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First observations on the breeding ecology of invasive *Dryocoetes himalayensis* Strohmeyer, 1908 (Coleoptera: Curculionidae: Scolytinae) in its introduced range in Europe – Short communication

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Abstract

Foit J., Kašák J., Májek T., Knížek M., Hoch G., Steyrer G. (2017): First observations on the breeding ecology of invasive *Dryocoetes himalayensis* Strohmeyer, 1908 (Coleoptera: Curculionidae: Scolytinae) in its introduced range in Europe. J. For. Sci., 63: 290–292.

The invasive bark beetle species *Dryocoetes himalayensis* Strohmeyer, 1908, originated from Himalayan regions, arrived in Europe in the 1970s, and is now considered to be established in several European countries (Czech Republic, France and Switzerland). This species is reported to develop in walnut (*Juglans regia* Linnaeus) and pear (*Pyrus lanata* D. Don) in the region of its origin; however, to date, there has been no information regarding its host trees and breeding ecology in its introduced range. The present paper reports the development of *D. himalayensis* in declining black walnut trees (*Juglans nigra* Linnaeus) in a floodplain forest of southern Moravia (Czech Republic). The galleries were associated with basal parts of trunks of various diameters (7–45 cm) and were accompanied by dark necrotic areas and noticeable outflow of black fluid from beetle entrance holes. Further studies on the bionomics of this species are necessary to clarify its potential status as a pest of walnut trees.

Keywords: bark beetle; black walnut; Czech Republic; forestry; *Juglans nigra*; pest

Invasive species represent one of the biggest threats to sustainable forestry (Chornesky et al. 2005). Information regarding the ecology of invasive species is an essential prerequisite for elimination of their negative impacts on ecosystems. *Dryocoetes himalayensis* Strohmeyer, 1908, is an invasive species with poorly known ecology. *D. himalayensis* was originally distributed only in the Himalayan region (India: Kashmir, Uttar Pradesh, and Uttarakhand) (Wood, Bright 1992; Maiti, Saha 2009). This species was first detected in Europe in 1975 in France and in 1980 in Switzerland (Knížek 2011a). It has been proposed as an introduced and established species in Europe (Kirkendall, Faccoli

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2010; Knížek 2011a, b; Knížek 2016). In 2009, this species was recorded for the first time in the Czech Republic (Knížek 2011a). In all these countries, this species was also collected in subsequent years (M. Knížek det.). The species is also known to be present in Pakistan (M. Knížek det., unpublished), and it was recently collected in Germany as well (H. Gebhardt, personal communication).

In its region of origin, *D. himalayensis* is reported to breed in walnut (*Juglans regia* Linnaeus) (Juglandaceae) and pear (*Pyrus lanata* D. Don) (Rosaceae) (Wood, Bright 1992). Interestingly, no host plant is mentioned for this species in either its original description (Strohmeyer 1908) or in any other literature we are aware of until the publication of the Palaearctic Catalogue (Wood, Bright 1992). Kleine (1914) mentioned the forest composition (walnut is also listed) of higher and lower elevations in Kashmir, where *D. himalayensis* and other bark beetle species occur, but did not link particular host plants to beetle species. In Europe, all records of this species were incidental, originating from sweeping of vegetation, beating of trees or shrubs, or from various traps. Therefore, no information on the host plants or breeding ecology of *D. himalayensis* is available for its introduced range. However, *D. himalayensis* was hypothesized to be possibly associated with oaks because it was always collected in or near oak stands in its European localities (Knížek 2011a). The aim of the present paper is to report first reliable observations of the breeding ecology of this invasive species in its introduced range in Europe.

METHODS

On August 23rd and September 7th, 2016, we found approximately 60 bark beetle gallery systems in 12 declining and moribund black walnut (*Juglans nigra* Linnaeus) trees close to the village of Vranovice (southern Moravia, Czech Republic, 48°56'57.4"N, 16°36'11.8"E, 170 m a.s.l.) in a floodplain forest. The infested trees were situated in even-aged 60- and 20-year-old black walnut stands with areas of 2.38 and 2.92 ha, respectively. Living larvae, pupae and adult beetles were present in the galleries. Thirty-seven adult beetle specimens were collected from 23 different gallery systems in six different trees for identification. Subsequently, the diameter and vitality of the infested trees were recorded. Five degrees of tree vitality were distinguished: (*i*) vital tree, (*ii*) tree with slightly reduced vitality (growth stagnation, dieback of peripheral branches), (*iii*) tree with significantly reduced vitality (tree crown recession, dieback of the terminal part of the crown), (*iv*) moribund tree (most of the crown dead), (*v*) dead tree. Further, the species' gallery system was briefly described based on the examination of 25 gallery systems.

RESULTS AND DISCUSSION

All the sampled beetles were identified (based on morphological traits) as *D. himalayensis* (det. G. Hoch & G. Steyrer, det. J. Foit, rev. M. Knížek) (Fig. 1). The species infested the trees, the vitality of which ranged from moribund trees to trees with only slightly reduced vitality. No other bark- and wood-boring beetles were present on the examined trees in most cases, which might suggest that *D. himalayensis* exhibits substantial aggressiveness. On the other hand, several trees in the studied stands died without being infested by *D. himalayensis*. The infested trees were more or less evenly distributed in the stands, and their diameter ranged from 7 to 45 cm. Although galleries of *D. himalayensis* occurred up to 8 m above the ground in one case, they were mostly limited to the basal parts of the trunks (up to approximately 4 m above the ground). Hence, *D. himalayensis* likely prefers the basal part of trunks with thick bark, whereas trunk diameter seems to be unimportant for the species.

The presence of the galleries was associated with dark brown (almost black) fluid oozing from entrance holes, and the gallery systems were usually surrounded by dark brown to black necrotic areas. These symptoms are likely caused by associated fungi which will be further examined in ongoing studies. The gallery systems of *D. himalayensis*

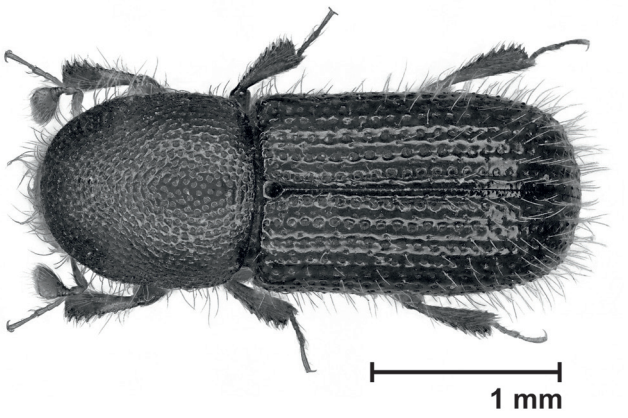

Fig. 1. Dorsal view of *Dryocoetes himalayensis* Strohmeyer, 1908, found at a locality close to the village of Vranovice (southern Moravia, Czech Republic) (August 23, 2016)

Fig. 2. Galleries of *Dryocoetes himalayensis* Strohmeyer, 1908, on *Juglans nigra* Linnaeus found at a locality close to the village of Vranovice (southern Moravia, Czech Republic) (September 7, 2016)

1 – mating chamber, 2 – egg galleries, 3 – larval galleries

(Fig. 2) were situated partly in the outer bark but mainly in the phloem. Overall, the surveyed galleries were quite indistinctly organised and resembled those of *Dryocoetes villosus* (Fabricius, 1792) (Pfeffer 1955). The studied gallery systems of *D. himalayensis* consisted of 1–5 contorted, predominantly transversal, sometimes of star-like appearance, egg galleries emerging from an indistinct mating chamber. Larval galleries were unevenly distributed along egg galleries and were contorted as well, mostly longitudinal. The egg galleries were 2–5 cm long (n = 17, mean ± standard error = 2.6 ± 0.2 cm) and 1.0–1.6 mm wide (n = 25, mean ± standard error = 1.28 ± 0.03 mm).

Black walnut is an increasingly popular forest tree species because it is considered a partial replacement for declining ash species (*Fraxinus* spp.) that are threatened by ash dieback caused by the pathogenic fungus *Hymenoscyphus fraxineus* (T. Kowalski) Baral, Queloz & Hosoya (Gross et al. 2014). Based on our findings, black walnut already suffers decline in some stands in southern Moravia, and *D. himalayensis* is involved in this process. Therefore, *D. himalayensis* represents a potential threat to black walnut. However, further studies are needed to clarify the causes of the observed black walnut decline and to evaluate the potential impact of *D. himalayensis* on black walnut and forestry.

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