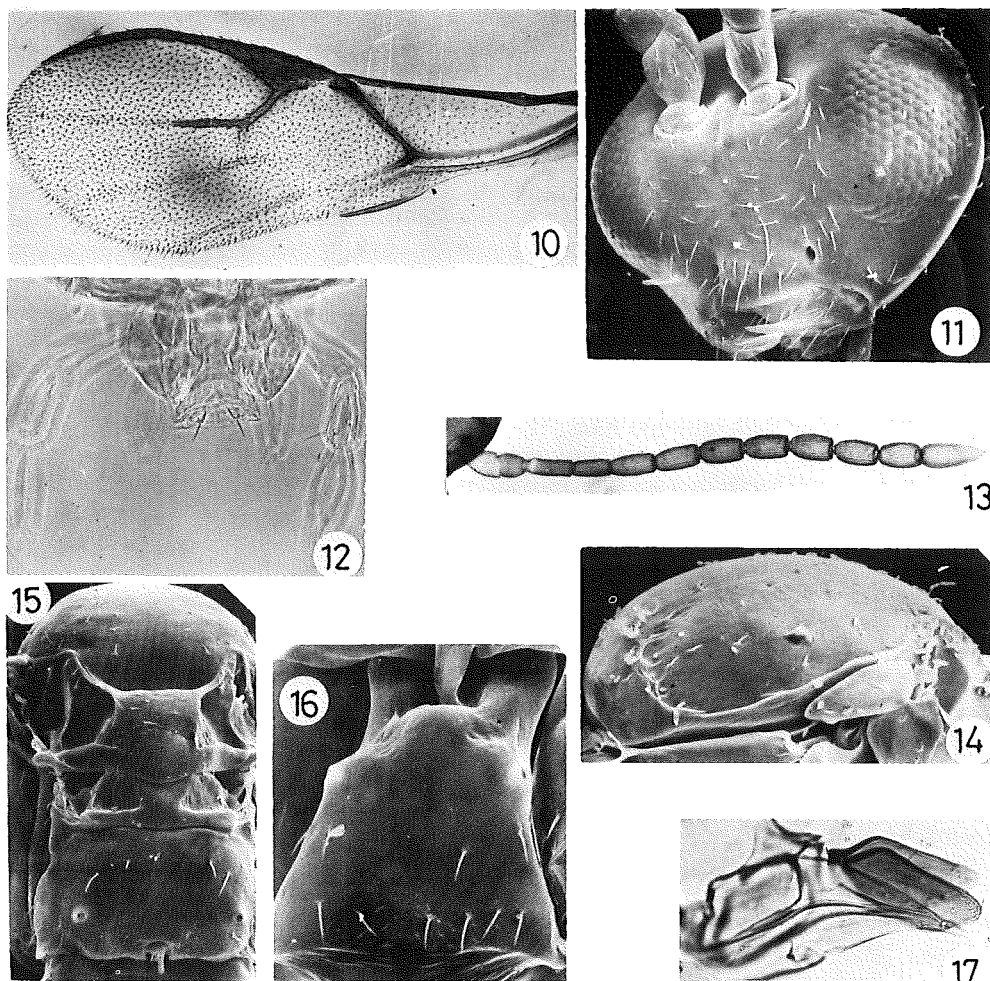
1. Setae on distal and posterior edges of forewing as short as those on surface of wing. Occasionally with a few isolated individual long fringes . . . *L. (P.) fabarum* (Marshall)
- Setae on distal and/or posterior edges of forewing longer than those on surface of wing
 2
- 2 (1). Forewing fringe setae present from point at which obscured radial vein meets wing apex until point where obscured cubital vein reaches dorsal aspect of wing. Second abscissa of radial vein straight, second interrarial vein not colorless where it meets radial vein
 *L. (P.) confusus* Tremblay and Eady
- Forewing fringe setae of irregular length, not present at area where obscured radial vein meets wing apex. Second abscissa of radial vein usually slightly to strongly arched, second interrarial vein entirely colorless *L. (P.) marismortui* n. sp.

Lysiphlebus (Phlebus) confusus Tremblay and Eady 1978
(Figs. 10–17)

Lysiphlebus confusus Tremblay and Eady, 1978, Boll. Lab. Entomol. Agr. Portici, 35: 180–184.
Lysiphlebus (Lysiphlebus) ambiguus Mackauer 1960 nec Haliday 1834 Beitr. Entomol., 10: 595–598.

Female

Head: Dorsal view, transverse, slightly wider than thorax at tegulae, slightly granular, shiny with sparse short setae. Transverse eye diameter about equal to temple. Ocellar triangle right-angled. In anterior view (Fig. 11), eyes small, hairless, oval, vertical diameter about $1\frac{2}{3}$ times width of gena. Clypeus rounded, slightly protruding with about 4–10 moderate-length setae. Labrum with about 2–5 setae. Maxillary palpi 3–4-segmented, labial palpi 1-segmented. Tentorial



Figs. 10–17. *Lysiphlebus confusus* Tremblay and Eady ♀. 10. Forewing. 11. Head, anterior view. 12. Ligula and maxillary palpi. 13. Antenna. 14. Mesothorax, lateral view. 15. Mesothorax, metathorax and propodeum. 16. Petiole, dorsal view. 17. Ovipositor mechanism.

index about 0.6. Occiput margined by a very slightly raised circular carina. Antenna (Fig. 13) filiform, usually with 10, sometimes 11 flagellar segments; scape and pedicel subglobular, F1, F2 parallel-sided, remaining flagellar segments slightly rounded; segments beginning with F3 bearing linear sensoria; length of F1 almost 2.5 times its width, slightly longer than F2 (ratio F2:F1 about 1:0.9). Face with scattered setae, those near orbits generally pointed ventrally; those near center pointing irregularly medially.

Thorax: Pronotum short, not covered dorsally by the gibbous mesoscutum. Mesoscutum (Figs. 14, 15) shiny matt. Notaulices shallow on ascendent aspect of mesoscutum, erased dorsally but demarcated by two rows of sparse, short setae that continue their paths posteriorly. Scutellum with 5–8 short setae. Forewing (Fig. 10): Pterostigma elongately triangular, about 4.5 times longer than wide, merging smoothly into the metacarp which is slightly longer or shorter than pterostigma; first abscissa of radial vein about 1.5 times width of pterostigma, slightly shorter than second abscissa; second interradial vein always distinct and colored at its point of origin from radial vein, remainder pale or colorless but distinct, about 0.5 times length of the colored segment of median vein; distal and posterior edges of wing lined with about 30–50 long, subequal setae, the first appearing about the point where obscured radial vein touches wing apex and continuing posteriorly to slightly beyond the point where obscured cubitus reaches apex.

Abdomen: Propodeum (Fig. 15) rounded, smooth with 1–4 setae anterad and 1–3 setae posterad of each spiracle. A short, shallow, scalloped depression reaches the posterior margin of the segment on each side of its central connection to the petiole. Petiole (Fig. 16) triangular, dorsum raised; spiracles distinctly situated on raised tubercles slightly anterad of lateral mid-line of segment; anterad of spiracles the raised dorsum narrows and falls toward segment's connection with propodeum; posterad of spiracles, dorsum smooth, rounded, with a single, sometimes irregular lateral pre-apical row of about 8 long setae. Gaster lanceolate. Ovipositor sheaths (Fig. 17) more or less elongate, apically rounded, about 2–2.5 times longer than wide; dorsal surface with a strongly raised hump, situated at about $\frac{1}{3}$ length; posterad of hump, dorsal surface is straight to convex. Ovipositor straight.

Coloration: Head dark brown to black, face and clypeus dark brown. Mandibles brownish; palpi yellow. Antenna dark brown to black except for scape, pedicel and base of F1 which are somewhat lighter. Thorax dark brown. Propodeum slightly lighter. Wings hyaline, venation brown. Petiole and following abdominal segment yellow, remainder of abdomen brown. Ovipositor sheaths dark brown to black. Legs: coxae and trochanters yellow, femora, tibiae and tarsi brown, yellowish near joints, apex of tarsi black.

Length: 1.2–2.0 mm.

Male

Similar to female with following notable differences: Antenna 11–12 flagellar segments. Coloration darker. Length 1.5–1.7 mm.

Mummies: Beige to dark brown.

HOST RECORDS: From *Aphis craccivora* Koch on leguminous plants (Emeq Hula, 5/75; Mishmarot, 3/75), on *Limonium* sp. (Qalya, 2/76), on *Trifolium tomentosum* (Rehovot, 4/76); from *Aphis fabae* Scopoli on *Carduus argentata* (Emeq Hula, 5/75), on *Cynara scolymus* (Jerusalem, 5/75), on *Solanum luteum* (Bet Guvrin, 8/76; En Yahav, 3/75; Jericho, 7/74, 2/75, 1/77; Merkaz Shapira, 6/73, 6/74, 1/75, 6/75, 5/77; Nahariyya, 6/75), on *Torilis arvensis* (Bustan haGalil, 6/75), on umbelliferous plants (Merkaz Shapira, 5/75; Emeq Hula, 5/75; En Gedi, 3/76), on *Urtica urens* (Rehovot, 2/76); from *Aphis gossypii* Glover on *Capsella bursa-pastoris* (Rehovot, 2/76), on *Chrysanthemum* sp. (En Yahav, 6/77; Rehovot, 4/75), on a cucurbitaceous plant (Rehovot, 12/75), on *Solanum luteum* (Merkaz Shapira, 6/76), on an unidentified plant (Hamadiya, 4/80); from *Aphis hederæ** Kaltenbach on *Hedera helix* (Rehovot, 1/76, 12/77, 9/78); from *Aphis ruborum* Börner on *Rubus sanctus* (En Hemed, 9/74; Nahal Saar, 10–11/74); from *Aphis umbrella** Börner on

malvaceous plants (Baniyas, 10/74; Hammat Gader, 4/75; Jericho, 2/76; Merkaz Shapira, 4/74; Rishon leZiyyon, 1/76); from *Aphis verbasci** Schrank on *Verbascum* sp. (Bet El'azari, 11/78; Gedera, 5/76; Mishmarot, 12/76; Mt. Hermon, 5/77; Rehovot, 12/75; Yavne, 4/76); from *Aphis zizyphi** Theobald on *Ziziphus spina-christi* (Yad Mordekhai, 5/75); from *Brachycaudus amygdalinus** Schouteden on *Polygonum equisetiforme* (Rehovot, 3/75), on *Prunus amygdalus* (Rehovot, 4/76); from *Melanaphis* sp. on *Sorghum halepense* (Emeq Hula, 6/75; En Zurim, 6/75) and from unidentified aphids on a chenopodiaceous plant (Auja el Fauqa, 3/75), on *Gerbera jamesonii* (Merkaz Shapira, 4/74), on *Lilium* sp. (Rehovot, 6/74), on a malvaceous plant (Merkaz Shapira, 5/73), on a leguminous plant (Sedeh Boqer, 3/74), on *Vicia* sp. (Rehovot, 2/76) and on *Vitex* sp. (Golan Heights, 6/78).

NOTES: Till recently this species was known as *Lysiphlebus ambiguus*. Tremblay and Eady (1978), reviewing Haliday's type specimen named *ambiguus*, found it to belong to the genus *Adialytus*, whereupon they redescribed *L. ambiguus* and gave it the name *confusus*.

Tremblay (1984) found *L. confusus* to be the most abundant parasite of *T. aurantii* in the Beirut area of Lebanon. Of the 10 identified aphid hosts found during the present study, 5 are new world records. Although not as numerous nor encountered as frequently as *L. fabarum*, this species has been collected throughout the year and in most areas of Israel. It is scarce in July, after which there is a slow but consistent population build-up during the fall and winter months. A small peak in population occurs in February and a second, greater peak, in June. With the summer wane of aphid hosts, this parasite again becomes scarce.

Indications are that *L. confusus* is more restricted by hot, dry weather than *L. fabarum*, for, in spite of the presence of its hosts, it was found only once in the warmer regions of the country during summer (Jericho, 7/74).

Oviposition is rather slow, taking from ½ to 2 minutes. Development from egg to mummy at $24 \pm 2^\circ\text{C}$ generally took 7–9 days. The first adults begin to emerge on the 12th day after oviposition. Specimens that develop in smaller aphid hosts are generally smaller and have fewer setae composing the wing fringes.

A laboratory colony of *L. confusus*, maintained for several generations under a 16L:8D photoperiod (which never occurs in Israel and only begins at about latitude 47°), at temperatures of $24 \pm 2^\circ\text{C}$ and 60–70% RH, produced one generation that included several males. The following generations (including the progeny of mated females) again consisted only of females.

Males were checked for fertility, mating behavior and mate selection. One male was dissected and its genitalia were squashed between a microscope slide and a cover-slip. The presence of active sperm confirmed the male's potential fertility. One female *L. confusus*, after mating with a sibling male, was dissected. Live sperm found present in its spermatheca confirmed that the males were capable of successfully inseminating the females during copulation. When placed together with conspecific females in gelatine capsules, the males responded immediately with much wing flapping and quickly located the females. Meeting them head-on, they would stroke antennae briefly (1–2 seconds) and quickly mount the female. Once on the female's back, the male would resume antennal stroking for about 25 seconds, after which copulation commenced, usually lasting about 25 seconds. One male, mated with five females in close succession, showed no significant change in the amount of time it took to complete the mating process. Although with the 5th female it took 35 seconds from the moment of mounting till copulation began, in all instances, the actual act of coition lasted 22–26 seconds.

There were no difficulties in getting *L. confusus* females and males to mate. Ovipositional behavior of mated and unmated females was identical and all progeny produced were morphologically similar females.

Some of the laboratory-reared males of *L. confusus* were exposed to field-collected, laboratory-emerged virgin females of *L. fabarum* to test their mating responses. When males were present,

the behavior of the females generally indicated their willingness to mate, for they underwent more than usually preening and remained in one place rather than roaming about as is their habit. In the presence of the *L. fabarum* females, the males of *L. confusus* displayed heightened activity: much wing-flapping, preening and roaming. But as they would approach the females, their general behavior became slow. Usually they would skirt the almost motionless *L. fabarum* females and when they would, upon occasion, make contact with their antennae, they quickly jump-flew away and broke off contact. On other occasions the situation was reversed, the female being the one to break off contact.

Despite this sexual isolation, one instance of mating between the two species did occur. Subsequently, the female was introduced to a colony of *Aphis verbasci* and oviposition was observed. After 5 days, parasite larvae could be seen developing inside the aphids and 2 days later mummies seemed to be forming, but mummification was incomplete and eventually the aphids died and dried out. The possibility exists, however, that despite the female having mated, fertilization did not take place and the progeny were uniparental.

The effect of photoperiod and climate as stimuli for inducing the appearance of sexual forms among aphids is a well-known phenomenon (Bodenheimer and Swirski, 1957). Numerous studies have shown environmental stimuli to influence uniparental vs. biparental reproduction in parasitic Hymenoptera (Flanders 1939, 1965).

These observations indicate that the Israeli *L. confusus* is not a unique strain, but simply reproduces uniparentally under the influence of geographic stimuli. They also indicate that *L. confusus* and *L. fabarum* should be regarded as two closely related but distinct species and are not in agreement with Carver (1984) who synonymized them.

Lysiphlebus (Phlebus) fabarum (Marshall 1896)
(Figs. 18–24)

Aphidius fabarum Marshall, 1896, in E. André, Espèces des Hyménoptères d'Europe et d'Algérie, 5: 599–600.

Aphidius cardui Marshall, 1896, in E. André, Espèces des Hyménoptères d'Europe et d'Algérie, 5: 593–594.

Aphidius aurantii Pierantoni, 1907, Atti Ist. Sci. Nat. Napoli, 59: 2.

Aphidius gomezii Quilis, 1930, Bol. Pat. Veget. Entomol. Agric., 1930: 55–57.

Lysiphlebus fabarum Marshall var. *inermis* Quilis, 1931, Eos, 7: 46.

Lysiphlebus innovatus Quilis, 1931, Eos, 7: 39–42.

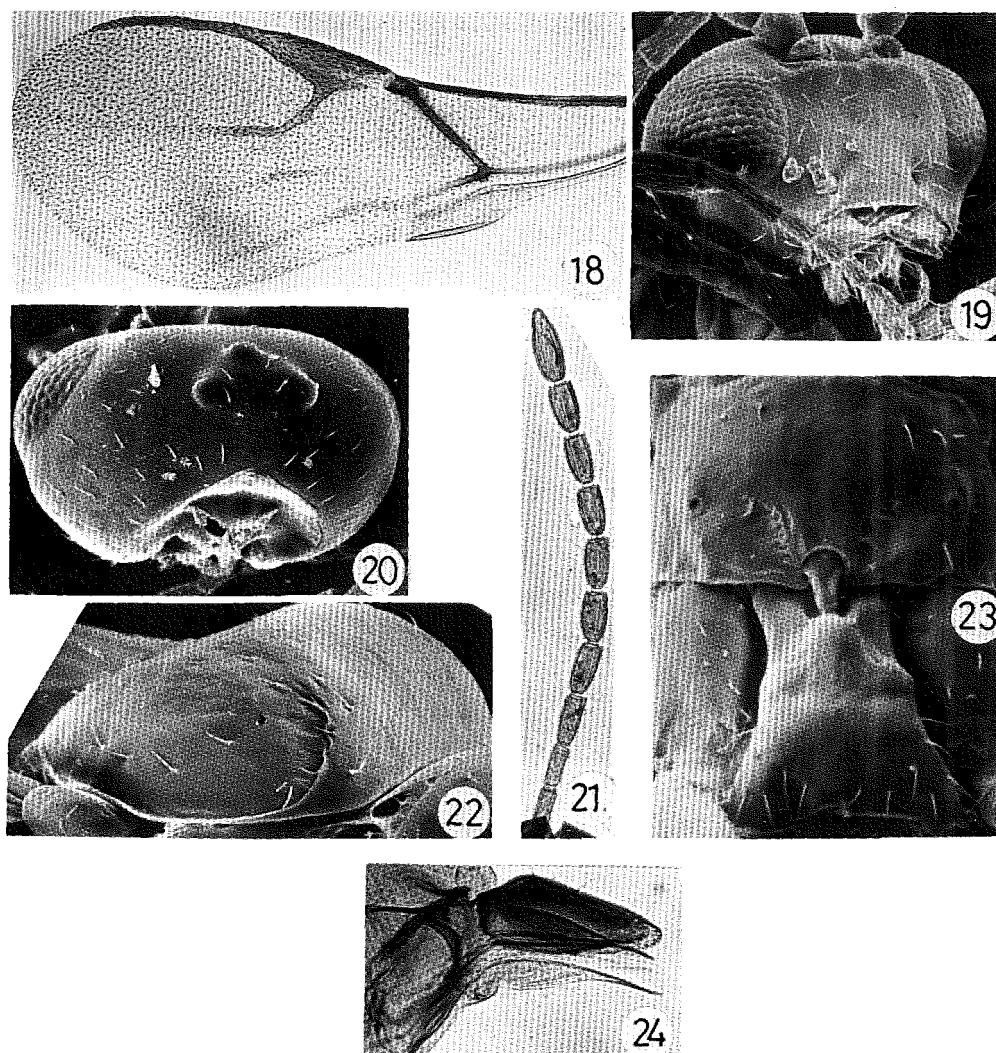
Aphidius janini Quilis, 1930, Bol. Pat. Veget. Entomol. Agric., 4: 461–463.

Lysiphlebus moroderi Quilis, 1931, Eos, 7: 43–45.

Female

Head: Dorsal view, transverse, wider than thorax at tegulae, rounded posteriorly, matt, with sparse moderate-length setae. Eyes slightly protuberant at anterior corners, transverse eye diameter slightly narrower than width of temple. Ocellar triangle right-angled. In anterior view (Fig. 19), eyes small, oval, hairless, longitudinal diameter about 3 times width of gena. Clypeus rounded, slightly protuberant, usually with 4–8 long setae. Labrum with about 4 long setae. Maxillary palpi 3–4 segmented, labial palpi 1-segmented. Tentorial index about 0.5–0.6. Occiput impressed, margined by a weak, circular carina. Antenna (Fig. 21) filiform, 10–11 flagellar segments, scape and pedicel subglobular; F1 less than 3 times longer than wide, slightly longer than F2; F1 and F2 parallel-sided, without linear sensoria, remaining segments slightly rounded, with linear sensoria. Face with irregularly scattered setae, those near orbits pointing ventrally, those near corner of face more or less pointed medially.

Thorax: Pronotum short, not covered by gibbous mesoscutum. Mesoscutum (Fig. 22) shiny



Figs. 18–24. *Lysiphlebus fabarum* Marshall ♀. 18. Forewing. 19. Head, anterior view. 20. Head, dorsal view. 21. Antenna. 22. Mesonotum, lateral view. 23. Propodeum and petiole. 24. Ovipositor mechanism.

matt. Notaulices very shallow, faint, visible only on ascendent area of mesoscutum, erased dorsally but delineated by 2 rows of sparse, medium-length setae that continue their paths posteriorly. Scutellum with 5–8 medium-length setae. Forewing (Fig. 18): Pterostigma elongately triangular, about 3.5 times longer than wide, merging smoothly into the subequally long metacarp; first abscissa of radial vein slightly longer than width of pterostigma, shorter than 2nd abscissa; second interrarial vein colored at anterior and usually at posterior apices, centrally colorless but distinct, about 0.5 times length of colored segment of median vein; distal and posterior edges of wings with short setae, as long as those of the disc, occasionally a few isolated long setae may be present on posterior edge.

Abdomen: Propodeum (Fig. 23) smooth, rounded, usually with 3 long setae anterad and 1–2 setae posterad of each spiracle; two divergent, moderately deep crenulate impressions present at posterior margin of segment. Petiole (Fig. 23) triangular, about 1.5–1.7 times longer than wide at spiracles, which are located slightly before middle of segment; dorsum raised, anterad of spiracles the raised surface narrows and falls toward point of connection with propodeum, posteriorly lined with a varying number of long setae, situated only near distal corners or spread along entire breadth. Gaster lanceolate. Ovipositor sheaths (Fig. 24) elongate, apically rounded, about 2.5 times longer than wide; dorsal surface with strongly raised hump at about $\frac{1}{3}$ length; posterad of the hump, straight to slightly concave; venter often with a slight pre-apical concavity. Ovipositor straight.

Coloration: Head and face brown to black, mouthparts brown to yellow. Antenna, scape, pedicel and base of F1 brown, remainder dark brown to black. Thorax brown to black, propodeum slightly lighter. Petiole and following abdominal segment yellow, remainder dark brown to black. Ovipositor sheaths black. Forelegs evenly yellowish throughout, except for slightly darker femora and black pretarsi; middle and hind legs brown to dark brown, except for yellowish trochanters and proximal area of tibiae. Wings hyaline.

Length: 1.3–1.8 mm.

Male

Unknown in Israel.

Mummies: Pale straw-colored to dark brown.

HOST RECORDS: From *Aphis chloris* Koch on *Hypericum triquetrifolium* (Bet Dagan, 4/77; Gedera, 5/76); from *Aphis craccivora* Koch on *Amaranthus blitoides* (Mevo Betar, 6/75), on *A. retroflexus* (Avigedor, 12/75; Bustan haGalil, 8/76; Gedera, 12/75; Merkaz Shapira, 6/75; Mevo Betar, 6/75; Zar'it, 8/76), on *Amaranthus* sp. (Merkaz Shapira, 5/74; Rehovot, 5/77), on *Anthemis* sp. (Jericho, 2/75), on *Asparagus stipularis* (Gedera, 5/76), on *Medicago* sp. (Jericho, 7/74), on *Ononis antiquorum* (Jericho, 2/75), on *O. natrix* (Gedera, 5/76), on a leguminous plant (Emeq Hula, 5/75), on *Phaseolus* sp. (Rehovot, 4/74), on *Retama roetam* (Mehola, 3/75), on *Robinia pseudoaccacia* (Merkaz Shapira, 6/76; Rehovot, 6/74), on *Tribulus bimucronatus* (Bet Oved, 8/75; Mishmar Ayyalon, 10/75), on *Trifolium tomentosum* (Rehovot, 4/76), on *Trifolium* sp. (Merkaz Shapira, 4/77), on *Trigonella arabica* (Qalya, 2/76), on *Vicia fabae* (Merkaz Shapira, 5/74) and on *Vicia* spp. (Kefar Ahim, 6/74; Negba, 4/77; Rehovot, 3/77); from *Aphis epilobiaria** Theobald on *Epilobium hirsutum* (Abu Ghosh, 7/74, 11/75, 12/76; Emeq Hula, 5/75); from *Aphis fabae* Scopoli on *Ammi majus* (Bene Re'em, 4/74), on *A. visnaga* (Merkaz Shapira, 5/73, 5/76), on *Arctotis* sp. (Merkaz Shapira, 6/73), on *Carduus argentata* (Emeq Hula, 5/75), on a chenopodiaceous plant (Rehovot, 3/75), on *Chrysanthemum* sp. (Rehovot, 4/78), on *Cynara scolymus* (Jerusalem, 5/75; Merkaz Shapira, 5/73), on *Medicago* sp. (Rehovot, 3/77), on *Mesembryanthemum acinacifolium* (Hemed, 5/76; Rehovot, 5/75), on *Silybum marianum* (Hafez Hayyim, 5/76), on *Solanum luteum* (Abu Ghosh, 11/75; En Yahav, 5/77; Merkaz Shapira, 5–6/74, 1/75, 5/77; Poleg Nature Reserve, 8/76; Rehovot, 3/74, 5/77); from *Aphis gossypii* Glover on *Amaranthus retroflexus* (Bustan haGalil, 8/76), on *Amaranthus* sp. (Merkaz Shapira, 9/74), on *Anchusia aegyptica* (Jericho, 2/76), on *A. italica* (Rehovot, 5/76), on *Carduus argentata* (Merkaz Shapira, 5/76), on *Centaurea* sp. (Rehovot, 1/78), on *Chrysanthemum* sp. (En Yahav, 5/77; Rehovot, 4/75), on a cucurbitaceous plant (Rehovot, 12/75), on *Ferula* sp. (Rehovot, 1/77), on *Gossypium* sp. (Gedera, 12/75; Shafir, 5/74), on *Gundelia tournefortii* (Gedera, 5/76), on *Lamium amplexicaule* (Rehovot, 1/75), on a malvaceous plant (Rehovot, 10/75), on *Trifolium* sp. (Rehovot, 3/75); from *Aphis hederæ* Kalténbach on *Hedera helix* (Rehovot, 1/76, 9/76, 11/76, 7/78); from *Aphis punicae* Passerini on *Punica granatum* (Merkaz Shapira, 6/73); from *Aphis umbrella* Börner on malvaceous plant (Auja el Fauqa, 3/75; Be'er Ya'aqov, 2/77; Gedera, 5/76; Hamat Gader, 4/75; Hemed, 1/77; Jericho, 2–3/75, 2/76; Merkaz Shapira, 4/74, 3/81; Qalya, 3/81; Rehovot, 1/77; Tel

Mond, 4/74); from *Dysaphis emicis** Mimeur on *Emex spinosa* (Avigedor, 12/75); from *Myzus persicae* (Sulzer) on *Amaranthus* sp. (Yad Rambam, 10/75), on *Anthemis* sp. (Jericho, 2/75), on *Epilobium hirsutum* (Abu Ghosh, 11/75), on a malvaceous plant (Yad Rambam, 10/75); from *Protaphis* sp. on *Carthamus tenuis* (Merkaz Shapira, 5/76); and from unidentified aphid species on *Amaranthus* sp. (Merkaz Shapira, 6/74), on *Centaurea* sp. (En Gedi, 12/74), on *Gerbera jamesonii* (Merkaz Shapira, 5/73, 4/74), on leguminous plants (Rehovot, 2/76, Sede Boquer, 3/74); on *Lilium* sp. (Rehovot, 6/74), on *Malus sylvestris* (Merkaz Shapira, 5/73), on *Polygonum equisetiforme* (Rehovot, 3/75), on *Portulaca oleracea* (Rehovot, 10/74), on *Sorghum halepense* (En Zurim, 6/75; Merkaz Shapira, 5/76), on an umbelliferous plant (En Gedi, 5/77), and on *Urtica* sp. (Hemed, 5/77).

NOTES: Mackauer (1960) noted the scarcity of males among *L. fabarum* in Europe, and suggested that the species might be thelytokous.

This species has been collected from almost all parts of the country and is present throughout the year. Populations are at a minimum in July and gradually build up during the fall and winter months, till the spring, when the species becomes very common. Populations peak in May and then become rather scarce with the rapid disappearance of aphid hosts during the following two months. While *L. fabarum* was found in cool regions of the country during the winter months (e.g., Abu Ghosh in the Judean Hills), it was likewise present in the warmest regions of the country during the summer (e.g., En Gedi and Jericho in the Dead Sea area).

Lysiphlebus fabarum can be considered one of the most important aphid parasites in Israel. Populations maintained on economically indifferent hosts (e.g., *Aphis chloris*, *A. hederae*, and *A. umbrella*) are available to attack other hosts that are important pests. An example is of *A. umbrella*, occurring on various widespread malvaceous plants in and around citrus groves. Vast colonies can be found entirely destroyed by *L. fabarum* which, upon emergence, can provide effective control of the citrus aphids as reported by Rosen (1967).

Although *A. umbrella* is often assiduously attended by ants, the parasite's efficiency does not appear to be impaired by them.

***Lysiphlebus (Phlebus) marismortui* Mescheloff and Rosen n. sp.**
(Figs. 25–31)

This new species, found on one occasion near the Dead Sea, is easily separated from its congeners by the distinct arch in the second abscissa of the radial vein, by the long setae found only along the posterior and postero-distal edge of the forewing and by its entirely colorless second interradial vein.

Female

Head: Dorsal view, transverse, wider than thorax at tegulae, posterior corners rounded, smooth, shiny, with sparse short setae. Eyes hairless, slightly protuberant at anterior corners, transverse diameter about equal to width of temple. Ocellar triangle slightly obtuse. In anterior view (Fig. 26), eyes small, oval, vertical diameter about twice width of gena. Apex of clypeus straight or slightly rounded, protuberant, usually with 5 long setae. Labrum with about 5 setae. Maxillary palpi 3-segmented, labial palpi 1-segmented. Tentorial index about 0.6. Occiput impressed, faintly outlined by a weak circular carina. Antenna filiform, 10 flagellar segments; scape and pedicel subglobular; F1 parallel-sided, about 2.5 times longer than wide, shorter than F2; F2 widens slightly apically, usually with 2 linear sensoria; remaining segments rounded, with about 8 linear sensoria. Face with sparse, scattered setae.

Thorax: Pronotum (Fig. 28) short, slightly granulate, not covered by mesoscutum. Mesoscutum gibbous, smooth, shiny. Notaulices shallow, visible only on the ascendant aspect of mesoscutum; two rows of sparse, moderate-length setae follow their paths posteriorly. Scutellum with 0–5 short

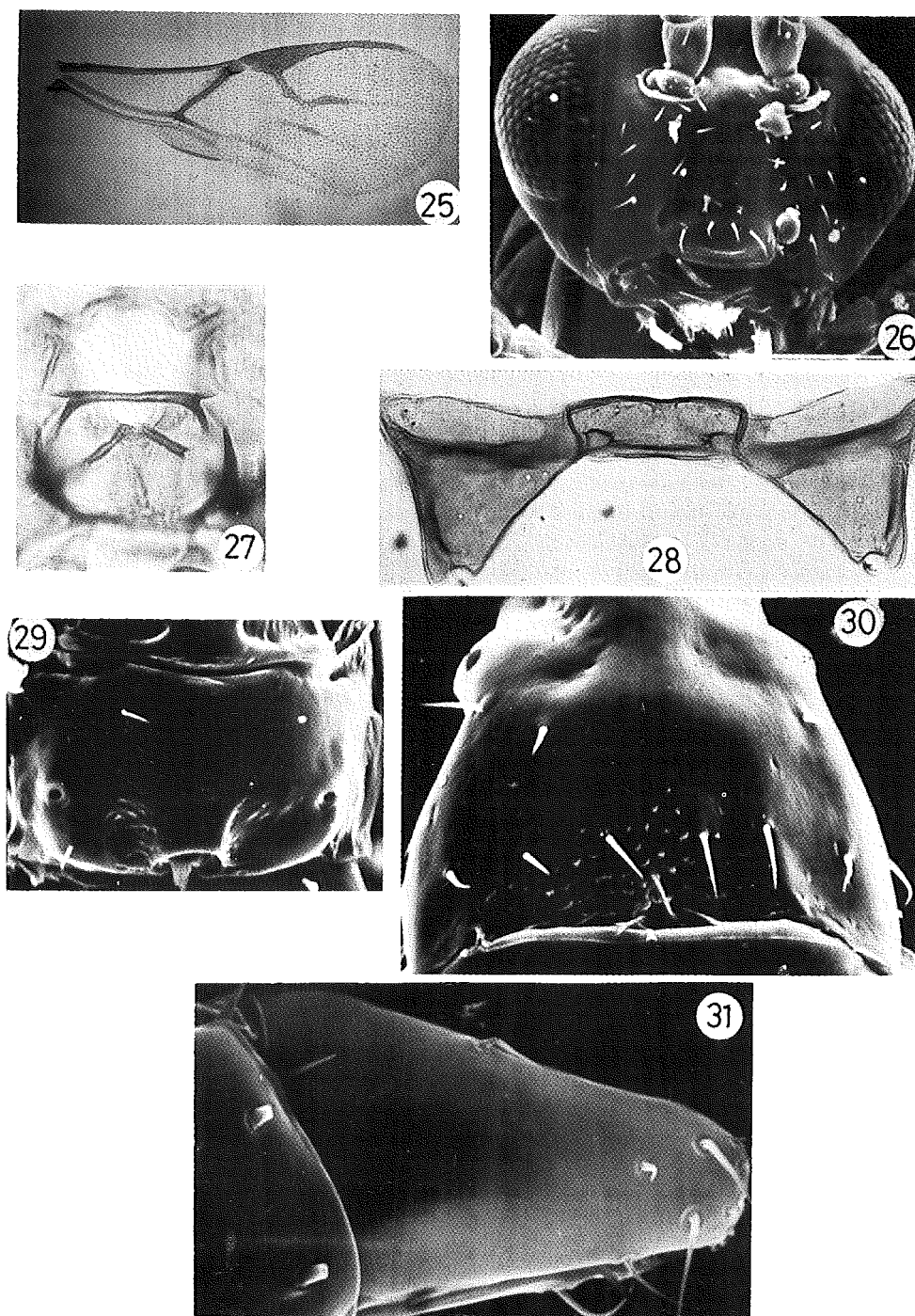


Fig. 25–31. *Lysiphlebus marismortui* n. sp. ♀. 25. Forewing. 26. Face, anterior view. 27. Occipital foramen. 28. Pronotum, dorsal view. 29. Propodeum. 30. Petiole. 31. Ovipositor sheaths.

setae. Forewing (Fig. 25): Pterostigma elongately triangular, about 3.5 times longer than wide, merging smoothly into the subequally long metacarp; first abscissa of radial vein about 1.5 times longer than width of pterostigma, subequal to second abscissa which is usually slightly to strongly arched; interrarial vein colorless throughout and barely visible, shorter than colored aspect of median vein; posterior and postero-distal edge of wing with fringe setae longer than those on disc, those located on posterior edge longer than those on distal apex; short fringe setae at area where obscured radial vein reaches apex.

Abdomen: Propodeum (Fig. 29) rounded, smooth, hairless or with one seta anterad and one seta posterad of each spiracle; short but distinct divergent impressions at posterior apex. Petiole (Fig. 30) triangular, dorsum raised, spiracles anterad of middle of segment on slightly raised tubercles; anteriorly, the raised aspect of dorsum narrows and falls; posteriorly segment convexly rounded, with a transverse row of about 8 long subapical setae. Gaster lanceolate. Ovipositor sheaths (Fig. 31) elongate, apically rounded, about 2.5 times longer than wide; dorsal surface with raised hump anterior to middle of segment, posteriorly straight to slightly concave, ventrally convex.

Coloration: Head, face and thorax brown to dark brown, palpi brown, propodeum slightly lighter. Petiole and following abdominal segment yellowish-brown, becoming darker toward apex of abdomen. Legs brownish, slightly lighter near articulations. Wings hyaline, venation brown.

Length: 1.5 mm.

Male

Unknown.

HOST RECORD: From *Aphis craccivora* Koch on *Trigonella arabica* (Qalya, 2/76). The female holotype specimen, No. 288 (mounted on a card point, wings slide-mounted in balsam) and paratypes (11 ♀♀) are in the aphidiid collection of the Hebrew University of Jerusalem, Faculty of Agriculture, Rehovot.

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