

First report of *Thanasimus femoralis* (Zetterstedt, 1828) (Coleoptera: Cleridae) in forest nursery in the Western Black Sea Region of Türkiye

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Citation: Öztürk N., Yüksel B. (2023): First report of *Thanasimus femoralis* (Zetterstedt, 1828) (Coleoptera: Cleridae) in forest nursery in the Western Black Sea Region of Türkiye. J. For. Sci., 69: 360–365.

Abstract: In this study, the first observation of *Thanasimus femoralis* was conducted in Türkiye. Adults of *T. femoralis* and *Thanasimus formicarius* were collected from pheromone traps together with *Ips sexdentatus*, *Ips acuminatus*, *Ips mannsfeldi*, and *Scolytus intricatus* in forest nurseries located in the Western Black Sea Region, between 2021 and 2022. The clerid and bark beetles were morphologically described. The aedeagus and antennae of *T. femoralis* were observed by scanning electron microscopy.

Keywords: clerid beetle; Curculionidae; forest nursery; pheromone trap; predator

Bark beetles (Coleoptera: Curculionidae, Scolytinae) are among the most destructive insects of forest products and cause significant ecological and economic damage (Knížek, Beaver 2004; Byers 2012; Lindgren, Raffa 2013). These beetles are a well-known and diverse subfamily of weevils that occur in all regions of the world (Raffa et al. 2015).

Natural enemies such as predators, parasitoids and pathogens play an important role in pest population regulation (Kirisits 2004; Vega, Kaya 2012). Predators can feed on many individual prey on the bark surface and beneath the bark during their lifetimes (Wegensteiner et al. 2015; Khanday et al. 2018). Clerid beetles are the most impor-

tant coleopteran predators and act as a biological control agent against bark beetles (Costello 2003; Schroeder 2003; Akbulut et al. 2005; Özcan, Koçoğlu 2018). Species of the genus *Thanasimus* (Latreille, 1806) (Coleoptera: Cleridae) are considered to be among the most efficient predators of bark beetles (Gerstmeier et al. 2019). Both *Thanasimus formicarius* (Linnaeus, 1758) and *Thanasimus femoralis* (Zetterstedt, 1828) [syn. *Thanasimus rufipes* (Brahm, 1797)] are mostly distributed in the Palearctic region (Wegensteiner et al. 2015) and most reported predators of *Ips typographus* (Linnaeus, 1758) in Europe (Bakke, Kvamme 1981). *Thanasimus* predators respond to the aggregation

Supported by Düzce University, Research Fund Project No. 2020.02.02.1144.

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<https://doi.org/10.17221/50/2023-JFS>

pheromone of bark beetles (Bakke, Kvamme 1978, 1981; Hansen 1983). The bark beetle predators are known to use these pheromone components as a kairomonal response (Hansen 1983).

In the present study, *T. femoralis* was reported for the first time in the Western Black Sea Region of Türkiye in 2022.

MATERIAL AND METHODS

The main objective of this study was to determine the insect species in forest nurseries in the Western Black Sea Region of Türkiye. For this purpose, five different provinces (Düzce, Bolu, Zonguldak, Kastamonu, and Sinop) and seven different forest nurseries were selected as study areas. Three pheromone traps were established for each forest nursery and inspected periodically from April to September during 2021 and 2022. Insect samples were caught with pheromones (ipsenol and 2-methyl-3-buten-2-ol and α -pinene) in areas of the Muzaffer Büyükerzi Forest Nursery of Kastamonu Regional Directorate of Forestry (41°24'17.58"N, 34°22'29.03"E, 1 170 m a.s.l.) in June 2022. Several types of plants, such as *Pinus nigra* Arnold, *P. sylvestris* L., *Picea orientalis* (L.) Link, *P. abies* (L.) H. Karst., *Acer pseudoplatanus* L., *Betula pendula* Roth., *Fraxinus excelsior* L., *Echinacea purpurea* L., *Salvia officinalis* L. are produced in this nursery. Predator and Scolytinae species were collected from pheromone traps. The insects were placed in a plastic container and taken to Düzce University for identification.

Specimens were observed and photographs were taken using an Olympus SZ-51 (Olympus, Japan) and Nikon SMZ 745T microscope (Nikon, Japan), Nikon DS-Fi-1 camera (Nikon, Japan). The aedeagus and antennae of both sexes of *T. femoralis* were examined with an FEI Quanta FEG 250 set (FEI Company, The Netherlands) at 20 kV. The specimens were removed out with fine forceps under a stereomicroscope (Olympus SZ-51) and washed 3–4 times with distilled water. The aedeagus was heated in a 10% solution of KOH in a beaker until soft. Before examination, it was dehydrated in an ascending alcohol series of 75%, 80%, 85%, 90%, and 100% for 10 min each and observed by scanning electron microscopy (SEM).

Identification of the specimens was made according to the literature of Freude et al. (1979, 1981), Grüne (1979), Kolibac (1992), Selmi

(1998), Aksu (2011), Thomaes et al. (2017), and Gerstmeier et al. (2019).

RESULTS AND DISCUSSION

As a result of this study, *T. formicarius* and *T. femoralis* were collected from pheromone traps together with bark beetles species. In total, 36 *Thanasimus* individuals were captured in pheromone traps. A total of 14 individuals were *T. femoralis*. The four bark beetle species *Ips sexdentatus* (Boerner, 1767) (Coleoptera: Curculionidae: Scolytinae), *Ips acuminatus* (Gyllenhal, 1827), *Ips mannsfeldi* (Wachtl, 1879) and *Scolytus intricatus* (Ratzeburg, 1837) have been found in forest nurseries in the Taşköprü district of Kastamonu Province.

The shape of the body and colouration of *T. femoralis* strongly resemble those of *T. formicarius*, except that the upper part of the elytra is directly bordered with a white band at the upper edge (Figure 1B).

Furthermore, the ventral side of the thorax in *T. femoralis* is black, while that of *T. formicarius* has a red-brown underside (Figure 1C–D). Adults of *T. femoralis* have brown legs and antennae and are about 5.5–8.5 mm in length. SEM analysis revealed morphological similarities for female and male antennae of *T. femoralis* (Figure 2).

The aedeagus of *T. femoralis* was examined with SEM (Figure 3). The tegmen (Figure 3C) is U-shaped and widest in the middle. The apex of the phallus (Figure 3B, D) is slender and shorter than the tegmen, the phallic plates are flattened, and spinous on the distal margins (Figure 3D).

The genus *Thanasimus* is distributed in Europe, Asia and Africa (Kolibac 1992; Löbl, Smetan 2007). *T. femoralis* is distributed in Europe, North Africa, and Asia (Löbl, Smetan 2007; Doychev, Ovcharov 2008; Farashiani et al. 2022). This is the first report of *T. femoralis* from Türkiye. The new observation in Türkiye shows that the species has been expanding its range.

Adults and larvae of the genus *Thanasimus* are predators of the bark beetle (Dippel et al. 1997; Kenis et al. 2004; Thomaes et al. 2017; Zhang et al. 2021). In previous studies, adults of *T. formicarius* were found to be effective in different developmental periods of *I. sexdentatus* (Özcan, Koçoğlu 2018). Also, male and female adults of *T. femoralis* were found to be effective predators of spruce bark beetles, *Ips typographus* (Linnaeus, 1758) (Rettelbach 1994). In laboratory experiment, the effect of the preda-

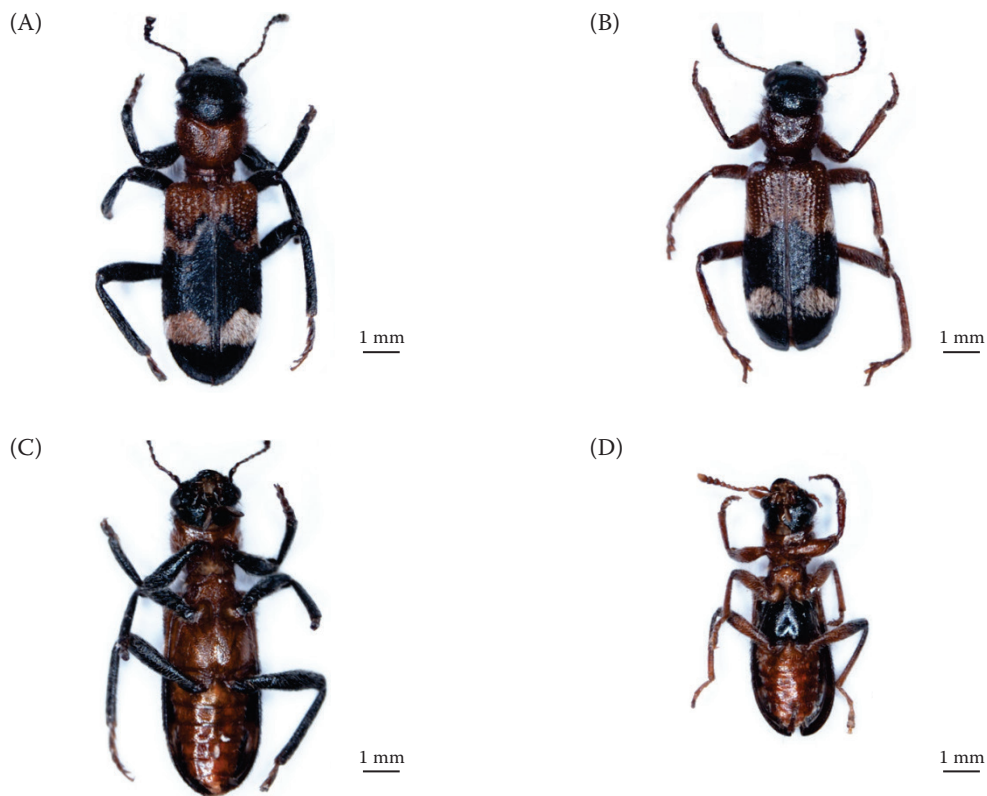


Figure 1. (A–B) Dorsal view of *T. formicarius* and *T. femoralis*; (C–D) ventral view of *T. formicarius* and *T. femoralis* (scale bar = 1 mm)

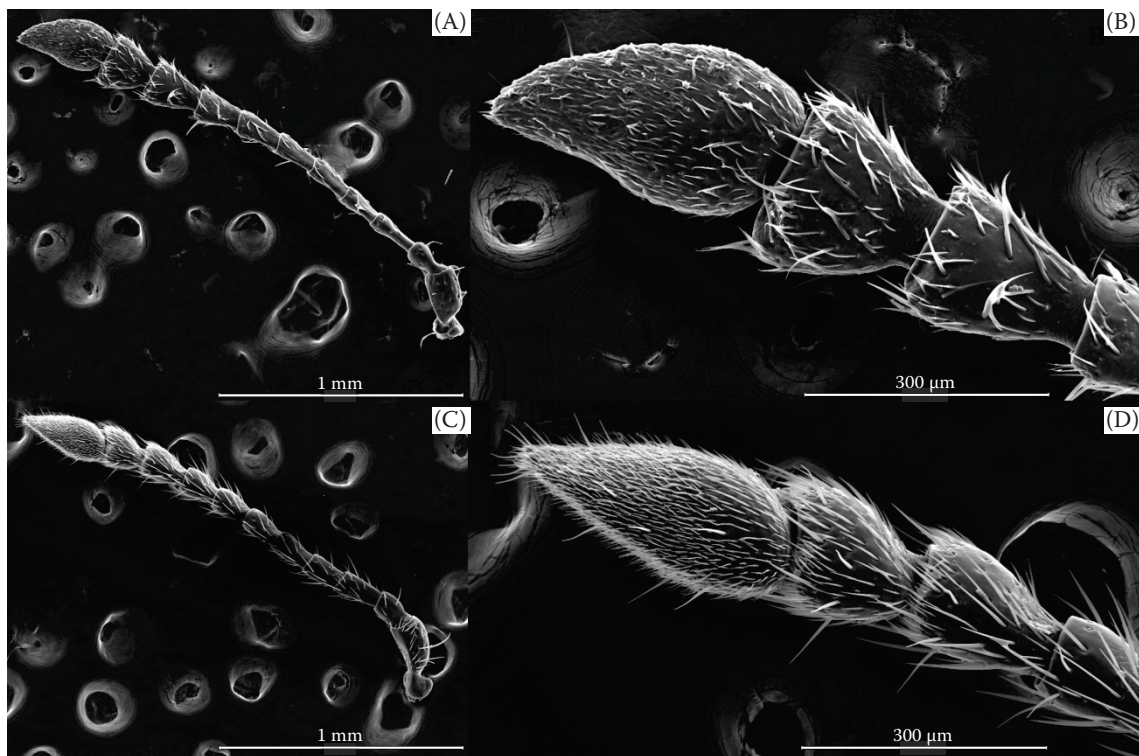


Figure 2. (A–B) Antenna of an adult female; (C–D) antenna of an adult male

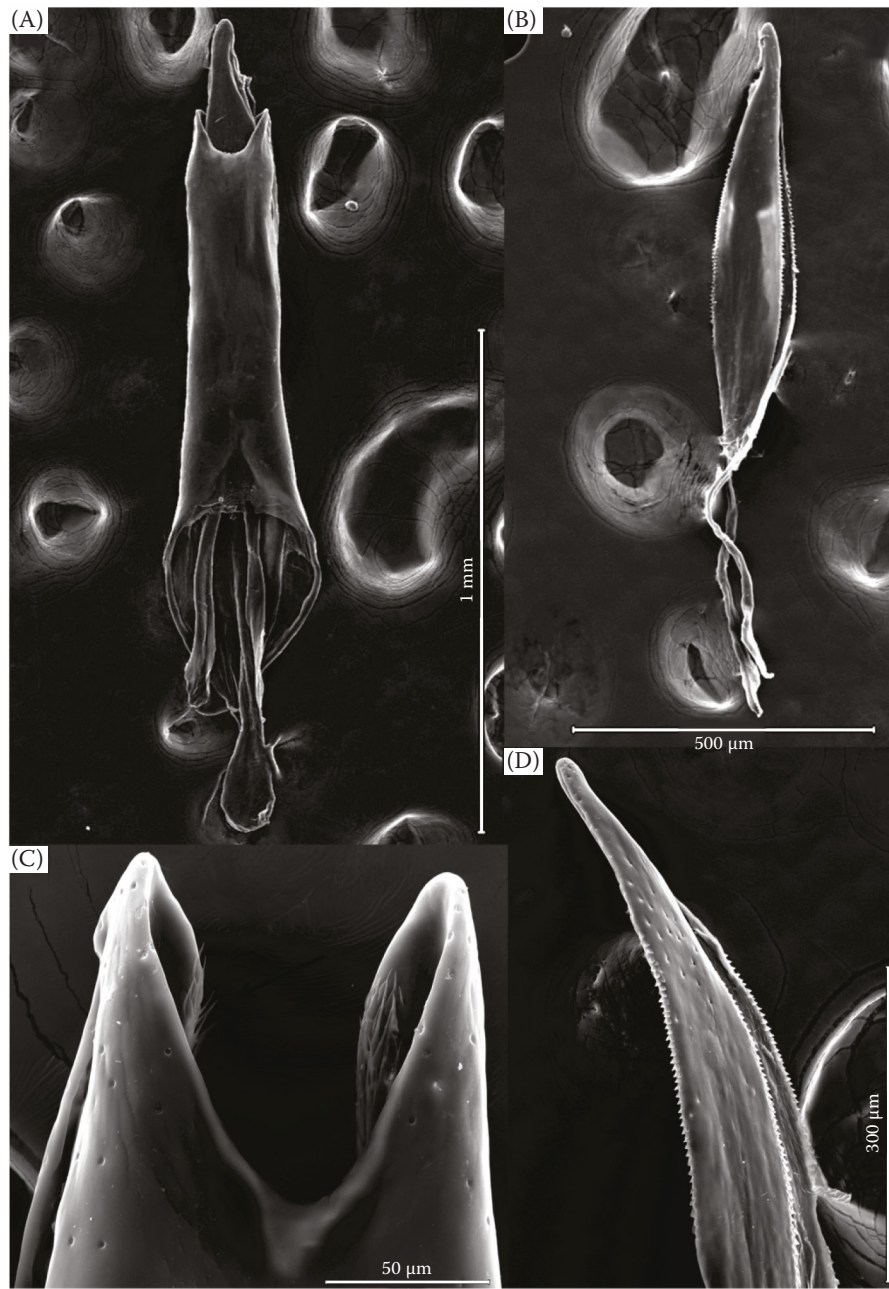


Figure 3. *Thanasimus femoralis*: (A) ditto in ventral view; (B, D) phallus in lateral view; (C) tegmen tip ventral

tory *T. formicarius* on the larval mortality of *I. typographus* was estimated at 18% (Mills 1985).

It is thought that the discovery of *T. femoralis* will play a significant role in the biological control of the bark beetle in Türkiye. The new record shows how well *T. femoralis* would be a feasible alternative to *T. formicarius* for biological control of bark beetles.

Acknowledgement: The authors greatly acknowledge the help of Asst. Prof. Dr. İsmail Baysal for their valuable efforts in the study.

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Received: April 27, 2023

Accepted: June 12, 2023

Published online: August 8, 2023