

Research Article

A new threat to fig trees in Türkiye: the first record of *Aclees taiwanensis* Kôno, 1933 (Coleoptera: Curculionidae)

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Abstract

Insects play critical roles in ecosystems but can become invasive species due to human activities. This study reports the first record of an invasive insect species, *Aclees taiwanensis* Kôno, 1933 (Coleoptera: Curculionidae), in Türkiye. Originally from Taiwan, this species has been recorded in Europe since 1997 and causes damage to fig trees (*Ficus* spp). It was detected on fig trees (*Ficus carica*) on the 1st of October, 2024, in Sarıyer-Bahçeköy, İstanbul. Although the exact pathway of its introduction remains unknown, it is suspected to have spread through local nurseries and landscaping activities. Türkiye is the world's largest fig producer, with a production of 356.000 tons in 2023. *Aclees taiwanensis* has the potential to spread, particularly in warm and temperate regions where the Mediterranean climate prevails. Due to globalization and climate change, the spread of such invasive insects is increasing. Therefore, monitoring and controlling the spread of *A. taiwanensis* is of great importance.

Key words: fig weevil, *Ficus carica*, invasive insects, fig production, Mediterranean, xylophagous

Introduction

Insects, with over one million species worldwide, constitute the most biologically diverse group of organisms and play critical roles in ecosystem functioning (Stork 2018). Insects are indispensable for ecosystem sustainability, as they perform vital functions such as pollination, decomposition of organic matter, and the maintenance of food chains (Losey and Vaughan 2006). However, human activities such as agriculture, trade, and travel are causing insects to move from natural habitats and to the new environments, resulting in the emergence of invasive species and the disruption of local ecosystem balance (Hulme 2009). Particularly, phytophagous insect species can be transported to new habitats through the movement of agricultural crops, wooden products, and ornamental plants used for landscaping. Due

to their ability to adapt to suitable biotic and abiotic conditions, they may find opportunities to proliferate in these new environments (McNeely et al. 2001; Hızal et al. 2015).

When environmental conditions are favorable—especially in the absence of predators or parasites—insects have the potential for excessive reproduction. If resources such as temperature, humidity, food, and suitable vegetation are sufficient, insect populations can grow exponentially (Çanakcıoğlu 1968). At this point, the issue of invasiveness arises. A biological invasion occurs when a species, mostly due to human activities, is successfully transported outside its natural range, establishes itself, and spreads (Diagne et al. 2020).

It is well known that invasive species are among the greatest threats to the environmental health and economic well-being of our planet. These species have negative impacts on economic products. Weeds reduce crop yields, causing financial losses, and in freshwater ecosystems, they narrow the area of water capture units, leading to a decrease in water resources. Pathogens that harm agricultural crops, livestock, and forests either directly damage plants, cause illness in animals, or decrease productivity, leading to higher pest control costs (McNeely et al. 2001). The economic cost of biological invasions to the global economy between 1970 and 2017 was 1.288 trillion USD, with the annual cost in 2017 calculated at 162.7 billion USD (Diagne et al. 2021). And the invasions fundamentally alter the world's biota, changing the roles of species within living communities, disrupting evolutionary processes, and causing radical changes in species richness, including species extinctions. This is considered the most significant threat to biodiversity after habitat destruction (Mack et al. 2000). Moreover, invasive species are widespread drivers of global change, causing significant ecological (e.g., biodiversity loss, disruption of ecosystem functioning), health (e.g., disease transmission), and social (e.g., decline in quality of life) damages worldwide (Diagne et al. 2020).

Türkiye consists of three different bioclimatic and biogeographic regions, along with its diverse topographic, geological, geomorphological, soil, and aquatic habitats, enhances ecosystem and species diversity (Kurtonur et al. 1996). Additionally, Türkiye's location at the intersection of the Asian and European continents has made it a central route for trade and economic activities since ancient times (Çelik 2020). These two factors indicate that Türkiye is particularly vulnerable to invasive species (TOB 2024). Within the scope of the "Assessment of the Threats of Invasive Alien Species in Terrestrial and Inland Water Environments in Türkiye" (TERIAS) project, 156 invasive species have been identified in Türkiye (TOB 2024), 13 of which belong to the order Coleoptera (Kekillioğlu and Bıçak 2024).

Türkiye's ecosystem and habitat diversity, along with its climatic characteristics, have increased the number of cultivated fruit species, leading to an abundance of fruit varieties. Today, the number of apple varieties in Türkiye exceeds 500, pear varieties 600, plum varieties 200, peach varieties 100, and grape varieties 1,200 (Durmuş and Yiğit 2003). In 2021, a total of 747.8 million tons of fresh vegetables and fruits were produced worldwide on 56.3 million hectares. That same year, Türkiye accounted for 2.5% of global fresh fruit and vegetable production, ranking fifth in the world (Aygören 2023). Türkiye is the world's leading producer of figs (*Ficus carica*), one of the crops for which it is the center of origin. According to 2023 data, approximately 1,319,000 tons of figs were produced worldwide, with 356,000 tons (about 27%) produced by Türkiye (FAO 2025). According to the Turkish Statistical Institute (TÜİK), fig production in Türkiye reached 375,000 tons in 2024 (TÜİK 2024).

Aclees taiwanensis Kôno, 1933 (Coleoptera: Curculionidae: Molytinae) initially introduced to France from Taiwan via bonsai trees in 1997, *A. taiwanensis*, commonly known as the fig weevil, was mistakenly identified as *Aclees cribratus* (Perrin 1997). It was later correctly identified as *A. taiwanensis* in Tuscany, Italy, by Ciampolini et al. (2005). The species was subsequently reported in South Korea in 2020 (Hong et al. 2020), Slovenia in 2023 (Alonso-Zarazaga et al. 2023), and Poland in 2023 (Mazur et al. 2024). Although it was detected in Germany the same year, it failed to establish due to the cold climate (EPPO 2023).

Aclees taiwanensis is an oligophagous species that feeds on fig trees (*Ficus* spp.). In Italy, adults have been reported to remain active year-round. While the larvae cause damage by feeding on the wood (xylophagous), adults feed on buds, leaves, and ripening fruits (Farina et al. 2021). The larvae feed on live wood at the base of the tree trunk and surface roots, creating feeding galleries. By obstructing phloem flow, they weaken the tree and eventually cause its death. While young saplings may host up to six larvae, mature trees can contain as many as 40 larvae (Lionel and Tamisier 2023). The time from egg to adult varies between approximately 9 to 16 weeks depending on temperature. This process consists of five larval stages lasting 41 to 77 days and a pupal stage lasting 23 days (Bassi et al. 2021). Adult activity peaks twice a year, in June and September. Additionally, a single female can lay an average of 116 eggs (minimum 56–maximum 186). The species overwinters by hiding in soil, bark crevices, or inside plants as larvae or pupae. Under laboratory conditions, an adult's lifespan can reach approximately three years (Farina et al. 2021).

In this study, *A. taiwanensis* (Coleoptera: Curculionidae), an invasive species that damages fig trees and is of significant concern for Türkiye, the world's leading fig producer, has been identified and recorded for the first time in Türkiye.



Figure 1. The recorded locality of *Aclees taiwanensis* Kôno, 1933

Materials and methods

Aclees taiwanensis was first detected on fig tree (*Ficus carica*) in Istanbul (Sariyer, Bahçeköy) at the coordinates 41,177991N, 28,992586E on the 1st of October, 2024 (Figure 1). The samples have been regularly collected from affected trees. And the other areas with insect have also been surveyed, and photographs have been taken as well from October 1 to the end of the October. The weevils were collected from the leaves and stems by hand and transferred into glass jars, then brought to the laboratory for species identification. The collected insect specimens were identified under a stereomicroscope, morphologically using Triplehorn and Johnson (2005) and Meregalli et al. (2020) sources. The specimens are kept in the collection of the Department of Forest Entomology and Protection, IUC Faculty of Forestry, Sariyer, Istanbul.

Istanbul's annual average temperature is 15.3 °C, average maximum temperature 19.4 °C and the minimum average temperature 12 °C, the average number of rainy days is 116, and the average precipitation amount is 661 mm between 1950 and 2024 (MGM 2025). The area exhibits the characteristics of the Mediterranean climate in terms of these meteorological features (Baydar 1994).

Results and discussion

Totally, 41 adult specimens were found on six different fig trees of varying ages within five localities in Bahçeköy (Table 1). All host trees on which *A. taiwanensis* was detected were *Ficus carica*. Adult feeding damage was observed on the leaves, while larval activity was evident through exit holes

Table 1. Collection sites of captured individuals.

Longitude, N	Latitude, E	Specimen Collection Date	Number of Specimens	Habitat and Host Plant
41,177991,	28,992586	01.10.2024	3	Garden in University Campus, <i>Ficus carica</i>
		08.10.2024	6	
		15.10.2024	3	
41,175070	28,992128	03.10.2024	2	Garden in University Campus, <i>Ficus carica</i>
		08.10.2024	2	
41,179401	28,992954	04.10.2024	1	Roadside, <i>Ficus carica</i>
41,179109	28,991353	08.10.2024	2	Roadside, <i>Ficus carica</i>
41,179018	28,991104	08.10.2024	8	Garden, <i>Ficus carica</i>
		12.10.2024	7	
		15.10.2024	4	
		24.10.2024	3	


Figure 2. *Aclees taiwanensis* Kôno, 1933 (Coleoptera: Curculionidae: Molytinae). a) Adult fig weevil's damage on the leaf, b) Mating adult fig weevils on the branch c) Mating adult weevils on the stem, d) Fig weevil's damage on the stem. Photographs by Ergün BACAK.

on the trunk and frass accumulation on the bark and the soil surface (Figure 2). According to our observations, so far, we have not found *A. taiwanensis* anywhere else except in Bahçeköy. Although there is no information on how and when the species was introduced to Istanbul, Sarıyer, numerous nurseries and plants used in landscaping are present in the vicinity of the detection site. However, there is a possibility that *A. taiwanensis* was introduced into these nurseries through exotic species imported from abroad.

Figs are predominantly cultivated in regions characterized by a Mediterranean climate. Although Türkiye has extensive fig plantations, there are significant variations in soil properties and climatic conditions across different cultivation areas (Arpacı et al. 2018). Farina et al. (2021) reported that *Aclees taiwanensis* infests four fig species (*F. pandurata*, *F. microcarpa*, *F. benjamina*, and *F. carica*), with fig trees generally being susceptible to its damage. However, the study revealed that the insect is able to complete its life cycle only on *F. carica* and *F. microcarpa*, causing the most severe damage to *F. carica*. Based on these findings, Mediterranean countries in Europe appear to be particularly vulnerable to the invasion of *A. taiwanensis*. As a Mediterranean country and the native range of figs, Türkiye cultivates figs in almost every region. In 2023, Türkiye, one of the world's leading fig producers, recorded a fig production of 356,000 tons (FAO 2025) and fig exports worth 339 million USD (TİM 2024). In this regard, *A. taiwanensis* has the potential to become a significant economic pest for Türkiye's fig industry.

Although *A. taiwanensis* has so far been observed only on fig trees in İstanbul, Sarıyer, Bahçeköy, it is uncertain how its population trend will evolve in the future, depending on its invasive capacity. However, the species could be particularly dangerous in regions with a Mediterranean climate, especially in mild areas where figs are widely cultivated. In recent years, climate change and globalization have significantly increased the introduction of hazardous alien species from subtropical and tropical regions into temperate zones (Tani et al. 2023).

According to Farina et al. (2021) no method for the control of the fig weevil has proven effective. In fact, knowledge about the insect's biology and behavior is primarily based on observations of adult specimens collected in the field, while information on its larval stages remains limited. However the populations of *A. taiwanensis* in İstanbul must be closely monitored in the coming period, and measures should be taken to prevent its spread to other regions.

Authors' contribution

Sample collection were done by Ergün BACAK, Vedat Beşkardeş. The species were identified by Ergün BACAK. Interpretation of results and initial writing and editing of this manuscript were done by all authors. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest/Declaration of interests

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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