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Zelkovaphis trinacriae, a new Eriosomatine aphid genus and species living on Zelkova in Sicily (Rhynchota: Aphididae)

Abstract - A new Eriosomatine aphid (*Zelkovaphis trinacriae* gen. n., sp. n.) living on *Zelkova sicula* in Sicily is described. To the same genus are tentatively referred the W–Asiatic *Schizoneura caucasica* Dzhibladze, living on *Z. carpinifolia* in Caucasus, and the E–Asiatic *Hemipodaphis persimilis* Akimoto, living on *Z. serrata* in Japan; a key is given to separate alate emigrants of the three aphid species. A taxonomical and morphological account is given of the new genus, focussing on its relationships with other Eriosomatinae genera. Adult morphs of *Z. trinacriae* on primary host and first instar nymphs of fundatrix and exules are described, and notes are added on its open, leaf–roll gall and biological behaviour. The aphid secondary host plant is hitherto unknown.

Riassunto - Zelkovaphis trinacriae, *nuovo genere e specie di afide Eriosomatino vivente in Sicilia su Zelkova (Rhynchota: Aphididae).*

Vengono decritti un nuovo genere e una nuova specie di afide galligeno (*Zelkovaphis trinacriae* gen. n. sp. n.) afferente agli *Eriosomatini*, rinvenuto su *Zelkova sicula*, Ulmacea di recente scoperta in Sicilia. Al medesimo genere vengono associate due altre specie affini, originariamente descritte come *Schizoneura caucasica* Dzhibladze, vivente in Caucaso su *Zelkova carpinifolia*, e *Hemipodaphis persimilis* Akimoto, più recentemente descritto per il Giappone su *Z. serrata*. Una sintetica chiave analitica consente di distinguere le tre specie sulla base delle rispettive alate migranti. Vengono forniti sintetici ragguagli morfologici e tassonomici relativi al nuovo genere e alla nuova specie, della quale viene descritta la modalità di sviluppo della galla e fornite notizie sulla parte del ciclo biologico sviluppato sull'ospite primario. L'afide si evolve annualmente attraverso un olociclo dioico, del quale rimane sinora sconosciuto l'ospite secondario. Si sottolinea l'interesse scientifico di questa nuova entità afidica, ritenuta ad elevato rischio di estinzione al pari del suo ospite primario, *Z. sicula*, autentico relitto vivente di pregevole importanza botanica.

Key words: Homoptera Aphididae, *Zelkovaphis trinacriae* gen. n. sp. n., Sicily.

An interesting Eriosomatine aphid making rosette-like, clustering leaf-roll galls on the recently described *Zelkova sicula* (Di Pasquale *et al.*, 1992) has been collected during the past five years in a small woodland area of Iblei Mounts in S-E Sicily.

disc. Anal plate moderately sclerotized. Cauda as a narrow sclerotized arch, bearing two hairs.

TYPE-SPECIES: ***Zelkovaphis trinacriae*** sp. n.

TAXONOMY. *Zelkovaphis* belongs to the group of Eriosomatine genera producing open or leaf-roll galls on their primary host. This new taxon as here understood is characterized by the morphological features of its morphs living on primary host and its gall structure, composed of several infested leaves per shoot, caused by a single fundatrix. Closely allied, both by its gall structure and some morphological features, appears to be *Aphidounguis* Takahashi, which may be regarded as a vicariant taxon of *Zelkovaphis*, but having *Ulmus* as primary host (Akimoto, 1983).

Among the other galligenous Eriosomatinae living on *Zelkova*, *Byrsocryptoides* Dzhibladze is comparatively more related to *Zelkovaphis*. However, that genus differs in its gall structure (being of the open leaf-roll type as in *Zelkovaphis,* but where each colony occupies a single leaf) as well as in the morphology, having fundatrices with 4-jointed antennae, while alate emigrants show a different wing-venulation and narrower forewing (Dzhibladze, 1960, 1965). Two other genera, *Colophina* Börner and *Paracolopha* Hille Ris Lambers, make globular semi-open and club-shaped closed galls on *Zelkova* leaves, respectively; moreover, their morphological features (Aoki, 1977, 1980, 1983; Akimoto, 1985) are clearly different, though *Colophina* shares with *Zelkovaphis* a similar wing and siphuncular structure, the latter being sclerotized and surrounded by hairs in alate emigrants.

The primary host of the genus *Gharesia* Stroyan – represented so far by the sole species *G. polunini* Stroyan, living on *Carex* in NW-Himalayas and W-North America – is not yet known. Stroyan (1963) has postulated *Celtis* as one of the possible Ulmaceae locally present, while more recently Akimoto (1983, 1985), on the base of wax gland structure in the aphid exule forms, quoted *Zelkova* as a more suitable host plant. Lacking some comparable morphs (fundatrix, emigrant), it appears difficult to evaluate the relationship of this genus to *Zelkovaphis*, although the exul morphology of both apterae (Stroyan, 1963) and alatae (Foottit & Mackauer, 1980) suggests a rather close link between the two genera (see footnote 2 on page 296).

The remaining genera of Eriosomatini, which have *Ulmus* as primary host (*Eriosoma* Leach, *Schizoneurella* Hille Ris Lambers, *Colopha* Monell, *Kaltenbachiella* Schouteden, *Tetraneura* Hartig) or are known on secondary host only (*Schizoneurata* Hille Ris Lambers), can be distinguished from *Zelkovaphis* either by their morphology or by their ecology. Among those genera, *Eriosoma* appears to be the most closely related to *Zelkovaphis,* at least in alate emigrants morph, by having similar wings and siphuncular features, the latter being sclerotized around the opening rim and surrounded by hairs at least in two of the three *Zelkovaphis* species. Also the *E. lanigerum* complex on its primary host (*U. americana*) produces rosette-like leaf galls, which are similar in structure to that of *Z. trinacriae*. However, apart from the different primary hosts (*Ulmus/Zelkova*), *Eriosoma* differs from *Zelkovaphis* in several morphological features,

viz. different structure of wax gland plates; presence of main discal setae on the genital plate; 5- or 6-jointed antennae of adult fundatrices, and 5-jointed ones of their first instar nymphs; antennal joint III of alate emigrants usually distinctly longer in most species than joints IV-VI together. These differences suggest separate paths of phylogenetic evolution (see also Danielsson 1979, 1982; Heie, 1980; Akimoto, 1983; Smith, 1985; Eastop, 1987).

Among the Eriosomatine *Zelkova*-feeding aphids, *Zelkovaphis* is so far the sole genus having representative species living all around the three main native areas (Mediterranean, Transcaucasia and East Asia) where that Ulmaceous genus is now distributed. In fact, the remaining known genera which are galligenous on *Zelkova* (viz. the Caucasian *Byrsocryptoides* and the Eastern-Asiatic *Colophina* and *Paracolopha*) are apparently restricted to a single biogeographical area. This suggests that *Zelkovaphis* is as a comparatively ancestral genus, differentiated before the existing *Zelkova* populations split into different isolated species now occurring in widely separated areas. This is in accord with the ancient origin of those other genera of Eriosomatinae producing open leaf-roll galls and having *Ulmus* as primary host (viz. *Eriosoma* and *Aphidounguis*), as postulated by Akimoto (1983).

Zelkovaphis trinacriae sp. n.

FUNDATRIX. Body broadly rounded-oval, dark grey or plumbeous in colour and covered with white wax secretion; antennae, rostrum and legs very dark brown. Head capsule with rounded frontal profile, not distinctly separated from prothorax and anteriorly more sclerotized. Thorax and abdomen membranous, except for the sclerotized stigmal plates and the more or less pigmented genital and anal plates. Antennae, rostrum and legs strongly sclerotized. Eyes represented by a triommatidion. Wax gland plates composed of numerous, hardly visible (in slide-mounted specimens) polygonal cells (each of about 12-16 μ in size) and having a rounded or transversely oval shape. Their distribution is as follows: one dorsal and one ventral large pair (60-120 μ of max. diameter) on head; the ventral ones are occasionally subdived into two or more parts and supplemented by smaller glands; prothorax with a pair of spinal plates and a marginal smaller one; from mesothorax to 6^{th} abdominal segment there are six rows of dorso-lateral plates; in addition, the urites 1-5 have a further pair of ventro-marginal wax-plates; four plates are present on 7^{th} segment. Eighth tergite with one, hardly visible transversely oval gland. Hairs on body rather small and acute, up to 30-48 μ on frons, 25-40 μ on urotergites 2^{nd}-3^{rd} and 25-50 μ on 7^{th}-8^{th} abdominal segments. Antennae ventrally inserted on head, very short (0.17-0.22 mm long and only 0.06-0.07 of body length), 3-jointed and having a few short hairs (up to 16-23 μ on III joint, equivalent to about half of its basal diameter). Third antennal joint 0.11-0.13 mm long, slightly subclavate in shape and bearing a few, weakly denticulated imbrications; it has two roundish primary rhinaria, having a slightly protruding inner membrane, of which the more apical one is surrounded by a group of 3-4 supplementary, smaller and as well short ciliated rhinaria.

Table 1 - Zelkovaphis trinacriae, *gen.n. sp.n. - Fundatrix, biometric data of some specimens. Measurements in mm.*

N°	Body length	Antennal length	III ant. j. length	Rostrum		Hind troc.-fem.	Hind tibia	Hind tarsus
				Tot. l.	Last j.			
1	2.82	.172	.114	.47	.128	.33	.28	.078
2	2.95	.220	.125	.52	.150	.34	.28	.083
3	3.30	.220	.120	.54	.130	.34	.28	.080
4	3.15	.220	.120	.56	.132	.34	.28	.080
5	3.30	.210	.126	?	.130	.35	.31	.086

Lengths less than 1 mm have the figure 0 omitted before the decimal points. Abbreviations: ant. j.= antennal joint; Tot. l.= total length; Last j.= ultimate rostral joint; troc.-fem.= trochantro-femur. Collecting data: all specimens (paratypes) from *Zelkova sicula*, Buccheri (Syracuse) - Italy: ns. 1-2, 16.V.1998; no. 3, 20.V.1998; no. 4, 18.IV.2000; no. 5, 5.V.2000.

Rostrum reaching just behind the second coxae; last joint cone-shaped and smooth, just longer (1.04-1.20) than the III antennal joint, 1.52-1.82 of the hind tarsus, and bearing 6-8 short supplementary hairs.

Legs short and rather stout; trochantro-femoral suture very distinct but usually completely lacking along the ventral side, particularly on middle and hind legs. Femora adorned with minute and sparsely scattered cuticular spiculations, particularly along their ventral side; hind tibiae 0.27-0.32 mm long and 1.87-2.46 of the last rostral joint; their short pointed hairs have a maximum length of 18-26 μ, corresponding to 0.28-0.40 times the tibial diameter at their median length. Tarsi just less than one third (0.27-0.30) of the tibial length of corresponding legs; they are subdivided into two joints, of which the first one is very short, triangular in lateral view and bearing two ventral hairs. Second tarsal joint cone-shaped, bearing 5-6 short pointed hairs, mainly placed on its distal half; empodial setae as long as the rather short and curved claws.

Cornicles absent. Cauda broadly rounded and little sclerotized, bearing two submarginal acute hairs about 30-48 μ long. Genital plate transversely rectangular, showing two lateral, more deeply sclerotized and slightly corrugated parts, each one bearing about 25-30 quite stout setae. Gonapophyses not clearly differentiated, but two small groups of 4-5 short gonochaetae (8-10 μ long) are detectable just anterior to the anal plate. The latter appears slightly more sclerotized on its anterior part and bears several setae (up to 40-65 μ long).

Body length 2.80-3.30 mm.

FIRST INSTAR NYMPH OF FUNDATRIX (two specimens). Body greyish, 0.74-0.76 mm long, mostly membranous with rather large sclerotized areas on head, pro- and mesothorax; smaller sclerotized spots, forming two submarginal rows, run from metathorax down to abdominal segments where, on 7th and 8th tergites, they turn into transverse bands. Dorsal hairs mostly short and blunt apically, about 8-12 μ on 1th-5th urotergites

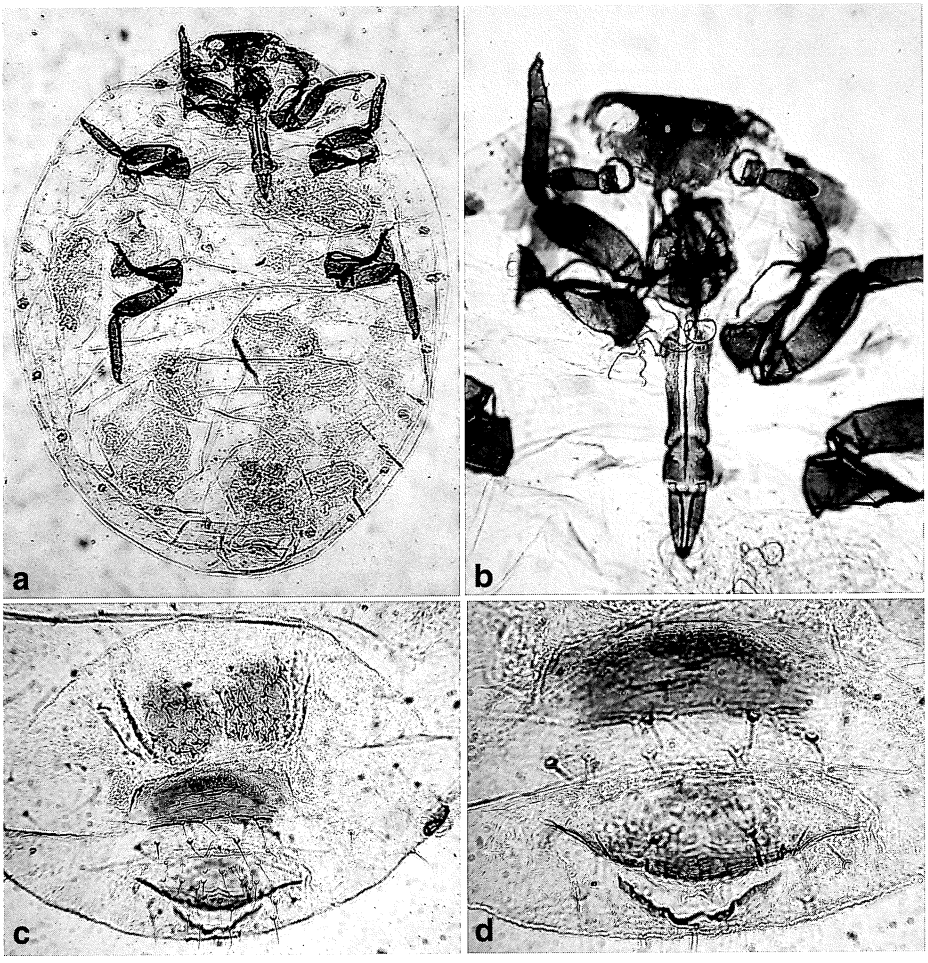
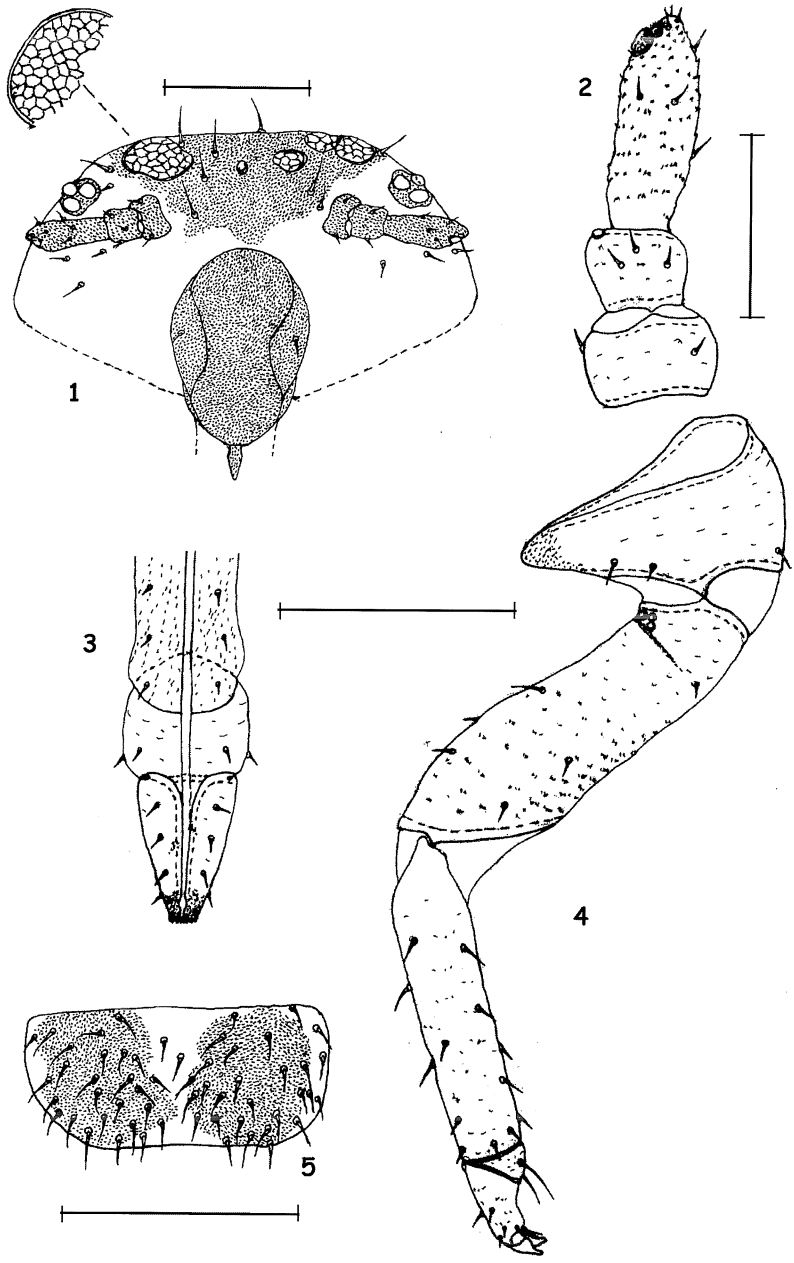


Plate I - *Zelkovaphis trinacriae* gen. n., sp. n. Fundatrix: general view of a specimen mounted in slide (a); ibidem, anterior part of body (b); ibidem, posterior part of body, focussing the ventral side (c); ditto, focussing the dorsal side (d).

(spinals) up to 24-30 μ (of the longer ones) on 8th urotergite. Antennae fully sclerotized and 3-jointed, 0.14-0.15 mm in length, of which 0.078-0.082 mm belong to last joint. Rostrum rather long (0.46-0.50 mm), reaching to two-thirds of the length of the abdomen. Apical rostral joint elongate cone-shaped, acute and deep sclerotized apically; it is 0.144-0.156 mm long or 3.00-3.25 times length of II hind tarsomer. Stylets a little longer than rostrum. Legs sclerotized and without full evidence of trochantro-femoral suture; tarsi of all legs 2-jointed, with a pair of long (39-43 μ) and subcapitate dorso-distal setae on II tarsal joint. Siphuncular pores absent.



Figs. 1-5 - *Zelkovaphis trinacriae* gen. n., sp. n. Fundatrix: head (from a ventral view) and particular of a wax gland plate (1); antenna (2); distal part of rostrum (3); hind leg (4); genital plate (5) [Bars = 0.2 mm, except for antenna which is 0.1 mm].

From *2nd instar nymph* onward, body without dorsal sclerotized areas on thorax and abdomen, and last rostral joint comparatively shorter (0.11 mm or 1.96 of the length of II tarsal joint in a 2nd instar specimen), cone-shaped and not sclerotized as it is in the first stage.

ALATE EMIGRANT. Body blackish in colour, including antennae and legs, and abdomen with a tinge of very dark green. Head and thorax well sclerotized, with mesoscutum having an unpigmented small triangular area between the two lobes and scutellum. Abdomen membranous, except for stigmal plates, siphunculi, cauda, a narrow band on 8th urotergite, genital and anal plate, which are pigmented. Antennae, rostrum and legs entirely sclerotized. Wax gland plates not evidenced. Body hairs rather short and acute, maximally 22-32 μ on frons, 30-45 μ those marginals on 2nd urotergite, 40-50 μ the spinals on 7th or 8th urotergites.

Antennae 6-jointed, 0.62-0.78 mm long or 0.30-0.36 of body length; all joints have mostly a smooth cuticle, except the last one, which is transversely adorned with rows of small spinules. Joint III a little shorter or subequal (0.81-1.07) to joints IV-V-VI altogether; VI joint usually shorter (0.73-0.95) or very rarely equal to V joint; the latter as long as or just longer than IV joint. The short conical processus terminalis (20-25 μ in length or 0.20-0.30 of the basal part of the joint) bears 4-6 short apical and subapical setae. Secondary rhinaria distribution: 14-20 on III, 3-5 on IV and 4-6 on V. The VI antennal joint has 0-1 (rarely two) transverse oval ring-like rhinarium at about the middle of its basal part.

The primary rhinarium on VI joint is represented by an irregular shaped, rather large and not ciliate plaque, lying obliquely and having a slightly protruding membrane which occasionally coalesces with the more basal rhinarium; the plaque is surrounded, apically, by 2-3 small, roundish and ciliated supplementary rhinaria. Antennal hairs thin and short, maximally 8-14 μ on III joint, where they do not exceed 1/4-1/5 of the joint diameter at their point of insertion or 0.32-0.55 of the joint's narrower basal articular diameter.

Rostrum reaching the mesosternum. Apical joint rather elongate, cone-shaped with a distinctly spinulose cuticle and about 8-10 supplementary hairs, in addition to the 6 apical ones; it is 0.15-0.17 mm long or 0.83-1.00 of the second hind tarsomer.

Forewing with a transparent membrane and distinctly infuscated costal and subcostal veins, including the pterostigma (mostly along its inner half side); remaining veins brownish, but not bordered. Medial vein (M) once forked at about one third of its length from base. Hind wing with two oblique veins (Cu_1 and Cu_2).

Legs normal, with femora very slightly imbricated and spinulose along their ventral side; tibiae mostly smooth with a few spinules on their distal parts only. Tarsi regularly 2-jointed and distinctly spinulose on II joint; the latter is 0.15-0.20 mm long. Femoral hairs thin and apically acute, the longest ones on ventral side about as long as the diameter of trochantro-femoral suture; tibial hairs mostly much shorter than tibial width, except for a few ones on distal inner side of tibiae, which are about equal to the median tibial diameter. The 1st tarsomer of all legs has two long (35-45 μ) lateral

setae and one short median sense peg. Empodial hairs finely produced apically and nearly as long as the claws.

Siphunculi very slightly elevated and inserted on posterior margin of the fifth urite, showing a well sclerotized ring (maximum external diameter 60-110 μ, of which about half is occupied by the central rimmed opening); they are surrounded by about 6-8 short peripheral hairs. Eighth urotergite bearing usually 4 hairs. Cauda a rounded and sclerotized arch, bearing two hairs 25-32 μ long. Genital plate transversely rectangular, with irregular spinulose imbrications and, as in fundatrix, subdivided into two more sclerified sublateral areas, each bearing 25-35 hairs, scattered all around, but mostly along their posterior margin. Anal plate with about 20-30 hairs.

Body length 1.76-2.39 mm.

FIRST INSTAR NYMPH OF EXULE (born from emigrant). Body ochreous in colour, with sclerotized head capsule (mostly anteriorly) and unpigmented remaining parts of body; antennae, legs and distal part of rostrum rather pigmented (brownish). Dorsal body setae long (maximally 78-100 μ on head) and finely produced apically. Antennae 5-jointed, 0.34-0.37 of body length, long haired and having the structure as figured (Fig. 18). Rostrum 0.72-0.80 mm and reaching behind the body length. Last rostral joint cone-shaped, 0.180-0.193 mm and longer (2.04-2.35) than the second hind tarsus; it shows a spinulose cuticle and bears 12-15 secondary, rather long hairs. Stylets a little longer than rostrum. Legs mostly long haired, with smooth femora; trochantro-femoral suture distinct along $^1/_2$ - $^2/_3$ of its dorsal side only. Tibiae sparsely spinulose on their distal half about; tarsi of all legs 2-jointed, apically cone-shaped and spinulose. Siphuncular pores absent. Cauda as a sub-triangular sclerotized arch and bearing two hairs.

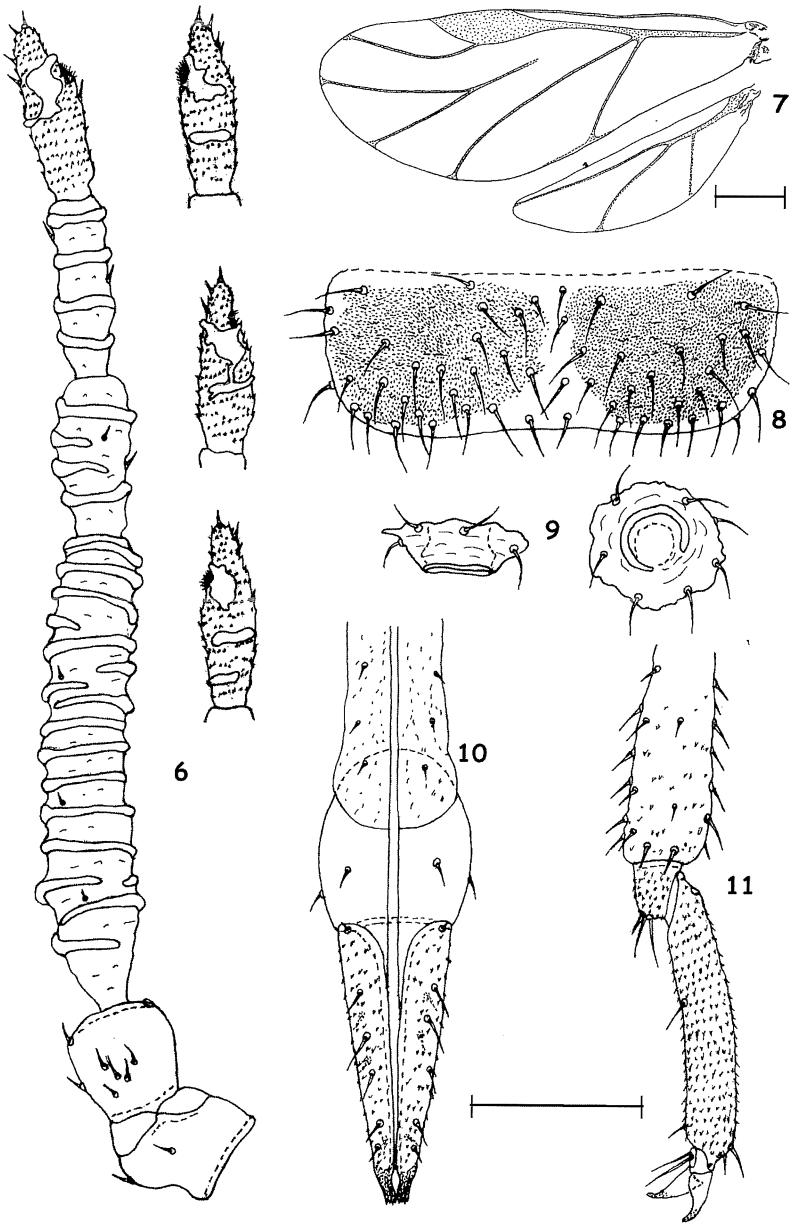
Body length 0.80-0.92 mm.

GALL STRUCTURE AND FORMATION. The open gall produced by the aphid is of the clustering type (*sensu* Akimoto, 1983), involving the leaves of an entire shoot. Soon after hatching the newly born fundatrix moves on to a very young shoot (just emerging from the open bud) and starts to inject its saliva. The shoot quickly turns to a reddish colour, and becomes slightly thickened on its axis and leaves, thus being easily distinguished from other, non-infested, shoots on the same plant. Once an infested shoot grows up containing the young fundatrix feeding on the stem, it gradually assumes the definitive aspect of a complete gall, including the green colour of normal leaves. Finally the gall consists of a group of slightly thickened and modified leaves that overlap one another, particularly on the apical part of the shoot, so forming a rosette-like "nest" within which the fundatrix and its progeny remain protected, producing filamentous waxy powder mixed with pale drops of honeydew. Each galligenous shoot is composed of 9-15 modified leaves altogether and reaches 5-8 cm in length; usually not all those leaves are involved in the gall-formation, the aphid colony being confined to the most apical group of 6-8 elements; most basal leaves remain very small, in spite of being aphid free and only slightly modified in their usual shape. After the alate emigrants have gone the galled shoots dry-up, but remain *in situ* maintaining more or

Table 2 - Zelkovaphis trinacriae, *gen.n. sp.n .- Alate emigrant, biometric data of some specimens. Measurements in mm.*

N°	Body length	Antennal length	Antennal joints length				Last rostral joint	Hind femur	Hind tibia	II hind tarsomer	Siph. diam.	No. Secondary rhinaria			
			III	IV	V	VI						III	IV	V	VI
1	2.06	.75	.29	.10	.13	.11	.168	.52	.86	.196	.08	20/19	5/5	5/5	0/0
2	2.20	.70	.30	.08	.11	.10	.168	.52	.84	.196	.08	15/17	3/?	5/5	0/0
3	2.27	.70	.28	.10	.10	.10	.168	.52	.78	.180	.08	14/15	5/3	4/4	0/0
4	2.04	.70	.28	.09	.12	.10	.166	.50	.79	.184	.08	16/14	4/5	4/4	0/0
5	2.16	.71	.28	.09	.12	.10	.160	.52	.80	.180	.08	14/14	3/4	6/5	0/0
6	2.39	.76	.32	.10	.12	.10	.166	.55	.92	.200	.08	19/17	4/4	5/6	0/0
7	2.45	.73	.29	.10	.12	.10	.160	.53	.78	.180	.09	16/16	4/5	4/4	0/0
8	2.24	.70	.26	.11	.11	.10	.168	.52	.84	.192	.11	16/18	5/3	4/4	0/0
9	2.22	.70	.30	.09	.11	.10	.160	.49	.76	.172	.07	20/17	4/4	4/4	0/0
10	2.07	.73	.31	.08	.12	.10	.164	.48	.71	.164	.08	20/19	3/3	5/4	0/0
11	1.76	.62	.24	.08	.10	.09	.160	.44	.64	.160	.07	15/16	3/4	4/4	1/0
12	2.30	68	.28	.09	.11	.09	.160	.53	.81	.192	.08	15/18	3/4	4/5	0/1
13	2.06	.71	.28	.10	.12	.10	.162	.51	.78	.188	.07	17/16	4/4	5/5	2/1
14	2.20	.78	.32	.10	.12	.12	.160	.50	.80	.174	.07	18/19	4/4	5/4	1/1
15	1.96	.65	.27	.09	.10	.09	.152	.45	.69	.160	.07	18/17	4/4	4/4	0/1

Lengths less than 1 mm have the figure 0 omitted before the decimal points. Abbreviations: siph. diam. = siphuncular diameter, which is inclusive of the sclerotized area encircling the rim opening. Collecting data: all specimens from *Zelkova sicula*, Buccheri (Syracuse) - Italy, at the following dates: ns. 1-7, 16.V.1998; no.8, 20.V.1998; ns.9-11, 21.V.1999; ns. 12-13, 12.V.2000; ns. 14-15, 1.V.2000. No. 1 is the holotype; remaining specimens are paratypes.



Figs. 6-11 - *Zelkovaphis trinacriae* gen. n., sp. n. Alate emigrant: antenna and rhinarial variations on last joint (6); fore and hind wings (7); genital plate (8); siphunculus, from a lateral (left) and dorsal view (9); distal part of rostrum (10); distal part of tibia and tarsus of hind legs (11) [Bars = 0.5 mm for wings; 0.1 mm remaining illustrations].

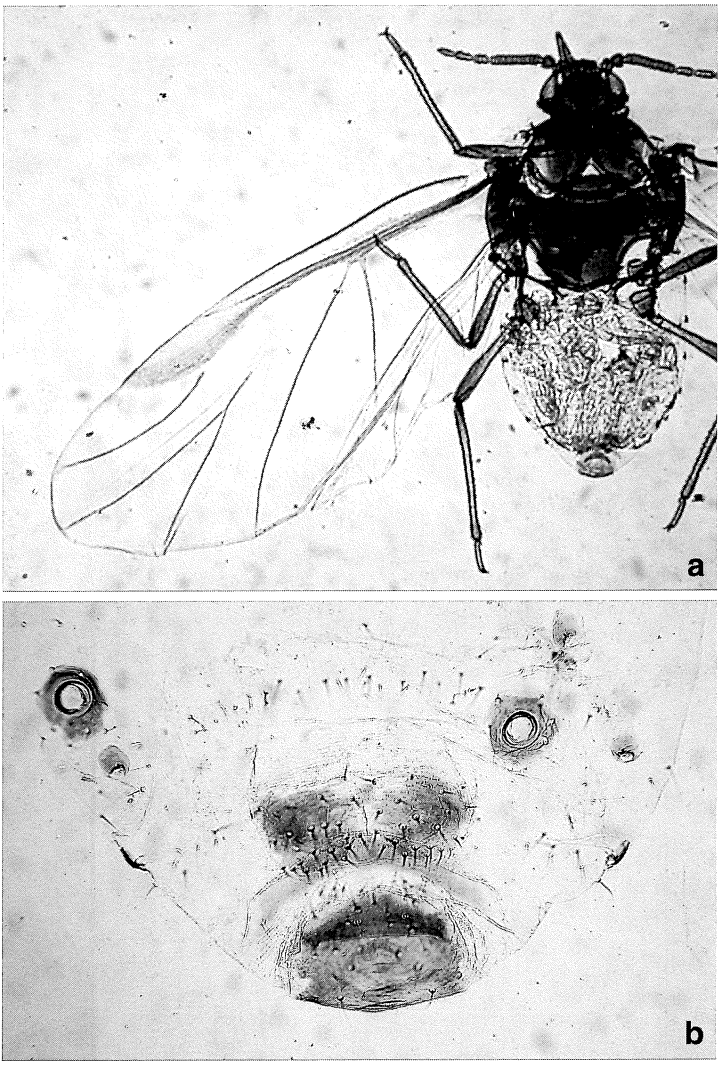
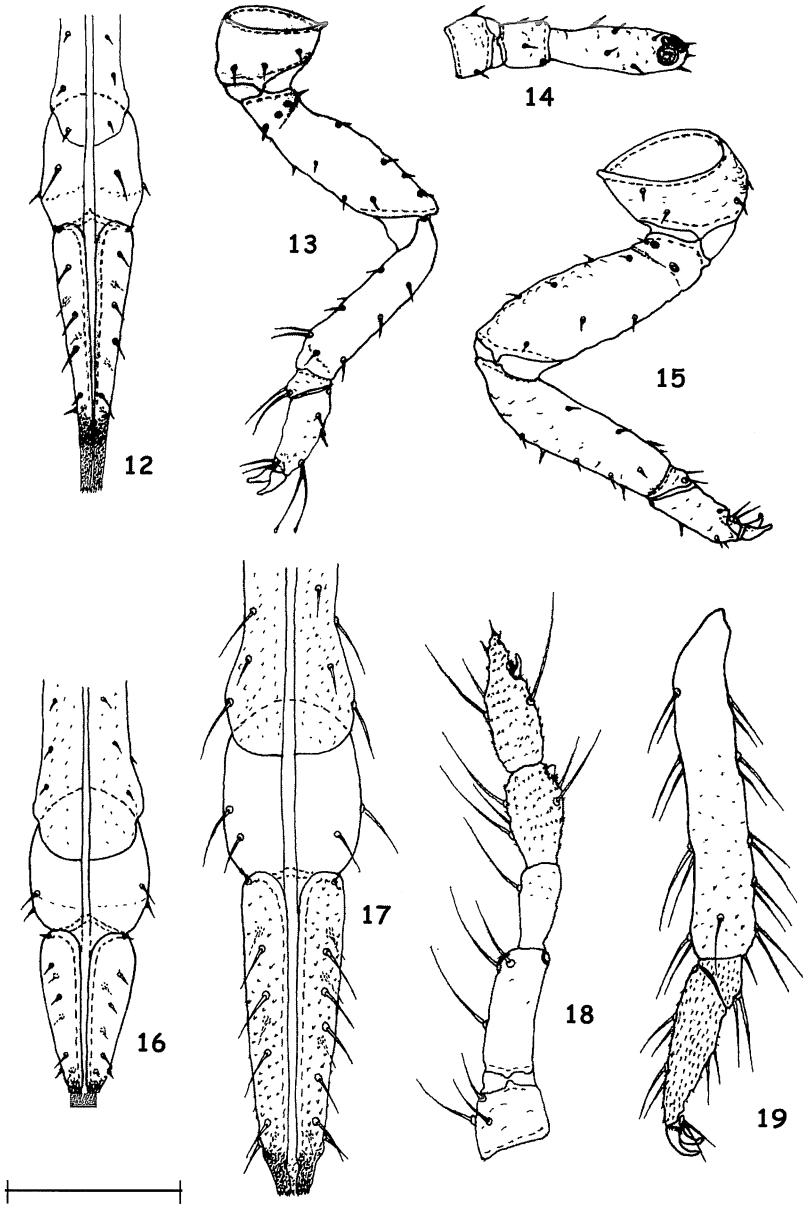


Plate II - *Zelkovaphis trinacriae* gen. n., sp. n. Alate emigrant: general view of a specimen mounted in slide (a); ibidem, posterior part of abdomen (b).

less their typical features until climatical events (rain, wind) destroy them, usually in the course of following winter months.

TAXONOMICAL REMARKS. As noted above, the new species, *Z. trinacriae*, appears closely allied to both *S. caucasica* and *H. persimilis,* which leads me to place the latter two



Figs. 12-19 - *Zelkovaphis trinacriae* gen. n., sp. n. Immature morphs. First nymphal stage of fundatrix: distal part of rostrum (12); hind leg (13); antenna (14). Second nymphal stage of fundatrix: hind leg (15); distal part of rostrum (16). First nymphal stage of exule: distal part of rostrum (17); antenna (18); tibia and tarsus of hind leg (19) [Bar = 0.1 mm].

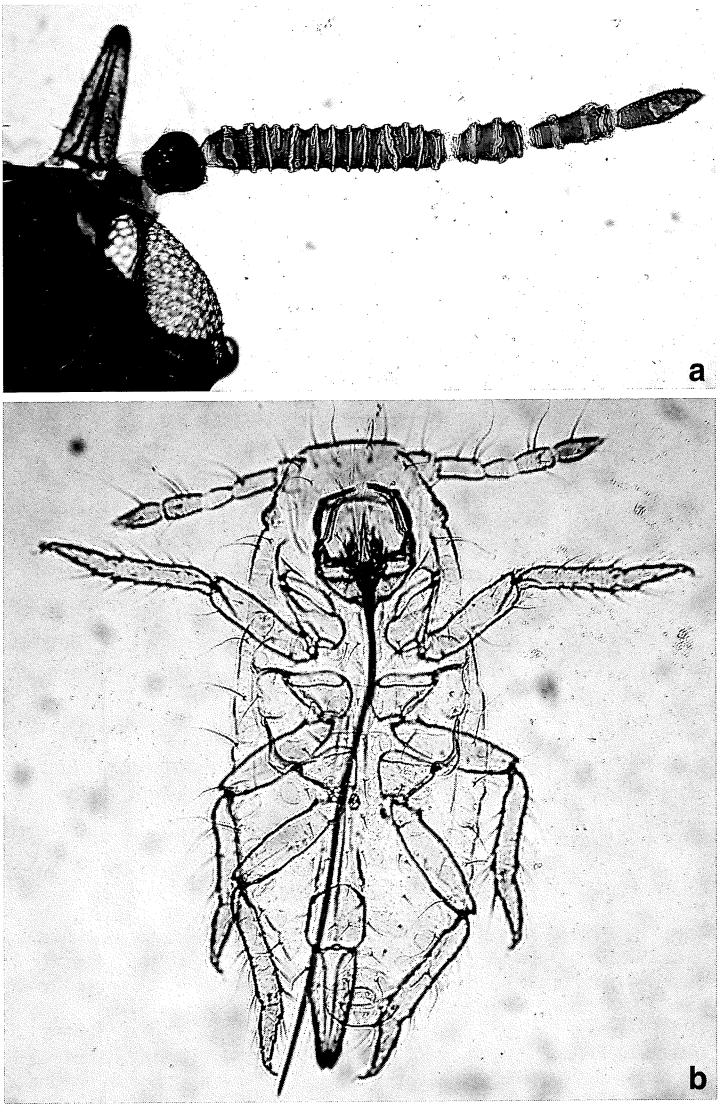


Plate III - *Zelkovaphis trinacriae* gen. n., sp. n. Alate emigrant: head with antenna and apical part of rostrum (a).First instar nymph of exule (b).

species within the new genus *Zelkovaphis*. The biological behaviour of the three species in fact shows two different lineages in their galls structure and number of generations on primary host. Both *S. caucasica* and *H. persimilis* develop three generations (viz. fundatrix, apterous fundatrigeniae and alate emigrants) on primary host (*Zelkova* spp.).

Their galls – as described and/or figured by Dzhibladze (1960) for the former species and by Aoki (1978, Fig. 1) and Akimoto (1983) for the latter one – are composed of several rolled leaves for each infested shoot, being quite different in their shape and structure from that of *Z. trinacriae* as already described. Nevertheless, all these species share a similar mode of gall formation (viz. one single fundatrix per shoot, from which originate the resulting gall and progeny, in Caucasian and Japanese species as well as in the Sicilian one) and a very close morphological relationship of their fundatrices and alate emigrants.

Adult morphology of the three species can be compared indeed on the basis of their fundatrices (*persimilis* and *trinacriae* only, as Dzhibladze, 1960, did not described that of *caucasica*)[1] and alate emigrants, a second generation of gall apterae being lacking in *Z. trinacriae*. Adult exules are only known so far for the Caucasian species, as evidenced by Blackman & Eastop (1994)[2]. These morphs are not yet known either for *persimilis* or for *trinacriae* whose first instar nymphs, on the other hand, appear to be morphologically quite different from each other (compare Akimoto's, 1983, description for the former and the present paper for the latter species).

The amount of above noted differences among the three named species may allow the separation of *trinacriae* from the other two species (*persimilis* and, perhaps, *caucasica* too) into different taxa at least of subgeneric level. Nevertheless, the lack of a full knowledge of some morphs in their life cycle at present leads me to consider all of them as components of the same genus *Zelkovaphis*.

The following key takes into consideration only the alate emigrants of the three named species, which can be separated as follows:

1. Ultimate rostral joint 0.16-0.19 mm, densely spinulated and longer (1.38-1.59) than the II hind tarsal joint, which is 0.11-0.13 mm long; siphunculi as simple pores not surrounded by a sclerotized area and hairs; genital plate bearing 22-37 hairs..... *Z. persimilis* (Akimoto)

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[1] The fundatrix of *H. persimilis,* following Akimoto's description, can be easily separated from that of *Z. trinacriae* by its relatively longer last antennal joint (it being more than three times of the II antennal joint or more than two times of the hind tarsus, against values which are less than both limits in *Z. trinacriae*); the former shows also a much less hairy genital plate, having 8-11 hairs against 50-60 hairs in *trinacriae*.

[2] One aptera exule and one alate sexupara seen by the courtesy of Mr. P. Brown from the Natural History Museum of London (collected on *Carex* at Vlazir, Iran) and identified by the late D. Hille Ris Lambers as "*Colopha caucasica*", show a general morphology which is quite related to *Gharesia polunini,* particularly in the structure of wax gland plates of the aptera, the alate antennal features and wing venation. Both morphs lack siphuncular pores and have a first tarsomer chaetotaxy 3:2:2. But, the aptera exule has a rather flattened oval body (ratio length/width=1.4), 5-segmented antennae, tarsi cone-shaped (similar to those of *Colopha* or *Kaltenbachiella*) while distinctly 2-jointed, and genital plate lacking main setae on its anterior part; therefore it cannot be regarded as a component of the genus *Gharesia*. Another sample from Iran, stored in the same collection, and collected on primary host (labelled with a query as "*Carpinus* or *Ulmus*" - which likely should be referred as *Zelkova*!) is composed of alate emigrants and apterous fundatrigeniae, which agree in morphology with the corresponding morphs of *S. caucasica* from Georgia (Caucasus).

- Ultimate rostral joint 0.08-0.17 mm and usually shorter or equal (0.58-1.00 and only occasionally up to 1.02) to the II hind tarsal joint; siphunculi having a sclerotized area around the opening rim and surrounded by a few hairs..... 2

2. Utimate rostral joint nearly smooth or with a few spinulations, 0.08-0.10 mm long or 0.58-0.72 of the II hind tarsomer (which is 0.11-0.16 mm in length); genital plate bearing about 25-35 hairs.....*Z. caucasica* (Dzhibladze)
- Ultimate rostral joint distinctly spinulated, 0.15-0.17 mm long or 0.83-1.00 of the II hind tarsomer (which is 0.16-0.20 mm long); genital plate bearing 50-70 hairs.....*Z. trinacriae* sp. n.

TYPES. As *holotype* is selected an alate emigrant collected on *Z. sicula* at Buccheri (Syracuse), Sicily, Italy on 16th May 1998; it is deposited at the Department of Phytosanitary Science & Technology (formerly Entomology Institute), University of Catania (Italy). *Paratypes* are 6 fundatrices and about 50 alate emigrants, collected on the same host plant and locality as the holotype at different dates from May 1998 to April 2002; they are in the author's collection and partly deposited at the Natural History Museum, Department of Entomology, London - Great Britain (Mr. P. Brown), the Muséum National d'Histoire Naturelle, Paris - France (Prof. G. Remaudière), the Department of Ecology and Systematics of Hokkaido University, Sapporo - Japan (Dr. S. Akimoto) and the Department of Biology, University of Leòn - Spain (Prof. J.M. Nieto Nafria).

DISTRIBUTION. The new species is so far known only from the type locality in Sicily (Italy), to which its primary host (*Zelkova sicula*) is apparently restricted (Pisano woodland at Buccheri, Syracuse province).

DERIVATIO NOMINIS. The species name is taken from an old denomination ("Trinacria") of Roman origin for Sicily.

BIOLOGICAL NOTES. The aphid performs a dioic life-cycle, having *Zelkova sicula* as primary host, while its secondary host plant is not yet known. Development on the primary host proceeds very quickly. Fundatrices appear at the host plant bud hatching time, which varied between years in the biotope from the last decade of March to the beginning of April. Each fundatrix nymph settles on the stem of a newly emerged shoot, inducing the development of a gall and taking about 18-20 days to reach the adult stage. Therefore, newly born nymphs of second generation were detected from 8-10 April, in the years 1999 and 2002 (with a dry and relatively warm winter time), to 16-18 April during the year 2000. The progeny of a single fundatrix can be estimated, on average, as 150-250 but up to more than 300 offsprings. The maximum number of nymphs counted inside two full developed galls at an estimated right time (with fundatrix nearly at end of its reproduction and first alatae just ready to fly out) were 280 and 320 specimens, respectively. Fundatrices remain alive (following the year variations) up to the first or the second decade of May. All their progeny evolve

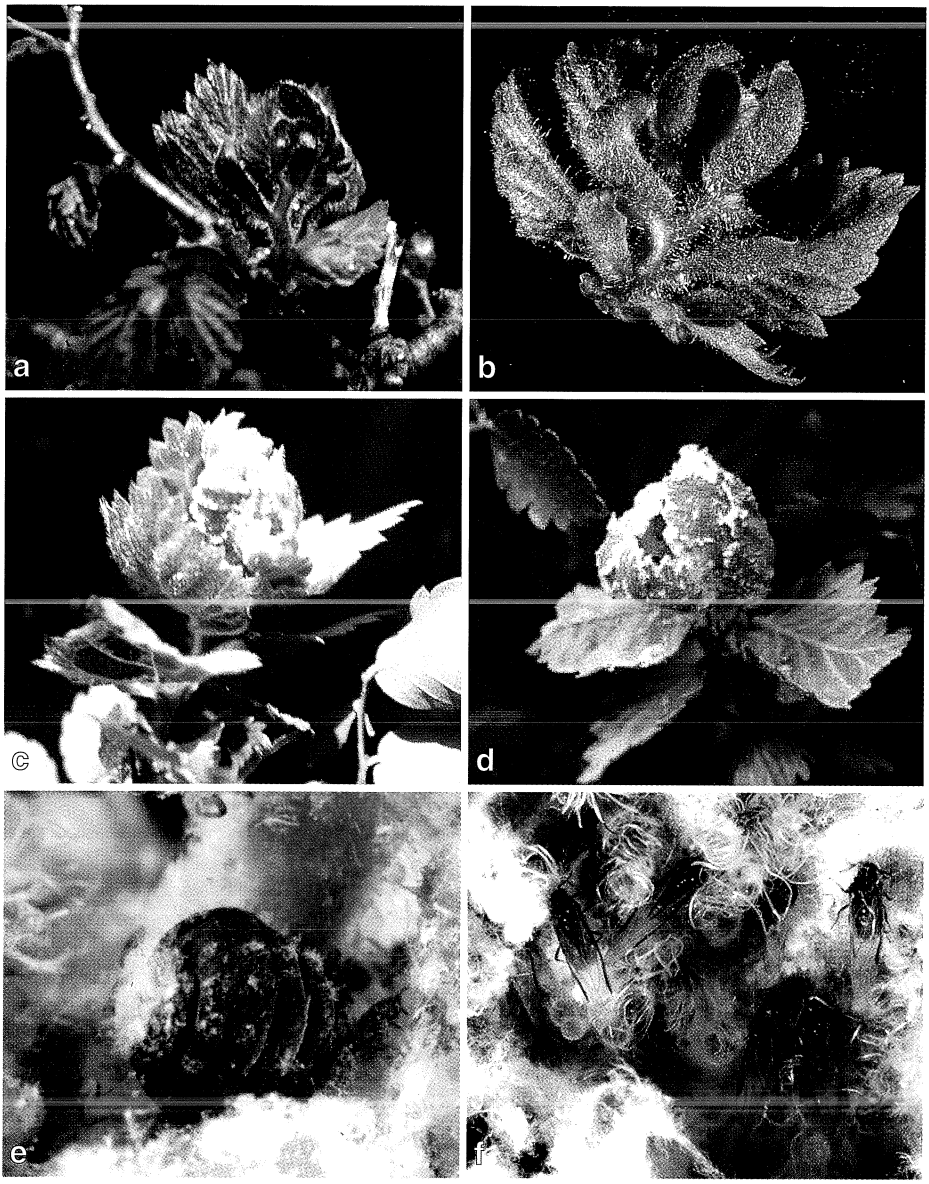

Plate IV - *Zelkovaphis trinacriae* gen. n., sp. n.: a newly forming gall at hatching time (Buccheri, Syracuse: 3rd April 2000) (a); an excised young gall (ib., 3rd April 2000) (b); full developed gall (ib., 5th May 2000) (c); exhausted old gall at end of alatae migration (ib., 1st June 2000) (d); adult fundatrix inside a gall (ib., 16th May 1998) (e); aphid colony inside a gall at beginning of emigrants flight (ib., 16th May 1998) (f).

into alate emigrants; during five years observations apterous fundatrigeniae of the second generation were never found. Therefore, the aphid life cycle period spent on primary host consists of two generations only (fundatrix and alate emigrants). The emigrants' flight starts between the end of April (years 1998 and 2001)[3] and the first decade of May (6-8 May in the year 2000) and lasts up to the second decade of May or the beginning of June (4-5 June in the year 2000), respectively. Once the galls are abandoned by last alate specimens, they soon completely dry up even on their most apical leaves, which have somewhat longer protected the residual part of the aphid colony. Neither predators or mummified aphid specimens inside the galls were found during the five years of investigation.

Due to the scanty availability of its primary host plant (which as far as known is strictly confined to a small area of about one half hectare, with a counted population of about 230 rather small shrubs (see Di Pasquale *et al.*, 1992), the aphid should be considered as being in a precarious ecological equilibrium in that place, where (or in adjacent areas) its secondary host plant might be also present. As a result of this the species is at a very high risk of extinction together with its primary host, unless it could be proved to survive as anholocyclic population on its still unknown secondary host plant.

Checks on the aphid's survival rate during the years of investigation showed a variable frequency of 13-25% of infested plants, with an average density of 2.5-13.7 galls/shrub and a range of 1-27 galls for each plant with a canopy diameter of about 1.0-1.5 m.

It is perhaps useful to note that on *Zelkova sicula* the new aphid, *Z. trinacriae,* is apparently the sole species so far detected among those already known Eriosomatine genera (*Byrsocryptoides*, *Colophina*, *Paracolopha)*, and the Calaphidine genus *Tinocallis* (see Blackman & Eastop, 1994, for a comprehensive survey), which live in the Asiatic regions of Caucasus and the far East where other species of *Zelkova* (mainly *Z. carpinifolia* and *Z. serrata* and other secondary ones) appear to be native.

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[3] It is worth mentioning that at that time (27/04/2000) in the same woodland area, other species of Eriosomatine – i. e. *Eriosoma lanuginosum* (Hartig), *Tetraneura caerulescens* (Passerini) and *T. ulmi* (L.) – were at the 1st or 2nd fundatrix nymphal stage.

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