DISPERSAL MECHANISMS AND SEX RATIO OF THERMOPHILOUS MICROCEPHALOTHIRS ABDOMINALIS CRAWFORD 1910

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Abstract

Alien and invasive thrips (Thysanoptera) species from tropical and subtropical regions are spread into temperate countries by human activities and by shifting their natural range as a result of global climate change. Climate change induced consequences in exotic pest introductions or even invasions often in synergy with biological commodity trade globalisation have recently become one of the main challenges for applied phytosanitary care in terms of supporting the ability of exotic elements to establish adequate populations with suitable fitness. The main threat consists in at least temporary survival in mild climate ecosystems dispersing from artificially heated interiors with the potential to transmit economically important plant viruses. The species of Microcephalothrips abdominalis Crawford 1910 (male), which is an important pest of Asteraceae family with the ability to transmit Tobacco streak virus (TSV). European records of its occurrence predominantly refer to warmer regions, including Atlantic and Mediterranean countries, especially Canary Islands (Zur Strauss 2003), southern France (Pizzk et al. 2012), Italy (Strapazzon 1999), Croatia (Vierbergen et al. 2006), Slovenia (Trdan 2002) and Hungary (Vierbergen et al. 2006) up to Slovakia (Fedor et al. 2018). Sampling the male of M. abdominalis in Slovakia (after the first record of female in 2018) has given the reason to discuss on climate change induced shift in distribution of this alien species in Central Europe (Zvaríková et al. 2020) and consider its possible reproduction mechanism as well as colonization strategies (sexually and parthenogenetically).

Keywords: climate change, introduction, invasive species, reproduction mechanism, Thysanoptera

Introduction

The presence of glasshouses with suitable host plants may contribute to the survival of alien species and also ease and support the establishment of their populations in new environment. In addition, climate change as a relatively new phenomenon plays an important role in the spread of alien species, often with the pest status, to the new environment (Hoffman & Parson 1997). Thermophilous neotropical species Microcephalothrips abdominalis is considered as a pest of Asteraceae family plants (Pizzk et al. 2012), that is able to transmit Tobacco streak virus (TSV). European records of its occurrence predominantly refer to warmer regions, including Atlantic and Mediterranean countries, especially Canary Islands (Zur Strauss 2003), southern France (Pizzk et al. 2012), Italy (Strapazzon 1999), Croatia (Vierbergen et al. 2006), Slovenia (Trdan 2002) and Hungary (Vierbergen et al. 2006) up to Slovakia (Fedor et al. 2018). Sampling the male of M. abdominalis in Slovakia (after the first record of female in 2018) has given the reason to discuss on climate change induced shift in distribution of this alien species in Central Europe (Zvaríková et al. 2020) and consider its possible reproduction mechanism as well as colonization strategies (sexually and parthenogenetically).

Material and methods

Yellow Moericke traps (Fig. 1) were installed in the glasshouses of the Botanical Garden in Bratislava (Fig. 3) during the season of 2019 and a total of 17 trapings in two-week intervals were carried out. Representatives of the flora belong to tropical and subtropical plants from Japan, New Caledonia and subtropical Asia. Temperatures range from 18 to 26 °C. Traps were situated near plants (Asteraceae, Cycadaceae, Moraceae, Araceae, Dryptophoridae), doors and windows and installed at different heights from 0 to 2 m above the ground according to the average height of the plants in individual glasshouses. During the research no new plants were planted or brought to the greenhouse. The thrips specimens were stored in AGA solution (ethyl alcohol, glycerol, acetic acid), mounted and identified according to the standard methods used for thrips (Schleipke & Klimt 1979, Zur Strauss 2003, Fedor et al. 2012).

Results and discussion

The first male specimen of M. abdominalis (Fig. 2) was observed in Bratislava Botanical Garden in August 2019, a year after the first record of this species (female) in Slovakia (Fedor et al. 2018). Due to the fact that the species can probably reproduce both sexually and parthenogenetically (O`Neill 1960; Bondy 2018 ), females are more numerous than males. As there is information only on female specimens in Central Europe (Senser 2013) we have two hypotheses about the species sex ratio in Central European conditions: 1. this species may reproduce by thylakothous parthenogenesis, similar to Thrips tabaci Lineman, 1889 (van Rijn et al. 1995 ), or introduced thrips in general (O`Neill 1960 ), where diplodiploids are produced from un-fertilized haploid eggs after doubling of the chromosome complement (Bondy 2018 ). The parthenogenetic reproduction is often considered as the most common in introduced species (O`Neill 1960 ) and according to the theory of "geographic parthenogenesis", this type of reproduction tends to occur in modified conditions (Kellner et al. 2013 ), for example at the margin of the area of distribution (e.g. Stenberg et al. 2003 ). 2. M. abdominalis distinguished by haplodiploid sex determination system, similar to arthropod mechanisms of Frankliniella occidentalis Pergande, 1895 (van Rijn et al. 1995 ), by females produce male or female offspring by selective fertilization (Bondy 2018 ). Haplodiploid sex determination system provides higher genetic variation (Lambreinos 2004) for species to be well adapted for colonization of new habitats (Higgins & Myers 1992 ). But since such reproduction is affected by various environmental and ecological factors (Wang et al. 2014; Crespi 1988) certainly the climate plays a crucial role in those phenomena.

As M. abdominalis considered to be a neotropical element (Pizzk et al. 2012 ), with its most northern occurrence in Europe recorded in Slovakia (Fedor et al. 2018 ), we formerly assumed its exclusive parthenogenetic population here. However, our observation as well as relevant literature (Trdan 2002) indicate that global warming may probably have an impact on development and dispersal of this species in Europe (Fedor et al. 2018). The climate conditions do not appear to be as limiting as it was thought. The barriers are removing through global warming mechanisms and may facilitate infiltration of M. abdominalis in Europe. With its possible sexual reproduction in Slovakia we assume its parthenogenesis more in the North, including southern Poland.

References


