

## A REVIEW OF THE SIX-DENTATE BARK BEETLES (*PITYOGENES CHALCOGRAPHUS*: *CURCULIONIDAE*: *SCOLYTINAE*) ATTACK ON PINE TREES IN ROMANIA AND SPAIN

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**Abstract.** *Pityogenes chalcographus* is among the most frequent species that cause significant damage to conifers, being an oligophagous species, besides *Picea* trees, being frequent on *Pinus* sp., *Larix* sp. or *Pseudotsuga* sp. In Romania it is considered a secondary pest, the attack being most often associated with another bark beetle, in Spain however, it is mentioned as an invasive species, being mentioned recently, on relatively small areas. In the western part of Romania, the species is common in conifer stands from forests, but our research highlights its presence in the green areas of Timișoara's landscaping (University of Life Sciences Park), on white pine. In the Madrid area, the species has a secondary value, being mentioned in overpopulated or ecologically stressed stands (bibliographic analysis).

**Keywords:** *Pityogenes chalcographus*, *Curculionidae*, *Scolytine*, pine trees, Romania, Spain

### INTRODUCTION

During the period 2021-2022, a study was carried out that aimed to highlight the diversity of harmful insect species present in the landscaping of Timișoara, focusing on the University of Life Science "King Mihai I" Park. During this study, the attack produced by the species *Pityogenes chalcographus* (*Coleoptera*: *Curculionoidea*) was observed on the trunk of *Pinus strobus* trees. In this context, this paper is a review that presents actual information on *Pityogenes chalcographus* damage and ecological performance under ever-changing climatic conditions. The main objectives pursued were to emphasize the importance of the pest, highlighting the attack on pine species, by destroying the ornamental value in urban habitats.

Scolytids (*Coleoptera*: *Curculionoidea*) are one of the most important groups of bark beetles, commonly found in forest ecosystems (CHARARAS, 1962), but in the last 10 years they have also been reported in urban landscaping areas, causing significant damage. Globally, more than 5812 species of insects belonging to this subfamily are known, grouped in 250 genera and 25 tribes (ALONSO-ZARAZAGA & LYAL, 2009; BIEDERMANN et al, 2019; GOMEZ DE DIOS et al., 2020), of which 104 species are reported in Romania (OLENCI et al., 2014), and about 150 such species in Spain (ALONSO-ZARAZAGA et al., 2017). They are mostly secondary pests, developing under natural conditions in injured or nutritionally deficient trees, but in certain climatic conditions they can also attack healthy trees (WOOD, 1982).

The species belonging to the *Pityogenes* genus distinguished from the other species by the relatively small size, 1.5-3.5 mm; the longitudinal ridge on the second half of the pronotum and the number of spines on the elytral declivity of males with 1-3 spines. (Avtzis et al., 2010)

*Pityogenes chalcographus* is one of the most abundant and frequent species in European forests (KULINICH & ORLINSKII, 1998). Usually considered the second most important insect pest of spruce in Central Europe, after *Ips typographus* (GRODZKI, 1997), which preferentially attacks conifer species, in addition to the species of *Picea*, being those of

the genera *Larix* sp., *Pinus* sp. and *Pseudotsuga* sp. which can serve as hosts (PFEFFER, 1995; ISAIA & PARASCHIV, 2011)

### MATERIAL AND METHODS

The experiment was set up in University of Life Science "King Mihai I" Park (Timișoara, Romania) (45°78'28" latitude and 21°21'56" longitude, altitude of 90 m above sea level). To identify the species of bark beetles, the coniferous trees on the site were investigated, as follows: *Abies alba* Miller, *Picea pungens* Engelm, *Pinus nigra* Arnold, *Pinus strobus* L., *Pinus sylvestris* L. Insects were collected using a usual methods, among which the most common was the visual method, that of direct observations (Figure 1).



Figure 1. Photos from the site investigation time (direct observation)

1.5 m long sections of eastern white pine trunks were analyzed from felled trees. Sections were numbered and marked. Bark beetle presence was determined from the number of entrance and exit holes. Three control points were chosen on both the sun-exposed and shaded sides of each section, at 30 cm from the top, in the middle and 30 cm from the bottom of the section (ie 6 seats per section). For each section the holes were counted, the section was debarked, the phloem quality was described and the galleries were examined. The total number of analyzed sections was 30 (KULA et al., 2013).

The study was carried out over a short period of time, October - November 2022, in addition to the data collected from the experimental site, information was used from the literature, but also from the Entomology discipline of USVT, provided by one of the co-authors. In the case of distribution in Spain, the information is entirely from the literature.

### RESULTS AND DISCUSSION

A total of 26 specimens of *Pityogenes chalcographus* (table 1) were identified on *Pinus strobus* trees during this study, 15 specimens in the sun-exposed sides of the trunk and 11 in the shaded sides.

Table 1.

Selected data on *Pityogenes chalcographus* from University of Life Science "King Mihai I" Park

	Sun-exposed sides of section			Shaded sides of section		
	*T	**M	***B	*T	**M	***B
No. of section with <i>Pityogenes chalcographus</i>	15			11		
Average no. of galleries/ section	3	5	10	5	3	6
Average no. of enter holes	5	5	8	2	0	4
No sign of infestation	3			1		

\*T - 30 cm top of the section

\*\* M – middle of the section

\*\*\* B – 30 cm bottom of the section

Several relationships between the number of *P. chalcographus* and the location of the trunks were found. The most favorable conditions for the species occurred in the bottom, sun-exposed section of the trunk. In 2022, the average number of galleries/ section was the highest (n=10) on the bottom layer of the sun-exposed sides of trunk and the lowest (3) on the bottom layer, both on sun and shaded sides of trunk. Also a significant difference was recorded between the middle and the bottom layer.

Numerous studies conducted by KULA et al. (2013), FIALA & HOLUŠA (2022), have highlighted the dependence relationship between the microclimate conditions and the bark beetles attack preferences. The present research pointed out that there is a relationship between the place of exploitation and the activity of species. These results are in accordance with those obtained by KACPRZYK (2012) who highlighted the direct impact of forest residues exploitation methods and mass reproduction in the species.

#### **Bionomics of *Pityogenes chalcographus***

*Pityogenes chalcographus* feeds under the bark of the branches of *Picea abies*, and on other several pine species. The species is a widely distributed pest in Europa (from Scandinavia to the Balkans), the natural distribution coincides with that of its main host tree, *P. abies* (KNIZEK et al., 2005; AVTZIS et al., 2008). The larval corridors are long and sparse (SCHROEDER, 2001, BOUGET AND DUELLI, 2004). Mass outbreaks are often in concert with *Ips typographus* (Coleoptera: Scolytinae). It has one generation per year, rarely 2 generation/ year (depending on the weather). Polygamous species forms a nuptial chamber where copulation takes place. Later they dig 3-8 larval galleries (figure 2), starting from the nuptial gallery, but also numerous star-shaped feeding galleries (BROWNE, 1968).

Morphologically, the adults are shiny and elongated with a body length range from 1.6- 2.9 mm, and black or bicolored, with black in front and red-brown on the latter half color. Males have three pairs of conical spines on the elytral declivity, whereas in females they are replaced by small knobs; females have a deep depression in the center of the frons, that is absent in males (AVTZIS et al., 2008).



Figure 2. Gallery systems of the bark beetle *Pityogenes chalcographus* on *Pinus strobus* trunks

### CONCLUSIONS

*Pityogenes chalcographus* is of major importance in urban green landscaping where numerous conifer species are found. Occupies trees that have been damaged, debilitated, preferring the sunny area of the trunks. Future research must be undertaken to follow the evolution of the attack on other *Pinus* species as well.

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