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Description of the alata vivipara of *Cinara cedri brevifoliae* from Cyprus (Aphididae Lachninae)

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Abstract

The alata vivipara of *Cinara cedri brevifoliae* Binazzi A. from Cyprus is described for the first time. For each of the studied specimens both sampling and biometric data are provided together with information on the main morphometric differences between the two subspecies. Moreover, additional bio-ecological notes concerning *C. cedri brevifoliae* are reported and debated.

Key words: *Cedrus brevifolia*, Cypriot cedar aphid, winged morph, endemism.

Introduction

The finding in Cyprus of *Cinara cedri* Mimeur on the endemic *Cedrus brevifolia* (Hooker fil.) Hanry was reported and discussed by Binazzi *et al*. (2015). It was noticed that *C. cedri*, though widespread in the Mediterranean basin, had never been previously recorded on *C. brevifolia* in its natural environment. The conclusion was, that the Cyprus cedar aphid is native to the island representing an endemism together with its host cedar. Further investigations carried out on other specimens collected in the island highlighted significant differences when compared with individuals belonging to the nominotypical taxon. The following morphological evaluation allowed the creation of a new subspecific taxon while molecular analysis shed light on *C. cedri* distribution in the Mediterranean basin (Binazzi *et al*., 2017).

Materials and methods

In May 2016, winged individuals of *C. cedri* were collected on a young *C. brevifolia* tree located along a road edge in the Troodos mountains (1154 m a.s.l.) (34°56'N 32°50'E) near Prodromos (Cyprus). The sample, composed of 8 alatae viviparous females plus some immature specimens, was collected by shaking cedar twigs and branches over a white cotton towel. Specimens were stored in 70% ethanol. Only four of them were suitable for examination and measurements.

In addition, the following 8 specimens from different Italian regions were used for morphological comparison (slides in "A.B. coll.", CREA, Firenze, Italy): 4 from *Cedrus atlantica* (Endl.) Manetti ex Carriere, Florence (Italy), 28.V.1974 (sl. C1/99, C2 100); 2 from *C. atlantica*, Piano Zucchi-Palermo (Italy), 24.VI.1983 (sl. C2/122); 2 from *Cedrus* sp., Sierra de Baza-Granada (Spain), 28.VII.1981 (sl. C2/116, from Notario coll.).

Additional morphological information was obtained from the original description by Mimeur (1935) of 3 specimens collected in the Ifrane region (Morocco), 1600-1700 m a.s.l., in July, from *C. atlantica* twigs.

Cinara cedri brevifoliae Binazzi A.

Alatae viviparous female (from 4 specimens) (figure 1-2)

Medium to large sized body with blackish head and pterothorax and light bronzy abdomen, with four rows of roundish intersegmental sclerites. Siphuncular cones blackish, small to medium sized, with evident apical flange. Tergite 1st with two spinal narrow sclerotized plates, tergite 7th with a reduced spinal sclerotic area or with several fragmented sclerites. Tergite 8th with a well sclerified solid bar interrupted in the middle. Cauda and genital plate dark brown. Antennae rather markedly coloured with dark brown the segment I, the distal part of III and IV, the distal 3/4 of V and the whole VI. Segments III, IV and V bear 6-11, 1-3 and 1 secondary rhinaria, respectively; processus terminalis (p.t.) of VI antennal segment with 4 subapical setae. Rostrum with dark brown apical segments. Legs rather uniformly dark brown to blackish except for a very short paler basal part of femora and tibiae. Tarsi with the same colour of tibiae.

Valuable ratios: ratio antennal segments V to VI, 1.29-1.69; ratio antennal segment III to diameter of siphuncular cones, 1.47-1.71; ratio rostral segments IV to V, 1.94-2.00; ratio dorsal length to basal of the 1st hind tarsal segment, 1.33-1.78; ratio of the 2nd hind tarsal segment to the IV rostral segment, 1.43-1.68.

Hairs: antennae with hairs rather marked in colour; abdominal tergites 1st to 7th with numerous brown long hairs; tergite 8th and genital plate bearing 26-44 and 11-16 hairs, respectively; fourth rostral segment with 6 accessory hairs; hind tibiae with numerous brown long hairs (measurements in table 1).

Collection data: 4 alatae viviparae, *Cedrus brevifolia* (Hooker fil.) Henry, Troodos Mountains near Prodromos, Cyprus, 1154 m a.s.l., 21.v.2016, leg. F. Binazzi (slide C10/931).

Preservation of material at the Research Centre for Plant Protection and Certification (CREA-DC), Florence, Italy, included in the collection "A. Binazzi" (=A.B.).

Morphotypus: specimen marked with* in slide C10/931.

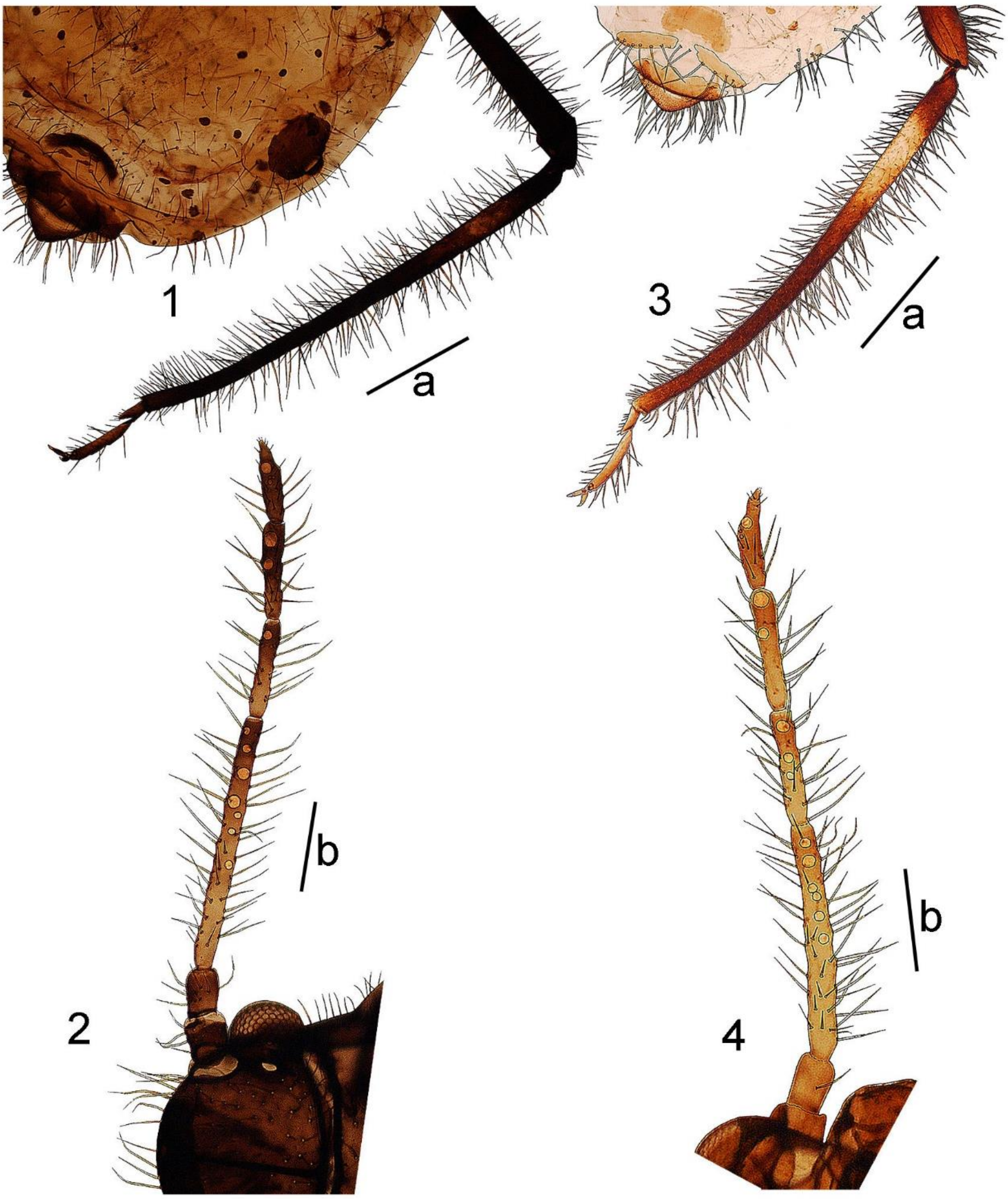

Figure 1-4. Morphological details: **1-2)** *C. cedri brevifoliae*; **3-4)** *C. cedri cedri*. Scales: a = 0.5 mm; b = 0.2 mm.

Taxonomy

C. cedri brevifoliae alatae viviparous female differs from the nominotypical morph (figure 1-4, table 1) in having larger body size (3.27-4.17 vs. 2.65-3.46), longer hind tibiae (2.09-2.37 vs. 1.50-2.01 mm) and longer antennal segment III and VI p.t. (.546-.618 vs. .366-.486 mm and .048-.060 vs. .030-.050, respectively). It differs also in the higher n. of secondary rhinaria on antennal segment III. Furthermore the ratio antennal segment V to VI is higher, 1.29-1.69 vs. 1.15-1.36. Another marked difference is the higher number of hairs on the abdominal tergite 8th. Moreover, in *C. cedri brevifoliae* alatae, legs and particularly hind tibiae are more dark-brown pigmented except for a slightly paler short basal part close to the knees. Finally, comparing our winged *C. cedri brevifoliae* records with the specimens of *C. cedri cedri* described by Mimeur in the original paper, a marked difference was noted in the length of body hairs which appear clearly longer in *C. cedri brevifoliae* (abdominal tergite 5th: .156-.172 vs. .120; antennal segment III: .126-.150 vs. .060; hind tibia: .192-.222 vs. .080).

Table 1. Alatae viviparous females: biometric data (mm) of *C. cedri brevifoliae* and *C. cedri cedri* (including Mimeur's specimens). Collection data in the text.

	C. cedri brevifoliae	*C. cedri cedri*
N° of specimens	4	11
Body length	3.27-4.17	2.65-3.46
Hind tibia length	2.09-2.37	1.50-2.01
Diameter of siphuncular cones	.324-.390	.261-.370
Length antennal segment III	.546-.618	.366-.486
Length antennal segment IV	.192-.240	.156-.234
Length antennal segment V	.222-.264	.174-.240
Length antennal segment VI b	.144-.156	.130-.198
N° of secondary rhinaria on:		
antennal segment III	6-11	3-9
antennal segment IV	1-3	2-3
antennal segment V	1	1
Length antennal segment VI p.t.	.048-.060	030-.050
Length rostral segment IV	.198-.210	.186-.204
Length rostral segment V	.102-.108	.078-.102
Length 1st segment of hind tarsus:		
basal length	.048-.054	.042-.054
dorsal length	.066-.096	.066-.072
ventral length	.132-.150	.108-.138
Length 2nd segment of hind tarsus	.300-.360	.264-.330
Length longest hair on:		
abdominal tergite 5°	.156-172	.114-.210
abdominal tergite 7°	.168-228	.132-.210
antennal segment III	.126-.150	.060-.150
hind tibia	.192-.222	.080-.270
N° of hairs on abdominal tergite 8	26-44	16-22
N° of hairs on the genital plate	11-16	8-16

Discussion

The finding in Cyprus of the winged morph of *C. cedri brevifoliae*, slightly improved the knowledge of its life cycle. The apterae of this species had been already collected in September in the same mountain locality (Binazzi *et al*., 2015; 2017) but, since sexuales are still unknown in the island, it remains unclear whether it has a holo- or anholocyclic scheme of life. It is known that environmental conditions play a fundamental role in influencing aphid life cycle (Dixon, 1998; Wieczorek *et al*., 2013; Depa *et al*., 2015a; 2015b). Therefore, in cold climatic conditions, the holocycle should be expected since it provides a crucial short-term ecological advantage compared with the anholocycle, which is generally more frequent in warm climatic conditions (Simon *et al*., 2002). Nevertheless, it is worth noting that, based on the available literature, the anphigonic morphs of *C. cedri sensu stricto* have only been recorded at low latitudes in warm Mediterranean regions such as North Africa (Morocco, Algeria) (Mimeur, 1935; Gahdab, personal communication), Spain and Sicily (Stroyan, 1979; Barbagallo and Stroyan, 1980; Notario *et al*., 1984) while in continental Italy they have never been observed so far.

This fact might be explained considering the geographical characteristics of the collection sites. In fact, either continentality or altitude, being responsible for low night temperatures and more generally high daily thermal excursion, can play an indirect role on aphid life cycles (Talhouk, 1972; Binazzi *et al*., 2016).

In Cyprus, the natural habitat of *C. brevifolia* includes a plain known as Cedar Valley and an area of about 700 hectares, ranging from 900 to 1400 m a.s.l., located in the slopes of the Tripylos mount whose highest peak is 1362 m. In this part of the Pafos forest, characterized by an annual rainfall of 600-900 mm and a minimum temperature of the coldest month ranging from 0 to 3 °C, *C. brevifolia* lives either in pure stands or in association with *Pinus brutia* Tenore (Stavrou *et al*., 2008). These ecological and climatic conditions are ideal for the occurrence of the holocycle and thus the presence of *C. cedri brevifoliae* sexual morphs should be reasonably expected.

The alatae morphs of this subspecies were all collected in May 2016 on *C. brevifolia.* The stand was located in the Troodos range at an altitude of about 1200 m a.s.l. Similarly, the same morph of *C. cedri cedri* was sampled in Florence (Italy) in May. All the other winged morphs recorded in Italy, Spain, and Morocco, were observed on *C. atlantica* in very diverse geographical, geomorphological and ecological contexts but always in a period ranging from the beginning of May to the end of July. These findings show a clear tendency of *C. cedri* to generate alatae morphs during the warm seasons. However, more extensive samplings and a long-term monitoring are required to fully understand life cycle, bio-ecology and behaviour of this subspecies.

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References

BARBAGALLO S., STROYAN H. L. G., 1980.- Osservazioni biologiche, ecologiche e tassonomiche sull' afidofauna della Sicilia.- *Frustula Entomologica*, 3: 1-182.

BINAZZI F., SABBATINI PEVERIERI G., ROVERSI P. F., 2015.- First record in Cyprus of *Cinara* (*Cinara*) *cedri* Mimeur (Aphididae Lachninae) on *Cedrus brevifolia* (Hooker fil.) Henry.- *Redia*, 98: 151-154.

BINAZZI F., PENNACCHIO F., PEVERIERI G. S., ROVERSI P. F., 2016.- The sexuales of *Cinara palaestinensis* Hille Ris Lambers, the Aleppo pine aphid (Hemiptera: Aphididae Lachninae).- *Zootaxa*, 4137: 417-424.

BINAZZI F., STRANGI A., PAOLI F., SABBATINI PEVERIERI G., ROVERSI P. F., BINAZZI A., 2017.- A new aphid subspecies on the endemic Cyprus cedar, *Cedrus brevifolia*: *Cinara cedri brevifoliae* ssp.n. (Aphididae Lachninae).- *Bulletin of Insectology*, 70 (1): 75-82.

DEPA Ł., KANTURSKI M., JUNKIERT Ł., WIECZOREK K., 2015a.- Giant females vs dwarfish males of the genus *Stomaphis* Walker (Hemiptera: Aphididae) - an aphid example of the ongoing course to permanent parthenogenesis?- *Arthropod Systematics & Phylogeny*, 73: 19-40.

DEPA Ł., TASZAKOWSKI A., KANTURSKI M., 2015b.- Impact of warm weather events on prolongation of the life cycle of *Stomaphis* Walker (Hemiptera, Aphididae, Lachninae).- *Turkish Journal of Zoology*, 39: 669-671.

DIXON A. F. G., 1998.- *Aphid ecology. An optimization approach*.- Chapman & Hall, London, UK.

MIMEUR J. M., 1935.- Aphididae du Maroc (Septième note).- *Bulletin de la Société des Sciences Naturelles du Maroc*, 15 (3): 251-258.

NOTARIO A., BINAZZI A., CASTRESANA L., BARAGAÑO J., MONTOYA R., 1984.- *Los pulgones del cedro:* Cinara cedri *Mimeur y* Cedrobium laportei *Remaudière*.- Ministerio de Agricultura, Pesca y Alimentacion, Instituto Nacional para la Conservacion de la Naturaleza (ICONA), Monografia 33.

SIMON J. C., RISPE C., SUNNUCKS P., 2002.- Ecology and evolution of sex in aphids.- *Trends in Ecology & Evolution*, 17: 34-39.

STAVROU N., VOSKARIDES K., KARAGIANNAKIDOU V., 2008.- Floristic composition and phytogeographical research on the endemic *Cedrus brevifolia* forests in Cyprus.- *Flora Mediterranea*, 18: 149-170.

STROYAN H. L. G., 1979.- Additions to the British aphid fauna (Homoptera: Aphidoidea).- *Zoological Journal of the Linnean Society*, 65: 1-54.

TALHOUK A. S., 1972.- Field investigations on *Pterochloroides persicae* (Chol.) and *Brachycaudus helichrysi* (Kltb.), two common aphids of the almond tree in Lebanon.- *Anzeiger fur Schadlingskunde und Pflanzenschutz*, 45: 97-103.

WIECZOREK K., KANTURSKI M., JUNKIERT Ł., 2013.- The sexuales of giant black bark aphid, *Pterochloroides persicae* (Hemiptera, Aphidoidea: Lachninae).- *Zootaxa*, 3626: 94-98.

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