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Short Communication

"Testing the limits" – an interesting record of the exotic banded greenhouse thrips *Hercinothrips femoralis* (Thysanoptera: Thripidae: Panchaetothripinae) at high Carpathian mountain altitudes

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Abstract: This study deals with an interesting record of exotic pest thrips *Hercinothrips femoralis* (Reuter, 1891) small population in the Carpathian mountain area (Vysoké Tatry Mts, N Slovakia) during the extensive research on high altitude forest succession. *Hercinothrips femoralis* is a well-known African pest species that has been introduced into the temperate regions of Europe, surviving only in glasshouses. The record in the coldest altitudes ever published (more than 1,000 m a.s.l.) indicates a role of passive migration and an effort of insects to taste ecological and environmental limits in their distribution.

Key words: *Hercinothrips femoralis*; distribution; High Tatras; pest; Thysanoptera

Introduction

Thrips (Thysanoptera) may be defined as tiny insects with some 6,000 species described worldwide (Mound 2014) and a tenth of them regarded as pests in agriculture, horticulture or forestry (Palmer et al. 1989; Lewis 1997; Mound & Teulon 1995). For the last few decades plenty of alien and invading pest species have been recorded in Europe (Goldarazena 2011; Karadjova & Krumov 2003; Rodikatis et al. 2006; Trdan 2002; Trdan et al. 2003, 2005; Vierbergen et al. 2006), including those listed in Slovakia (Fedor & Varga 2007; Varga 2008; Varga & Fedor 2008).

Many exotic species primarily distributed in tropical and subtropical regions can easily spread into temperate countries, especially by human activities, such as globalized trade with biological commodities (Collins 1998; Fedor & Varga 2007; Jenser & Czenz 1988; Lewis 1997; Pelikán 1989, 1991; Varga & Fedor 2008; Vierbergen et al. 2006; Vierbergen & de Jong 2013). Surviving in glasshouses they often infiltrate into nearby farmland surrounding to establish new populations and test ecological and environmental limits in their distribution, however, with cold weather they rapidly disappear outside the artificially heated places. However, testing the limits is sometimes an interesting story.

One of them, the banded greenhouse thrips *Hercinothrips femoralis* (Reuter, 1891) (Thysanoptera: Thripidae: Panchaetothripinae), is a well-known pest species characterized by three transversal grey or grey-brown bands on its forewings, 2 segment tarsi and 8 segment antennae: AS III and IV with forked sense cones, AS VI dark brown, AS VIII sharp-ended (Mound et al. 1976; zur Strassen 2003). It belongs to foliicolous polyphagous thrips feeding on variety of plants, e.g., figs, sugar beet, ground nuts, banana, cotton, sugar cane, pineapple and ornamentals (Houston et al. 1991). More than 50 host plant species have been recorded (Trdan et al. 2007). *H. femoralis* may cause severe damage to banana fruits with typical smoky-red discoloration (Houston et al. 1991; Rodikatis et al. 2006), which can occasionally lead to skin cracks as a typical symptom of *H. femoralis* infestation (Lewis 1997). Chemical and biological pest control may be often ineffective (Rodikatis et al. 2006).

Originally an African species (Mound et al. 1976), *H. femoralis* has a cosmopolitan distribution with common occurrence in Africa, North and Central America, but may be found in Europe, Japan, Korea or New Zealand (Houston et al. 1991). In temperate regions it has been obtained mainly from glasshouses (Mound et al. 1976). In Slovakia, where the first record comes

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Fig. 1. The study site of Podbanské (Tatras National Park, N Slovakia) (Photo: O. Majzlan).

from the glasshouse in Bratislava (SW Slovakia) from June 2007 (Varga 2008), it still appears as a relatively rare pest thrips, even in artificially heated glasshouses. However, this paper presents an interesting record of its temporal population under the cold Carpathian mountain conditions (Vysoké Tatry Mts, Slovakia).

Material and methods

The material comes from the site of Podbanské (coordinates: 49°08′ N, 19°53′58.62″ E, altitude: 1,010 m a.s.l.) (Fig. 1) in the Vysoké Tatry National Park (Tatras NP) Mts (N Slovakia). The soil photoeclector, situated in the spruce forest with *Vaccinium myrtillus* (*Vaccinio myrtilli-Piceetum* Šoltés 1976) during the vegetation period 2008 is a trap constructed on the principle of insect positive phototaxis (Majzlan & Fedor 2003). Covering the area of 1 m^2 it has been widely applied to study phenology of soil-dwelling arthropods (Adis 1988; Grimm et al. 1975; Troger et al. 1994; Majzlan & Fedor 2009, 2011).

The trap was installed for the period of 144 days (May 9, 2008 – September 29, 2008), using ethyleneglycol as the conservation liquid. The thrips were preserved in AGA solution, later mounted on microscopic slides (Fedor et al. 2012; Sierka & Fedor 2004) and deposited in the collections of the authors.

Results and discussion

We present an interesting record of a *Hercinothrips femoralis* small population from cold Carpathian (Vysoké Tatry Mts) forest ecosystem with the mean air temperature of 11.33℃ during the April – September 2008 vegetation period, far from any urban area with artificially heated habitats (more than 30 km from a larger town). Eleven and five specimens (all females) were sampled in June 30 and July 15, 2008, respectively. This record refers to the coldest altitudes out of artificially heated area ever published before. Obviously, *H. femoralis* is unable to hibernate and survive in such cold winter conditions typical of the Carpathian mountain area. In spite of that, this record indicates an effort of practically any species, even introduced from tropical regions or expanding from secondary habitats to establish small populations out of naturally or artificially suitable conditions and taste limits for ecological and environmental factors. Probably, the sampled specimens, potentially being able to survive until autumn, refer to the population derived from a single female transported from a longer distance. No specimens of *H. femoralis* have been recorded in the site since this record.

There is no doubt that intensive world trade with ornamental crops and food provides many opportunities for widespread artificial dispersal of many pests (Lewis 1997; Mound 1983; Vierbergen 1995). This way, *H. femoralis* has been a common element of glasshouses in temperate regions of Europe (Mound et al. 1976; Vierbergen & de Jong 2013), including Slovakia (Varga 2008). The most likely explanation of this extraordinary record should correspond with dispersion mechanisms of *H. femoralis* from glasshouse populations, although for long distances. In fact there are no glasshouses, botanic gardens or any possible habitats with suitable conditions for exotic pest source population in the sur-

roundings what may hint at anemochorous planktonic migration.

Thrips generally belong to weak flyers and due to their poor membranous wings and small body size they are unable to pass long distances by their own activity (Lewis 1997). Normally, the fringed wings produce a flight speed about 0.1 to 0.5 m s^{-1}, depending on the species (Lewis 1973). For instance, the maximum airspeed of 0.33 m s^{-1} was recorded for barley thrips *Limothrips denticornis* (Haliday, 1836) (Lewis 1958). Hypothetically, with the mean flight speed of 0.3 m s^{-1} *H. femoralis* could pass the distance of 1000 m in the time limit of 55.56 minutes.

However, with the synergic effects of wind turbulence, migration of thrips may be more effective. Good flyers move probably higher by their own activity and thus reach the stronger air flows (Lewis 1973). Furthermore, some species climb up to the grass stems with the purpose of exposure to the wind (Mound 1983) or to be carried on potential nest material (Pelikán et al. 2002; Fedor et al. 2011). In this sense, thrips could travel long distances between neighbouring fields with the assistance of wind currents (Lewis 1997; Fedor et al. 2011) and could be trapped up to tens of kilometres from the previous breeding location (Holzapfel & Harrel 1968; Lewis 1973). Moreover, rapidly changing weather such as storms could be associated with the thrips mass flights (Kirk 2004). Windy weather and frequent occurrence of the storms in this region could play a crucial role in dispersal mechanisms of the *H. femoralis* population. On the contrary, the mountains could serve as the geographical barrier of the populations spreading from the southern latitudes.

Before making any conclusion, this short communication should present an interesting fact of high ability of thrips to migrate for long distances within their effort to taste ecological and environmental limits for their distribution.

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