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First report of *Smynthuroides betae* (Hemiptera: Aphididae) on *Phelipanche ramosa* (Orobanchaceae)

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Smynthuroides betae Westwood (Hemiptera: Aphididae: Eriosomatinae: Fordini), also known as bean root aphid, is a host-alternating aphid species with a 2-yr life cycle. Its primary host is *Pistacia* spp. (Anacardiaceae), on which it creates leaf galls. Secondary hosts occur in many genera and families of plants, principally Asteraceae, Fabaceae, and Solanaceae (Blackman & Eastop 2008). *Smynthuroides betae* feed on roots, often in ants' nests (*Lasius* spp.; Hymenoptera: Formicidae). On both primary and secondary hosts it may be a serious pest, inflicting direct harm through induction of persistent leaf galls on *Pistacia* and by sucking the sap of secondary hosts and causing root deformations. Its occurrence is not restricted to areas of its primary host's occurrence (Mediterranean region); permanently parthenogenetic (anholocyclic) populations also occur in various parts of the Northern Hemisphere that are characterized by moderate climate (Capinera 2001).

Holoparasitic plants of the family Orobanchaceae parasitize the roots of both wild and cultivated hosts. Several species are serious agricultural pests (weeds). One of the most damaging weeds is the branched broomrape, *Phelipanche ramosa* (L.) Pomel (syn. *Orobancha ramosa* L.) (Orobanchaceae), an obligate root parasite that causes significant losses in a variety of crops, especially tomatoes and tobacco. It is native to Eurasia and North Africa, but has been introduced in many other areas of the world.

Field surveys conducted in Poland in Sep and Oct 2017 revealed infestations of *P. ramosa* by larvae and adult apterous females of a secondary-host generation of *S. betae* in 1 locality in Świętokrzyskie Voivodeship, Sandomierz County, near Szewce (50.6166°N, 21.6166°E, 145 masl). Here, *P. ramosa* parasitized roots in a 2-ha area of tomato crops containing about 2,000 shoots. Infestation with *S. betae* was observed on the underground parts of broomrape shoots, on both haustoria and tubers, by digging plants from the soil (Fig. 1). Numerous larvae fed on broomrape sap, resulting in weakened or dead shoots (Fig. 1). A single plant was parasitized by over 50 *S. betae* nymphs, and 10 to 20% of the total population of plants were infested. Distinguishing characteristics of *S. betae* include (a) globular body shape; (b) diameter about 2 mm; (c) short appendages; (d) whitish to yellowish color; (e) slightly waxy covering; and (f) the young nymphs are flattened and olive-green (Fig. 2).

DNA was extracted using a DNeasy Blood & Tissue Kit by Qiagen (Venlo, Netherlands) and a standard barcode sequence of mitochondrial cytochrome c oxidase subunit I (COI) was amplified using

the primers LCO1490 and HCO2198. The Neighbor-Joining phylogenetic tree showed that the newly sequenced COI region of *S. betae* (GenBank accession no. MG581930) was 99% similar to other *S. betae* sequences found in GenBank (EU701910.1, KR045151.1).

So far, only a few insects have been reported to feed on *Orobancha* (Orobanchaceae), (e.g., *Phytomyza orobanchia* Kalténbach (Diptera: Agromyzidae), which is very promising as a biological control agent of broomrape (Linke et al. 1990; Klein & Kroschel 2002); *Smicronyx cyaneus* Gyll. (Coleoptera: Curculionidae) on *Orobancha foetida* Poir. (Orobanchaceae) (Zermane et al. 2001); and *Geoica utricularia* (Passerini) (Hemiptera: Aphididae) on *O. foetida* (Boukhris-Bouhachem et al. 2011). Heretofore, *Smynthuroides betae* has been reported from *Orobancha crenata* Forsskál, *O. variegata* Wallr., and *P. aegyptiaca* (Pers.) Pomel (all Orobanchaceae) (Holman 2009). To the best of our knowledge, this is the first report of *S. betae* parasitizing *P. ramosa*. Further observations on the potential use of this insect as a control method for *P. ramosa* might be useful, because poor growth and necrosis have been observed in broomrape. Use of natural enemies appears to be a promising approach for suppression of root parasitic plants (Klein & Kroschel 2002; Qasem 2010). Recent observations have shown that the melon aphid (*Aphis gossypii* Glover [Hemiptera: Aphididae]) may be a biological control method for broomrape, because it was found to completely stop the growth and flowering of broomrape plants (Borkowski & Dyki 2008).

Summary

The bean root aphid, *Smynthuroides betae* Westwood (Aphididae: Eriosomatinae: Fordini) is reported for the first time feeding on haustoria of branched broomrape, *Phelipanche ramosa*, (Orobanchaceae) a crop-parasitic plant. Field surveys conducted in Poland revealed infestations of *P. ramosa* by nymphs and adult apterous females of a secondary-host generation of *S. betae* in 1 locality in Sandomierz County, near Szewce, Poland. Numerous nymphs of *S. betae* fed on broomrape sap, resulting in poor growth or dead shoots, and 10 to 20% of the total population of broomrape was infested. Potential use of this insect as a biological control method for invasive broomrapes requires further study.

Key Words: bean root aphid; branched broomrape; holoparasitic plant; haustoria

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Fig. 1. General habit of the holoparasitic broomrape *Phelipanche ramosa*: noninfected plant (A, D), plant weakened by aphids infection (B, E), *Smynturodes betae* feeding haustoria of broomrape (also visible are *Lasius* sp. ants) (C, F).

Sumario

El áfido de la raíz del frijol, *Smynturodes betae* Westwood (Aphididae: Eriosomatinae: Fordini) se reporta por primera vez alimentándose de haustorios de orobanque ramificado, *Phelipanche ramosa*, (Orobanchaceae) una planta parásita de los cultivos. Los sondeos de campo realizados en Polonia revelaron infestaciones de ninfas y hembras adultas apteras de *S. betae* que utiliza la planta *P. ramosa*

como un hospedero secundario en 1 localidad del condado de Sandomierz, cerca de Szewce, Polonia. Numerosas ninfas de *S. betae* se alimentaron de savia del orobanque, lo que resultó en un crecimiento deficiente o brotes muertos, con una infestación del 10 al 20% de la población total del orobanque. El uso potencial de este insecto como un método de control biológico para el orobanque invasivo requiere más estudio.

Palabras Clave: áfido o pulgón de la raíz de frijol; orobanque ramificado; planta holoparasitaria; haustoria

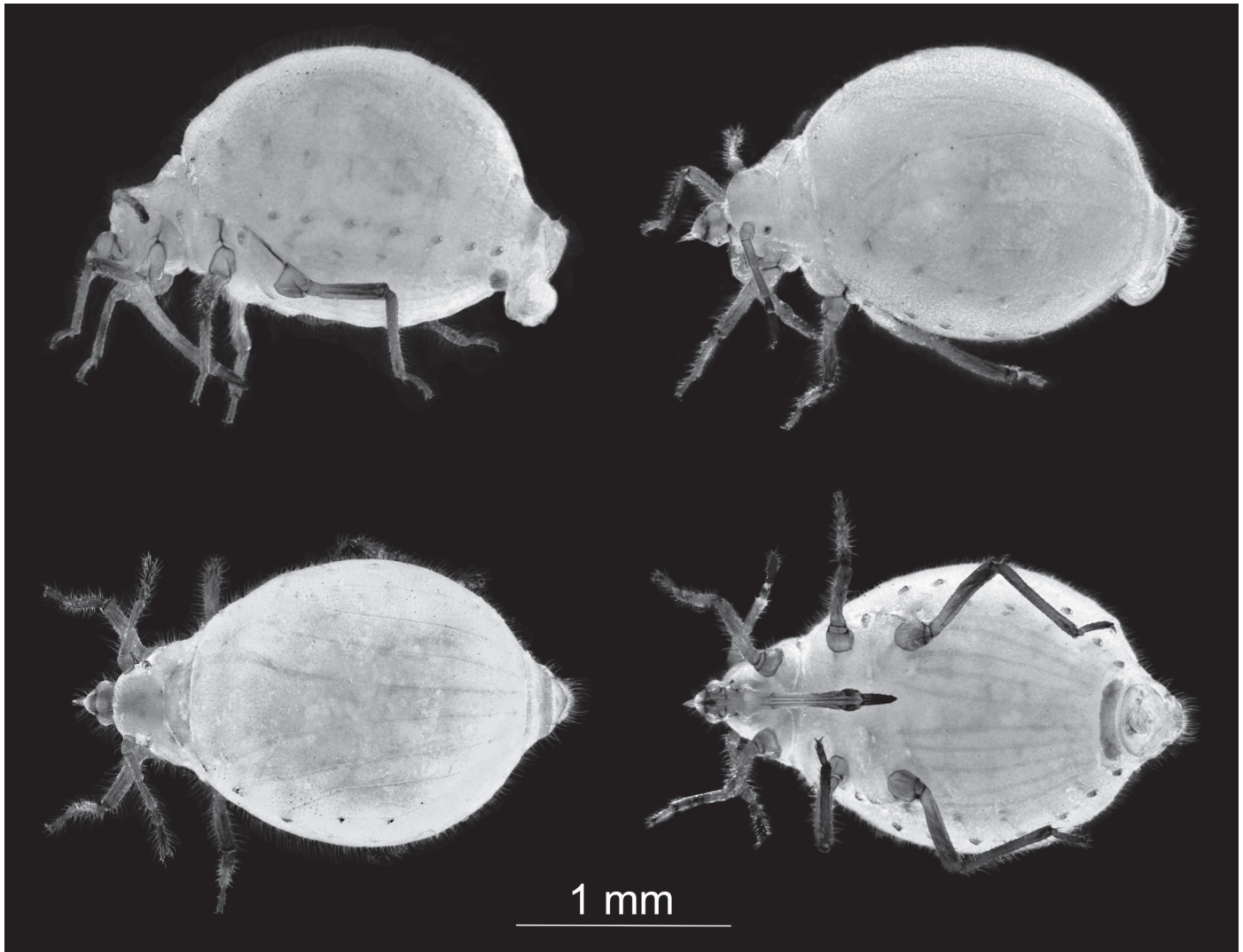


Fig. 2. General appearance of adult viviparous female of *Smynthurodes betae* collected from haustoria of *Phelipanche ramosa*.

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