

## MORPHOLOGICAL AND BIOLOGICAL DIFFERENCES BETWEEN TWO INVASIVE SPECIES *CORYTHUCHA CILIATA* SAY AND *CORYTHUCHA ARCUATA* SAY (HEMIPTERA, TINGIDAE)

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### Abstract

The research aimed the study of two controversial species in Romania, *Corythucha ciliata* Say (sycamore tiger or sycamore lace bug) and *Corythucha arcuata* Say (oak tiger or oak lace bug) (Hemiptera, Tingidae). Knowing and differentiating the two species is important in order to observe their behavior, the way of damage, but also to be able to find methods to reduce the frequency of attack on plane trees and oak trees. Both insects are aggressive pests, damaging the leaves of trees and leading to their premature defoliation. The research aimed to identify, monitor and differentiate the two species from a morphological and biological point of view. The two species were observed and monitored over two years, 2020-2022, being identified in several locations in Transylvania, on plane (*Platanus* spp.) and oak (*Quercus robur* Linné). Regarding the biological cycle, in the temperate-continental climate of Cluj-Napoca, *Corythucha ciliata* Say develops two generations per year, while *Corythucha arcuata* Say develops three generations per year. The main criterion for differentiating the two species is the color of the ribs and the specific pattern on their wings.

**Key words:** invasive species, lace bugs, morphological differentiation, biological cycle, monitoring

*Corythucha ciliata* Say and *Corythucha arcuata* Say are native to North America (Halbert S, Meeker D., 1998; Cho G *et al*, 2020). The wide distribution of these two species is caused by human activities, the flight of adults and by wind (Rabitsch W., Streito J.C., 2010). Species in the *Tingidae* family are generally small and tend to stay on the underside of leaves. They overwinter as adults. According to the literature, both species overwinter under the bark of trees and can withstand a temperature of -30°C (Malumphy C.P. *et al*, 2007). The number of generations varies from one country to another, according to climatic conditions; for example, in the Wuhan region of China, both species can develop up to 5 generations per year (Xia W.S. *et al*, 2007). Females lay eggs on the underside of leaves, and the incubation period until the first larvae emerge is 25 days (Drew W.A., Arnold D.C., 1977). Larvae go through 5 instars to maturity (Xia W.S. *et al*, 2007). In the case of the two species, both larvae and adults feed on the leaves of the host plants, causing chlorotic spots, and in the case of a severe attack, even their defoliation. In October, when the temperatures start to drop, the adults retreat under the tree bark for the winter (Bălăcenoiu F. *et al*, 2021). The first reporting of the species in Romania was in 1990 for

*Corythucha ciliata* Say, in Craiova (Tatu A., Tăușan I., 2011), and *Corythucha arcuata* Say was identified for the first time in 2015, in the west of the country (Don I. *et al*, 2016). Both species spread quickly, being able to be identified in different areas of Romania: Bucharest (Neacșu I. Roșca I., 2015), Macea (Arad County) (Don I. *et al*, 2016), Timișoara (Timiș County) (Grozea I. *et al*, 2020), Cluj-Napoca (Florian T. *et al*, 2022).

The two species share the same habitat, complicating their identification. The analysis of the morphological characteristics of these two species allows us to discover the strengths of each, to be able to identify them more easily in their natural environment.

### MATERIALS AND METHODS

The purpose of the research carried out during 2020-2022 was: the identification and monitoring of populations of *Corythucha ciliata* Say and *Corythucha arcuata* Say; observations on the host plants from the space analyzed; tracking the biological cycle, the damage mode of the two species and the morphological differentiation. The samples were collected from different locations in Cluj-Napoca, from several plane trees for *Corythucha ciliata* Say, respectively oak for *Corythucha arcuata* Say. In order to be able to

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monitor the biological cycle of the two species, simple adhesive panel traps and repellent adhesive panels were installed. The two species of insects were analyzed with a binocular magnifying glass and photographed, establishing morphological differentiations, for their easier identification.

## RESULTS AND DISCUSSIONS

The first identification of the species *Corythucha ciliata* Say was made in 2020, on August 18, in Chereușa locality (Satu-Mare County), then in Tășnad (Satu-Mare County) and



Figure 1 **Adult of *Corythucha ciliata* Say (original)**

Regarding the species *Corythucha arcuata* Say, it was reported for the first time in 2021 in the Făget forest in Cluj-Napoca (Cluj County), then in 2022 it was identified in Ocna Mureș, (Alba County) on a fruit tree, an apple, *Malus domestica* Linné (figure 3) and in the campus of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, on a solitary oak *Quercus robur* Linné (figure 4). The first traps were installed on 15.06.2022 in the Făget forest in Cluj-Napoca (Cluj County). Adhesive panel traps without pheromones were read 4 days later to monitor the

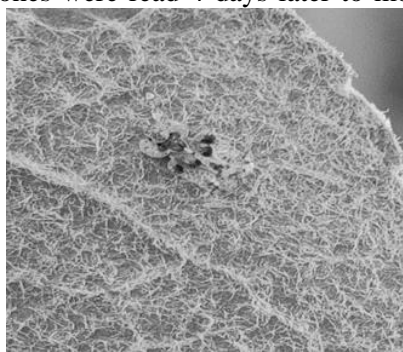


Figure 3 ***Corythucha arcuata* Say on a leaf of *Malus domestica* Linné (original)**

Cluj-Napoca (Cluj County). In 2021, the sycamore tiger was identified in Sibiu (Sibiu County). Research continued from 2020 until now in Cluj Napoca, the species being located in various parks or green areas of the city such as the "Iuliu Hațieganu" Sports Park (figure 1), the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, but also in street alignments on different species of sycamore: *Platanus orientalis* Linné, *Platanus x acerifolia* Willdenow. The first reporting in 2022 was made in the city of Alba-Iulia, on June 6, and specimens of the first and second larvae age can be observed (figure 2).

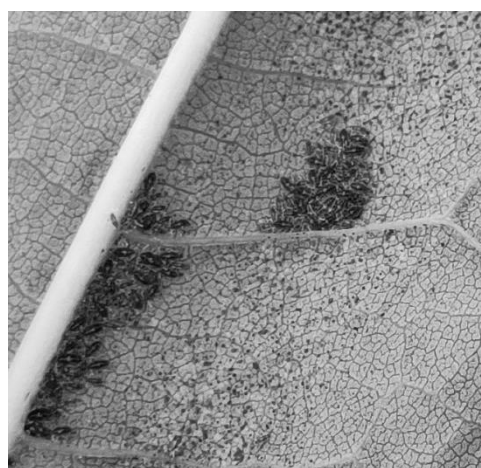


Figure 2 **Larvae of *Corythucha ciliata* Say (original)**

attack frequency. On June 19, a total of 13 adults were captured on the 4 traps. The research continued on the campus of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, on 21.07.2022, traps of different colors (white, yellow, black, blue) were installed on sycamore and oak trees. On 18.08.2022, the traps with adhesive panels were replaced with adhesive traps with repellent (figure 5), and the results are presented in the tables below (table 1 and 2).



Figure 4 **Eggs, larvae and adults of *Corythucha arcuata* Say on a leaf of *Quercus robur* Linne (original)**



Figure 5 Pheromone adhesive traps installed on *Quercus robur* Linné (original)

Tabel 1

Numerical density of *Corythucha arcuata* Say individuals on adhesive panel traps (Cluj-Napoca, 2022)

<i>Corythucha arcuata</i> Say - <i>Quercus robur</i> Linné (A= adults)			
The color of the panels	Panels with adhesive		Panels with adhesive and repellent
	No. of specimens 18.08.2022	No. of specimens 09.09.2022	No. of specimens 09.09.2022
Blue	184 A	264 A	169 A
Black	211 A	146 A	178 A
White Yellow	324 A	457 A	298 A
Yellow	182 A	239 A	335 A

Tabel 2

Numerical density of *Corythucha ciliata* Say individuals on adhesive panel traps (Cluj-Napoca, 2022)

<i>Corythucha ciliata</i> Say - <i>Platanus x acerifolia</i> Willdenow	
The color of the panels	Panels with adhesive
	No. of specimens 09.09.2022
White	27 A
Blue	6 A
Yellow	13 A
Black	7 A

Regarding the biological cycle, following research carried out in 2020-2022 in Cluj-Napoca (Cluj County) in the "Iuliu Hațieganu" Sports Park, through visual control and the use of colored adhesive traps, it was found that in the temperate climate mainland from Cluj-Napoca, *Corythucha ciliata* Say has 2 generations per year. The first generation appeared in May-June, with the increase in temperature, and the second generation towards the end of August and the beginning of September.

Regarding the second species, *Corythucha arcuata* Say, the biological cycle is similar to that of the sycamore tiger, having 3 generations per year. The first generation develops in May-June, the second in June-July and the third in August-September.

The two species were examined under a magnifying binocular glass to be able to achieve morphological differentiation.

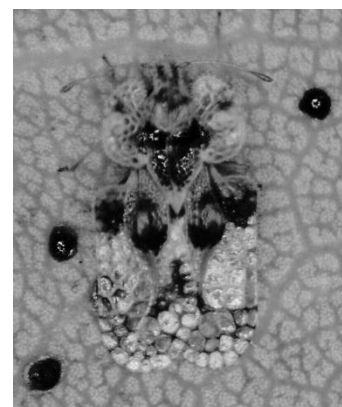


Figure 6 *Corythucha arcuata* Say (original)

The main criterion for differentiating the two species is the color and pattern on the wings. The transverse veins of the apex are strongly highlighted in *Corythucha arcuata* Say (figure 6), while the apex, base and pronotal margins are whitish in *Corythucha ciliata* Say (figure 7), except for two brown spots in the medio-ulnar

area. Both species are flattened dorso-ventrally, and the pronotum is prominent, forming a "hood-like structure", thus covering the head of the insect, which has a dark-brown color in the case of the species *Corythucha arcuata* Say. Differences can also be observed in the size of the two species; the length of *Corythucha arcuata* Say varies between 3-3.5 mm and the length of *Corythucha ciliata* Say is 3-6 mm.

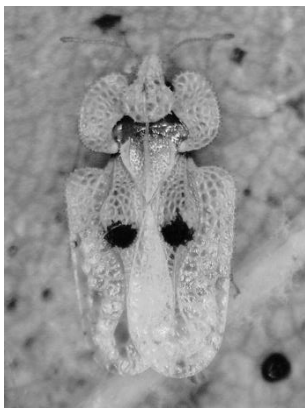


Figure 7 *Corythucha ciliata* Say (original)

## CONCLUSIONS

Following the research carried out in 2020-2022, the invasive species *Corythucha ciliata* Say and *Corythucha arcuata* Say were identified in several locations in Transylvania: Chereușa (Satu-Mare County), Tășnad (Satu-Mare County), Cluj-Napoca (Cluj County) in 2020, Sibiu (Sibiu County) in 2021, Alba Iulia (Alba County) in 2022 and Ocna Mureș (Alba County) in 2022. Following field sampling, the maximum number of captures of on adhesive panels was 457 adults for *Corythucha arcuata* Say and 27 adults of *Corythucha ciliata* Say. Regarding the biological cycle of the two species, in the temperate-continental climate of Cluj-Napoca, *Corythucha ciliata* Say has 2 generations per year, and *Corythucha arcuata* Say has 3 generations per year. According to the examinations carried out with binoculars, the strong criterion for morphological differentiation of the two species is the color of the wings and the size of the adult.

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