

## ***Tramaforda wooli*, a new genus and species of Fordinae (Homoptera: Eriosomatidae) from Israel**

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### **ABSTRACT**

*Tramaforda wooli* (Eriosomatidae: Fordinae), a new genus and species of gall-forming aphids, is described from Israel. The new species forms leaf-edge galls on *Pistacia atlantica*. Autumn alate emigrants differ from all other *Pistacia*-feeding Fordinae in having only five antennal segments. Both the embryos inside the emigrants and the neonates born to the emigrants have remarkably long hind legs. Sexuparae, returning to *Pistacia* from an unknown secondary host in the spring, also have long hind legs with exceptionally long second segment of the hind tarsus.

KEY WORDS: aphids, Fordinae, galls, taxonomy, *Tramaforda wooli*

### **INTRODUCTION**

The faculty of gall forming is known in three families of the superfamily Aphidoidea: Adelgidae, Phylloxeridae and Eriosomatidae (=Pemphigidae). The family Eriosomatidae primarily consists of gall-inducing aphids, and is further divided into three subfamilies, Eriosomatinae, Fordinae and Pemphiginae. Each of these subfamilies is associated with a single plant family, or genus, as its primary host (Wool, 1984; Blackman and Eastop, 1994), except the Pemphigini Prociphilina, that are associated with more than one genus of tree.

Swirski and Amitai (2001) have recently summarized the knowledge on the taxonomy and faunistics of the Aphidoidea of Israel, including 19 species of Fordini (Fordinae of this paper; Eriosomatidae). Aphids of the subfamily Fordinae induce a variety of galls on *Pistacia* trees and bushes in the Mediterranean region and south-west Asia, and apart from the extremely polyphagous *Aphis gossypii* Glover, no other aphids have been recorded from this plant genus (Blackman and Eastop, 1994). Most Fordinae species have a two-year cycle involving host alternation, the alatae emerging from the galls in autumn to colonize roots of various herbaceous plants, especially Poaceae.

Ecological studies have been conducted on the *Pistacia*-feeding generations of Fordinae in Israel over the last 30 years (Koach and Wool, 1977; Inbar and Wool, 1995; Wool, 2004). Several undescribed species have been recorded (e.g. Koach and Wool, 1977). One of these, which induces characteristic leaf-edge galls on *P. atlantica*, also has a very distinctive combination of morphological features, which justifies the creation of a new genus.

Aphids were cleared in boiling KOH and mounted on glass slides with Euparal. Terminology follows Bodenheimer and Swirski (1957). Most of the material discussed in this paper is deposited in the National Collection of Insects, Department of Zoology, Tel Aviv University (TAUI). Several paratypes have been deposited in the Natural History Museum, London, GB (NHM).

## TAXONOMY

### *Tramaforda* Manheim, n. gen.

Type species: *Tramaforda wooli* n. sp., by present designation and monotypy

### Diagnosis and description

The main characters that this genus shares with all other Fordinae are: Vein M of forewing simple; siphunculi absent; tarsi 2-segmented; gall-former on *Pistacia* (Bodenheimer and Swirski, 1957). Its assignment to the Tribe Fordini is also substantiated by the non-ciliate primary rhinaria of both alatae forms (Bodenheimer and Swirski, 1957, Davatchi, 1958). The main differences from other genera of Fordinae are: The embryos inside the alatae have very long hind legs (about 1.5 times as long as body), known in no other eriosomatid genera. This character should also unambiguously identify the apterous morphs that develop on the secondary host (which have not yet been located). The alatae found in these galls (fall migrants) have 5 antennal segments, not 6 as in all other species. These unique characters justify the creation of *Tramaforda* as a new genus. The sexuparae of *Tramaforda* have five-segmented antennae, similar to the sexuparae of the genus *Forda*. The general appearance of the sexupara with its long hind legs and rostrum resembles aphids of the genus *Trama* (Lachnidae, Tramini).

### Etymology

The name *Tramaforda* refers to the general similarity of the sexupara, with its long hind legs and rostrum, to aphids of the genus *Trama* (Lachnidae: Tramini).

### *Tramaforda wooli* Manheim, n. sp.

(Figs. 1–6)

Fordini sp. B. Koach and Wool, 1977: 211.

*Forda* sp. B. Wool et al., 1994: 105; Inbar and Wool, 1995: 111.

## Diagnosis

This species can be distinguished from related species by the characters given in the generic description.

## Description

**Fundatrix.** Immatures yellowish; adults blackish; head greenish; legs and antennae colorless; tip of rostrum, eyes, and front of head blackish. Antenna with five segments.

**Aptera.** Body elongate. Immatures light yellow; older individuals yellow; antenna 5-segmented; tip of URS (ultimate rostral segment) black. Posterior abdominal segments often covered by wax.

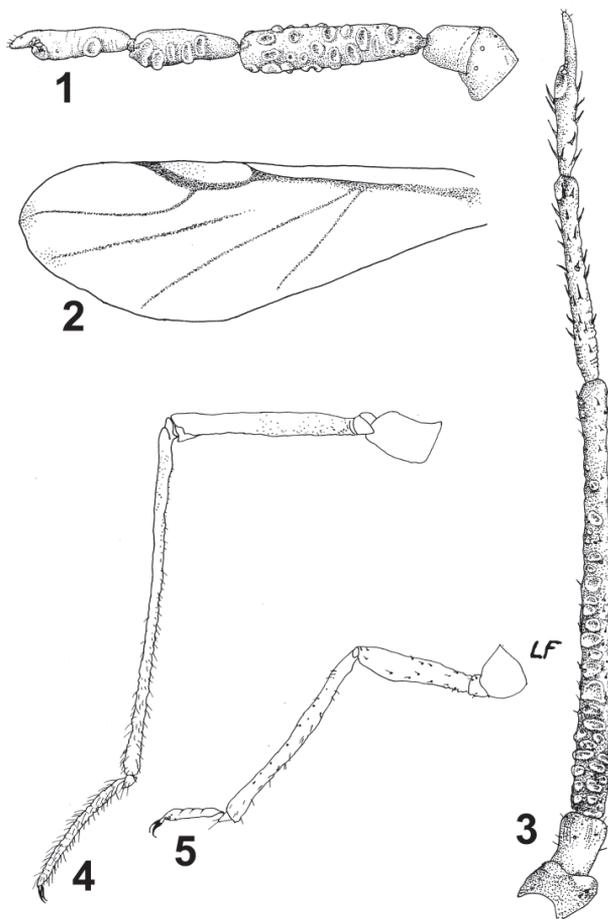
**Alate (fall migrant).** Body oval. Body length  $2.8 \pm 0.1$  mm ( $n=10$ , see other measurements in table 1). Antenna 5-segmented (Fig. 1). Segments IV and V each with uncilliated round primary rhinaria. Segment III with average of  $19.3 \pm 3.35$ , segment IV with  $4.7 \pm 0.95$ , and segment V with  $1.8 \pm 0.58$  round secondary rhinaria. Tip of rostrum extends to fore coxa.

Thorax black, middle of scutum with unpigmented area. Wing veins conspicuous (Fig. 2), stigma brown. Legs: light brown; second segment of hind tarsus not curved and not as long as in sexuparae, about 4 times as long as first tarsal segment (Fig. 5). Abdomen greenish yellow. Genital plate, anal plate and spiracles light brown.

**Embryo.** Two or 3 embryos with visible mouthparts fill the entire abdomen of alate fall migrant. Triommatidia visible. Hind leg remarkably long and folded around the abdomen tip, 1.5 times as long as body when extended. Rostrum extends to middle of abdomen. These embryos develop into the winter generation. In the absence of evidence to the contrary, we assume that these individuals become sexuparae, since we have not found adult apterous aphids of this species.

**Sexupara.** Exceptionally large compared with other species of Fordinae. Body length  $3.6 \pm 0.3$  mm ( $n=11$ , see other measurements in table 1), oval. Head blackish. Antenna 5-segmented (Fig. 3) with uncilliated primary rhinarium on each of segments IV and V. Ultimate segment with four uncilliated accessory rhinaria. Segment III with average number of secondary rhinaria  $34.5 \pm 7.8$ , mostly on proximal half. Segment IV with  $1.2 \pm 0.6$  secondary rhinaria. Segment V with no rhinaria. Segment III longer than others (table 1). Wing veins brown. Unpigmented narrow oval area in middle of scutum. Hind tarsus with second segment slightly curved and very long, about 10 times as long as first segment (Fig. 4). URS long. Rostrum tip extends beyond hind coxa. Each abdominal segment with pair of dark brown spots in spinal position progressively larger posteriorly. Cauda rounded and short, not extending beyond anal plate. Body mostly hairless, or with short and sparse setae. Genital plate, anal plate, legs and antenna with pointed hairs, progressively longer posteriorly.

**Sexuale.** Free-living sexuales have not been found. However, about 20–25 embryos were observed inside the abdomen of sexuparae. As in other eriosomatids, they lack mouthparts.



Figs. 1–5. *Tramafora wooli*. 1. Antenna of alate (fall migrant). Fig. 2. Wing of alate (fall migrant). Fig. 3. Antenna of sexupara. Fig. 4. Hind leg of sexupara. Fig. 5. Hind leg of alate (fall migrant).

### Material examined

Holotype: alate viviparous female, ISRAEL: Mt. Scopus [Botanical Gardens], 1.x.1992, ex gall on *Pistacia atlantica*, D. Wool (Slide-mounted; TAUI). Paratypes: same data as holotype (15 alate viviparous females; TAUI); ISRAEL: Canada Park [near Latrun (about 30 km southeast of Tel-Aviv)], 28.iv.1992, on *Pistacia atlantica*, D. Wool (8 alate viviparous females (sexuparae); TAUI); ISRAEL: Jerusalem, Mt. Scopus, 29.ix.1991, on *Pistacia atlantica*, D. Wool (18 alate viviparous females and 4 apterous viviparous females; NHM); ISRAEL: Canada Park, April 1991, on trunk of *Pistacia atlantica*, O. Manheim (4 alate viviparous females (sexuparae), NHM); ISRAEL: Jerusalem, 1990, D. Wool (2 alatae viviparous females and 1 apterous viviparous female; NHM). All the paratypes are slide-mounted. Additional specimens, not included as paratypes were collected at Ha'ela Junction; Giv'at Brenner and Bet Guvrin.

Table 1  
Measurements of *Tramaforda wooli*

Character	Fall migrants		Sexuparae	
	Avg. $\pm$	std	Avg. $\pm$	std
Forewing length, from base to stigma end	2.40 $\pm$	0.085	3.62 $\pm$	0.296
Forewing width	1.05 $\pm$	0.180	1.68 $\pm$	0.110
Total forewing length	3.20 $\pm$	0.205	4.76 $\pm$	0.311
Body length	2.78 $\pm$	0.101	4.04 $\pm$	0.421
Head width	0.44 $\pm$	0.015	0.75 $\pm$	0.050
Length of antennal segment II	0.06 $\pm$	0.003	0.12 $\pm$	0.007
Length of antennal segment III	0.22 $\pm$	0.008	0.99 $\pm$	0.104
Length of antennal segment IV	0.13 $\pm$	0.007	0.46 $\pm$	0.059
Length of processus terminalis (PT)	0.02 $\pm$	0.004	0.09 $\pm$	0.008
Length of antennal segment V (without PT)	0.14 $\pm$	0.009	0.35 $\pm$	0.044
No. of secondary rhinaria on antennal segment III	19.3 $\pm$	3.35	34.5 $\pm$	7.8
No. of secondary rhinaria on antennal segment IV	4.7 $\pm$	0.95	1.2 $\pm$	0.6
No. of secondary rhinaria on antennal segment V	1.8 $\pm$	0.58	0	
Clypeus width	0.17 $\pm$	0.007	0.33 $\pm$	0.037
Total rostrum length	0.42 $\pm$	0.027	2.03 $\pm$	0.332
Length of URS	0.08 $\pm$	0.003	0.54 $\pm$	0.022
Thorax width	0.64 $\pm$	0.021	1.18 $\pm$	0.115
Femur length, foreleg	0.40 $\pm$	0.021	0.96 $\pm$	0.098
Tibia length, foreleg	0.44 $\pm$	0.020	1.28 $\pm$	0.085
Length of second tarsal segment, foreleg	0.14 $\pm$	0.006	0.28 $\pm$	0.016
Femur length, midleg	0.31 $\pm$	0.014	0.84 $\pm$	0.068
Tibia length, midleg	0.44 $\pm$	0.019	1.44 $\pm$	0.101
Length of second tarsal segment, midleg	0.13 $\pm$	0.006	0.31 $\pm$	0.015
Femur length, hind leg	0.40 $\pm$	0.016	1.26 $\pm$	0.100
Tibia length, hind leg	0.59 $\pm$	0.028	2.18 $\pm$	0.138
Length of second tarsal segment, hind leg	0.18 $\pm$	0.010	0.83 $\pm$	0.057

Measurements in mm (mean $\pm$ std) and counts $\pm$ std (secondary rhinaria) of N=10 fall migrants and N=11 sexuparae.

### Etymology

*Tramaforda wooli* is named in honor of Prof. David Wool, Tel Aviv University, the world authority on the biology and ecology of *Pistacia* galls and gall-forming aphids, who led me into their fascinating world.

### Hosts

Primary: *Pistacia atlantica*. Secondary: unknown.

### Galls (On *Pistacia atlantica*; Fig. 6)

Flat, green, resembling a fold of the leaflet margin of the host. The fold is towards the upper surface of the leaflet. In most cases the gall extends to the midvein, but sometimes occupies only a third or half of the distance from the margin to the midvein. The upper margin of the gall tightly joins the upper surface of the leaflet but the gall is not sealed. The outer margins of the gall are strongly serrated. Mature live galls are as green as the rest of the leaf, but with red or brownish serrated margins. Deserted or parasitized galls may be yellow or red. The gall cavity does not extend into the serration, and the gall margins carry no trichomes. Wax, produced by the aphids, was found inside some galls. The gall length is 1–2 cm.



Fig. 6. Leaf of *Pistacia atlantica* carrying galls of *Tramaforda wooli*.

### Distribution

So far, galls of *Tramaforda wooli* were found only in a restricted area in the Judean Hills and the Coastal Plain (between 31°37' – 31°52'N and 34°48' – 35°15'E), despite the fact that the primary host, *P. atlantica*, is widespread also in northern Israel and in the northern and central Negev and sparse in central Israel (Koach and Wool, 1977, Inbar and Wool, 1995). Many other localities with *P. atlantica* were included in a long term survey and often searched but no galls of *T. wooli* were found (Wool, unpublished). Sexuparae were so far trapped only at Canada Park, at the foothills of the Judean Mountains. There are no records of this aphid or its galls, outside Israel.

### Life Cycle

The holocycle of this species is probably two-year long as in most Fordinae. The fundatrix nymph triggers the formation of a new gall in the beginning of April. In mid April, only the fundatrix is found in the gall, together with one or two exuviae. In mid June, 3-4 apterae of the second generation were often found together with the dead fundatrix and wax (The apterae move quite quickly when disturbed.). A third generation begins to appear in the galls at the end of August. The total number of aphids per gall reaches at most 25. In mid September, some galls contain third generation aphids with wing pads. In early October, the alate fall migrants leave the galls. The secondary host of the species is not yet known. In late April to early May of the second year, sexuparae begin to return to the primary host, and may be found on the trunks of *P. atlantica* and also on *P. palaestina* until the end of May to early June (Wool et al., 1994 and unpublished data). The embryos inside the sexuparae, the sexuales, do not have mouthparts. The sexuals probably mate on the trunk of the primary host – as is the case in other Fordinae – and a single fertilized, overwintering egg is formed in each female, from which a new fundatrix emerges next spring.

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