Zootaxa 4567 (1): 047–060
https://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.4567.1.3
http://zoobank.org/urn:lsid:zoobank.org:pub:B1916909-5696-44EF-AC8F-E41CDF1E6DA8

Braconid and ichneumonid (Hymenoptera) parasitoid wasps of Lepidoptera from the Maltese Islands

DAVID MIFSUD[1,4], LUCIA FARRUGIA[2] & MARK R. SHAW[3]

[1]*Division of Rural Sciences and Food Systems, Institute of Earth Systems, University of Malta, Msida, Malta.*
E-mail: david.a.mifsud@um.edu.mt
[2]*Department of Biology, Faculty of Science, University of Malta, Msida MSD 2080, Malta. E-mail: lucia.farrugia.13@um.edu.mt*
[3]*Honorary Research Associate, National Museums of Scotland, Chambers Street, Edinburgh EH1 1JF, U.K.*
E-mail: markshaw1945@gmail.com
[4]*Corresponding author. E-mail: david.a.mifsud@um.edu.mt*

Abstract

Fourteen species of Ichneumonidae are here recorded from the Maltese Islands. Of these, all were reared from Lepidoptera hosts with the exception of *Netelia* (*Paropheltes*) *inedita* (Kokujev) which was collected from a malaise trap. Of these, the following species (or genera) are here reported for the first time from the Maltese Islands: *Chirotica meridionalis* Horstmann, *Gelis carbonarius* (de Stefani), *G. exareolatus* (Förster), *G. seyrigi* Ceballos, *Glypta* sp., *Meloboris* sp., *Netelia* (*Paropheltes*) *inedita* (Kokujev), *Ophion obscuratus* Fabricius and *Orthizema* sp. Twenty-five species of Braconidae are also here reported from Lepidoptera hosts with the exception of *Homolobus* (*Phylacter*) *meridionalis* van Achterberg which was collected from a malaise trap. Of these, the following species (or genera) represent new records for the Maltese Islands: *Apanteles metacarpalis* (Thomson), *Ascogaster* sp., *Clinocentrus excubitor* (Haliday) [previously misidentified as *C. exsertor* (Nees) by Papp (2015)], *Cotesia vestalis* (Haliday) [previously misidentified as *C. ruficrus* (Haliday) by Papp (2015)], *Dolichogenidea britannica* (Wilkinson), *Homolobus* (*Phylacter*) *meridionalis* van Achterberg, *Iconella* ? *meruloides* (Nixon), *Lysitermus tritoma* (Bouček), *Lysitermus suecius* (Hedqvist), *Microgaster messoria* Haliday, *Meteorus pulchricornis* (Wesmael), *Pholetesor circumscriptus* (Nees) [previously misidentified as *P. bicolor* (Nees) by Papp (2015)] and *Spathius pedestris* Wesmael. Thus previous records of *Clinocentrus exsertor* and *Pholetesor bicolor* from Malta were found to be based on misidentifications and are here excluded from the braconid fauna of Malta. Maltese records of *Cotesia abjecta* (Marshall) and *Cotesia jucunda* (Marshall) by Papp (2015) were found to be misidentifications and should both refer to *C. glomerata* (Linnaeus). Thus, both *Cotesia abjecta* and *Cotesia jucunda* are also here removed from the braconid fauna of Malta. The record of *Cotesia tibialis* (Curtis) by Papp (2015) was also based on a misidentification and should be attributed to *C. ruficrus* (Haliday). Thus, *C. tibialis* is also removed from the braconid fauna of Malta.

Key words: Braconidae, Ichneumonidae, Malta, Mediterranean, host records

Introduction

Parasitoid wasps are major enemies of virtually all Lepidoptera in terrestrial ecosystems. The most important parasitoids of the larval and pupal stages are Ichneumonidae and Braconidae of the superfamily Ichneumonoidea (Quicke, 2015) and, to a lesser extent but especially for somewhat concealed hosts, Eulophidae and Pteromalidae (less commonly other families) of Chalcidoidea (Noyes, 2018). Egg parasitism (or more cumbersomely parasitoidism), however, is practised by different families of Chalcidoidea and also Platygastridae. Hymenopterous parasitoids overall exhibit many life history strategies and behaviours to exploit their various hosts, but as far as Lepidoptera are concerned the host is attacked in its egg, larval or pupal stage, never as adults. Parasitoids may be solitary (one egg per host) or gregarious (a brood of several developing in or on each host), and the parasitoid larva(e) may develop either externally to the host's body (ectoparasitism) or inside it (endoparasitism). The host might be killed, or at least permanently arrested, by a venom at the time the adult oviposits, in which case the parasitoid is termed an idiobiont, or it might continue to develop and look after itself subsequently in which case

Accepted by J. Jennings: 7 Feb. 2019; published: 14 Mar. 2019

the parasitoid is a koinobiont. Either the stage attacked is the one killed (in the case of larval hosts sometimes after considerable growth and moulting) or else there is a delay in the development of the parasitoid such that the egg is attacked but the larva (or prepupa) is the stage killed—egg-larval parasitism—or the larva is attacked but development is delayed until the host has pupated—larva-pupal parasitism. In all of the above traits, a given parasitoid species is normally completely consistent, but some parasitoids of parasitoids (hyperparasitoids, or secondary parasitoids) can behave as a primary or secondary parasitoid of some Lepidoptera facultatively. All of the four possibilities, idiobiont endoparasitism, idiobiont ectoparasitism, koinobiont endoparasitism and koinobiont ectoparasitism occur, but the commonest are idiobiont ectoparasitism (typically of concealed hosts) and koinobiont endoparasitism (typically of exposed hosts). A somewhat fuller account of parasite(oid)ism, as it applies to European butterflies, is given by Shaw *et al.* (2009).

TABLE 1. Braconid records from the Maltese Islands recorded from lepidopteran hosts. Following re-examination of the specimens, those known to have been misidentified are marked with an asterisk (*), and commented on later in this paper.

Braconidae	Comments	Reference
Adelius subfasciatus Haliday, 1833	1♂ recorded from a Nepticulidae larva feeding on *Rhamnus lycioides* Linnaeus.	Papp, 2015
Bracon (*Bracon*) *murgabensis* Tobias, 1957	1♂ and 1♀ recorded from larvae of *Coleophora festivella* Toll, 1952 feeding on *Lotus cytisoides*. Possibly gregarious.	Papp, 2015
Habrobracon stabilis (Say, 1836)	3♂♂ and 3♀♀ recorded from larvae of *Plodia interpunctella* (Hübner, 1813). 6♂♂ and 2♀♀ recorded from seed pods of *Ceratonia siliqua* Linnaeus associated with unidentified Lepidoptera larvae. Almost certainly gregarious.	Papp, 2015
Apanteles carpatus (Say, 1836)	3♀♀ recorded from larvae of *Phyllonorycter messaniella* (Zeller, 1846). As this is a regular parasitoid of Tineidae but not of Gracillariidae, the host part of the record requires confirmation (the host remains were not preserved).	Papp, 2015
Apanteles galleriae Wilkinson, 1932	1♀ recorded from larva of *Galleria mellonella* (Linnaeus, 1758).	Papp, 2015
Choeras dorsalis (Spinola, 1808)	1♂ and 3♀♀ recorded from larvae of *Avaria hyerana* (Milliére, 1858). 1♀ recorded from larva of *Nothris verbascella* (Denis & Schiffermuller, 1775).	Papp, 2015
Choeras semele (Nixon, 1965)	1♀ recorded from larva of *Cacoecimorpha pronubana* (Hübner, 1799).	Papp, 2015
Cotesia glomerata (Linnaeus, 1758)	Recorded from larvae of *Pieris brassicae* (Linnaeus, 1758). Gregarious.	Valletta, 1972; Farrugia, 1995
**Cotesia jucunda* (Marshall, 1885)	1♂ and 2♀♀ recorded from larva of *Pieris rapae* (Linnaeus, 1758).	Papp, 2015
**Cotesia ruficrus* (Haliday, 1834)	1♂ recorded from a larva of a Plusiinae.	Papp, 2015
**Cotesia tibialis* (Curtis, 1830)	1♀ recorded from larva of *Mythimna unipunctata* (Haworth, 1809).	Papp, 2015
Dolichogenidea zerafai (Papp, 2015)	2♂♂ and 2♀♀ recorded from larvae of *Bedellia somnulentella* (Zeller, 1847).	Papp, 2015
Microplitis spectabilis (Haliday, 1834)	Recorded from an immature larva of *Noctua pronuba* (Linnaeus, 1758). Gregarious.	Mifsud, 1997
**Photolestor bicolor* (Nees, 1834)	1♀ recorded from larva of *Phyllonorycter trifasciella* (Haworth, 1828).	Papp, 2015
Mirax rufilabris Haliday, 1833	4♂♂ and 3♀♀ recorded from larvae of *Acalyptris minimella* (Rebel, 1926). 4♂♂ and 1♀ recorded from larvae of *Ectoedemia euphorbiella* (Stainton, 1869). 1♀ recorded from unidentified nepticulid larvae feeding on *Rhamnus lycioides* Linnaeus. 2♂♂ recorded from larvae of *Stigmella aurella* (Fabricius, 1775).	Papp, 2015
**Clinocentrus exsertor* (Nees, 1811)	2♀♀ recorded from larvae of *Avaria hyerana* (Millière, 1858).	Papp, 2015

So far, little is known about the Hymenoptera parasitoids of Lepidoptera occurring in the Maltese Islands. Parasitoids of Lepidoptera that have been reported from the Maltese Islands belong to the following families: Braconidae, Eulophidae, Ichneumonidae and Pteromalidae. Sixteen species of the family Braconidae have been recorded as reared from Lepidoptera as listed in Table 1.

Mifsud (2012) provided a check-list of the Ichneumonidae from the Maltese Islands in which all previous records were included. Information on species recorded from Lepidoptera hosts is provided in Table 2 with further comments where appropriate. Since then, Vas, Mifsud & Broad (2015) recorded *Trichomma enecator* (Rossi, 1790) from one male specimen that emerged from a pupa of *Aphelia amplana* (Hübner, 1813), while Vas (2016) described *Temelucha rea* from two females recorded from flowers of *Limbarda crithmoides* (Linnaeus) Dumort from Malta. Most probably, this species is a parasitoid of *Eublemma parva* (Hübner, 1808), since this moth also emerged from the flowers (Vas, 2016).

TABLE 2. Ichneumonid records from lepidopteran hosts after Mifsud (2012).

Ichneumonidae	Comments
Hyposoter ebeninus (Gravenhorst, 1829)	Recorded from *Pontia daplidice* (Linnaeus, 1758). It is unclear whether or not the more likely determination as *H. ebenitor* Aubert, 1972 was ruled out.
Metopius dentatus (Fabricius, 1779)	Recorded from *Hyles euphorbiae* (Linnaeus, 1758) and *Gastropacha quercifolia* (Linnaeus, 1758). The first of these seems questionable.
Ctenochares bicolorus (Linnaeus, 1767)	Recorded from pupae of *Autographa gamma* (Linnaeus, 1758).
Pimpla rufipes (Miller, 1759)	Recorded from pupae of *Pieris brassicae*, *Pieris rapae* and *Papilio machaon melitensis* (Eller, 1936).
Venturia canescens (Gravenhorst, 1829)	Recorded from larvae which probably belonged to *Selania leplastriana* (Curtis, 1831). This host, however, seems improbable and requires confirmation.
Diadegma semiclausum (Hellen, 1949)	Recorded from *Plutella xylostella* (Linnaeus, 1758).
Diadegma exareolator Aubert, 1964	1♂ and 2♀♀ recorded from *Bedellia somnulentella* (Zeller, 1847).
Diadegma armillatum (Gravenhorst, 1829)	A single specimen was recorded from larvae of *Prays oleae* (Bernard, 1788).

Materials and methods

Most of the material used during the present study was reared from Lepidoptera larvae. Very often larvae were kept isolated in plastic tubes until parasitoids emerged and then after 24 hours these were mounted on cards for further study. Subfamilies of both Ichneumonidae and Braconidae are arranged alphabetically and so are the genera within them.

Depositories and abbreviations:

DM—David Mifsud legit;
DMC—David Mifsud private collection;
LF—Lucia Farrugia legit;
MSC—Martin Schwarz private collection;
MZ—Mark Zerafa legit;
NMS—National Museum of Scotland;
TC—Thomas Cassar legit;
TCC—Thomas Cassar private collection.

Results

Family Ichneumonidae

(all records hereunder are solitary parasitoids)

Subfamily Banchinae

***Glypta* sp.**

Material examined: MALTA, Naxxar, 27.vi.2014, 1♂, emerged from larva of *Cydia* sp. feeding on *Vicia faba* green seeds. Larva was collected on iv.2013, MZ, NMS [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: This genus was never previously recorded from the Maltese Islands. However, it is a very large genus of koinobiont endoparasitoids of almost exclusively tortricid hosts, and undoubtedly several species will be found to occur in Malta.

***Syzeuctus tigris* Seyrig, 1926**

Material examined: MALTA, Sliema, 25.vii.2016, 1♀, emerged from flowers of *Limbarda crithmoides* with larvae of *Eublemma parva* (Hübner) (Lepidoptera: Erebidae), LF, NMS; Sliema, 13.ix.2016, 1♂ & 1♀, emerged from flowers of *Limbarda crithmoides* with *Eublemma parva*, LF, NMS; Għar Lapsi, 2.x.2016, 1♂, emerged from flowers of *Limbarda crithmoides* with *Eublemma parva*, LF, NMS. GOZO, Ramla l-Ħamra, 8.vii.2016, 1♂, emerged from flowers of *Limbarda crithmoides* with larvae of *Eublemma parva*, LF, NMS [parasitoids determined only to generic level by Mark Shaw and species was determined by David Mifsud; hosts determined by Michael Zerafa].

Notes: This species was first recorded in the Maltese Islands by Schembri (1992) without host data. It is a koinobiont endoparasitoid of concealed Lepidoptera larvae.

Subfamily Campopleginae

***Diadegma exareolator* Aubert, 1964**

Material examined: MALTA, Selmun, 23–30.i.2010, 1♂, emerged from *Bedellia somnulentella* (Zeller) (Lepidoptera: Lyonetiidae), MZ, NMS; Ħad-Dingli, 12.iii.2009, 1♂, emerged from *Dialectica scalariella* (Zeller) (Lepidoptera: Gracillaridae) on *Borago officinalis*, MZ, NMS; Mosta Valley, 10.vi.2009, 1♀, emerged from *Dialectica scalariella* (Zeller), MZ, NMS [parasitoids determined by Mark Shaw; hosts determined by Michael Zerafa].

Notes: This species was reported from the Maltese Islands by Shaw & Horstmann (1997) from *Bedellia somnulentella*. Most rearing records of *D. exareolator* are from *B. somnulentella*; however it has also been reared from other species in families such as Gracillaridae, Choreutidae and Yponomeutidae. *Diadegma exareolator* is a koinobiont endoparasitoid that attacks the host in its larval state and kills it in its cocoon (Shaw & Horstmann, 1997).

***Meloboris* sp.**

Material examined: MALTA, Mtaħleb, 11.iv.2008, 1♀, emerged from *Coleophora helianthemella* Miller (Lepidoptera: Coleophoridae), MZ, NMS [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: This genus has not previously been recorded from the Maltese Islands. *Meloboris* species are koinobiont endoparasitoids of various groups of Lepidoptera; nevertheless, a *Coleophora* species seems an improbable host and a small parasitoid cocoon overlooked on vegetation seems a more plausible source.

***Venturia canescens* (Gravenhorst, 1829)**

Materials examined: MALTA, Mosta, 20–30.ix.2016, 38 exx., emerged from *Plodia interpunctella* (Hübner)

(Lepidoptera: Pyralidae) larva feeding on bird seed mixture collected on 31.vii.2016, LF, DMC [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: This koinobiont endoparasitoid was first reported from Malta by Schembri (1992) and again by Mifsud (1997) from larvae probably belonging to *Selania leplastriana* (Curtis) (but see comment in Table 2). It is a common parasitoid of species from the pyralid subfamily Phycitinae, such as *Ephestia* and *Plodia* spp. (Rogers, 1972; Harvey *et al*., 2001). These moths are commonly found in warehouses, granaries, flour mills or similar environments that contain stored food products.

Subfamily Cryptinae

Orthizema sp.

Material examined: MALTA, Mosta Valley, 23.ii.2010, 3♂♂, emerged from *Eudarcia melitensis* Gaedike & Zerafa (Lepidoptera: Tineidae). Larva was collected on 22.i.2010, MZ, MSC [parasitoid determined by Martin Schwarz; host determined by Michael Zerafa].

Notes: This genus has not previously been recorded from the Maltese Islands.

Subfamily Ichneumoninae

Ctenochares bicolorus (Linnaeus, 1767)

Material examined: MALTA, Ħaż-Żebbug, 5.xii.2015, 1 ex., emerged from pupa of *Autographa gamma* (Linnaeus) (Lepidoptera: Noctuidae), MZ, DMC [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: From Malta, Schembri (1992) recorded this endoparasitoid from pupae of *Autographa gamma*. Rearing records all suggest that *C. bicolorus* is a parasitoid of noctuids of the subfamily Plusiinae (Fitton *et al*., 1983), but it is not clear whether it is a larva-pupal koinobiont or an idiobiont attacking the pupal stage.

Subfamily Ophioninae

Ophion obscuratus Fabricius, 1798

Material examined: MALTA, Buskett, 25.xii.2010, 1♂, emerged supposedly from a larva of *Lasciocampa quercus* (Linnaeus) (Lepidoptera: Lasciocampidae), MZ, NMS. **Additional material:** Buskett, Verdala Palace, 1.xii.2016–30.i.2017, 1♂ & 3♀♀, in Malaise trap, DM, NMS; Gnejna, 25.xii.2015, 1♀, TC, TCC [parasitoids were determined by Mark Shaw; host determined by Michael Zerafa].

Notes: New record for the Maltese Islands. The specimen purportedly from *L. quercus* is of a comparable (relatively small) size to those seen from the usual noctuid hosts of this taxon in Britain, and *Ophion* species normally kill the host as a prepupa. Thus the record seems highly improbable, but the host remains are unavailable for re-examination. *Ophion obscuratus* is a nocturnal koinobiont endoparasitoid of several noctuid hosts that feed on exposed low vegetation.

Subfamily Phygadeuontinae

Chirotica meridionalis Horstmann, 1983

Material examined: MALTA, Baħar iċ-Ċagħaq, 3.v.2015, 1 ex., emerged from case of *Phalacropteryx apiformis* (Rossi) (Lepidoptera: Psychidae), TC, MSC [parasitoid determined by Martin Schwarz; host determined by Michael Zerafa].

Notes: *Chirotica meridionalis* represents a new record for the Maltese Islands and is almost certainly an idiobiont ectoparasitoid, known to parasitize Psychidae. It has been recorded from *Phalacropterix apiformis* (Rossi, 1790) and *P. bruandi* (Lederer, 1855) (Yu *et al*., 2012; Aubert *et al*., 1984).

Gelis carbonarius (de Stefani, 1884)

Materials examined: MALTA, It-Torri l-Abjad, 25.xii.2005, 1♀, captured laying into a case of *Coleophora semicinerea* Straudinger (Lepidoptera: Coleophoridae), MZ, MSC [parasitoid determined by Martin Schwarz; host determined by Michael Zerafa].

Notes: New record for the Maltese Islands. *Gelis carbonarius* has been reported as a parasitoid of Braconidae that are associated with Lepidoptera (Stefanescu *et al*., 2009; Frago *et al.*, 2012). *Gelis carbonarius* is probably polyphagous and can be either a primary parasitoid or a pseudohyperparasitoid, similarly to the closely related species *Gelis agilis* (Fabricius, 1775) (M. Schwarz, *pers comm.*, 2017). *Gelis* species are idiobiont ectoparasitoids.

Gelis exareolatus (Förster, 1850)

Materials examined: MALTA, Qammieġħ, 15.i.2006, 1♀, emerged from *Coleophora acrisella* Milliére (Lepidoptera: Coleophoridae), MZ, MSC; Ħad-Dingli, 27.x.2009, 1♂ & 1♀, emerged from *Coleophora festivella* Toll, MZ, MSC; Ħad-Dingli, 20.x.2011, 1♀, emerged from *Coleophora fretella* Zeller, which was collected on 13.xii.2010, MZ, MSC; Għajn Tuffieħa, 4.i.2015, 1♂, emerged from *Coleophora fretella*, which was collected on 7.xii.2014, MZ, MSC [parasitoids determined by Martin Schwarz; hosts determined by Michael Zerafa].

Notes: New record for the Maltese Islands. *Gelis exareolatus* has been recorded as a primary idiobiont ectoparasitoid of *Coleophora* spp. (especially on *Juncus*), *Exoteleia dodecella* (Linnaeus) as well as *Kermania pistaciella* Amsel (Schwarz & Shaw, 1999; Yu *et al*., 2012; Mehrnejad, 2002). It is also known as a pseudohyperparasitoid, parasitizing the cocoons of braconids attacking *K. pistaciella* (van Achterberg & Mehrnejad, 2002).

Gelis seyrigi Ceballos, 1925

Materials examined: MALTA, Mellieħa, 14.iii.2003, 1♀, emerged from *Oiketicoides* sp. (Lepidoptera: Psychidae), MZ, MSC [parasitoid determined by Martin Schwarz; host determined by Michael Zerafa].

Notes: New record to the Maltese Islands. *Gelis seyrigi* was reported as a parasitoid of *Coleophora* spp. (Lepidoptera: Coleophoridae) and this idiobiont ectoparasitoid may be associated with saline habitats (Schwarz & Shaw, 1999; Yu *et al*., 2012).

Subfamily Pimplinae

Pimpla rufipes (Miller, 1759)

Material examined: MALTA, Siġġiewi, xi.2005, 1♀, from pupa of *Vanessa atalanta* (Linnaeus) (Lepidoptera: Nymphalidae), GD, DMC; Wied il-Għasel, 22.xi.2013, 1♀, from pupa of *Orgyia trigotephras* Boisduval (Lepidoptera: Erebidae) which was collected on 13.xi.2013, MZ, DMC [parasitoids determined by Mark Shaw; hosts determined by Michael Zerafa].

Notes: *Pimpla rufipes* was recorded from the Maltese Islands by Schembri (1992) from pupae of *Pieris brassicae*, *Pieris rapae* and *Papilio machaon melitensis*. Mifsud (1997) recorded this species again from pupae of *P. brassicae*. This species is an idiobiont endoparasitoid that attacks a range of medium sized exposed or weakly cocooned Lepidoptera pupae (Fitton *et al*., 1988, as *P. hypochondriaca*).

Subfamily Tryphoninae

***Netelia* (*Paropheltes*) *inedita* (Kokujev, 1899)**

Material examined: MALTA, Buskett, Verdala Palace, 1.xii.2016–30.i.2017, 2♀♀, in Malaise trap, DM, NMS [determined by Mark Shaw].

Notes: New record for the Maltese Islands. This species was only collected via malaise traps but we are including it in this work since it represents a new record for Malta and the genus is known to comprise only koinobiont ectoparasitoids of Lepidoptera.

Family Braconidae

Subfamily Agathidinae

***Agathis* sp.**

Material examined: MALTA, Mosta Valley, 2.iv.2007, 1♀, emerged from *Coleophora fretella* (Zeller) (Lepidoptera: Coleophoridae), MZ, DMC [parasitoid determined to generic level by Mark Shaw; host determined by Michael Zerafa].

Notes: This koinobiont endoparasitoid genus is represented by three species in the Maltese Islands (Simbolotti & van Achterberg, 1999; Papp, 2015).

Subfamily Braconinae

***Habrobracon hebetor* (Say, 1836)**

Material examined: MALTA, Mosta, 6.ix.–1.x.2016, 13 exx., emerged from *Plodia interpunctella* (Lepidoptera: Pyralidae) feeding on bird seed mixture which was collected on 31.viii.2016, LF, DMC, NMS; Wied Għollieqa, 30.ix.–17.xi.2016, 73 exx., emerged from larvae of *Apomyelois ceratoniae* feeding on *Ceratonia siliqua* seed pods, LF, DMC, NMS [parasitoids determined by Mark Shaw; hosts dteremined by Michael Zerafa].

Notes: This species was previously recorded from Malta by Papp (2015) from 1♂ & 1♀ associated with stored beeswax without host data. It is a small, gregarious idiobiont ectoparasitoid that attacks final instar larvae of many weakly concealed Lepidoptera from different families. It is commonly reared from *Plodia interpunctella* and has also been recorded from *Apomyelois ceratoniae* (Yu *et al*., 2012).

Subfamily Cheloninae

***Ascogaster* sp.**

Material examined: MALTA, Girgenti, 25.vii.2016, 1 ex., emerged from caper buds infested with Tephritidae and probably Tortricidae though none was reared TC, DMC [parasitoid determined to generic level by Mark Shaw; host determination not made].

Notes: This genus is here recorded for the first time from the Maltese Islands. The host would probably have been a tortricid, of which *Ascogaster* species are egg-larval koinobiont endoparasitoids.

Subfamily Doryctinae

***Spathius pedestris* Wesmael, 1838**

Material examined: MALTA, Siggiewi, 3.x.2016, 1♀, emerged from *Ceratonia siliqua* pods infested with larvae of *Apomyelois ceratoniae*, LF, DMC [parasitoid determined by Mark Shaw; host identified by Michael Zerafa].

Notes: New record for the Maltese Islands. This species is probably thelytokous.

Subfamily Euphorinae

Meteorus pulchricornis (Wesamel, 1835)

Material examined: MALTA, Buskett, 25.v.2014, 2♂♂, from larvae of *Xanthia ruticilla* (Esper) (Lepidoptera: Noctuidae), MZ, DMC [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: New record for the Maltese Islands. It is a koinobiont larval endoparasitoid with an exceptionally wide recorded host range that extends to fifteen families (in ten superfamilies) of Lepidoptera and includes numerous Noctuidae (Maeto, 2018).

Subfamily Homolobinae

Homolobus (*Phylacter*) *meridionalis* van Achterberg, 1979

Material examined: MALTA, Buskett, Verdala Palace, 1.xii.2016–30.i.2017, 1♀, in Malaise trap, DM, DMC [parasitoid determined by Mark Shaw].

Notes: Even though this koinobiont endoparasitoid was not reared from a lepidopteran host, it is being included for two reasons: (i) it represents a new record for the Maltese Islands and (ii) because its only known host is a lepidopteran. This species was recorded as a parasitoid of the noctuid, *Dryobota labecula* (Esper, 1788) feeding in spring on *Quercus* in southern France, but it is probably a bivoltine species and likely to parasitize low-feeding noctuids in its overwintering generation (Shaw, 2015).

Subfamily Lysiterminae

Lysitermus tritoma (Bouček, 1956)

Material examined: MALTA, Mosta Valley, v.2010, 1♂ & 2♀♀, emerged from larvae of *Eudarcia derrai* (Gaedike) (Lepidoptera: Tineidae), which were collected on 22.i.2010, MZ, NMS [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: New record for the Maltese Islands. Hosts of this species were not previously known, however Jonsell *et al*. (2016) suggest that it is a parasitoid of Lepidoptera and it is almost certainly an idiobiont ectoparasitoid.

Lysitermus suecius (Hedqvist, 1957)

Material examined: MALTA, Buskett, 22.xi.2006, 1♀ & 1♂, emerged from larvae of *Luffia lapidella* (Goeze) (Lepidoptera: Psychidae), MZ, NMS [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: New record for the Maltese Islands. From the Lepidoptera, this species has been reported to parasitize *Luffia* spp. in Sardinia (van Achterberg, 1991) and the above data is in accordance with this. It is almost certainly an idiobiont ectoparasitoid.

Subfamily Microgastrinae

Apanteles carpatus (Say, 1836)

Material examined: MALTA, Naxxar, 2.vi.2006, 1♀, from larva of Tineidae, MZ, DMC; Naxxar, 5.vi.2006/ 26.iii.2010, 3♀♀, emerged from larvae of *Phyllonorycter messaniella* Zeller (Lepidoptera: Gracillariidae), MZ,

NMS; Naxxar, 10.ii.2010, 1♀, emerged from *Tinea messalina*, MZ, DMC; Mosta Valley, 20.iv.2007, 1♀, emerged from Tineidae, MZ, DMC; Ħad-Dingli, 1.v.2014, 1♀, emerged from *Tinea messalina* Robinson (Lepidoptera: Tineidae), MZ, DMC [parasitoids determined by Mark Shaw; hosts determined by Michael Zerafa].

Notes: This species was previously reported from Malta by Papp (2015) whose material was re-examined and his identification confirmed. *Apanteles carpatus* is a cosmopolitan koinobiont endoparasitoid that regularly attacks Lepidoptera of the family Tineidae (Askew & Shaw, 1986; Yu *et al*., 2012). The above record from Gracillariidae may represent a misidentified lepidopteran host.

Apanteles galleriae Wilkinson, 1932

Material examined: MALTA, Żejtun, 11.vii.2016, 1♂, from larva of *Galleria melonella* (Linnaeus) (Lepidoptera: Pyralidae), LF, DMC [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: This species was previously reported from Malta by Papp (2015) from the same lepidopteran host. It is a cosmopolitan, koinobiont, endoparasitoid of *Galleria mellonella* (Linnaeus) (Lepidoptera: Pyralidae), *Achroia grisella* (Fabricius) (Lepidoptera: Pyralidae) and *A. innotata* (Walker) (Watanabe, 1987).

Apanteles metacarpalis (Thomson, 1895)

Material examined: MALTA, Selmun, 3–10.ii.2013, 4 exx., emerged from *Chrysoesthia atriplicella* (Amesl) (Lepidoptera: Gelechiidae) mining in *Atriplex halimus*, MZ, NMS [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: New record for the Maltese Islands. This species is a koinobiont endoparasitoid of a limited range of species of the family Gelechiidae.

Choeras dorsalis (Spinola, 1808)

Material examined: MALTA, Binġemma, 2–3.vi.2014, 2♂♂, emerged from larvae of *Nothris verbascella* on *Verbascum*, MZ, DMC; Bingemma, 11.v.2014, 1♀, reared from larva of *Nothris verbascella* Denis & Schiffermüller (Lepidoptera: Gelechiidae), MZ, DMC; Fawwara, 28–29.iii.2006, 1♂ & 3♀♀, reared from larva of *Avaria hyeranana* (Milliére) (Lepidoptera: Tortricidae), MZ, DMC; Mosta Valley, 24.vi.2014, 1♀, emerged from Lepidoptera larva feeding on *Dittrichia viscosa*, MZ, DMC [parasitoid identified by Mark Shaw; host identified by Michael Zerafa].

Notes: *Choeras dorsalis* was previously reported from Malta by Papp (2015) whose identification is here confirmed. It is a koinobiont endoparasitoid recorded from several families of Lepidoptera larvae (Arthur & Mason, 1986; Yu *et al*., 2012).

Choeras semele (Nixon, 1965)

Material examined: MALTA, Naxxar, 10.iii.2008, 1♀, emerged from larvae of *Cacoecimorpha pronubana* (Hübner) (Lepidoptera: Tortricidae), MZ, NMS [parasitoid identified by Mark Shaw; host identified by Michael Zerafa].

Notes: *Choeras semele* was previously reported from Malta by Papp (2015) whose identification is here confirmed. It is a koinobiont endoparasitoid recorded from several families of Lepidoptera larvae (Arthur & Mason, 1986; Yu *et al*., 2012).

***Cotesia glomerata* (Linnaeus, 1758)**

Material examined: MALTA, Naxxar, 15.iii.2013, 3 exx., emerged from *Pieris rapae*, MZ, DMC; Qrendi, 8–11.x.2016, 290 exx., emerged from *Pieris brassicae* larvae feeding on *Diplotaxis tenuifolia*, which were collected on 6.x.2016, LF, DMC; St. Thomas Bay, 30.xi.2013, 1♂ & 1♀, reared from larva of *Pieris brassicae*, DM, DMC; Naxxar, i.2014, 1♂ & 2♀♀, reared from larva of *Pieris rapae*, MZ, DMC [parasitoids determined by Mark Shaw; hosts determined by Michael Zerafa].

Notes: First reported from Malta by Valletta (1972) from larvae of *Pieris brassicae*. Farrugia (1995) also reared this parasitoid from the same host species. The records of *Cotesia abjecta* (Marshall, 1885) and *Cotesia jucunda* (Marshall, 1885) by Papp (2015) from Malta are incorect and should both refer to *C. glomerata* following re-examination of his cited material. Thus both *C. abjecta* and *C. jucunda* are removed from the braconid fauna of Malta. *C. glomerata* is a gregarious koinobiont endoparasitoid that commonly parasitizes larvae of *Pieris brassicae*. It also commonly parasitizes larvae of *Pieris rapae*, however the former is preferred over the latter (Vos *et al*., 1998).

***Cotesia ruficrus* (Haliday, 1834)**

Material examined: MALTA, Għajn Znuber, 22.ii.2006, 2♀♀, emerged from larva of *Mythimna unipuncta* (Haworth) (Lepidoptera: Noctuidae), MZ, DMC [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: The above material was identified and cited by Papp (2015) as *C. tibialis* (Curtis) but it proved to be misidentified and should be attributed to *C. ruficrus*, which is a gregarious koinobiont endoparasitoid with a wide range of recorded hosts of (particularly) low-feeding Noctuidae. Thus, *C. tibialis* is here removed from the braconid fauna of Malta.

***Cotesia vestalis* (Haliday, 1834)**

Material examined: MALTA, Naxxar, 26.vi.2012, 1♂, reared from a larva of a Plusiinae, MZ, DMC [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: The above cited material was incorrectly identified and cited as *C. ruficrus* (Haliday) by Papp (2015). *Cotesia vestalis* (= *plutellae* Kurdjumov) is a well-known koinobiont endoparasitoid of the plutellid, *Plutella xylostella* (Linnaeus) but parasitises several other low-feeding hosts including species of Noctuidae and Nymphalidae.

***Dolichogenidea britannica* (Wilkinson, 1941)**

Material examined: MALTA, Sliema, 14.vii–08.ix.2016, 2♂♂ & 9♀♀, from flowers of *Limbarda crithmoides* with larvae of *Gymnoscelis rufifasciata* (Lepidoptera: Geometridae) and *Eublemma parva* (Lepidoptera: Erebidae), LF, NMS. GOZO, Ramla l-Ħamra, 28–31.vii.2016, 2♂♂, from flowers of *Limbarda crithmoides* infested with larvae of *Gymnoscelis rufifasciata* and *Eublemma parva*, LF, DMC, NMS [parasitoids determined by Mark Shaw; hosts determined by Michael Zerafa].

Notes: New record for the Maltese Islands. This species is a koinobiont endoparasitoid whose usual host is the gelechiid, *Ptocheuusa paupella* (Zeller) (Lepidoptera: Gelechiidae), and both of the above suggested hosts seem highly unlikely. However, additional host records from other Gelechiidae and also Cosmopterigidae are known (Fernandez-Triana *et al*., 2014), but no such hosts emerged from the collected plant material.

***Dolichogenidea appellator* (Telenga, 1949)**

Material examined: MALTA, Dingli, 15.v.2004, 1♀, reared from unidentified larva feeding on *Inula crithmoides*, MZ, NMS [parasitoid identified by Mark Shaw].

Notes: This species was previously reported from Malta by Papp (2015) under its junior synonym *D. litae* (Nixon). Otherwise, his identification is here confirmed. It is a koinobiont endoparasitoid, known from plutellid and gelechiid hosts.

Iconella ? *meruloides* (Nixon, 1965)

Material examined: MALTA, Wied Għollieqa, 29.vii.2016, 1♂, emerged from *Ceratonia siliqua* seed pods infested with larvae of *Apomyelois ceratoniae* (Zeller) (Lepidoptera: Pyralidae), LF, NMS; Wied Għollieqa, 9.ix.–1.x.2016, 2♂♂ & 1♀, emerged from *Ceratonia siliqua* seed pods infested with larvae of *Apomyelois ceratoniae*, LF, NMS [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: The material is definitely not atributable to the related *Iconella myeloenta* (Wilkinson, 1937) although that is a well-known parasitoid of *A. ceratoniae*. Although smaller and possibly with a slightly longer ovipositor it agrees well with the type of *I. meruloides*, known as a parasitoid of the unrelated *Lobesia botrana* (Denis & Schiffermüller) (Lepidoptera: Tortricidae) (Nixon, 1976). New record for the Maltese Islands, but its identity is in doubt pending further material. It is a koinobiont endoparasitoid.

Microgaster messoria Haliday, 1834

Material examined: MALTA, Il-Fawwara limits of Għajn Tuffieħa, 29.iii.2006, 1♀, emerged from *Avaria hyerana* (Lepidoptera: Tortricidae), MZ, NMS; Mgarr, 15.xii.2013, 1♂ & 2♀♀, from *Cydia amplana*, MZ, DMC, NMS [parasitoids identified by Mark Shaw; hosts identified by Michael Zerafa].

Notes: This is a solitary koinobionnt endoparasitoid of Lepidoptera larvae including Tortricidae, Gracillaridae and Crambidae among others (Vance, 1932; Yu *et al*., 2012; Shaw, 2012). The *M. messoria* larva undergoes three instars in which it feeds on the host internally. It then emerges from the host and feeds on it externally during its final instar prior to constructing its cocoon (Vance, 1932, as *M. tibialis*).

Pholetesor circumscriptus (Nees, 1834)

Material examined: MALTA, Għajn Znuber, 8.iv.2009, 1♀, emerged from larva of *Phyllonorycter trifasciella* (Haworth) (Lepidoptera: Gracillariidae), MZ, DMC [parasitoid determined by Mark Shaw; host determined by Michael Zerafa].

Notes: New record for the Maltese Islands. This koinobiont endoparasitoid was previously reported as *P. bicolor* (Nees) by Papp (2015), but re-examination of that material proved that to be a misidentification. Thus *P. bicolor* is excluded from the Maltese braconid fauna.

Subfamily Miracinae

Mirax rufilabris Haliday, 1833

Material examined: MALTA, Naxxar Gap, 20.xi.2008, 2 exx., emerged from larva of *Ectoedemia euphorbiella* (Lepidoptera: Nepticulidae), MZ, DMC; Naxxar Gap, 22–23.xii.2009, 2 exx., emerged from larva of *Ectoedemia euphorbiella* which was collected in iii.2009, MZ, NMS [parasitoids identified to generic level by Mark Shaw; host identified by Michael Zerafa].

Notes: This species was recorded from Malta by Papp (2015) but the material was not closely re-examined to confirm or otherwise his identification. It is a koinobiont endoparasitoid of Lepidoptera from the family Nepticulidae (Shaw & Huddleston, 1991; Shaw & Askew, 1976).

Subfamily Rogadinae

***Aleiodes apicalis* (Brullé, 1832)**

Material examined: MALTA, Wied il-Kbir, 20.xii.2014, 1 ex., from Lepidoptera larva feeding on *Rumex conglomeratus* which was collected in March of 2014, MZ, DMC; Torri l-Abjad, 27.xii.2005, 1♀, emerged from unidentified Lepidoptera larva feeding on *Lactuca*, MZ, DMC [parasitoids determined by Mark Shaw; hosts determined by Michael Zerafa].

Notes: This species was recorded from Malta by Papp (2015) as *Aleiodes* (*Aleiodes*) *ductor* var. *reticulator* (Nees, 1834). Although this species has been widely misidentified as a form of *A. ductor*, its correct name is *A. apicalis*. It is a koinobiont endoparasitoid of plusiine noctuids, and may even be restricted to *Autographa gamma* (Linnaeus). On reviewing the above-mentioned material, it was noted that they had both emerged from a lepidopteran larval mummy. The host Lepidoptera remains were both determined as certainly a plusiine noctuid, probably *Autographa gamma* by Mark Shaw.

***Aleiodes testaceus* (Telenga, 1941)**

Material examined: MALTA, Buskett, 24.v.2014, 1♀, emerged from ? *Gymnoscelis rufifasciata* (Haworth) (Lepidoptera: Geometridae) larva feeding on *Quercus ilex*, MZ, DMC [parasitoid and host determined by Mark Shaw].

Notes: This species was previously recorded from Malta by Papp (2015) based on 2♀♀ without host data. It is a parasitoid of small Geometridae (*Eupithecia* and close relatives) associated with flowers, especially of trees such as *Quercus* and shrubby plants, but including field layer plants (van Achterberg & Shaw, 2016).

***Clinocentrus excubitor* (Haliday, 1836)**

Material examined: MALTA, Fawwara, limits of Għajn Tuffieħa, 29.iii.2006, 1♀, emerged from larva of *Avaria hyerana* (Milliére) (Lepidoptera: Tortricidae), MZ, NMS [parasitoid identified by Mark Shaw but this is probably a species aggregate; host identified by Michael Zerafa].

Notes: New record for the Maltese Islands. This koinobiont endoparasitoid was previously reported as *C. exsertor* (Nees) from Malta by Papp (2015), but re-examination of the material proved that to be a misidentification and it should be referred to *C. excubitor*.

Acknowlegements

We would like to thank Martin Schwarz for the identification of *Chirotica meridionalis* Horstmann, *Gelis carbonarius* (de Stefani), *G. exareolatus* (Förster), *G. seyrigi* Ceballos and *Orthizema* sp. We also thank Michael Zerafa who collected parasitoids for us and donated this material for the present study. We also thank him for identifying Lepidoptera hosts. We also thank Thomas Cassar for providing additional material he collected or reared from Lepidoptera hosts.

References

Achterberg, C. van (1991) Revision of the genera of the Afrotropical and W. Palaearctic Rogadinae Foerster (Hymenoptera: Braconidae). *Zoologische Verhandelingen*, 273 (1), 1–101.

Achterberg, C. van & Mehrnejad, M.R. (2002) The braconid parasitoids (Hymenoptera: Braconidae) of *Kermania pistaciella* Amsel (Lepidoptera: Tineidae: Hieroxestinae) in Iran. *Zoologische Mededelingen*, 76, 27–39.

Achterberg, C. van & Shaw, M.R (2016) Revision of the western Palaearctic species of *Aleiodes* Wesmael (Hymenoptera, Braconidae, Rogadinae). Part 1: Introduction, key to species groups, outlying distinctive species, and revisionary notes on

some further species. *ZooKeys*, 639, 1–164.
https://doi.org/10.3897/zookeys.639.10893

Arthur, A.P. & Mason, P.G. (1986) Life history and immature stages of the parasitoid *Microplitis mediator* (Hymenoptera: Braconidae), reared on the Bertha armyworm *Mamestra configurata* (Lepidoptera: Noctuidae). *The Canadian Entomologist*, 118 (5), 487–491.
https://doi.org/10.4039/Ent118487-5

Askew, R.R. & Shaw, M.R. (1986) Parasitoid communities: their size, structure and development. *In*: Waage, J. & Greathead, D. (Eds.), *Insect parasitoids.* 13th symposium of the Royal Entomological Society of London, Academic Press, pp. 225–264.

Aubert, J.F., Halperin, J. & Gerling, D. (1984) Les Ichneumonides D'Israel. *Entomophaga*, 29 (2), 211–235.

Farrugia, C. (1995) The entomofauna associated with cauliflower (*Brassica oleracea* var. *botrytis*) cultivation in Gozo. *In*: Axiak, V (Ed.), *Biology Abstracts BSc 1994-1995 MSc 1994-1995*. Malta University Press, pg. 9.

Fernandez-Triana, J., Shaw, M.R., Cardinal, S. & Mason, P.G. (2014) Contributions to the study of the Holarctic fauna of Microgastrinae (Hymenoptera, Braconidae). I. Introduction and first results of transatlantic comparisons. *Journal of Hymenoptera Research*, 37, 61–76.
https://doi:10.3897/jhr.37.7186

Fitton, M.G., Gauld, I.D., Roberts, L.I.N. & Walker, A.K. (1983) An African ichneumonid (Hymenoptera) in Australasia. *Bulletin of Entomological Research*, 73, 465–468.

Fitton, M.G., Shaw, M.R. & Gauld, I.D. (1988) Pimpline Ichneumon-Flies Hymenoptera, Ichneumonidae (Pimplinae). *In*: Barnard, P.C. & Askew, R.R. (Eds.), *Handbook for the Identification of British Insects*. Vol. 7, Part 1. London: Royal Entomological Society of London, pp. 3–110.
https://doi.org/10.1017/S0007485300009081

Frago, E., Pujade-Villar, J., Guara, M. & Selfa, J. (2012) Hyperparasitism and seasonal patterns of parasitism as potential causes of low top-down control in *Euproctis chrysorrhoea* L. (Lymantriidae). *Biological Control*, 60 (2), 123–131.
https://doi.org/10.1016/j.biocontrol.2011.11.013

Harvey, J.A., Harvey, I.F. & Thompson, D.J. (2001) Lifetime reproductive success in the solitary endoparasitoid, *Venturia canescens*. *Journal of Insect Behaviour*, 14 (5), 573–593.
https://doi.org/10.1023/A:1012219116341

Jonsell, M., Alonso, C.G., Forshage, M., Achterberg, C. van & Komonen, A. (2016) Structure of insect community in the fungus *Inonotus radiatus* in riparian boreal forests. *Journal of Natural History*, 50 (25–26), 1613–1631.
https://doi.org/10.1080/00222933.2016.1145273

Maeto, K. (2018) Polyphagous koinobiosis: the biology and biocontrol potential of a braconid endoparasitoid of exophytic caterpillars. *Applied Entomology and Zoology*, 53 (4), 433–446.
https://doi.org/10.1007/s13355-018-0581-9

Mehrnejad, M.R. (2002) The natural parasitism ratio of the pistachio twig borer moth, *Kermania pistaciella*, in Iran. *Acta Horticulturae*, 591, 541–544.
https://doi.org/10.17660/ActaHortic.2002.591.83

Mifsud, D. (1997) Biological control in the Maltese Islands: Past initiatives and future programmes. *EPPO bulletin*, 27 (1), 77–84.
https://doi.org/10.1111/j.1365-2338.1997.tb00619.x

Mifsud, D. (2012) *Syrphophilus bizonarius* (Gravenhorst, 1829) (Hymenoptera) - new to Malta, with a revised check-list of the Ichneumonidae of the Maltese Islands. *Bulletin of the Entomological Society of Malta*, 5, 179–183.

Nixon, G.E.J. (1976) A revision of the north-western European species of the *merula, lacteus, vipio, ultor, ater, butalidis, popularis, carbonarius* and *validus*-groups of *Apanteles* Förster (Hymenoptera, Braconidae). *Bulletin of Entomological Research*, 65 (4), 687–735.
https://doi.org/10.1017/S0007485300006386

Noyes, J.S. (2018) Universal Chalcidoidea Database. World Wide Web electronic publication. Available from: http://www.nhm.ac.uk/chalcidoids (accessed 20 December 2018)

Papp, J. (2015) First contribution to the knowledge of the braconid wasps (Hymenoptera, Braconidae) of Malta. *Bulletin of the Entomological Society of Malta*, 7, 93–108.
https://doi.org/10.17387/BULLENTSOCMALTA.2015.07

Quicke, D.L.J. (2015) *The Braconid and Ichneumonid Parasitoid Wasps: Biology, systematics, evolution and ecology.* Wiley, Chichester? 681 pp.

Rogers, D. (1972) The ichneumon wasp *Venturia canescens*: oviposition and avoidance of superparasitism. *Entomologia Experimentalis et Applicata*, 15, 190–194.
https://doi.org/10.1111/j.1570-7458.1972.tb00195.x

Schembri, S.P. (1992) A preliminary list of the Ichneumonidae of the Maltese Islands (Hymenoptera). *Bollettino della Società Entomologica Italiana*, 124 (1), 49–54.

Schwarz, M. & Shaw, M.R. (1999) Western Palaearctic Cryptinae (Hymenoptera: Ichneumonidae) in the National Museums of Scotland, with nomenclatural changes, taxonomic notes, rearing records and special reference to the British check list. Part 2. Genus *Gelis* Thunberg (Phygadeuontini: Gelina). *Entomologist's Gazette*, 50 (2), 117–142.

Shaw, M.R. (2012) Notes on some European Microgastrinae (Hymenoptera: Braconidae) in the National Museums of Scotland, with twenty species new to Britain, new host data, taxonomic changes and remarks, and descriptions of two new species of *Microgaster* Latreille. *Entomologist's Gazette*, 63, 173–201.

Shaw, M.R. & Askew, R.R. (1976) Ichneumonoidea (Hymenoptera) parasitic upon leaf-mining insects of the orders Lepidoptera, Hymenoptera and Coleoptera. *Ecological Entomology*, 1, 127–133. https://doi.org/10.1111/j.1365-2311.1976.tb01213.x

Shaw, M.R. & Horstmann, K. (1997) An analysis of host range in the *Diadegma nanus* group of parasitoids in Western Europe, with a key to species (Hymenoptera: Ichneumonidae: Campopleginae). *Journal of Hymenoptera Research*, 6 (2), 273–296.

Shaw, M.R. (2015) A rearing record of *Homolobus* (*Phylacter*) *meridionalis* van Achterberg (Hymenoptera: Braconidae, Homolobinae) in the south of France. *Entomologist's Gazette*, 66, 245–247.

Shaw, M.R., Stefanescu, C. & Nouhuys, S. van (2009) Parasitoids of European Butterflies. *In*: Settele, J., Shreeve, T., Konvička, M. & van Dyck, H. (Eds.), *Ecology of Butterflies in Europe*. Cambridge University Press, pp. 130–156.

Shaw, M.R. & Huddleston, T. (1991) Classification and biology of braconid wasps (Hymenoptera: Braconidae). *In*: Dolling, W.R. & Askew, R.R. (Eds.), *Handbook for the Identification of British Insects.* Vol. 7, Part 11. London: Royal Entomological Society of London, pp. 3–126.

Simbolotti, G. & Achterberg, C. van (1999) Revision of the West Palaearctic species of the genus *Agathis* Latrielle (Hymenoptera: Braconidae: Agathidinae). *Zoologische verhandelingen*, 325, 1–167.

Stefanescu, C., Planas, J. & Shaw, M.R. (2009) The parasitoid complex attacking coexisting Spanish populations of *Euphydryas aurinia* and *Euphydryas desfontainii* (Lepidoptera: Nymphalidae, Melitaeini). *Journal of Natural History*, 43 (9–10), 553–568. https://doi.org/10.1080/00222930802610444

Valletta, A. (1972) *The Butterflies of Malta.* Malta: Giovanni Muscat, 64 pp.

Vance, A.M. (1932) *Microgaster tibialis* Nees as a hymenopterous parasite of *Pyrausta nubialis* Hubn. in Europe. *Annals of the Entomological Society of America*, 25 (1), 121–135. https://doi.org/10.1093/aesa/25.1.121

Vas, Z. (2016) A new species of *Temelucha* Förster from Malta with an updated and revised identification key to the Western Palaearctic *Temelucha* species (Hymenoptera, Ichneumonidae, Cremastinae). *Journal of Hymenoptera Research*, 48, 67–84. https://doi.org/10.3897/JHR.48.7094

Vas, Z., Mifsud, D. & Broad, G.R. (2015) New records of ichneumon wasps (Hymenoptera, Ichneumonidae) from Malta. *Bulletin of the Entomological Society of Malta*, 7, 139–142. https://doi:10.17387/BULLENTSOCMALTA.2015.11

Vos, M., Hemerik, L. & Vet, L.E.M. (1998) Patch exploitation by the parasitoids *Cotesia rubecula* and *Cotesia glomerata* in multi-patch environments with different host distributions. *Journal of Animal Ecology*, 67, 774–783. https://doi.org/10.1046/j.1365-2656.1998.00239.x

Watanabe, C. (1987) Occurrence of *Apanteles galleriae* (Hymenoptera: Braconidae), parasite of wax moth, in Japan. *Kontyu*, 55 (1), 165.

Yu, D.S., Achterberg, K. van & Horstmann, K. (2012) World Ichneumonidae 2012. Taxonomy, biology, morphology and distribution. Taxapad. Available from: http://www.taxapad.com/ (accessed 20 December 2018)