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FIRST RECORD OF *CINARA* (*CINARA*) *CEDRI CEDRI* MIMEUR (HEMIPTERA APHIDIDAE) IN BULGARIA

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Georgiev G., M. Georgieva, K. Trencheva, P. Mirchev, M. Kechev, S. Belilov, V. Petrova - First record of *Cinara* (*Cinara*) *cedri cedri* Mimeur (Hemiptera Aphididae) in Bulgaria.

In 2017, damages caused by aphids were observed for the first time on Cedar trees in Bulgaria. In 2020, apterae specimens of *Cinara* (*Cinara*) *cedri cedri* were collected and identified on *Cedrus atlantica* and *C. deodara* in seven localities both on young trees in forest nurseries and on old trees in plantations or in green urban systems. The pest appears to be a serious threat to the health status and decorative characteristics of Cedar trees. In case of high population density, the needles are covered with large honeydew secretions and sooty mold.

KEY WORDS: *Cinara cedri cedri*, *Cedrus atlantica*, *C. deodara*, honeydew, Bulgaria

INTRODUCTION

Cinara (*Cinara*) *cedri cedri* Mimeur, 1936 is one of the many species of the genus *Cinara* Curtis, 1835, and one of eight such species that can live on species of *Cedrus*. It is widely distributed in Europe, also present in Asia, to the east of China (Beijing) and Korea, and evidently introduces by human action in USA and Argentina (BLACKMAN & EASTOP, 2021, YU & WANG, 2014, LEE *et al.*, 2020).

In the spring of 2017, damages caused by aphids were observed on ornamental Cedar trees in the urban areas of towns of Hissar (Central Bulgaria) (Maria Dobрева, personal communication) and Nessebar (Central Black Sea coast) (Yanko Georgiev, personal communication). In this study, *C. cedri cedri* is recorded for the first time in Bulgaria.

MATERIAL AND METHODS

Based on the information about appearance of aphids on Cedar trees in Bulgaria, the field work for identification of the pest was conducted in 2020. The biological material was collected in different localities of Bulgaria – nurseries, urban areas and plantations (Table 1).

Cuttings of damaged shoots and branches with aphid colonies were transported to the Laboratory of Entomology in Forest Research Institute - Sofia. A part of aphid samples was preserved in 75% ethanol. Mature specimens were mounted on slides following the methods of BLACKMAN & EASTOP (2000).

In this work, three categories of degree of attacks are accepted: presence of single specimens of *C. cedri* on shoots and young branches; presence of small colonies on shoots and branches; presence of large colonies,

attended by feeding on the needles and abundant honeydew secretions.

The photographs of live specimens and preparations were taken by digital camera Leica DFC 295, attached on the microscope Leica DM 6B. The slides were photographed by digital camera ProgResCT5 attached on the microscope Zeiss AX10.

The identification of *C. cedri cedri* was made by the keys of BINAZZI *et al.* (2017), BLACKMAN & EASTOP (2021) and LEE *et al.* (2020). The biological material is preserved in Entomological collections of Forest Research Institute and Agricultural Faculty of University of Forestry in Sofia.

RESULTS

Cinara cedri cedri was found on young trees of *Cedrus atlantica* (Endl.) Manetti ex Carrière in two forest nurseries, and old trees of *C. atlantica* and *C. deodara* (Roxb.) G.Don in urban green systems and Cedar plantations in seven localities in South Bulgaria (Fig. I).

A low population density of *C. cedri cedri* (slight degrees of attacks) was mainly registered (Table 1). Single apterae specimens were predominately observed on plants (Fig. II, 1, 2). Rarely, small colonies have been observed on the shoots and branches (Fig. II, 3). In case of high pest density, the foliage of attacked trees were covered with large honeydew secretions upon which sooty mold developed (Fig. II, 4). The attacked trees were visited by bees to collect honeydew (Fig. II, 5). Dense colonies were mainly observed on ornamental trees in urban areas (Fig. II, 6).

The main differential morphological characteristics of apterous viviparous females of *Cinara* (*Cinara*) *cedri cedri* are illustrated in Fig. III, 1, 2, 3, 4, 5, 6.

Table 1 - Main characteristics of studied localities of *Cinara cedri cedri* in Bulgaria

№	Locality	Date of collection	Geographic coordinates	Altitude, m a.s.l.	Tree species	Host characteristics	Degree of attack
1	Poroy vill.	10.05.2020	42°44'04" N 27°33'48" E	124	<i>Cedrus atlantica</i>	Young trees in a nursery	Slight
2	Sofia	30.04.2020 - 19.05.2020	42°37'51" N 23°21'13" E	654	<i>Cedrus atlantica</i>	Solitary trees in urban areas	Strong
3	Sofia	11.06.2020	42°39'05" N 23°20'21" E	625	<i>Cedrus deodara</i>	Solitary trees in urban areas	Slight
4	Pesnopoy vill.	08.06.2020	42°28'31" N 24°48'14" E	280	<i>Cedrus atlantica</i> <i>Cedrus deodara</i>	Trees in Cedar plantation	Severe
5	Assenovgrad	20.05.2020 09.06.2020	42°00'23" N 24°52'31" E	240	<i>Cedrus atlantica</i> <i>Cedrus deodara</i>	Solitary trees in urban areas	Severe
6	Banya	09.06.2020	42°31'22" N 24°50'47" E	462	<i>Cedrus atlantica</i>	Trees in Cedar plantation	Severe
7	Karlovo	10.06.2020	42°38'35" N 24°47'47" E	462	<i>Cedrus deodara</i>	Solitary trees in urban areas	Slight
8	Pomorie	25.07.2020	42°35'55" N 27°36'55" E	6	<i>Cedrus atlantica</i>	Young trees in a nursery	Slight

Fig. I - Studied localities of *Cinara cedri cedri* in Bulgaria

DISCUSSION

The apterous *Cinara cedri cedri* differs from the endemic in Cyprus *C. cedri brevifoliae* by the length of hind tibia (1.5-2.1 mm vs. 1.1-1.6 mm), the ratio of apical rostral segments IV to V (2.0-2.5 vs. 1.8-2.1), the ratio antennal segments V to VI (1.2-1.4 vs. 1.0-1.2), and the longest hairs on antennal segment III (up to 0.17 mm vs. up to 0.13 mm) and tergite VII (up to 0.24 mm vs. up to 0.19 mm) (BINAZZI *et al.*, 2017).

Three other species of *Cinara* genus feed on Cedar trees: *C. (Cedrobium) laportei* (REMAUDIÈRE, 1954), *C. (C.) indica* Verma, 1970 and *C. (C.) deodarae* Seo, 1994. The apterous *C. laportei* has five-segmented antennae. It is indigenous to the Atlas Mountains (North Africa), where is connected with *Cedrus atlantica*. Since the early 1970s, it spread to vast areas in the Mediterranean, other European regions, Africa and Asia (MENDEL *et al.*, 2016). *C. indica* is distributed in the Himalayan region, and *C. deodarae* is known only from Korea (BINAZZI *et al.*, 2017). *C. cedri cedri* differs from

Fig. II - *Cinara cedri cedri*: 1 – an apterous viviparous female (dorsal view) (Sofia, 08.05.2020, *Cedrus atlantica*); 2 – an apterous viviparous female (lateral view) (Sofia, 08.05.2020, *C. atlantica*); 3 – a small colony (Pesnopoy vill., 08.06.2020, *C. deodara*); 4 – sooty mold on honeydew secretions (Sofia, 30.04.2020, *C. atlantica*); 5 – a bee collecting honeydew (Assenovgrad, 09.06.2020, *C. atlantica*); 6 – a part of crown of strongly attacked solitary tree with honeydew secretions and layer of sooty mold on them (Sofia, 19.05.2020, *C. atlantica*).

C. deodarae by absence of extensive pattern of dark sclerotization on abdominal tergites I-VI, and from *C. indica* – by diameter of siphuncular cones (up to 0.450 mm), and long and strong hairs on abdomen and tibiae (up to 0.240 mm vs. 0.100-0.110 mm) and antennae (up to 0.170 mm vs. 0.060-0.150 mm).

Two other *Cinara* species on *Abies*, occasionally feeding on *Cedrus*: the Holarctic *C. (Cinara) confinis* (KOCH, 1856) and the Nearctic *C. (Cinara) curvipes* (PATCH, 1912), which differ from *C. cedri cedri* by the largest body size (up to 4.0-7.8 mm) (BINAZZI *et al.* 2017). Recently, *C. curvipes* was found in Slovenia on *Abies alba* and *A. concolor* (JURK *et al.*, 2009).

The first attacks of *C. cedri cedri* in Bulgaria (Hissar and Nessebar) were observed in central part of the country. Most likely, the species entered Bulgaria not through the gradual expansion of its range from the south, but through human activity, on planting material for landscaping. In this study, *C. cedri cedri* was established on *Cedrus atlantica* and *C. deodora* but it is known that the pest attacks *C. libani* as well (MENDEL *et al.*, 2016).

In conclusion, it should be noted that *Cinara cedri cedri* appears to be a serious threat to the species of *Cedrus* in Bulgaria. Before the pest entered the country, the Cedar trees had the best health status and decorative

Fig. III - Morphological characteristics of *Cinara cedri cedri*: 1 – antennal segments I-III; 2 – antennal segments IV-VI; 3 – an apical part of rostrum; 4 – siphunculus; 5 – cauda; 6 – tarsi of first pair of legs.

characteristics among the species used for landscaping of urban areas.

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REFERENCES

- BINAZZI F., STRANGI A., PAOLI F., SABBATINI PEVEVIERI 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.

- BLACKMAN R.L., EASTOP V.F., 2000 - *Aphids on the World's Crops: An Identification and Information Guide*, Second edition. The Natural History Museum, Wiley, London, 476 pp.
- BLACKMAN R.L., EASTOP V.F., 2021 - *Aphids on the World's Plants: An online identification and information guide* [cited 27 June 2021]. Available from URL: <http://www.aphidsonworldsplants.info/>.
- JURK M., POLJAKOVIĆ-PAJNIK L., JURK D., 2009 - *The first record of Cinara curvipes (Patch, 1912) (Homoptera, Aphididae) in Slovenia and its possible economic impact*. - Zbornik gozdarstva in lesarstva, 88: 21-29.
- LEE J., LEE T., SEO H.Y., LEE M., LEE S., HONG K., LEE W., 2020 - *One new record of the genus Cinara Curtis, 1835 (Hemiptera: Aphididae: Lachninae) from Korea*. - Journal of Asia-Pacific Biodiversity, 13: 465-469.
- MENDEL Z., BRANCO M., BATTISTI A., 2016 - *Invasive Sap-Sucker Insects in the Mediterranean Basin*. In: *Insects and Diseases of Mediterranean Forest Systems*, Paine T.D. & Lieutier F. Ed., Springer International Publishing, Switzerland, pp. 261-291.
- YU G.-Y., WANG H., 2014. - *First record of Cinara cedri Mimeur (Hemiptera: Aphididae, Lachninae) on Cedrus deodara in Beijing, China*. - Journal of Environmental Entomology, 36: 260-264.