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FIRST RECORD IN CYPRUS OF *CINARA (CINARA) CEDRI* MIMEUR (APHIDIDAE LACHNINAE) ON *CEDRUS BREVIFOLIA* (HOOKER FIL.) HENRY

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Binazzi F., Sabbatini Peverieri G., Roversi P.F. – First record in Cyprus of *Cinara (Cinara) cedri* Mimeur (Aphididae Lachninae) on *Cedrus brevifolia* (Hooker fil.) Henry.

The Authors report on the discovery in South Cyprus of the aphid *Cinara (Cinara) cedri* Mimeur collected on the endemic cedar, *Cedrus brevifolia* (Hooker fil.) Henry. This is the first record of the lacnid in Cyprus. The ecological aspects of the cedar and its interaction with the related aphid species are discussed. The Authors suggest the hypothesis that the aphid may be co-endemic with its host conifer since it shows significant morphological differences compared with specimens from other European regions. The question whether the Cyprus cedar aphid can be injurious or not to its host plant is debated as well. The exact taxonomic position of this lacnid is currently under investigation.

KEY WORDS: Aphididae, Lachninae, *Cinara* species, *Cedrus brevifolia*, Cyprus.

APHID RECORD AND ECOLOGICAL NOTES

The genus *Cedrus* Trew. (fam. Pinaceae) includes four closely related, species, i.e., *C. atlantica* (Endl.) Carr., growing on the Atlas mountains of North Africa (Morocco and Algeria), *C. libani* A. Rich., distributed in Lebanon, Syria and NE Turkey, *C. deodara* (D. Don) G. Don, living in the Hindu Kush, Karakorum and the Indian Himalayas and the Cyprus Cedar *C. brevifolia* (Hooker fil.) Henry, an endemic conifer tree that grows only in Cyprus (ROLLEY, 1950; M'HIRIT, 1987) (Fig. I). *Cedrus atlantica*, *C. libani* and *C. brevifolia* were recently confirmed as independent species on the basis of morphological and anatomical characteristics of needles (JASINSKA *et al.*, 2013). Since only minor morphological differences exist among Cedar species, some Authors argued that they are likely to have originated from a common ancestor originally distributed from the Himalaya to the Moroccan Atlas (HOLMBOE, 1914; STAVROU *et al.*, 2008). ELIADES *et al.* (2011) recently advanced a similar hypothesis arguing that the high genetic diversity of *C. brevifolia* might be related to its origin from a widespread congeneric species. This assumption is also based on fossil records from Western Kazakhstan, Southern Europe, Central Europe and Ahaggar Massif in central Sahara. However these records are insufficient and no hard evidence is available to clarify whether that *Cedrus* ancestor ever had a continuous distribution (CYPRUS MINISTRY OF AGRICULTURE, NATURAL RESOURCES AND ENVIRONMENT. FORESTRY DEPARTMENT, 2010).

C. brevifolia natural habitat currently covers a region of approximately 700 hectares, at an altitude from 900 to 1400 m a.s.l., located in the slopes of Tripolos area and in a site known as "Cedar Valley" (Fig. I). It forms either pure or mixed stands mainly associated with *Pinus brutia* Tenore (STAVROU *et al.*, 2008).

According to the Cyprus Ministry of Agriculture, measures for *C. brevifolia* protection were originally established in 1879 by the Forestry Department, thus recognizing its importance as a natural resource and the risk of its extinction (WILD, 1879). Afterwards, in the thirties, the cedar natural habitat started to be systematically protected leading to the prohibition of tree-felling and forest grazing in 1939. In 1984, the sites of Tripolos and the Cedar Valley were designated as a conservation area (STAVROU *et al.*, 2008). The whole area was then included in the European network Natura 2000 and the Cedar forests were accepted as a priority habitat of Community Interest. However, despite all the achievements in terms of environmental protection, serious threats for *C. brevifolia* still persist particularly for what concerns forest fire and climate change. In fact, only few stands of a formerly more extensive Cedar forest still remain on the island. Therefore, the Cyprus Cedar, with its peculiar ecosystem and high genetic diversity, deserves priority conservation measures (CYPRUS MINISTRY OF AGRICULTURE, NATURAL RESOURCES AND ENVIRONMENT. FORESTRY DEPARTMENT, 2010).

During a recent stay of the first A. in Cyprus in September 2015, a sample of aphids was collected on a young plant of *C. brevifolia* in a mountain site of the island. Aphid specimens were obtained by shaking low branches of the cedar over a white cotton towel, from which they were gathered and picked up by forceps. The sample, was composed of 12 apterous viviparous females plus some immature specimens. After sampling, the specimens were stored in 100% ethanol. Aphids were collected from an isolated plant located along a road in the Troodos mountains near Prodromos (1700 m a.s.l.). The finding represents the first record of this aphid species in Cyprus.

The aphids were then identified as *Cinara (Cinara) cedri*

Mimeur (Aphididae Lachninae)¹. This species is known to live on *Cedrus* spp. Its original indigenous area is very likely the Moroccan Medium Atlas where the samples studied by Mimeur (1935) for describing the species were collected for the first time (REMAUDIERE, 1954). Afterwards, the lachnid was reported in Turkey by TUATAY & REMAUDIÈRE (1964). In Europe, *C. (C.) cedri* was firstly observed in Italy by COVASSI & BINAZZI (1974) and BINAZZI (1978). From then onwards, the aphid has been recorded in almost the whole European continent as well as in many other countries of the Near East (i.e., Asian Turkey, Caucasian Russian Republics, Georgia, Armenia, Azerbaijan, Lebanon, Syria, Israel, Giordan, Sinai Peninsula, Arabian Peninsula, Iran and Irak). Overseas, this cedar aphid, together with its host plants, was introduced into Argentina where it was found for the first time in Paranà in 1986 on *C. deodara* (DELFINO & BINAZZI, 2002) and in North America (California and New York) (BLACKMAN & EASTOP, 1994, 2015).

older twigs and branches. When infestations are heavy, the excreted honeydew is very abundant and, consequently, the sooty mould fungi develop very copiously (BINAZZI & SCHEURER, 2009).

The introduction of Cedar trees into Europe, at first only with ornamental purposes in parks and gardens, dates back to the 19th century. In particular, *C. libani* started to be imported in 1863 while *C. deodara* and *C. atlantica* in 1822 and 1842, respectively (COVASSI & BINAZZI, 1974). From then onwards, the three cedar species have been spread almost everywhere either for the beauty of their foliage or for their simple ecological requirements. Obviously, trade of nursery material, which lasted for about two centuries, facilitated the spreading of the related aphids (i.e., the mentioned *C. (C.) cedri* and the other species *C. (Cedrobius) laportei* Remaud.). Conversely, so far, no aphid species had been ever recorded on the endemic *C. brevifolia* in its natural environment.



Fig. I – *Cedrus brevifolia* (Hooker fil.) Henry in a mixed forest in South Cyprus.

DISCUSSION

Up till now, in Europe, *C. (C.) cedri* has been reported as feeding on *C. atlantica* and *C. deodara* while in Turkey it was detected on *C. libani* (TUATAY & REMAUDIÈRE, 1964; COVASSI & BINAZZI, 1974; NOTARIO *et al.*, 1984). Damage to the former cedars has never been reported in Europe whereas on the latter, injuries such as chlorosis, early needle falling and stunting of infested trees have been often observed everywhere. When climatic and micro-ecological conditions become strongly favorable, this aphid is able to develop very dense colonies on cedar's

In light of the above, the question arises of what might be the original area of the two mentioned cedar aphid species. The fact that these lachnids were not found on *C. deodara* in its native environment on the Himalayas, is currently strengthening the assumption that their origin has to be restricted to the Mediterranean basin. To our knowledge only two aphid species are recorded on *C. deodara* in the Himalayan regions, i.e., the introduced Nearctic fir-feeding *C. (C.) curvipes* (Patch) and the native *C. (C.) indica* Verma (GHOSH & SINGH, 2004). Moreover the latter was also recently recorded in Turkey (Sultandagi) on *Cedrus* sp. (ŞENOL *et al.*, 2015). Since Mediterranean regions have been, undoubtedly, widely and fairly investigated, it is reasonable to assume that the original source of *C. (C.) cedri* and *C. (Cedrobius) laportei* was actually the Moroccan Atlas where they were initially

¹ The aphids were identified by Dr. A. Binazzi, Florence, Italy.

found and described by the French researchers J.M. Mimeur and G. Remaudière.

From this source area, these species have been widely spread all over the continental Europe up to the Middle East (BLACKMAN & EASTOP, 1994, 2015).

This hypothesis is also strengthened by the evidence that *C. (Cedr.) laportei*, moving from the same native area of the congeneric *cedri*, became harmful to either *C. deodara* or *C. libani* proving that the latter ones were new hosts (see COVASSI & MASUTTI, 1998).

Another congeneric aphid species occasionally found on *Cedrus*, is *C. (C.) confinis* (Koch) which lives commonly on *Abies*. This species was cited (sub *abieticola*) on *C. deodara* for Italy by Covassi 1971 and for the UK and India by Eastop (1972).

A point that requires further investigation is whether the Cyprus cedar aphid has been introduced from outer regions (e.g., Anatolia or Asia Minor) or it is native of the island, therefore representing an endemism together with its host cedar. The AA. share the second hypothesis. In fact, from a preliminary morphological study of some mature specimens mounted on slides, significant differences emerged between the Cyprus aphid and the already known type of *C. (C.) cedri* which we could currently label as *sensu stricto*.

This approach is supported as well by the results of an experimental work carried out by FABRE *et al.* (1988) on the susceptibility of the four Cedars to the attack of the two known aphid species. This trial showed that *C. (C.) cedri* failed to adapt to the endemic *C. brevifolia*.

If further morphological and molecular investigations, currently under way, should confirm the taxonomic validity of these differences, the Cypriot *C. (C.) cedri* taxon could be elevated to the rank of subspecies. In this perspective, it is plausible to assume that this aphid does not represent a threat for *C. brevifolia* as it is co-evolved with its host conifer. Obviously it would not be the same assuming that the aphid was accidentally introduced into Cyprus.

Nevertheless the question remains why the Cypriot cedar aphid has never been previously detected. The answer might be that presumably it never gave rise to infestations high enough to be clearly observed. In fact dense colonies of aphids are easily recognized by the abundant honeydew rain under the infested tree canopies (COVASSI & SCHEURER, 2009).

However, the assumption that the cited endemic cedar sap-sucking inhabitant is not a threat for its endemic host is only valid as long as severe climate changes or other disruptive actions do not occur (see GOKCEKUS & GUCEL, 2010). In fact, if that should be the case, plants might be weakened to the point of fostering the aphid outbreaks, therefore disrupting the natural host-parasite balance.

RIASSUNTO

PRIMO RINVENIMENTO A CIPRO DI *CINARA (CINARA) CEDRI* MIMEUR (APHIDIDAE LACHNINAE) SU *CEDRUS BREVIFOLIA* (HOOKER FIL.) HENRY

Gli Autori riferiscono sul primo ritrovamento dell'afide dei cedri, *Cinara (Cinara) cedri* Mimeur, nell'isola di Cipro sull'endemico *Cedrus brevifolia* (Hooker fil.) Henry. Il reperto è di particolare interesse in quanto, in base ad

alcune differenze morfologiche riscontrate dal confronto con altri esemplari europei, si suppone che possa trattarsi di un'entità diversa, forse subspecifica, e dunque anch'essa endemica dell'isola sulla sua pianta ospite. Vengono discusse le caratteristiche ecologiche stazionali del cedro di Cipro e le possibili relazioni con l'afide suo ospite anche dal punto di vista fitosanitario. La questione dell'esatta posizione tassonomica dell'afide del cedro di Cipro è in corso di studio.

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