Ann. For. Res. 57(1): 87-95, 2014
DOI: 10.15287/afr.2014.196

ANNALS OF FOREST RESEARCH
www.afrjournal.org

First report of three scolytid species (Coleoptera: Curculionidae, Scolytinae) in Romania

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Olenici N., Knížek M., Olenici V., Duduman M.-L., Biriș I.-A., 2014. First report of three scolytid species (Coleoptera: Curculionidae, Scolytinae) in Romania. Ann. For. Res. 57(1): 87-95, 2014.

Abstract. Scolytids constitute an insect group of forest ecosystems that is very important both ecologically and economically, and which has been well studied in most European countries. However, new species are found quite often, especially in regions searched less intensively to date. In this paper three species of scolytid fauna not previously known in Romania are reported for the first time: *Trypodendron laeve, Xylosandrus germanus* and *Hylastes linearis*. Individuals of all three species were collected in the north-eastern part of Romania. *T. laeve* was found only in natural coniferous forests, at altitudes above 1230 m and in association with *T. lineatum*, but in much lower abundance. The Asian species *X. germanus* was found in an old beech forest situated at a much higher altitude (760-900 m) than observed in western and central Europe. The third species, *H. linearis*, was captured as a single specimen in a plateau region (375 m).
Keywords *Hylastes linearis*, *Trypodendron laeve*, *Xylosandrus germanus*, new records, Romanian fauna, alien invasive species.

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Manuscript received May 18, 2014; revised July 02, 2014; accepted July 08, 2014; online first July 09, 2014.

Introduction

Scolytid bark and ambrosia beetles constitute an essential structural and functional component of the forests, occupying a distinct position in the saproxylic food web of these very complex ecosystems (Stokland 2012). They initiate the process of decomposition of bark and wood tissues by feeding on them directly, and also by facilitating penetration by other in-

sects, fungi and bacteria (Kirisits 2004, Persson et al. 2011, Hulcr et al. 2012, Stokland & Siitonen 2012, Six 2013). While a few species are important pests (Postner 1974), some are even regarded as keystone species in forest ecosystems (Müller et al. 2008).

Given their importance, the scolytids have been studied for long time and quite intensively. As a consequence, they are relatively well known, especially in North America and Europe (Wood 1982, Pfeffer 1995, Knížek & Beaver 2007). However, even in countries with long traditions of entomological research, new species continue to be described and species that have been overlooked to date, or which have only recently arrived from abroad, are still found (Kirkendall et al. 2008, Faccoli et al. 2009, Kirkendall & Faccoli 2010, Faccoli & Sidoti 2013).

Romania has enjoyed a good entomological tradition since the middle of the 19th century, when a list of 29 scolytid species found in Transylvania was first published (Bielz 1851), followed by a second list containing 43 species (Bielz 1887). Just 25 years later, a total of 58 species were known for the same historical province (Petri 1912), compared to only 20 species reported for the other territories making up Romania (Fleck 1905, Eggers 1911). With the contributions of Marcu (1926, 1934, 1941, 1957), the number of reported species increased to 66 in subsequent years.

Between 1955 and 1971, Negru (1955, 1960, 1965, 1967, 1968, 1971), Negru & Pîrvescu (1955), Negru & Ceianu (1957), Paşcovici (1962) and Tudor (1969) published data on 18 new species of bark beetle. A further seven species previously unknown in the Romanian fauna were found in Ştefan Negru's collection (Vasiliu et al., 1978) after his premature death in 1970. Only four new species have been reported in the Romanian faunistic journals in the intervening period, by Bucşa & Curtean (1995) and Kocs (2010), with several more published abroad and mentioned by Pfeffer (1995) and Knížek (2011). Altogether there have been 104 species reported for Romania so far.

The objective of this paper is to present three scolytid species reported in Romania for the first time and some data concerning their abundance and distribution.

Materials and methods

Site locations. Details about the research areas are provided in Figure 1 and Table 1.

The "Giumalău Old-Growth Forest Reserve" is located on the northern side of the Giumalău Mountains and is part of the Rarău-Giumalău Natura 2000 site. It is a pure Norway spruce forest of 309.5 ha, comprising uneven aged stands. The collection of insects took place at 20 and 32 collecting sites in 2007-2008 and 2009, respectively, in forest compartments 120A and 121A, at 1230-1500 m altitude, on south-west facing slopes.

The forest reserve in the Călimani Mountains, named the "Dwarf Mountain Pine with Pinus cembra Reserve," is a strict nature reserve (IUCN protected area first category), included within the Călimani National Park and Călimani-Gurghiu Natura 2000 site. It covers 384.2 ha and is a habitat of Community interest, designed to protect plant species such as *Pinus cembra* L., *Pinus mugo* Turra and *Rhododendron kotschyi* Simonk. Despite its name, the main plant association is represented by mixed stands of Norway spruce (*Picea abies* (L.) H. Karst.) and Swiss stone pine (*Pinus cembra* L.), growing on mountain sides with varying slopes, a general north-easterly aspect and obvious signs of glaciation. The traps were set up in forest compartment 69A, at 1525-1720 m altitude.

Voievodeasa Forest Reserve is situated at the eastern edge of the Obcina Mare Mountains, in the subzone of montane mixed forests (European beech [*Fagus sylvatica* L.], European silver fir [*Abies alba* Mill.] and Norway spruce). The landscape is gentle and the climate mild. At the level of the reserve (size: 102 ha), the

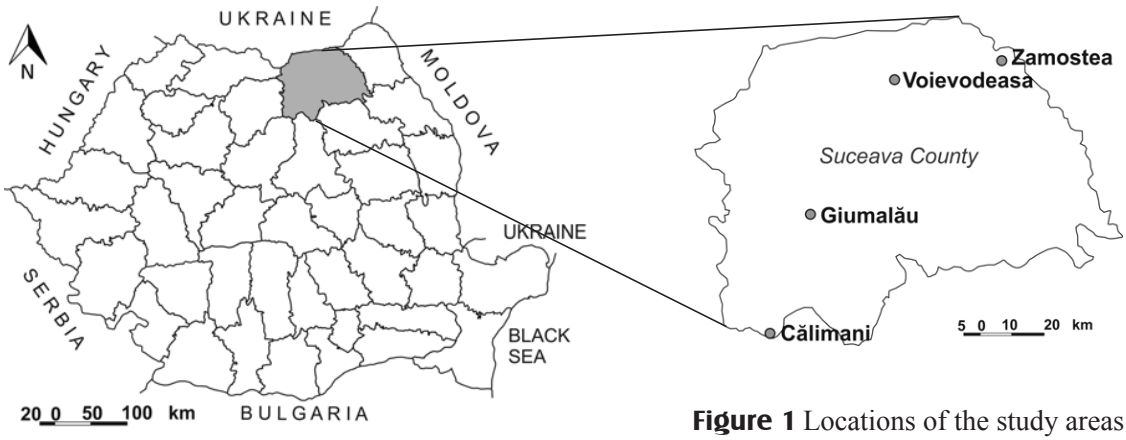

Figure 1 Locations of the study areas

Table 1 The main characteristics of the study areas

Location	Coordinates	Elevation (m)	Slope (°)	Aspect	Mean Annual Temperature (°C)	Mean Annual Precipitation (mm)	Forest composition	Forest age (years)
Giumalău	47°26'N 25°29'E	1200-1650	20-45	NW	1.7-2.9	924	100% P.a.	uneven
Călimani	47°06'N 25°15'E	1450-1780	10-40	NE	2.4-4.0	970-1150	70% P.a. 30% P.c.	uneven
Voievodeasa	47°49'N 25°41'E	590-925	12-18	SE	6.5-7.8	650-700	35% F.s. 35% A.a. 30% P.a.	35-130
Zamostea	47°53'N 26°09'E	375	-	-	7.8	615	100% P.a.	45

Note. P.a. – *Picea abies*, P.c. – *Pinus cembra*, F.s. – *Fagus sylvatica*, A.a. – *Abies alba*

tree species are almost equally represented. The traps were placed in the tree stand 5A, which is 44.2 ha in size and has a tree composition comprising 90% beech and 10% silver fir of ages 100-150 years. The stand is situated at 760-900 m altitude.

The Norway spruce stands in Zamostea forest are surrounded by broadleaf stands, mainly of beech and sessile oak (*Quercus petraea* (Matt.) Liebl.).

Two of the new species, *Trypodendron laeve* Eggers 1939, and *Xylosandrus germanus* (Blandford 1894), were found during studies of saproxylic beetles conducted in the forest reserves Giumalău, Călimani and Voievodeasa, in the eastern Carpathians (Fig. 1). The third, *Hylastes linearis* Erichson, 1836, was caught at Zamostea, in the northern part of the Moldavian Plateau.

Collecting methods. Beetles of *T. laeve* and *X. germanus* were collected using interception traps made from polyethylene, while *H. linearis* was captured in a flight intercept trap made from black plastic and baited with alpha-pinene and ethanol. The trapping periods, numbers of traps, their placement and insect collection interval are presented in Table 2.

Species identification. The identification of scolytid species was done using the key published by Pfeffer (1995) and the nomenclature for this group of insects is that used in the Catalogue of Palaearctic Coleoptera (Knížek 2011).

Table 2 Details concerning the collection of insects

Location	Year	Trapping periods	Number of traps	Trap placement (rows x traps)	Collection interval
Giumalău	2007	18 May-20 Sept.	20	(2x5) + (2x5)	2 weeks
	2008	19 May-30 Sept.	20	(2x5) + (2x5)	2 weeks
	2009	14 May-21 Sept.	32	(2x5) + (2x5) + (2x6)	2 weeks
Călimani	2010	26 May-21 Sept	20	4x5	2 weeks
Voievodeasa	2011	10 May-26 Sept.	20	4x5	2 weeks
	2012	3 May-20 Sept.	20	4x5	2 weeks
Zamostea	2010	29 April-22 June	3	1x3	3-4 days

Results and discussion

Trypodendron laeve

A total of 35 specimens of *Trypodendron laeve* (Fig. 2) were caught during this study, 24 in Giumalău and 11 in Călimani (Table 3). In Giumalău, there were no captures in 2007 and only 7 and 17 in 2008 and 2009, respectively. Captures occurred all through the season.

Morphologically this species is most closely allied to *T. lineatum* (Olivier 1795), except that the colour of elytra is more uniformly brown without evident darker and lighter longitudinal strips. It is totally devoid of microscopic tubercles on the elytral declivity and has darker brown legs, with the femur of all three pairs nearly black.

This is the first report of this species in Romania. It was found only locally at high altitudes (above 1230 m), in the forest reserves Giumalău and Călimani. Other locations at different altitudes were studied also, sites at which many specimens of *T. lineatum* were collected, but none of *T. laeve* (unpublished data). This would seem to strengthen the hypothesis that *T. laeve* is a boreo-montane species (Bussler & Schmidt 2008a, b), although it has also been found at lower altitudes in central Europe (Krehan & Holzschuh 1999, Bussler & Schmidt 2008b, Lukášová et al. 2012).

The discovery of this species in old forests at high altitudes, very far from the wood trade corridors, but not in forests at low altitudes where greater management activities and wood transport operations occur, might be an argument supporting the theory that *T. laeve* is

Figure 2 Lateral view of *Trypodendron laeve*

Table 3 *Trypodendron laeve* captures

Location	Year	Collection date	Number of beetles captured
Giumalău	2008	3 June	1
		17 July	2
		29 July	1
		13 August	2
		26 August	1
		TOTAL	7
	2009	10 August	12
		24 August	3
		7 September	2
		TOTAL	17
Călimani	2010	29 July	1
		12 August	2
		25 August	8
		TOTAL	11

in fact a native species and not alien to Europe (Kirkendall & Faccoli 2010).

In this study *T. laeve* was probably only caught at very low numbers in each year and at each location because its abundance in central Europe is low generally (Lukášová et al. 2012). The captures were scattered throughout the season, from the end of May to August-September, without any definite distribution pattern. It seems that the beetles caught were almost exclusively young, probably searching for places to overwinter (Bussler & Schmidt 2008a, b), and not the insects that had developed in the previous year. The main flight, which is very short and occurs earlier in the year, when snow may still be on the ground (Kvamme 1986, Krehan & Holzschuh 1999, Martikainen 2000, Öhrn et al. 2011), probably took place before the trapping period. In order to obtain a clear picture of *Trypodendron* species distribution and abundance in Romania, a study using pheromone traps such as those implemented in the Czech Republic and Poland (Lukášová et al. 2012), and covering the whole flight period, would be desirable.

Xylosandrus germanus

Xylosandrus germanus (Fig. 3) were captured in high numbers in Voievodeasa Forest Reserve in both 2011 and 2012, totalling 71 and 97 females, respectively. The flight peak was in the middle of June (Fig. 4).

All of the traps, with the exception of two in 2011, caught this species, resulting in a mean number of 3.6 (1*S.D.*: 2.7) and 4.9 (1*S.D.*: 3.4) individuals per trap in 2011 and 2012, respectively. There was no obvious influence of the altitudinal gradient on the captures. In 2012, the most individuals (17) were found in a trap situated at about 900 m altitude, in a place with more than 2000 hours insolation year^{-1}.

With the exception of the body size and certain generic characteristics, *Xylosandrus germanus* is in general terms morphologically similar to the indigenous *Anisandrus dispar*

Figure 3 Lateral view of a female of *Xylosandrus germanus*

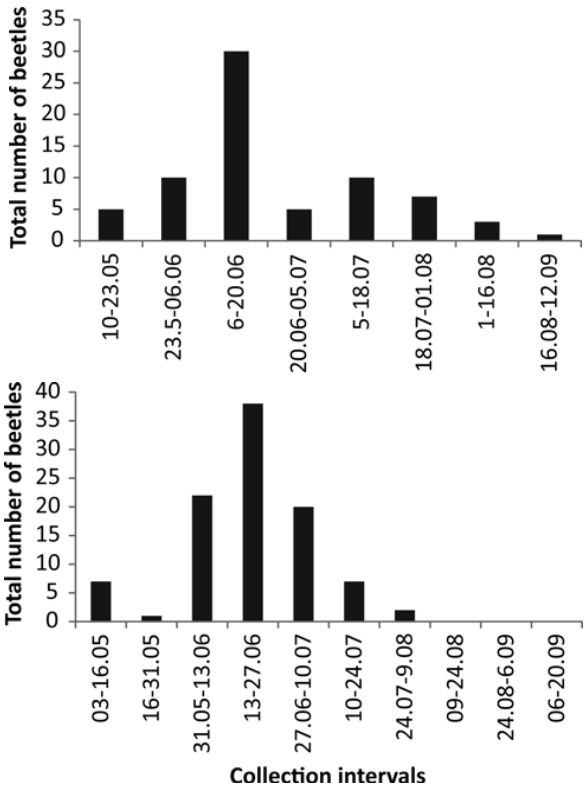

Figure 4 Dynamics of *Xylosandrus germanus* captures in Voievodeasa Forest in 2011 (top) and 2012 (bottom)

(Fabricius 1792). *X. germanus*, however, is an alien invasive species in Europe (DAISIE 2009, Kirkendall & Faccoli 2010). Its native area is eastern Asia and the insect was accidentally introduced to Europe after the Second World War (Groschke 1952). In the years

since it has spread and become established in many countries (Knížek 2011). Everywhere the species has established, it has permanent populations only at relatively low elevations (Holzschuh 1995, Bruge 1995, Henin & Versteirt 2004, Bense 2006), with the highest population reported to date at 578-600 m (Bussler et al. 2010, Blaschke & Bussler 2012). In Voievodeasa Forest a permanent population was discovered at an altitude of 760-900 m, on a slope with a south-easterly aspect.

In a similar study of saproxylic beetles conducted in a mixed sessile oak and beech forest at Runcu-Groşi (46°11'N, 22°07'E, at 455-572 m) in south-western Romania in 2008, no *X. germanus* specimens were found; this was the case although Runcu-Groşi is not far from the border with Hungary, where the species has been present since 2005 (Lakatos & Kajimura 2007). It would seem that this alien species is still only represented by small local populations in both countries and does not have a generalised distribution like the indigenous *Anisandrus dispar*. However, the species continues to spread and may yet colonise further areas in Romania, and in Europe.

The beetle's flight dynamics in Voievodeasa Forest were similar to the observations made by Graf & Manser (2000) and Bussler & Müller (2004), beginning early in May, with a maximum in June-July, and corresponding to one generation per year. The low catch number in May 2012 was due to the rainy weather conditions that prevailed throughout almost the whole month.

There is no information as to how this species arrived in the northern part of Romania, but the high number of captures of *X. germanus* may indicate a long-term development of the population in this area or a high degree of habitat favourability for this species. As it has a very large range of host plants, including both deciduous and coniferous trees, its spread to a large part of Romania's forests can be expected, especially in broadleaf forests growing at altitudes up to 700-900 m, where the stress caused by a warming climate is also more severe.

Hylastes linearis

One specimen of *Hylastes linearis* (Fig. 5) was found on 3 May 2010 at Zamostea, Suceava county.

Hylastes linearis differs from all other known central European *Hylastes* species in its body proportions, mainly the pronotum. Possessing a very distinct, slim body form, the species' body size ranges between 3.0-4.5 mm (medium size species) and it is dark brown in colour. It has a rostrum with a longitudinal fine keel, the pronotum markedly longer than it is wide with a ratio of 1.2-1.35 (0.9-1.2 in other species), with the widest part in the anterior half (in the posterior or near to the base in other species). The pronotal punctures are longitudinal (round in other species) and the elytra are twice as long as they are wide (the highest ratio on average in comparison with other species).

This European-Mediterranean species (Gatti 2011) is widely distributed in Europe, but is not present in the Scandinavian or Baltic countries (Knížek 2011). Larval development takes place in the dead roots and stumps of several *Pinus* species (Pfeffer 1995), including *P. sylvestris* and *P. nigra* var. *austriaca*, which are preferred hosts (Gatti 2011). Its preference for a milder climate and the scarcity of hosts might explain why the species was not found in Romania previously. The species appears

Figure 5 Dorsal view of *Hylastes linearis*

to be quite rare overall, as stated by Eichhoff (1881).

Acknowledgements

The research presented was conducted within the following projects: CEEX-C719/2006 - NATFORMAN, PN 09460203/2009, PNII-PT-PCCA-2011-3.2-1574 / Contract number 119/2012, all funded by the Romanian Ministry of National Education for NO, VO, MLD and IAB. For MK the research was partly supported from provided institutional support for long-term conceptual development of research organization MA CR – Decision No. RO0114 (reference number 8653/2014- MZE-17011). We thank the two anonymous reviewers, who analysed a previous version of the manuscript, for their valuable comments, as well as David Butler Manning (Dresden University of Technology) for English revision.

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