

DOI: 10.5586/am.1071

Publication history

Received: 2016-02-05

Accepted: 2016-04-25

Published: 2016-05-05

Handling editor

Tomasz Leski, Institute of
Dendrology, Polish Academy of
Sciences, Poland

Authors' contributions

MG and MT collected and
examined the material;
all authors contributed to
manuscript preparation

Funding

This study was supported by the
Polish Ministry of Science and
Higher Education under grant
No. DI2014012344.

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](http://dx.doi.org/10.5586/am.1071)

Digital signature

This PDF has been certified using digital
signature with a trusted timestamp to
assure its origin and integrity. A verification
trust dialog appears on the PDF document
when it is opened in a compatible PDF
reader. Certificate properties provide
further details such as certification time
and a signing reason in case any alterations
made to the final content. If the certificate
is missing or invalid it is recommended to
verify the article on the journal website.

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.

Acknowledgments

We are very grateful to professor Tomasz Majewski for confirming our identification of the fungus and his constant support of our studies. We would like to thank Danny Haelewaters for many helpful comments on the manuscript and André De Kesel for taking excellent “in situ” photographs of our specimens.

References

1. Brown PMJ, Thomas CE, Lombaert E, Jeffries DL, Estoup A, Lawson Handley LJ. The global spread of *Harmonia axyridis* (Coleoptera: Coccinellidae): distribution, dispersal and routes of invasion. *BioControl*. 2011;56:623–641. <http://dx.doi.org/10.1007/s10526-011-9379-1>
2. Garcés S, Williams R. First record of *Hesperomyces virescens* Thaxter (Laboulbeniales: Ascomycetes) on *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae). *J Kans Entomol Soc*. 2004;77(2):156–158. <http://dx.doi.org/10.2317/0304.18.1>
3. Ceryngier P, Twardowska K. *Harmonia axyridis* (Coleoptera: Coccinellidae) as a host of the parasitic fungus *Hesperomyces virescens* (Ascomycota: Laboulbeniales, Laboulbeniaceae): a case report and short review. *Eur J Entomol*. 2013;110(4):549. <http://dx.doi.org/10.14411/eje.2013.075>
4. de Kesel A. *Hesperomyces* (Laboulbeniales) and coccinellid hosts. *Sterbeeckia*. 2011;30(1):32–37.
5. Herz A, Kleespies RG. Occurrence of natural enemies in different populations of the invasive ladybird *Harmonia axyridis* (Pallas, 1771) (Coleoptera, Coccinellidae) in Germany. *Mitt Dtsch Ges Allg Angew Entomol*. 2012;18:201–206.
6. Ceryngier P, Romanowski J, Szymańska J, Galanciak M, Bardzińska M, Romanowski M. Population of the invasive harlequin ladybird *Harmonia axyridis* (Coleoptera: Coccinellidae) from Pelješac Peninsula, southern Croatia. *Studia Ecologiae et Bioethicae*. 2013;11:79–91.

7. Pfliegler WP. First Hungarian record of the fungus *Hesperomyces virescens* (Ascomycota: Laboulbeniales), parasitic on the harlequin ladybird (Coccinellidae: *Harmonia axyridis*). *Acta Naturalia Pannonica*. 2014;7(1):139–142.
8. Haelewaters D, Minnaar IA, Clusella-Trullas S. First finding of the parasitic fungus *Hesperomyces virescens* (Laboulbeniales) on native and invasive ladybirds (Coleoptera, Coccinellidae) in South Africa. *Parasite*. 2016;23.
9. Haelewaters D, Comont RF, Zhao SY, Pfister DH. *Hesperomyces virescens* (Fungi, Ascomycota, Laboulbeniales) attacking *Harmonia axyridis* (Coleoptera, Coccinellidae) in its native range. *Chin Sci Bull*. 2014;59(5–6):528–532. <http://dx.doi.org/10.1007/s11434-013-0060-1>
10. Raak-van den Berg CL, van Wielink PS, de Jong PW, Gort G, Haelewaters D, Helder J, et al. Invasive alien species under attack: natural enemies of *Harmonia axyridis* in the Netherlands. *BioControl*. 2014;59(2):229–240. <http://dx.doi.org/10.1007/s10526-014-9561-3>
11. Ceryngier P. *Stethorus pusillus* (Coleoptera: Coccinellidae) as a host of the ectoparasitic fungus *Hesperomyces coccinelloides* (Ascomycota: Laboulbeniales: Laboulbeniaceae) in Poland. *Polish Journal of Entomology / Polskie Pismo Entomologiczne*. 2013;82(1):13–18. <http://dx.doi.org/10.2478/v10200-012-0018-7>
12. Majewski T. The Laboulbeniales of Poland. Cracow: W. Szafer Institute of Botany Polish Academy of Sciences; 1994.
13. Haelewaters D, Gorczak M, Pfliegler WP, Tartally A, Tischer M, Wrzosek M, et al. Bringing Laboulbeniales into the 21st century: enhanced techniques for extraction and PCR amplification of DNA from minute ectoparasitic fungi. *IMA Fungus*. 2015;6(2):363–372. <http://dx.doi.org/10.5598/ima fungus.2015.06.02.08>
14. Kozłowski MW. Owady Polski: chrząszcze. Warszawa: Multico Oficyna Wydawnicza; 2009. (Kocham Polską Przyrodę).
15. Webberley KM, Tinsley MC, Sloggett JJ, Majerus ME, Hurst GD. Spatial variation in the incidence of a sexually transmitted parasite of the ladybird beetle *Adalia bipunctata* (Coleoptera: Coccinellidae). *Eur J Entomol*. 2006;103(4):793–797. <http://dx.doi.org/10.14411/eje.2006.108>
16. Haelewaters D, van Wielink P, van Zuijlen JW, Verbeken A, de Kesel A. New records of Laboulbeniales (Fungi, Ascomycota) for the Netherlands. *Entomolog Ber*. 2012;72(3):175–183.