



<http://dx.doi.org/10.11646/zootaxa.3999.4.1>

<http://zoobank.org/urn:lsid:zoobank.org:pub:CB6127D2-DF5B-4F86-A3D9-6A2F9DBD021C>

New species of cynipid inquilines of the genus *Synergus* (Hymenoptera: Cynipidae: Synergini) from the Eastern Palearctic

SZABINA SCHWÉGER¹, GEORGE MELIKA^{2,6}, CHANG-TI TANG³, PÉTER BIHARI⁵, MIKLÓS BOZSÓ², GRAHAM N. STONE⁴, JAMES A. NICHOLLS⁴ & ZSOLT PÉNZES^{1,5}

¹University of Szeged, Department of Ecology, Középfasor 52 Szeged, Hungary. E-mail: schwegerszabina@gmail.com

²Plant Health and Molecular Biology Laboratory, National Food Chain Safety Office, Directorate of Plant Protection, Soil Conservation and Agri-environment, Budaörsi str. 141-145, Budapest 1118, Hungary. E-mail: melikageorge@gmail.com; miklvt.bozs@gmail.com (for Miklós Bozsó)

³Department of Entomology, National Chung Hsing University, Taichung, 40227 Taiwan. E-mail: cynipidsman@gmail.com

⁴Institute of Evolutionary Biology, University of Edinburgh, King's Buildings, West Mains Road, Edinburgh EH9 3JT, Scotland, U.K. E-mails: graham.stone@ed.ac.uk (for Graham N. Stone); james.nicholls@ed.ac.uk (for J. A. Nicholls)

⁵Biological Resesarch Center of Hungarian Academy of Sciences, Institute of Genetics, Temesvári krt 62, Szeged, 6726. E-mail: penzes@bio.u-szeged.hu; bihari.peter@gmail.com (for Péter Bihari)

⁶Corresponding author

Table of contents

Abstract	451
Introduction	452
Materials and methods	453
Results	454
Key to Synergini genera	454
Key to the Eastern Palearctic <i>Synergus</i> species	458
<i>Synergus abei</i> Melika & Schwéger, new species	459
<i>Synergus belizinellus</i> Schwéger & Melika, new species	462
<i>Synergus changtitangi</i> Melika & Schwéger, new species	466
<i>Synergus formosanus</i> Schwéger & Melika, new species	469
<i>Synergus ishikarii</i> Melika & Schwéger, new species	472
<i>Synergus kawakamii</i> Tang & Melika, new species	475
<i>Synergus khazani</i> Melika & Schwéger, new species	478
<i>Synergus symbioticus</i> Schwéger & Melika, new species	482
<i>Synergus chinensis</i> Melika, Ács & Bechtold, 2014	485
<i>Synergus gifuensis</i> Ashmead, 1904	485
<i>Synergus hakonensis</i> Ashmead, 1904	487
<i>Synergus japonicus</i> Walker, 1874	489
<i>Synergus iwataensis</i> Shinji, 1941	489
<i>Synergus jezoensis</i> Uchida & Sakagami, 1948	489
<i>Synergus mizunarae</i> Shinji, 1940	490
<i>Synergus xialongmeni</i> Melika, Ács & Bechtold, 2004	491
Discussion	492
Acknowledgements	494
References	495

Abstract

Eight new species of cynipid inquilines, *Synergus abei* Melika & Schwéger, *S. belizinellus* Schwéger & Melika, *S. changtitangi* Melika & Schwéger, *S. formosanus* Schwéger & Melika, *S. ishikarii* Melika & Schwéger, *S. kawakamii* Tang & Melika, *S. khazani* Melika & Schwéger and *S. symbioticus* Schwéger & Melika, from the Eastern Palearctic are described. Descriptions, diagnoses, biology, and host associations for the new species and a key to all known Eastern Palae-

arctic *Synergus* species are given. All taxa are supported by morphological and molecular data. We discuss the status of all previously described Eastern Palaearctic *Synergus* species, and provide validation and synonymization of some species.

Key words: Cynipidae, inquiline, Synergini, *Synergus*, *Saphonecrus*, taxonomy, morphology

Introduction

Most of the ca. 1,400 described species of Cynipidae are gall inducers (Csóka *et al.* 2005). However, around 180 species classified into ten genera develop as inquilines inside galls of other cynipids (Pujade-Villar *et al.* 2003, Nieves-Aldrey & Medianero 2010, Bozsó *et al.* 2014, 2015, Nieves-Aldrey & Butterill 2014). Inquilinism is a form of cleptoparasitism, usually considered to represent a unilaterally beneficial relationship that benefits only the inquiline (Askew 1984). There are many examples of inquilinism in Hymenoptera. This paper focuses on the inquiline cynipids that feed obligately on plant tissues within developing galls and to some extent, stimulate the development of tissues characteristic to galls and particularly on inquilines that attack hosts in the gallwasp tribe Cynipini (oak gallwasps). Inquilines which attack hosts in the gallwasp tribe Cynipini (oak gallwasps) include eight genera, which from seven genera, *Agastoroxenia* Nieves-Aldrey & Medianero, *Saphonecrus* Dalla Torre & Kieffer, *Synergus* Hartig, *Synophrus* Hartig, *Ufo* Melika & Pujade, *Lithosaphonecrus* Tang, Melika & Bozsó, *Lithonecrus* Nieves-Aldrey & Butterill and *Rhoophilus* Mayr form a distinct monophyletic lineage, Synergini *sensu stricto*, while for the inquiline genus *Ceroptres* Hartig a new tribe, Ceroptresini, was recently established (Ronquist *et al.* 2015). *Synergus* is the most species-rich oak gall inquiline cynipid genus, with 110 known species world-wide, with a long and complex history of taxonomic revision (see Pujade-Villar *et al.* 2003, Melika 2006). Currently 42 valid species of *Synergus* are known from the Palaearctic: 30 from the Western Palaearctic and 12 from the Eastern Palaearctic (Sadeghi *et al.* 2006, Bernardo *et al.* 2013, Abe *et al.* 2011, Pujade-Villar *et al.* 2014). All known Western Palaearctic *Synergus* species associate with galls on *Quercus* L. (subgen. *Quercus*; Fagaceae). Precise host associations are only known for two of the 12 Eastern Palaearctic *Synergus* species: the bivoltine *S. gifuensis* Ashmead and univoltine *S. japonicus* Walker (Abe 1990, 1992, Abe *et al.* 2007), and are *Quercus* species in each case. The first generation of *Synergus gifuensis* develops in the asexual galls of *Andricus mukaigawae* (Mukaigawa) and *A. kashiwaphilus* Abe, while the second emerges from sexual galls of *Biorhiza nawai* (Ashmead); *S. japonicus* associates with the asexual galls of *A. mukaigawae* and *A. kashiwaphilus* (Abe 1990, 1992, Pujade-Villar *et al.* 2002). *Synergus chinensis* Melika, Ács & Bechtold and *S. xialongmeni* Melika, Ács & Bechtold, were described from China, and reared from undescribed oak cynipids (Melika *et al.* 2004). Host associations are unknown for *S. deqingensis* Pujade-Villar, Wang & Chen, the most recently described species (Pujade-Villar *et al.* 2014).

In the last decade, two *Synergus* species were described from the Eastern Palaearctic for which the host plant associations are other than *Quercus* (subgen. *Quercus*). One *Synergus* species, *S. itoensis* Abe, Ide & Wachi, appeared to have a capability to induce its own gall in the seed coat of the acorn of *Quercus* (subgen. *Cyclobalanopsis*) *glauca* Thunb. (Abe *et al.* 2011). *Synergus castaneus* Pujade-Villar, Bernardo & Viggiani, described from China, is the first known cynipid inquiline (Synergini) reared from *Castanea* galls (Fagaceae) (but not from the well-known gall of *Dryocosmus kuriphilus* Yasumatsu) (Bernardo *et al.* 2013). The herein described new species, *Synergus kawakamii* **sp. n.** is the first *Synergus* known to associate with galls developing on a *Castanopsis* (D. Don) Spach species (Fagaceae). Recently, Pujade-Villar *et al.* (2014) revised and re-validated *Synergus jezoensis* Uchida & Sakagami; the uncertain status of four other Eastern Palaearctic species described in the first half of 20th century, *Synergus atamiensis* Ashmead, *S. hakonensis* Ashmead, *S. iwatensis* Shinji, and *S. mizunarae* Shinji (Abe *et al.* 2007) is partially solved below.

The *Synergus* was traditionally subdivided into two sections. Section I contains species with a more or less broad band of punctures on metasomal tergites 2+3 (syntergite). Section II exhibit a syntergite with only a small dorsoposterior patch of punctures, which never extends laterally (Mayr 1872). This division is artificial and is not supported by a DNA sequence-based phylogeny (Ács *et al.* 2010), however, the section classification remains useful for biology-based separation and classification of species. The traditionally used characters for separating *Saphonecrus* from *Synergus* e.g. count of the lateral frontal carina and the lateral pronotal carina, the completeness of fore wing radial cell and the count of flagellomeres in female antenna are variable in *Saphonecrus* (*Synergus*).