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On the genus *Israelaphis* Essig in Sicily, with description of a new species (Rhynchota-Homoptera Aphidoidea)

Abstract - Two aphid species belonging to genus *Israelaphis* Essig were collected for the first time in Sicily (Italy) during the years 1998-99. One of the two aphids is described as a new taxon, *I. ilharcoi* sp.n., the other one being the well known type-species *I. carmini*. Both species are recorded for Israel, Portugal and Sicily, where they live on annual grasses belonging to the genera *Bromus*, *Avena*, *Hordeum*. Notes are given on their life-cycle and taxonomy. A key to apterous viviparous morphs allows the identification of the four aphid species which are known up to now to belong to the genus.

Riassunto - *Annotazioni sul genere* Israelaphis *Essig in Sicilia, con descrizione di una specie nuova.*

Nel corso del 1998-99 sono state riscontrate in Sicilia due specie del genere *Israelaphis* Essig, peculiari afidi a distribuzione mediterraneo-atlantica afferenti a una sottofamiglia autonoma (*Israelaphidinae*) nell'ambito dell'eterogeneo gruppo dei "Drepanosifini" (ex Callafidini) in senso lato. Delle due entità rinvenute, una corrisponde alla specie-tipo, *I. carmini* Essig, l'altra viene descritta quale specie nuova, col nome di *I. ilharcoi* sp.n.. Entrambi gli afidi, oltre che in Sicilia, risultano presenti in Portogallo e in Israele; essi si sviluppano attraverso un olociclo monoico a decorso invernale, con nascita delle fondatrici in ottobre e conclusione del ciclo biologico in maggio-giugno, allorché si ha il differenziamento degli anfigonici e la deposizione dell'uovo durevole. In tal modo l'insolita attività biologica dell'afide risulta perfettamente coincidente con lo sviluppo vegetativo delle sue piante ospiti, Graminacee annuali principalmente dei generi *Bromus*, *Avena* e *Hordeum*.
Oltre a dettagli morfologici sulle varie forme conosciute della nuova specie vengono richiamati alcuni aspetti biologici e sistematici generali sul genere *Israelaphis*, che annovera sin'oggi quattro specie note, distinguibili sulla base della chiave analitica riportata.

Key words: aphids, *Israelaphis*, *Israelaphidinae*, taxonomy, Sicily (Italy).

INTRODUCTION

The genus *Israelaphis* is a peculiar taxon of grass-feeding Aphididae (sensu Eastop, 1977) at present including three known species (Remaudière & Remaudière, 1997). It was erected by Essig (1953), who described and figured well the type species, *I. carmini*, on the base of a single adult male specimen (believed to be an "apterous female" by the author!), "collected by sweeping various plants" in March 1931 by Dr. J. Carmin in Israel.

The first sample of an aphid belonging to this genus was only recently found in Sicily (Italy) by the authors, although they had previously made a number of aphid collection in the island over many years. Resulting from this, a survey was quickly set up in Sicily with the aim of perhaps finding other species of the genus and establishing their distribution. A total of thirty samples was collected in the field during the two years 1998-99, from which up to now only two species have been identified, viz. *I. carmini* and the one here described as a new taxon. This new taxon agrees with the one already accurately described but not named by Ilharco (1985), being designated "*Israephis* kind a" in his paper; it is therefore dedicated to Dr. F.A. Ilharco and is redescribed below.

Israelaphis ilharcoi sp.n.

APTEROUS VIVIPAROUS FEMALE. Body oval-shaped, usually bearing 40 long and slightly spiculate dorsal processes, which are distributed as follows: a single spinal pair on head, prothorax and abdominal tergites 5 and 8; spinal and marginal pairs on each segment from mesothorax to abdominal tergite (urotergite) 4, and also on urotergites 6 and 7. Occasionally, as stated by Ilharco (1985) the prothorax bears an additional pair of marginal processes, so bringing the total number up to 42. However, such a pattern has not yet been seen in Sicilian specimens. The length of the processes gradually increases from the head to urotergite 8; the observed ranges are: on head 0.12-0.22 mm, on prothorax (spinals) 0.15-0.27 mm, from mesothorax to urotergite 4 (both spinals and marginals) 0.16-0.30 mm, on urotergite 6 0.36-0.48 mm, spinal pair on urotergite 8 0.52-0.78 mm; this last pair is much more scaly than the anterior pairs and extends beyond the cauda. The dorsal processes do not bear apical setae, but each has a short one (about 6-9 μ long) inserted nearly at mid-length, except for the processes on urotergite 8 which bear 2-4 small setae up to 12-16 μ long distributed along their shafts. Stigmal pores rounded, with well sclerotised peritrema; those on thorax and urite 7 are surrounded by a small area of more strongly alveolate cuticle. Dorsal body cuticle clearly areolate, particularly on head. Dorsal body hairs all very short, 4-8 μ long and apically blunt, about 10-14 in number on urotergites 2-5 (difficult to count exactly); ventral setae on abdominal segments longer (max. length 25-35 μ) and pointed. Dorsal sclerites absent apart from the rather pigmented head cuticle and the feebly pigmented dorsal processes. Head dorsally hardly separate from pronotum; its

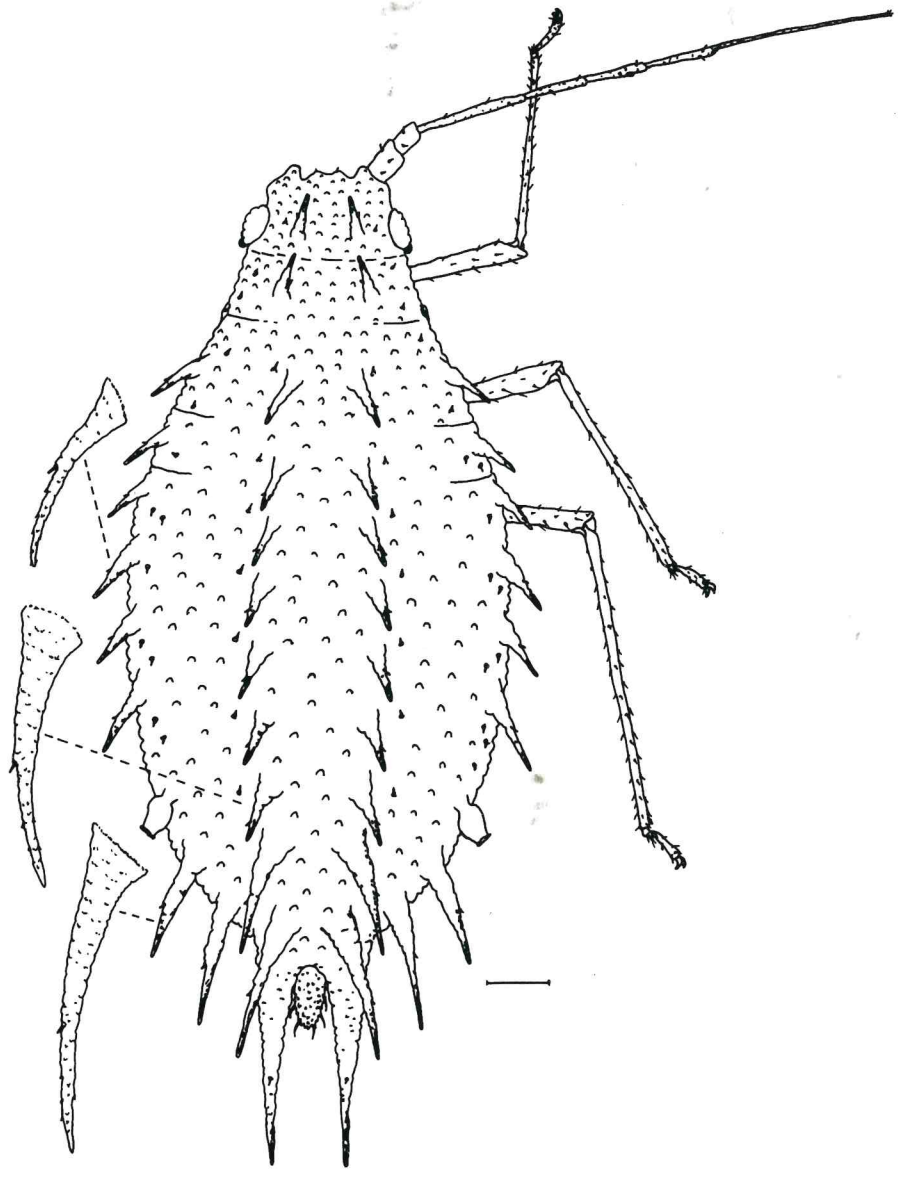

Fig. 1 - *I. ilharcoi* sp.n., shape of apterous viviparous female (after Ilharco, 1985, redrawn) and details of dorsal tubercles. Scale segment 0.2 mm.

frontal outline with well developed antennal tubercles and a less prominent median one that is slightly bilobed due to a small median incision. Antennae 6-jointed and only slightly pigmented in macerated specimens except for distal darkening extending variably from apex over most or all of joint VI and rarely also the apical part of joint V; joints I and II as well as basal part of III (which appears almost as if reticulated) much more imbricate than following ones. Antennal flagellum (joints III-VI) 0.48-0.75 of body length; processus terminalis clearly longer (1.32-1.88) than joint III and 2.65-3.32 times as long as basal part of VI. Antennal hairs very short and blunt apically; those on joint III up to 6-10 μ long and 0.26-0.36 times basal articular diameter of joint. Secondary sensoria not present and primary ones not ciliated, but with a more or less crenulate internal ring; primary sensorium on joint V sited at about 0.7 of the length of the joint measured from the base; accessory sensoria on joint VI grouped

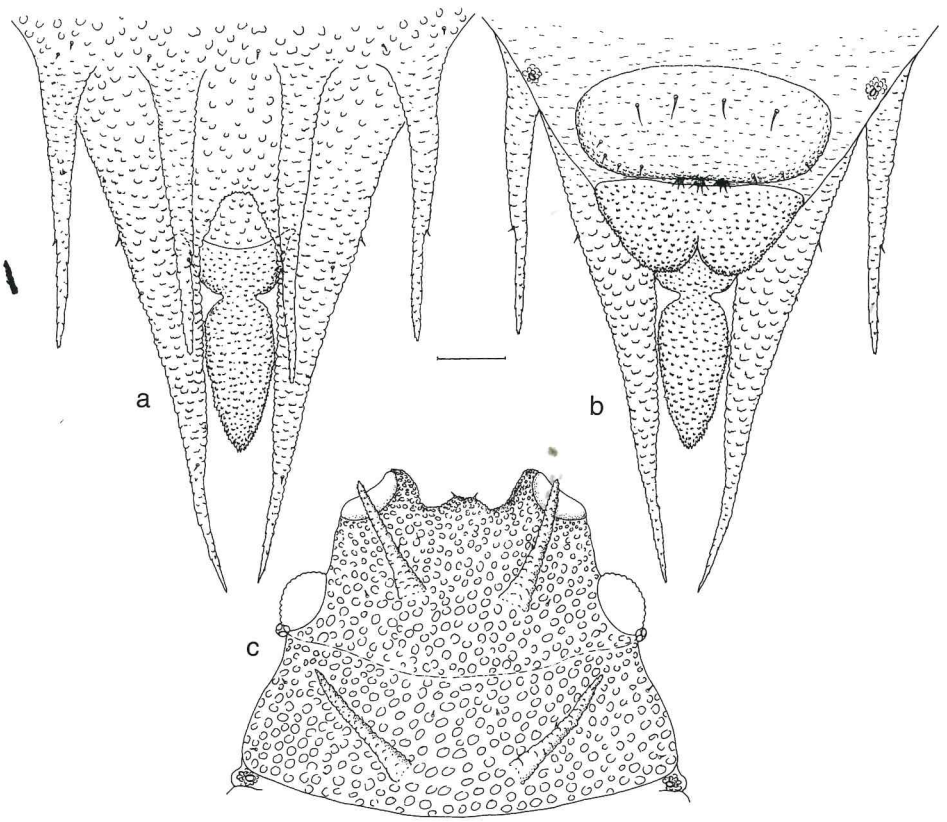

Fig. 2 - *I. ilharcoi* sp.n., apterous viviparous female: a. posterior end of body from dorsum; b. same, from venter (hairs on anal plate and cauda are omitted); c. head and prothorax. Scale segment 0.1 mm.

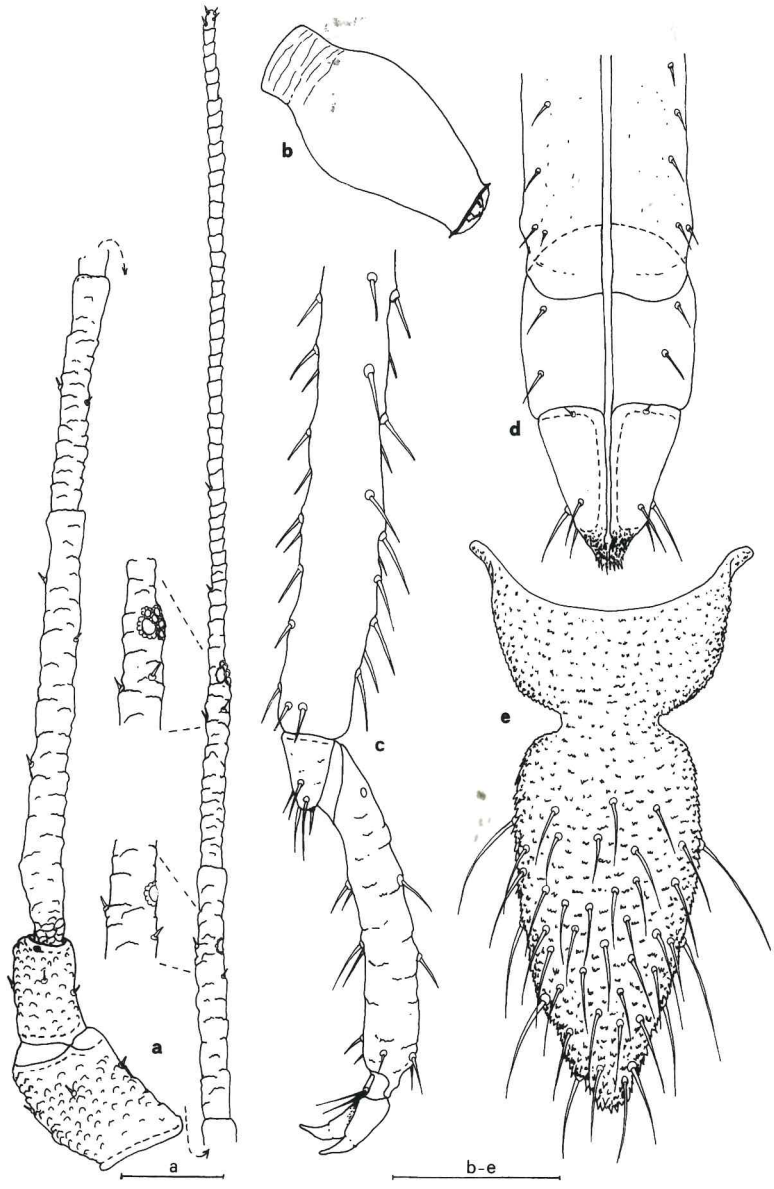

Fig. 3 - *I. ilharcoi* sp.n., apterous viviparous female: a. antenna and its details; b. siphunculus; c. distal part of hind tibia and tarsus; d. distal part of rostrum; e. cauda (from ventral side). Scale segments 0.1 mm.

around the primary one. Rostrum short, just reaching middle coxae, with a distally pigmented shortly conical apical segment. The latter is without supplementary hairs, or exceptionally (only one specimen seen) with one small pair; about as long as wide at base and 0.38-0.48 as long as second hind tarsomer. Legs normal and rather slender, with coxae and femora not enlarged or modified for leaping; well sclerotised but hardly pigmented, except for the darkish second tarsomers, and only occasionally also the tibial apices. Femora slightly imbricate, mostly on distal part, with short blunt setae that are maximally 12-16 μ in length along the dorsal margin. Trochantro-femoral suture clearly visible, though not much differentiated. Tibiae quite smooth and with rather short setae; these are 8-15 μ long and distinctly blunt on the basal part of the tibia, becoming gradually longer and rather pointed towards the distal end, where they are maximally 34-48 μ long, hardly equalling the tibial diameter. First tarsomer chaetotaxy 5:5:5; second hind tarsomer 1.25-1.75 times as long as siphunculus, and with basal placoid sensorium slightly displaced laterally; empodial hairs with finely produced apices. Siphunculi with a characteristic vasiform shape, having a short basal stalk that is usually transversely corrugated, followed by a smooth dilated median part and a constricted distal neck opening into a well developed flange; their length nearly equal to that of the first antennal joint. Cauda tongue-shaped, constricted at about one third of its length from base and 1.95-2.58 times as long as siphunculi; with finely spinulose cuticle and bearing about 40-45 rather short lateroventral setae. Anal plate quite deeply bilobed. Genital plate with usually 4 main discal setae and about 6-9 much smaller ones along its distal margin. Rudimentary gonapophyses three, as usual in members of this genus, each one with a group of 5-6 small setae.

Body colour grass-green or yellowish green, with slight whitish wax secretion, especially ventrally; head slightly darker (brownish); antennae ochreous with brown apices; legs ochreous with brown tarsi; dorsal processes and cauda brownish; siphunculi brown.

Body length (to tip of cauda) 2.30-3.00 mm.

FIRST INSTAR NYMPH. Body with a complete series of dorsal processes, arranged as in the apterous viviparous female and ranging in length from 60-65 μ on the head to 130-150 μ for the spinals on urotergite 6; each process apically ending in a small hemispherical transparent tip. Head and pronotum sclerotised. Frons distinctly sinuate, its median process slightly bilobed and imbricate. Compound eyes and triommatidia well developed. Antennae 4-jointed, 0.65-0.70 mm long, with processus terminalis about twice as long as joint III and 2.8-3.6 times as long as basal part of IV; primary sensoria not ciliated. Rostrum reaching to between middle and hind coxae; its ultimate joint well pigmented and about half as long as second hind tarsomer. Hind tibiae with a row of 6-7 rastral hairs inserted on the middle part of their inner side. Siphunculi very short, mammiform in shape, about 50 μ in diameter. For other morphological features see Fig. 4. Colour in life pale green, with apical part of antennae, and tarsi, brownish.

Body length 0.90-0.95 mm.

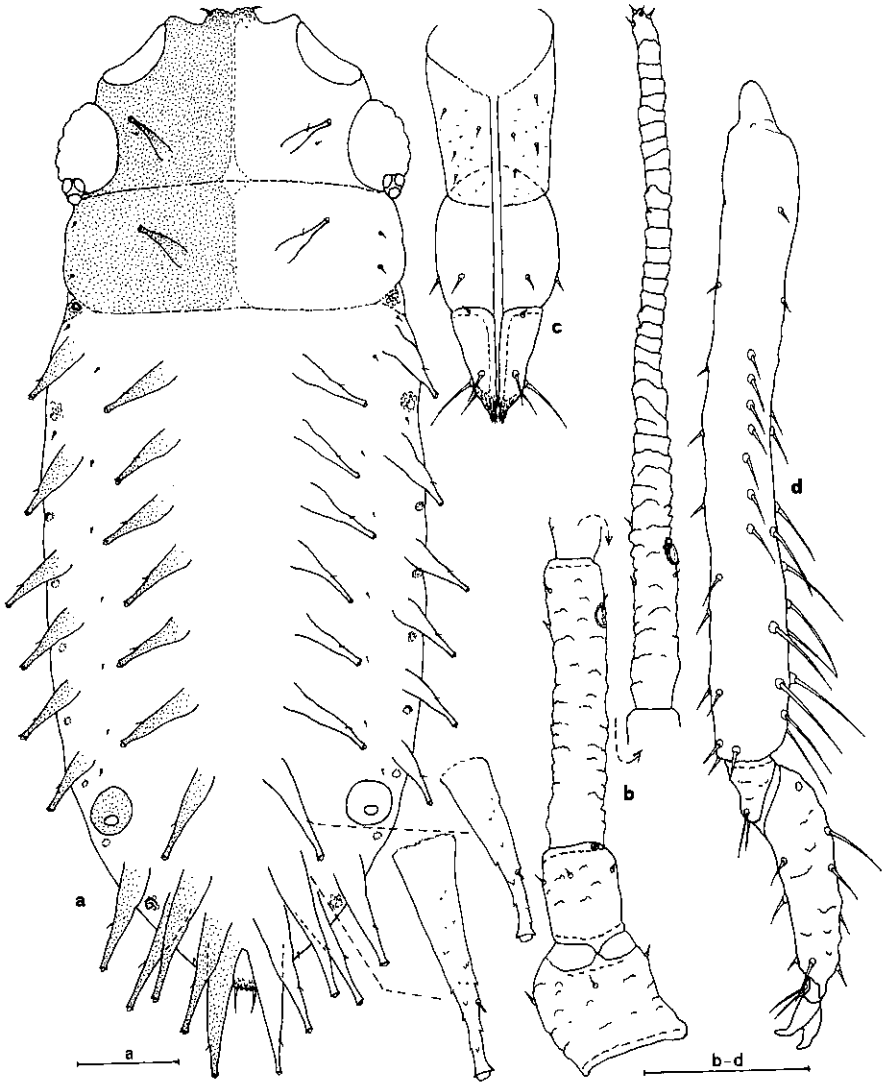

Fig. 4 - *I. ilharcoi* sp.n., first instar nymph: a. body shape with details; b. antenna; c. distal part of rostrum; d. hind tibia and tarsus. Scale segments 0.1 mm.

OVIPAROUS FEMALE. As is usual in the genus, the ovipara differs markedly in shape from the apterous viviparous female. Body oval and shining olive-brownish in colour, without wax secretion; antennae and legs completely brown. Head well sclerotised, together with large transverse bands on each of the thoracic and abdominal tergites. Dorsal processes strongly reduced compared with those of apterous viviparae, both in number and size, but apparently never completely lacking as in oviparae of *I. carmini*, where only the spinal pair on urotergite 8 is present. Ilharco (1985) records a total number of 1-14 dorsal "papillae" in a Portuguese population. A generally similar picture is seen in specimens from Sicily, which usually bear reduced dorsal tubercles

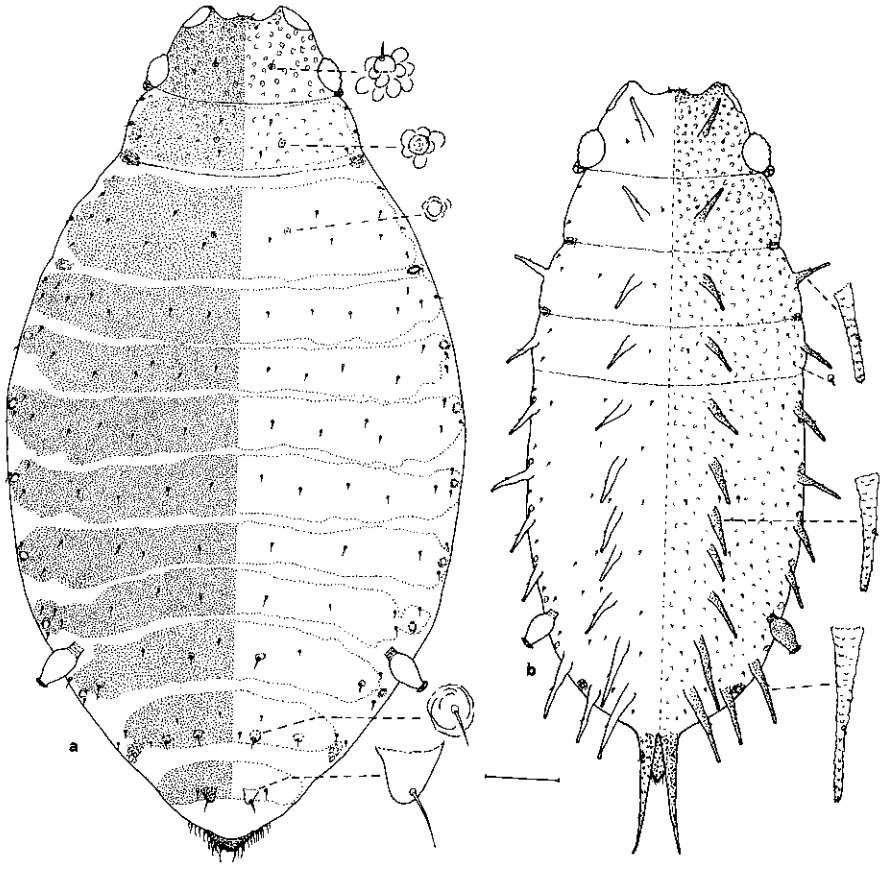

Fig. 5 - *I. ilharcoi* sp.n., a. oviparous female: body shape with details; b. male: body shape with details. Scale segment 0.2 mm.

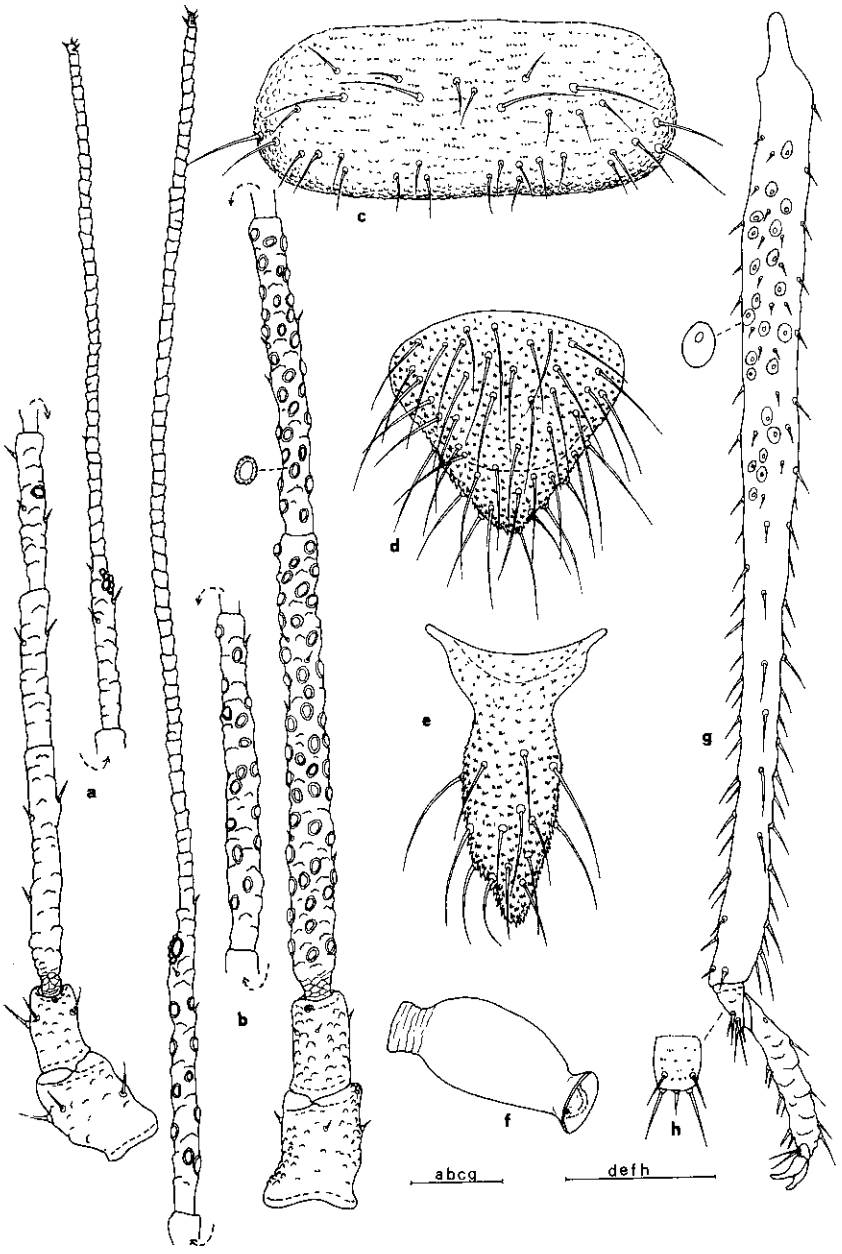

Fig. 6 - *I. ilharcoi* sp.n., oviparous female: a. antenna; c. genital plate; d. cauda (ventral side); g. hind tibia and tarsus; h. first hind tarsomer (ventral side). – Male: b. antenna; e. cauda (ventral side); f. siphunculus. Scale segments 0.1 mm.

on the head, pro- and mesothorax and last two or three urotergites. But one (1) out of the seven specimens seen has a nearly complete set (39 in number!) of small dorsal processes. The size of these tubercles varies from that of very small papillae each with an apparently apical or subapical hair of length 12-16 μ on head up to 30-40 μ on tergite 8, to that of more or less developed (up to about 30-150 μ long) "normal" processes; the tubercles on tergite 8 are as a rule more constant in shape and size, appearing quite large at the base, blunt apically and 40-100 μ long. The body hairs, including those on the antennae and legs, are a little longer and apically more acute than those of the viviparous female. Antennae extensively pigmented and about two-thirds (0.59-0.69) of body length; processus terminalis 3.06-3.47 times as long as basal part of joint VI. Legs extensively well pigmented; hind tibiae slightly swollen on the basal one-third and bearing a few (12-24) pheromonic plaques ("pseudosensoria"); these are quite unusual in shape, having a large marginal ring and a small transparent central membrane. Cauda short and triangular, with about 35-40 or more long, apically acutely produced ventral setae. Anal plate bilobed. Genital plate much more hairy than in apterous vivipara, having 28-36 hairs scattered all over it. For other morphological features and biometric data, see drawings and Table 1.

Body length 1.98-2.40 mm.

The *nymphal stadia* of the oviparous female have a regular set of dorsal processes such as occurs in all other nymphs and the adult viviparae and males.

MALE. Apterous, smaller and much more slender than the apterous viviparous female, with which it shares the number and general shape of the dorsal processes; these are smaller than in the vivipara, their length being 0.12-0.14 mm on the head, 0.13-0.15 mm on urotergite 3 and 0.29-0.38 mm on urotergite 8. Antennae longer (1.28-1.30 times) than body, with joints I and II unpigmented, like the body, and contrasting strongly with the flagellum (joints III-VI), which is heavily pigmented. Processus terminalis 3.5-4.0 times as long as basal part of joint VI. Flagellar joints all bearing small round or slightly oval secondary sensoria; in the three examined specimens these number 57-76 on joint III, 27-42 on IV, 27-30 on V and 12-14 on the basal part of VI. Legs more slender than in apterous vivipara and slightly more pigmented, with the tarsi and distal part of the tibiae darker. Cauda similar in shape to that of apterous vivipara but bearing only 9-15 hairs. For other morphological details see drawings and Table 1.

Body length 1.80-2.10 mm.

TAXONOMY. The new species very much resembles *I. carmini*, from which it can be separated only by the higher number of dorsal processes (40-42 in *I. ilharcoi*, against 10-12 in *I. carmini*); this feature is common to the adult stage of both apterous viviparae

(1) This specimen may perhaps be considered to be an intermediate form between the viviparous and oviparous female, although its general aspect is that of the latter morph, including a regular number of pseudosensoria on the hind tibiae and a more hairy genital plate.

Table 1 - Israelaphis ilharcoi *sp.n.: biometric data of some apterous viviparous (ns. 1-10), oviparous female (ns. 11-14) and male (ns. 15-16); measurements in mm.*

N°	Body length	Ant. length	Antennal joints III	IV	V	VI	Last rostr. joint	II hind tars.	Siph. length	Cauda length	Length spinal processes Head	Proth.	3rd t.	8th t.
1	2.74	2.20	.50	.28	.25	.24+.68	.08	.21	.13	.30	.20	.20	.28	.78
2	2.76	2.20	.50	.25	.29	.24+.67	.09	.21	.14	.31	.19	.18	.24	.72
3	2.45	2.06	.41	.25	.23	.22+.73	.08	.20	.14	.27	.20	.22	.26	.56
4	3.02	1.85	.36	.22	.24	.19+.62	.10	.20	.16	.32	.17	.22	.24	.68
5	2.58	1.53	.27	.17	.19	.17+.51	.09	.18	.13	.27	.17	.19	.22	.52
6	2.66	1.88	.43	.22	.24	.19+.57	.08	.20	.15	.31	.22	.27	.28	.73
7	2.86	1.84	.36	.20	.23	.20+.61	.09	.21	.14	.33	.21	.22	.28	.63
8	2.30	1.76	.37	.20	.22	.20+.55	.08	.19	.14	.26	.18	.21	.26	.63
9	2.79	1.64	.34	.19	.18	.20+.53	.08	.18	.13	.29	.12	.16	.20	.61
10	2.68	1.63	.34	.20	.19	.18+.52	.08	.19	.13	.28	.12	.15	.15	.61
11	2.40	1.53	.24	.16	.17	.17+.59	.08	.19	.16	.08	*	*	—	.04
12	2.10	1.46	.25	.16	.16	.16+.54	.08	.17	.15	.08	.04	.03	—	.04
13	2.30	1.36	.22	.14	.15	.16+.49	.08	.18	.14	.08	.05	.03	—	.03
14	2.15	1.36	.21	.13	.15	.15+.52	.08	.18	.14	.08	*	—	—	.03
15	1.80	2.31	.48	.26	.26	.22+.88	.08	.20	.12	.16	.14	.13	.14	.30
16	2.10	2.64	.48	.32	.32	.27+1.02	.08	.22	.14	.20	.12	.12	.13	.30

Lengths less than 1 mm have the figure 0 omitted before the decimal point. * Here only a small papilla is present.
No. 1, Holotype; ns. 2-16, paratypes; all specimens sampled in Sicily (from different localities and host plants – see text), except ns. 9-10 which are from Portugal Sintra, on *Bromus* (*A.*) *rigidus*.

and males, as well as to all immature stadia including those of the oviparous female. Adults of this morph of the two species are harder to separate; but those of *I. ilharcoi* usually have some small spinal tubercles or papillae on the head and thorax and quite often on urotergites 6 and 7 also, in addition to the constant pair on tergite 8; such additional tubercles are lacking in *I. carmini*. No other morphological differences are apparent between the various morphs of the two aphids. It is also noteworthy that (a) the two aphid species often live together on the same host plants; and (b) Ilharco (1985) found specimens in some Portuguese populations where both species were present, having an intermediate number (13-38) of dorsal processes; he considered these specimens to be "natural hybrids" between *I. carmini* and his "taxon a", now *I. ilharcoi*, mostly on the grounds that he had seen cross matings in the laboratory between typical males and oviparae of the two postulated species.

Similar intermediate specimens have also been collected in two biotopes in Sicily (Caltagirone and Cerami – see map) where they occurred in mixed populations of *I. carmini* and *I. ilharcoi*. Here some apterae, immature viviparae and males have a variable number (1-9) of more or less developed supplementary dorsal processes on tergites in front of the siphunculi, in contrast to typical specimens of *I. carmini*, which have 10-12 processes situated on urotergites 5-8 only. The two main samples collected in the Caltagirone and Cerami biotopes contained respectively 37% and 43% of such specimens. However, only a few specimens have 1-4 well developed processes, the rest of the additional ones being small dorsal prominences or papillae. In other words, the general facies of these specimens usually remains that of *I. carmini*.

The above circumstances may at first sight lead to reasonable doubts about the reproductive isolation of the two aphids. However, in the laboratory the nymphs produced by apterous viviparae of either taxon, having the dorsal process distribution typical of its taxon, constantly show the same number of processes (or nearly so) as the mother. Possibly the tendency to produce a somewhat higher number of additional dorsal processes may prove ultimately to lie within the normal range of variation of *I. carmini*; although it seems likely that the two aphid taxa are involved in a rather recent process of speciation. On the other hand, it is evident that specimens with an intermediate number of processes form only a rather small proportion within mixed populations of the two aphids. The typical numbers of dorsal processes (40-42 for *I. ilharcoi* and 10-12 for *I. carmini*) form the prevalent condition in collected specimens; it is clearly distinctive and involves all stages and morphs of the two taxa. Therefore we agree with Ilharco (1985) in believing that the actual morphological and biological differences between them justify their acceptance as distinct aphid species.

GEOGRAPHICAL DISTRIBUTION. The distribution of *I. ilharcoi* nearly corresponds to that of the genus as a whole; it occurs in Sicily in several known localities (see map), while Ilharco (1985) records it from the Iberian peninsula at Sintra, Portugal, and from Israel.

HOST PLANTS AND LIFE CYCLE. The new species has been collected in Sicily mainly on a few species of *Bromus*, subgenus *Anisantha*, viz. *B.* (*A.*) *rigidus* Roth, *B.* (*A.*) *sterilis*

L. and *B.* (*A.*) *gussonei* Parlatore. A number of other samples come from *Avena sterilis* L., and a few from *Hordeum murinum* L. and *H. leporinum* Link. In one or two field collections made by thrashing mixed grasses some aphid specimens apparently came down from *Phleum echinatum* Host; but an attempt to rear some nymphs and adults on this grass in the laboratory failed. In Portugal, Ilharco (1985) also collected the species on *B.* (*A.*) *rigidus* and *B.* (*A.*) *sterilis*.

I. ilharcoi, like the other known species of *Israelaphis*, completes a holocycle. The fundatrix has not yet been collected in Sicily; our earliest available sample as nymphs of apterous viviparous apparently of the second generation is dated 12th October. Therefore we estimate that in Sicily the fundatrix should be present in the field about the beginning of October, in which month Ilharco (1985) observed the hatching of eggs in Portugal. Later generations of apterous viviparae develop during the winter months and the early spring; until the middle of April only viviparae have been collected in the Sicilian localities. Alatae never appeared during our observations over two years. Oviparous females and males were first found in the field from the third decade of April (first oviparae on 23.IV.99, first males on 6.V.98 and 14.V.99). However, an earlier appearance of sexuales in Sicily cannot be excluded, as for *I. carmini* (q.v.); in fact Ilharco (1985) found them in Portugal from the end of February and during March. In any case the proportion of sexuales in the colonies increases progressively during the ensuing weeks up to the conclusion of the holocycle, which is usually between mid-May and mid-June. The eggs are laid on or around the host plants, which soon become dried up at this time.

TYPES. The selected *holotype* is an apterous viviparous female collected at Erice (Trapani), Sicily, 6.V.98, on *Avena sterilis*; it is preserved in the collection of the Institute of Agricultural Entomology, University of Catania (Italy). *Paratypes* are: (1) a group of 60 apterous viviparous females, 7 oviparous females and 3 males, collected by the authors in Sicily at different localities (see map) and on different dates in 1998 and 1999 on the previously recorded host plants; and (2) a group of 26 apterous viviparous females collected at Sintra, Portugal, on *B.* (*A.*) *rigidus* and *A. sterilis* in 1977-1980 (*leg.* F.A. Ilharco).

The paratypes are deposited in the authors' collection and in those of Dr F.A. Ilharco (Estaçao Agronómica Nacional, Oeiras, Portugal), Prof. J.M. Nieto Nafrìa (Departamento de Biologia Animal, Universidad de León, Spain), and the Natural History Museum, South Kensington, London.

Israelaphis carmini Essig

The type-species of the genus, *I. carmini*, appears to be quite common in Sicily, where most samples were collected in association with *I. ilharcoi*, on the same range of host plants (*Bromus* spp., *Avena sterilis*, *Hordeum murinum*). The morphology of all known morphs of the species is well illustrated by Ilharco (1961b, 1965 and 1966) under the name *I. tavaresi* Ilharco, now synonymized with *I. carmini* (Ilharco, 1985).

Outside Sicily it is hitherto only recorded from Israel (original description, Essig, 1953) and Portugal. The holocycle extends in Sicily from October to May or mid-June, as for *I. ilharcoi*. As to sexuales, the first specimen (one oviparous female) has been collected here as early as the third decade of March (Mineo, Catania, 24.III.99, on *Hordeum murinum*); but both sexes were much more common in mid-May (Cerami, Enna, 14.V.99, on *Bromus sterilis* and *Avena sterilis*).

GENERAL AND LOCAL DISTRIBUTION OF *ISRAELAPHIS*

The present known range of the genus *Israelaphis* extends from the eastern end of the Mediterranean Basin (Near East: Israel) to the Atlantic coast of the Iberian peninsula (Portugal), and includes also Spain and Italy (Sicily). It is likely that representatives of the genus exist in other Mediterranean countries where ecological habitat and suitable host plants permit their establishment.

Fig. 7 shows the present distribution of the four known species; the most widespread are *I. carmini* and *I. ilharcoi*, while *I. lambersi* Ilharco (recorded from Portugal and Spain) and *I. alistana* Mier Durante, as yet known only in the Aliste area (Zamora province, Spain) (Nieto Nafrìa & Mier Durante, 1998) seem to be restricted at present to the Iberian peninsula.

Fig. 8 shows the distribution of *I. carmini* and *I. ilharcoi* in Sicily. Both species hitherto were always collected in hilly and mountainous biotopes, usually at 500-600 m but up to about 1000 m above sea level. Several attempts to find the aphids in lower habitats gave no positive results during the two-year survey. Both species have been collected in different sites on the Erei and Iblei Mountains, and quite a few samples from the Nebrodi and Sicani Mountains and other hilly localities. However, several collecting attempts on the slopes of Mount Etna and the Peloritani Mountains have up to now yielded no useful results; and no data are available at present from Madonie, a quite large mountainous area which appears highly suitable for the two aphids. To sum up, the two species seem to be rather scattered and even locally common, but not generally widespread in those areas of Sicily that we have checked.

No records are available yet of *Israelaphis* in Italian regions other than Sicily.

BIOLOGICAL FEATURES OF *ISRAELAPHIS*

One of the most interesting features of *Israelaphis* is its winter life-cycle, which extends from autumn (usually starting from October) to spring (up to May or June), when diapausing eggs are laid on the host plants. *I. alistana* apparently has an even shorter cycle, running from March to June (Mier Durante, 1978; Nieto Nafrìa & Mier Durante, 1998), while in *I. lambersi* "the eggs rarely hatch before January" (Ilharco, 1985). This unusual behaviour seems to be strictly related to the host plants, which are short-lived annual grasses (Gramineae) with a winter vegetative cycle. These in fact emerge after the first autumnal rains, which occur from the end of September to

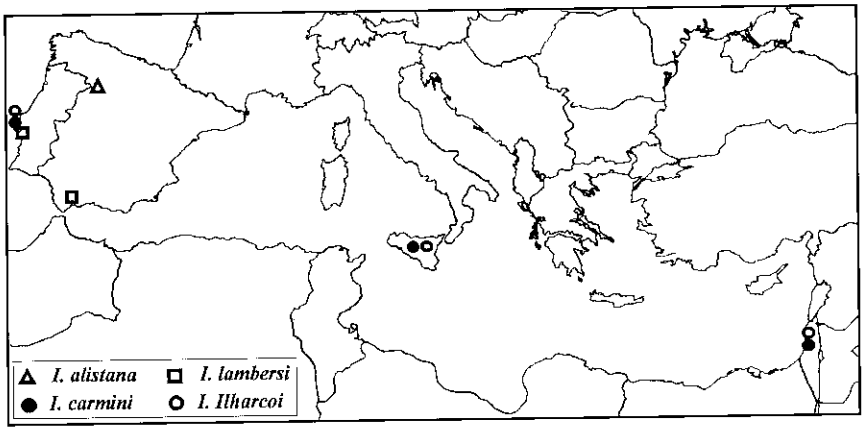

Fig. 7 - Geographical distribution of *Israelaphis* species: *I. alistana*, Spain (Fonfria and Pino, Aliste area); *I. carmini*, Portugal (Cascais and Sintra), Sicily (see Fig. 8) and Israel (Petah Tiqva); *I. ilharcoi*, Portugal (Sintra), Sicily (see Fig. 8) and Israel (Petah Tiqva); *I. lambersi*, Portugal (Cascais and Oeiras), Spain (Morón de la Frontera, Sevilla province).

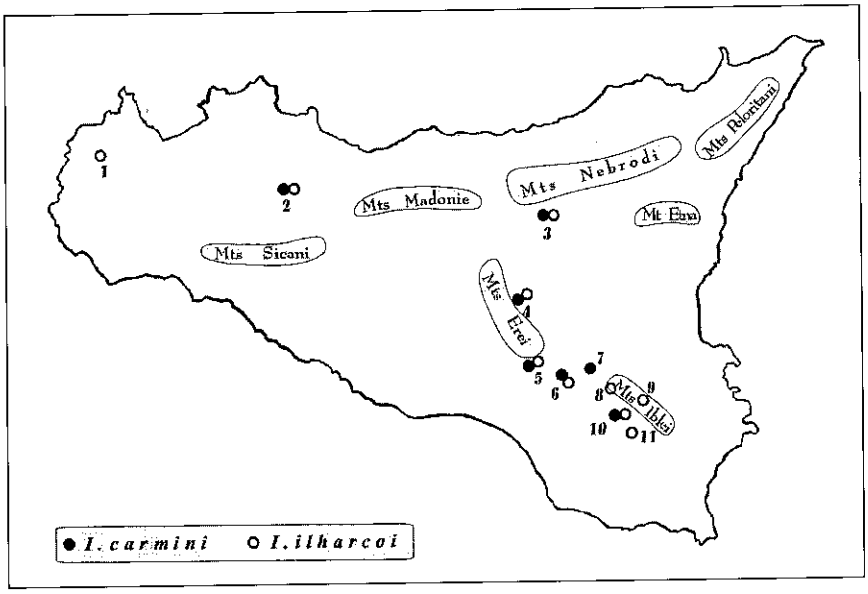

Fig. 8 - Distribution of *Israelaphis* in Sicily: 1. Erice (Trapani); 2. Ficuzza, com. Godrano (Palermo); 3. Cerami (Enna); 4. Valguarnera Caropepe (Enna); 5. S. Michele di Ganzaria (Catania); 6. Caltagirone (Catania); 7. Mineo (Catania); 8. Vizzini (Catania); 9. Buccheri (Siracusa); 10. Monterosso Almo (Ragusa); 11. Giarratana (Ragusa).

October in Sicily, and end their vegetative development before the following dry summer months. The most suitable hosts for *Israelaphis*, such as *Bromus*, *Avena* and most others [2], develop during this winter and spring period.

Another peculiar aspect of *Israelaphis* is the paucity of alate morphs, since only the alate vivipara of *I. lambersi* is as yet described (Ilharco, 1966); they are not only rare but may have a reduced fore-wing membrane or be even brachypterous (Ilharco, 1962); the wing venation is also abnormal.

It is likely that the absence or at most scanty production of alatae, which are unknown in three of the four known *Israelaphis* species, negatively affects their power of dispersal, which may explain why their populations are usually rather localized.

TAXONOMICAL REMARKS

The systematic position of *Israelaphis* constitutes a very interesting problem. Ilharco (1961a) first included the genus in the newly named subfamily *Israelaphidinae*, as a subordinate taxon of the Callaphididae *sensu* Börner & Heinze (1957). However, in his paper the same author mentioned a suggestion from Hille Ris Lambers (*in litt.*) that *Israelaphis* may represent a linking group between Setaphidini (now Schoutedeniini *sensu* Remaudière, 1988) and Aphidini. Later in the same year (1961b) and again in 1966 Ilharco discussed the morphological relationships of *Israelaphis* with genera of various aphid groups; he keyed the tribe *Israelaphidini*, placing it near Paoliellini (now subfamily Lizeriinae *sensu* Quednau & Remaudière, 1994), Spicaphidini and Drepanosiphonini (*sic*), as part of the subfamily Callaphidinae *sensu* Bodenheimer & Swirsky (1957). More recently other aphidologists dealing with the systematics of high-ranked aphid groups, starting with Eastop (1977), recognized *Israelaphidinae* as a distinct subfamily within the large polyphyletic group of the so-called "Drepanosiphine" aphids. Within this heterogeneous grouping Quednau & Remaudière (1994) proposed a scheme covering its comprehensive phylogenetic relationships, and showed some connections of *Israelaphidinae* with other subfamilies such as *Neuquenaphidinae*, *Lizeriinae*, *Greenideinae* and *Parachaitophorinae*.

The morphological and biological features of *Israelaphis* are indeed so peculiar that its relationships to other groups are quite difficult to understand clearly, and some aspects still remain obscure. Perhaps a more secure knowledge may result in future through investigations of genetical relationships and biochemical affinities to other genera of Aphididae *s. lat.*.

One of the questions that arise is why the species of *Israelaphis*, which feed on common annual grasses most of which have a much wider geographical distribution, should be apparently restricted to the Mediterranean Basin with a slight extension into western Iberia, where they are an isolated group without other closely related taxa. In

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[2] Gramineae species at present recorded as host plants for *Israelaphis*, in addition to *Bromus* and *Avena*, belong to the genera *Hordeum*, *Vulpia*, *Phleum*, *Lophochloa*, *Phalaris* and *Anthoxanthum*.

fact apart from the Drepanosiphinae *sensu* Remaudière & Stroyan (1984), which are probably not so closely related, the other taxa most similar to *Israelaphis* (e.g. *Neuquenaphidinae*, *Lizeriinae*, *Greenideinae* tribe *Schoutedeniini*, and *Taiwanaphidinae* of the genus *Sensoriaphis*) have a general gondwanian distribution or are restricted to a part of that range, viz. Neotropical, Afrotropical or Australian distribution. No west Palaearctic taxa are similar to *Israelaphis*, except perhaps the

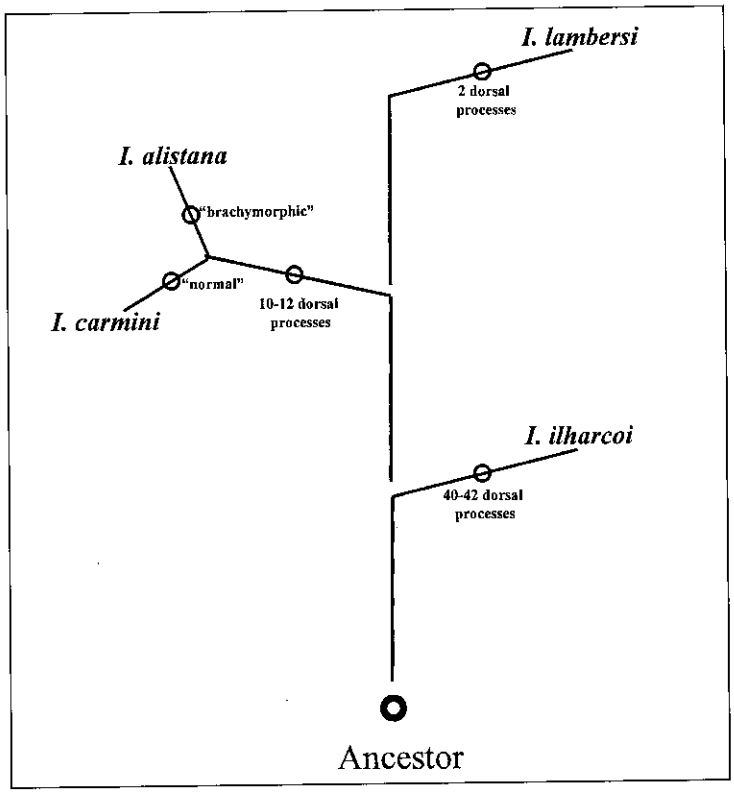

Fig. 9 - Morphological relationships (mainly from apterous viviparous females and males) of the four known species of *Israelaphis*.

fossil Palaeosiphonini (Heie, 1967 and 1971). Here the well-known representative species *Palaeosiphon hirsutus* (Germar & Berendt) form Baltic amber, apart from some obvious differences such as the 5-jointed antennae, the presence of apical setae on the dorsal processes and the elongate ultimate rostral segment, appears quite similar to *Israelaphis* in a number of morphological characters: the presence of long dorsal processes, the shape and position of siphunculi on urite 6, bilobed anal plate, elongate cauda and long processus terminalis; therefore, it may possibly represent an ancient

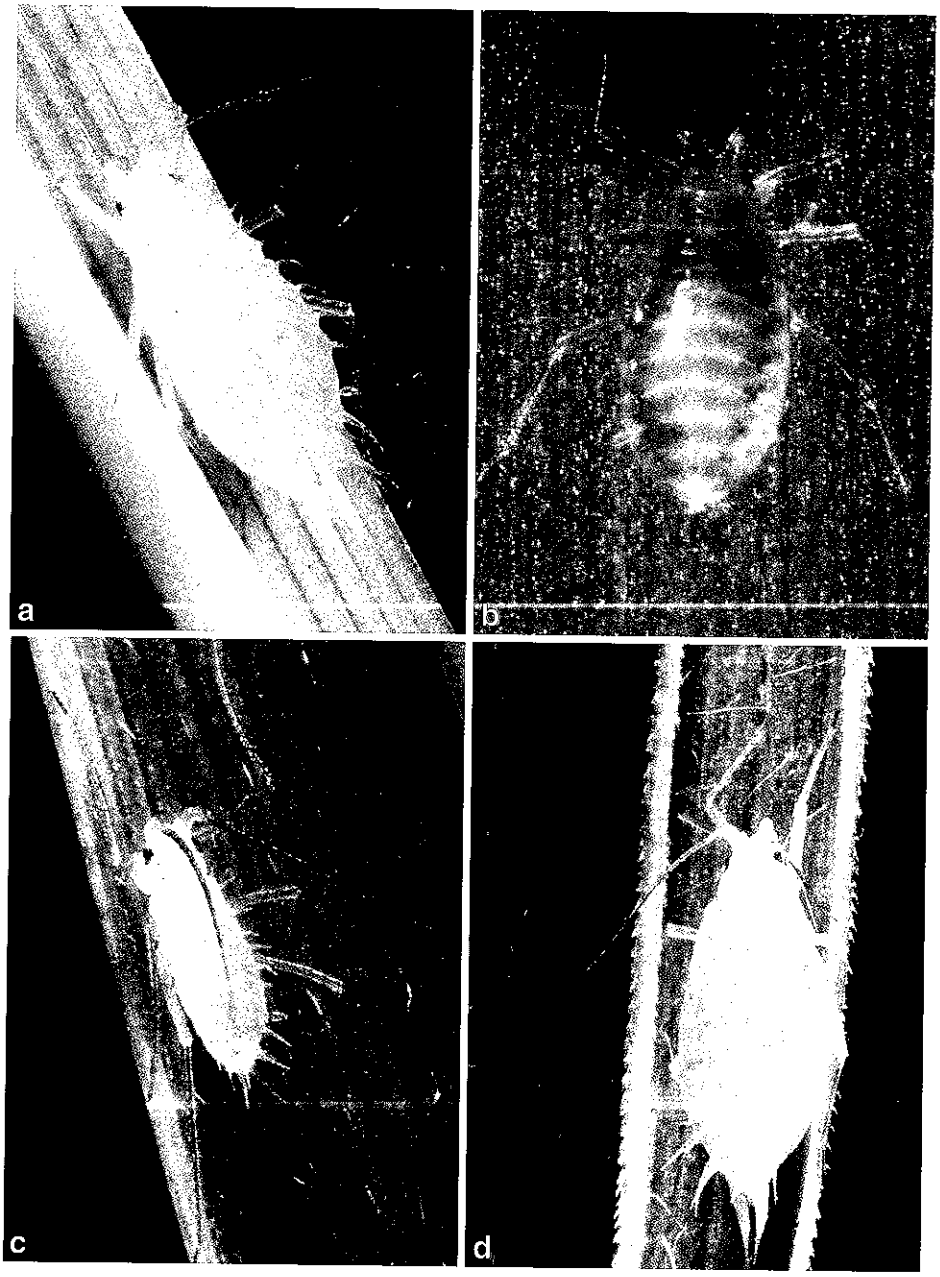

Plate 1 - *I. ilharcoi* sp.n.: a. apterous viviparous female; b. oviparous female; c. male – *I. carmini*: d. apterous viviparous female.

ancestral form. Heie (1967) stressed the comparison of *Palaeosiphon* with *Israelaphis* and tentatively proposed to place both genera in the same tribe *Palaeosiphonini*.

As regards the morphological relationships between the currently known four species of *Israelaphis* (Fig. 9), the most differentiated is *I. lambersi* because of its reduced number of dorsal processes, its curved siphunculi, its shorter antennae and their shorter processus terminalis. The other three species share a higher number of dorsal processes (not less than 10), and are more similar to one another in appearance. The morphology of *I. alistana* is like that of *I. carmini*, but compared to which it is on average a smaller species and also more pigmented, especially on its appendages; moreover *I. alistana* shows a certain shortness (brachymorphism) of some peripheral structures (i.e. comparatively shorter antennal joints and especially the processus terminalis, shortness of tibiae and particularly of the second tarsomer, etc.) (see also Ilharco, 1985, for comparative biometric data). *I. ilharcoi* is separable from *I. carmini* by its greater number of dorsal processes, but these two species do not differ in any other morphological features.

KEY TO APTEROUS VIVIPARAE OF *ISRAELAPHIS*

1. Abdominal spinal processes present only on 8th tergite. Siphunculus with clavate part curved inward, nearly at a right angle to its pedunculate narrow basal part. Processus terminalis usually shorter than 3 x basal part of antennal joint VI ..... *I. lambersi* Ilharco, 1961
– Dorsal spinal and marginal processes present, 10-42 in number and occurring from head to 8th urotergite or at least from 6th to 8th urotergite. Siphunculus straight, not curved as in (1). Processus terminalis more or less than 3 x basal part of VI 2
2. Dorsal processes usually present from head to 8th abdominal tergite ..... ***I. ilharcoi*** sp.n.
– Dorsal processes usually limited to urotergites posterior to siphunculi (so present from 6th to 8th tergite, but sometimes also with a spinal pair on 5th tergite) 3
3. Ratio of length of ultimate rostral segment to that of hind tarsal joint II 0.50 or less; and ratio of length of processus terminalis to that of u.r.s. 4.60 or more ..... *I. carmini* Essig, 1953
– Ratio u.r.s./hind tarsus II usually more than 0.50; ratio p.t./u.r.s. 4.50 or less ..... *I. alistana* Mier Durante, 1978

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