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Competing interests

No competing interests have been declared.

Copyright notice© The Author(s) 2016. This is an Open Access article distributed under the terms of the [Creative Commons Attribution License](#), which permits redistribution, commercial and non-commercial, provided that the article is properly cited.**Citation**Gorczak M, Tischer M, Pawłowska J, Wrzosek M. First record of *Hesperomyces virescens* (Laboulbeniales, Ascomycota) on *Harmonia axyridis* (Coccinellidae, Coleoptera) in Poland. *Acta Mycol.* 2016;51(1):1071. <http://dx.doi.org/10.5586/am.1071>**Digital signature**

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SHORT COMMUNICATION

First record of *Hesperomyces virescens* (Laboulbeniales, Ascomycota) on *Harmonia axyridis* (Coccinellidae, Coleoptera) in Poland

Michał Gorczak*, Marta Tischer, Julia Pawłowska, Marta Wrzosek

Department of Molecular Phylogenetics and Evolution, Faculty of Biology, University of Warsaw, Aleje Ujazdowskie 4, 00-048 Warsaw, Poland

* Corresponding author. Email: gorczak.michal@wp.pl**Abstract**

Hesperomyces virescens Thaxt. is a fungal parasite of coccinellid beetles. One of its hosts is the invasive harlequin ladybird *Harmonia axyridis* (Pallas). We present the first records of this combination from Poland.

Keywords

harlequin ladybird; invasive species; ectoparasitic fungi

Introduction

Harmonia axyridis (Pallas) is a ladybird of Asiatic origin considered invasive in Europe, Africa, and both Americas [1]. One of its natural enemies is *Hesperomyces virescens* Thaxt., an obligatory biotrophic fungal ectoparasite of the order Laboulbeniales. This combination was described for the first time in Ohio, USA in 2002 [2] and soon afterwards recorded in many other localities in North America ([3] and references therein). Four years later it was recorded in Belgium [4] and subsequently in the Netherlands (2008), Germany (2008), the United Kingdom (2011), the Czech Republic (2013), Croatia (2013), and Hungary (2014) [3–7]. Recently (2013), *H. virescens* was also recorded on *H. axyridis* in South Africa [8]. Although *H. virescens* was reported on different coccinellid hosts from many countries it was never observed on *Harmonia axyridis* in its native range. Haelewaters et al. [9] presented historical record of the fungus on *Harmonia axyridis* collected in the 1930s in Sichuan Province, China and there is no more recent record of this combination from that region. *Hesperomyces virescens* infection is considered a rare example of acquiring novel parasite by invasive species as it is assumed that invasive *Harmonia axyridis* strain was originally free of infection [9,10]. Despite extensive studies of Laboulbeniales, the first report of *Hesperomyces* from Poland was only in 2013: *H. coccinelloides* on *Stethorus pusillus* [11]. Here we report the presence of a second species, *Hesperomyces virescens*, in Poland.

Material and methods

Harmonia axyridis beetles were collected in vicinity of the University of Warsaw Botanic Garden, Warsaw, Poland (52°13'1" N, 21°1'38" E), on following days: 2014-10-30 – 2014-11-06, 2015-03-09 – 2015-03-10, and 2015-10-26 – 2015-11-17. Insects



Fig. 1 a *Hesperomyces virescens* Thaxt. thalli on pronotum of *Harmonia axyridis* (Pallas). b *Hesperomyces virescens* Thaxt. mature thallus.

were killed with ethyl acetate vapors or by freezing in -20°C , then observed for the presence of Laboulbeniales fungi using a dissecting microscope (Nikon SMZ800). Several thalli were mounted in glycerin as described by Majewski [12], which are deposited at the Warsaw University Herbarium (WA) under numbers WA0000052035 to WA0000052040. Photographs were taken using a NIKON DX-1200 camera (Fig. 1). Some thalli were used for generating ribosomal DNA sequences, which have been already published in Haelewaters et al. [13]. All insects are in the authors' collection except for four specimens, which were sent to Harvard University.

Results

Of the total 1443 ladybirds screened, 16 (1.11%) were infected by *Hesperomyces virescens*. Both autumn 2014 and spring 2015 collections were rather accidental with only a small number of beetles screened (Tab. 1). During autumn 2015 more systematic collection was performed aiming to gather all *H. axyridis* from one overwintering site, on the outer walls of the building. The number of ladybirds caught was 1340, of which 14 (1.03%) were infected. Thirteen of the infected ladybirds bore parasites on the posterior part of their elytra. Four *H. axyridis* bore about 20 mature thalli. In other specimens the thallus density was much lower, between one to ten mature thalli per insect.

Discussion

Despite a long tradition of Laboulbeniales studies in Poland neither Janina and Wincenty Siemaszko nor Tomasz Majewski ever found any fungus of the genus

Tab. 1 Number of collected and infected *Harmonia axyridis*.

| Date | N collected | N infected | % infected |
|---------------|-------------|------------|--------------|
| October 2014 | 30 | 0 | 0.00% |
| November 2014 | 30 | 1 | 3.33% |
| March 2015 | 23 | 1 | 4.35% |
| 2015-10-26 | 182 | 5 | 2.75% |
| 2015-10-27 | 181 | 1 | 0.55% |
| 2015-10-28 | 540 | 0 | 0.00% |
| 2015-10-29 | 317 | 5 | 1.58% |
| 2015-11-12 | 140 | 3 | 2.14% |
| Autumn 2015 | 1360 | 14 | 1.03% |
| Total | 1443 | 16 | 1.11% |

Hesperomyces [11]. In his book Kozłowski [14] showed a photo of *Adalia bipunctata* from Poland infected by Laboulbeniales ectoparasitic fungi, probably *H. virescens*. However the finding was never published formally. Since the specimen is not available for study, the proper identification of the fungus is impossible. It most probably belonged to *H. virescens* as this is the only known species of *Hesperomyces* found on *A. bipunctata*. However in Toruń, Kuyavian-Pomeranian Voivodship, more than 4000 *A. bipunctata* were collected and screened but no infection was detected [15]. In 2013 Ceryngier reported from Poland a related species, *H. coccinelloides*, on another coccinellid beetle, *Stethorus pusillus* [11].

Although our finding is neither the northernmost nor easternmost in Europe it moves the boundary of known distribution of *H. virescens* on *Harmonia axyridis* [3]. Comparing to infection rates recorded in Belgium (96.5%, $n = 86$) [4], Germany (79.1%, $n = 134$) [3], and South Africa (29.4%, $n = 1794$) [8], the infection rate in our studied population was very low (1.1%). This may indicate that conditions for fungus development are suboptimal or that the fungus was only recently acquired by the host. However, it should be noted that infection rate of *H. virescens* is known to change greatly between localities and years or even seasons [3,4,8,9,16]. Further studies on *H. virescens* on *Harmonia axyridis* and other lady beetle species in Central and Eastern Europe may improve our understanding of this parasite-host combination.

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