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New and Little-Known Species of Ichneumonidae (Hymenoptera) for the Iranian Fauna

Janko KOLAROV[1] Neveen S. GADALLAH[2] Hassan GHAHARI[3*]

Reijo JUSSILA[4]

[1]Faculty of Pedagogie, University of Plovdiv, Plovdiv, BULGARIA

[2]Entomology Department, Faculty of Science, Cairo University, Giza, EGYPT

[3]Department of Agriculture, Yadegar-e-Imam Khomeini (RAH) Shahre Rey Branch, Islamic Azad University, Tehran, IRAN

[4]Zoological Museum, Department of Biology, University of Turku, FINLAND

e-mails: [1]jkolarov@uni-plovdiv.bg, [2]n_gadallah@cu.edu.eg, [3*]hghahari@yahoo.com

[4]reijo.jussila@utu.fi

ORCID IDs: [1]0000-0002-0027-4162, [2]0000-0002-4381-9599, [3]0000-0001-6781-3776

*Corresponding author

ABSTRACT

This paper deals with faunistic surveys on Ichneumonidae (Hymenoptera) of Iran. In total, 18 species in eight subfamilies are recorded as new for the fauna of the country: Anomaloninae (one species), Banchinae (three species), Campopleginae (three species), Ctenopelmatinae (two species), Metopiinae (one species), Orthocentrinae (three species), Phygadeuontinae (two species), and Tryphoninae (three species).

Keywords: Faunistic list, new records, distribution, host records, Iran, Middle East.

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INTRODUCTION

Darwin wasps (Ichneumonidae), are one of the most species-rich groups of the tree of life (Klopfstein et al., 2019a), consisting of 1,601 genera and more than 25,300 described species worldwide (Yu, van Achterberg, & Horstmann, 2016). However, the knowledge of their true diversity is still lacking (Klopstein et al., 2019a), and an estimated 60,000–100,000 species are still waiting formal descriptions (Townes, 1969; Gauld, Sithole, Gomez, & Godoy, 2002; Meier et al., 2024).

The majority of ichneumonid species feed as larvae onto or into the pupae or larvae of other holometabolous insects (especially larvae and pupae of Lepidoptera) or spiders (Takasuka & Broad, 2024). Others parasitize the prepupae or pupae of aculeate Hymenoptera or woodboring beetles (Wahl, 1993; Huber, 2009; Broad, Shaw, & Fitton, 2018). Despite their abundance and widespread occurrence in most habitats, especially in forests rather than in grasslands and agricultural habitats, comparatively few ichneumonids have been used successfully in biological control programs (Sime & Brower, 1998; Huber, 2009; Quicke, 2015).

In Iran, over 622 species have been recorded so far (Yu et al., 2016; Karimi et al., 2023), while many unrecorded and undescribed species are still awaiting. The purpose of this paper is to represent 18 new species records as part of ongoing faunistic studies of Ichneumonidae in Iran.

MATERIAL AND METHODS

The paper is based on the collected ichneumonid material from different localities and altitudes of Iran by Malaise traps, light traps and sweeping net, and placed in ethanol 75%. Then the specimens were mounted on triangular labels, and sorted to subfamily following Broad et al. (2018) the genera have been identified by employing different identification keys (e.g., Townes, 1969, 1970a, b, 1971; Bennett, 2015). The specimens were identified or confirmed by the first and last authors, and with the help of J. Sawoniewicz (University of Bialystok, Poland). All the specimens are deposited in the collections of the determiners. Classification, nomenclature, distributional data and host records are reported following Yu et al. (2016), and other related references are given.

RESULTS

In total, 18 new species records of Ichneumonidae in eight subfamilies, Anomaloninae, Banchinae, Campopleginae, Ctenopelmatinae, Metopiinae, Orthocentrinae, Phygadeuontinae, and Tryphoninae were collected and identified from different regions of Iran. The list of species is given below alphabetically, together with distribution and host data.

Subfamily Anomaloninae Viereck, 1918

Genus *Heteropelma* Wesmael, 1849

***Heteropelma megarthrum* (Ratzeburg, 1848)**

Material examined: Razavi Khorasan province, Fariman, Kalateh-Khosh, 2♀, April 2011; Golestan province, Kordkoy, Salikandeh, 1♂, August 2017.

General distribution: Austria, Belarus, Belgium, Bulgaria, China, Czech Republic, Finland, France, Georgia, Germany, Hungary, India, Ireland, Italy, Japan, Kazakhstan, Korea, Latvia, Lithuania, Moldova, Mongolia, Netherlands, Norway, Poland, Romania, Russia, Sweden, Türkiye, Ukraine, United Kingdom (Yu et al., 2016), Iran (new record), Slovakia (Holý & Zeman, 2018), Switzerland (Klopfstein, Riedel, & Schwarz, 2019b).

Host records: The following hosts are summarized by Yu et al. (2016) for *H. megarthrum*: *Ochropacha duplaris* (Linnaeus) (Lepidoptera: Drepanidae), *Arichanna melanaria* (Linnaeus), *Bupalus piniarius* (Linnaeus), and *Ematurga atomaria* (Linnaeus) (Lepidoptera: Geometridae), *Anarta myrtilli* (Linnaeus), *Panolis flammea* (Denis and Schiffermüller), and *Polychrysia moneta* (Fabricius) (Lepidoptera: Noctuidae), *Bena prasinana* (Linnaeus) (Lepidoptera: Nolidae), *Araschnia levana* (Linnaeus) (Lepidoptera: Nymphalidae), and *Sphinx pinastri* Linnaeus (Lepidoptera: Sphingidae).

Subfamily Banchinae Wesmael, 1845

Genus *Alloplasta* Foerster, 1869

***Alloplasta piceator* (Thunberg, 1822)**

Material examined: Chaharmahal & Bakhtiari province, Lordegan, 1♀, 1♂, June 2015.

General distribution: Austria, Belgium, Bulgaria, Canada, China, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, Moldova, Netherlands, Norway, Poland, Romania, Russia, Spain, Sweden, Switzerland, Türkiye, United States of America, Ukraine, United Kingdom (Yu et al., 2016), Czech Republic, Slovakia (Holý & Zeman, 2018), Iran (new record).

Host records: *Alloplasta piceator* was recorded as a parasitoid of the two noctuid species, *Orthosia gothica* (Linnaeus), and *Orthosia gracilis* (Denis and Schiffermüller) (Brock, 2017; Broad et al., 2018). Other host records mentioned in Yu et al. (2016) have been reported but not confirmed recently (Crowley & Broad, 2023).

Genus *Glypta* Gravenhorst, 1829

***Glypta bifoveolata* Gravenhorst, 1829**

Material examined: Mazandaran province, Ramsar, Dalkhani forest, 3♀, July 2013.

General distribution: Austria, Belarus, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Latvia,

Lithuania, Luxembourg, Moldova, Mongolia, Netherlands, Norway, Poland, Romania, Russia, Spain, Sweden, Switzerland, Türkiye, Ukraine, United Kingdom (Yu et al., 2016), Iran (new record), Slovakia (Holý & Zeman, 2018).

Host records: The following lepidopteran hosts are summarized by Yu et al. (2016) as hosts for *G. bifoveolata*: *Bupalus piniarius* (Linnaeus) (Geometridae), *Xestia castanea* (Esper) (Noctuidae), *Dichrorampha simpliciana* (Haworth), *Epiblema foenella* (Linnaeus), *Hedya salicella* (Linnaeus), and *Zeiraphera griseana* (Hübner) (Tortricidae), and *Zygaena filipendulae* (Linnaeus) (Zygaenidae).

Glypta vulnerator Gravenhorst, 1829

Material examined: Guilan province, Astara, Sheykh-Mahalleh, 1♂, 7 July 2012.

General distribution: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Spain, Sweden, Switzerland, Türkiye, United Kingdom (Yu et al., 2016), Czech Republic (Holý & Zeman, 2018), Iran (new record).

Host records: The following lepidopterans have been summarized by Yu et al. (2016) as hosts for *G. vulnerator*: *Cochylimorpha hilarana* (Herrich-Schäffer), *Epiblema foenella* (Linnaeus), *Eucosma cana* (Haworth), and *Pammene gallicana* (Guenée) (Tortricidae).

Subfamily Campopleginae Foerster, 1869

Genus *Cymodusa* Holmgren, 1859

Cymodusa exilis Holmgren, 1860

Material examined: Isfahan province, Najaf-Abad, Lavark Research field, 1♀, September 2013; Kuhgiloyeh & Boyerahmad province, Pataveh, 1♀, 2♂, September 2015.

General distribution: Armenia, Austria, Azerbaijan, Belgium, Bulgaria, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Israel, Italy, Moldova, Mongolia, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Switzerland, Tajikistan, United Kingdom, Uzbekistan (Yu et al., 2016), Czech Republic (Holý & Zeman, 2018), Iran (new record).

Host records: *C. exilis* has been reared from *Scythris crassiuscula* (Herrich-Schäffer) (Lepidoptera: Scythrididae) (Shaw et al., 2016).

Genus *Diadegma* Foerster, 1869

Diadegma chrysostictos (Gmelin, 1790)

Material examined: Guilan province, Astara, Asgar-Abad, 2♀, 2♂, September 2015.

General distribution: Austria, Azerbaijan, Azores, Belgium, Bosnia-Hercegovina, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Egypt, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Moldova, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Tajikistan,

Tunisia, Türkiye, United States of America, Ukraine, United Kingdom, Uzbekistan (Yu et al., 2016), Iran (new record), Slovakia (Holý & Zeman, 2018).

Host records: The following lepidopterans have been recorded by Shaw et al. (2016) as hosts for *D. chrysostictos*: *Scrobipalpa ocellatella* (Boyd) (Gelechiidae), *Endrosis* sp. (Oecophoridae), *Ephestia elutella* (Hübner), and ?*Ephestia kuehniella* Zeller (Pyralidae), *Monolis laevigella* (Denis and Schiffermüller) (Tineidae), and *Kessleria saxifragae* (Stainton) (Yponomeutidae).

Genus *Dusona* Cameron, 1901

Dusona polita (Foerster, 1868)

Material examined: Kordestan province, Baneh, Kani-Chulkeh, 1♂, 5 July 2011.

General distribution: Algeria, Austria, Azerbaijan, Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Luxembourg, Moldova, Netherlands, Norway, Poland, Romania, Russia, Slovakia, Spain, Sweden, Ukraine, United Kingdom (Yu et al., 2016), Iran (new record), Switzerland (Klopfstein, Riedel & Schwarz, 2019b).

Host records: Recorded by Shaw et al. (2016) as being a parasitoid of the geometrid *Erannis defoliaria* (Clerck), and the noctuid *Orthosia cruda* (Denis & Schiffermüller).

Subfamily Ctenopelmatinae Foerster, 1869

Genus *Rhorus* Foerster, 1869

Rhorus longicornis (Holmgren, 1858)

Material examined: Mazandaran province, Qaemshahr, Sarokola, 1♀, 12 May 2015.

General distribution: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Kazakhstan, Latvia, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Spain, Sweden, Switzerland, Türkiye, Ukraine, United Kingdom (Yu et al., 2016), Iran (new record).

Host records: Unknown.

Genus *Scopesis* Foerster, 1869

Scopesis frontator (Thunberg, 1822)

Material examined: Guilan province, Lahijan, Narenjkelayeh, 1♂, September 2014.

General distribution: Austria, Belarus, Belgium, Czech Republic, Estonia, Finland, France, Germany, Hungary, Ireland, Latvia, Netherlands, Norway, Poland, Romania, Russia, Sweden, Switzerland, Ukraine, United Kingdom (Yu et al., 2016), Bulgaria, Türkiye(Riedel, Florez & Schmidt, 2024), Iran (new record).

Host records: Summarized by Yu et al. (2016) as being a parasitoid of the following tenthredinids: *Cladius pectinicornis* (Geoffroy), *Macrophya duodecimpunctata* (Linnaeus), and *Tenthredopsis tarsata* (Fabricius), as well as the noctuid *Xestia collina* (Boisduval) which is most probably a doubtful host record.

Subfamily Metopiinae Foerster, 1869

Genus *Exochus* Gravenhorst, 1829

***Exochus gravis* Gravenhorst, 1829**

Material examined: West Azarbaijan province, Chaldoran, Aqdash, 2♀, 26 July 2012.

General distribution: Austria, Bulgaria, Denmark, France, Germany, Greece, Hungary, Lithuania, Netherlands, Poland, Romania, Russia, Spain, Türkiye, Ukraine, United Kingdom (Yu et al., 2016), Czech Republic (Holý & Zeman, 2018), Iran (new record), Georgia (Riedel et al., 2023), Switzerland (Klopfstein et al., 2019b).

Host records: Unknown.

Subfamily Orthocentrinae Foerster, 1869

Genus *Megastylus* Schiødte, 1838

***Megastylus* (*Dicolus*) *pectoralis* (Foerster, 1871)**

Material examined: East Azarbaijan province, Khomarloo, near waterfall, 1♀, 1♂, September 2006.

General distribution: Armenia, Austria, Canada, Finland, France, Germany, Hungary, Lithuania, Mexico, Norway, Poland, Russia, United States of America, Ukraine, United Kingdom (Yu et al., 2016), Iran (new record), Switzerland (Klopfstein et al., 2019b).

Host records: Unknown.

Note: This is the first record of *Megastylus* (*Dicolus*) *pectoralis* for the Middle East.

Genus *Plectiscidea* Viereck, 1914

***Plectiscidea* (*Plectiscidea*) *canaliculata* (Foerster, 1871)**

Material examined: Guilan province, Astara, Qarehsoo, 2♀, 19 May 2015.

General distribution: Austria, Azerbaijan, Czech Republic Finland, France, Germany, Latvia, Lithuania, Montenegro, Netherlands, Norway, Poland, Russia, Serbia, Spain, Sweden, Ukraine, United Kingdom (Yu et al., 2016), Iran (new record), Georgia (Riedel et al., 2023), Switzerland (Klopfstein et al., 2019b).

Host records: The following hosts have been summarized by Yu et al. (2016) for *P. canaliculata*: *Allodia grata* (Meigen) (Diptera: Mycetophilidae), *Choristoneura murinana* (Hübner) (Lepidoptera: Tortricidae), and *Yponomeuta padella* (Linnaeus) (Lepidoptera: Yponomeutidae).

Note: This is the first record of *Plectiscidea* (*Plectiscidea*) *canaliculata* for the Middle East.

Plectiscidea (*Fugatrix*) *communis* (Foerster, 1871)

Material examined: East Azarbaijan province, Absh-Ahmad, near Imamzadeh Shah-Qasem, 1♀, 26 June 2010.

General distribution: Austria, Bulgaria, Canada, Czech Republic, Estonia, Finland, France, Germany, Iceland, Ireland, Italy, Kazakhstan, Lithuania, Montenegro, Norway, Poland, Romania, Russia, Serbia, United States of America, Ukraine, United Kingdom (Yu et al., 2016 as *Fugatrix communis*), Iran (new record), Slovakia (Holý & Zeman, 2018), Netherlands (Verheyde et al., 2021), Switzerland (Klopfstein et al., 2019b).

Host records: Unknown.

Note: This is the first record of *Plectiscidea* (*Fugatrix*) *communis* for the Middle East.

Subfamily Phygadeuontinae Foerster, 1869

Genus *Bathythrix* Foerster, 1869

Bathythrix claviger (Taschenberg, 1865)

Material examined: Golestan province, Kordkoy, Gorji-Mahalleh, 1♀, 1♂, 10 May 2013; Mazandaran province, Behshahr, Zaghmarz, 1♂, July 2018.

General distribution: Austria, Bulgaria, Canada, Czech Republic, Finland, France, Germany, India, Ireland, Italy, Japan, Korea, Latvia, Netherlands, Norway, Poland, Russia, Spain, Sweden, Türkiye, United Kingdom, United States of America (Yu et al., 2016), Iran (new record), Slovakia (Holý & Zeman, 2018), Switzerland (Klopfstein et al., 2019b).

Host records: The following hosts have been summarized by Yu et al. (2016) for *B. claviger*: *Agelastica alni* (Linnaeus) (Coleoptera: Chrysomelidae), *Dendroctonus micans* (Kugelann) (Coleoptera: Curculionidae), *Diprion pini* (Linnaeus) (Hymneoptera: Diprionidae), and *Allantus cinctus* (Linnaeus), *Ametastegia glabrata* (Fallén), and *Strongylogaster* sp. (Hymenoptera: Tenthredinidae). Kolarov (1995) has also reported *Phymatodes alni* (Linnaeus) (Coleoptera: Cerambycidae) as a host for this species.

Genus *Helcostizus* Foerster, 1869

Helcostizus restaurator (Fabricius, 1775)

Material examined: East Azarbaijan province, Arasbaran forest, 2♂, September 2014.

General distribution: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Moldova, Norway, Poland, Russia, Spain, Sweden, Switzerland, Türkiye, Ukraine, United Kingdom, United States of America (Yu et al., 2016), Iran (new record), Netherlands (Verheyde et al., 2021), Slovakia (Holý & Zeman, 2018).

Host records: The following coleopteran species are summarized by Yu et al. (2016) as hosts for *H. restaurator*: *Callidium aeneum* (De Geer), *Cerambyx scopolii* Fuessly, *Dicentrus blunthneri* Le Conte, *Dorcadion pedestre* (Poda), *Molorchus minor* (Linnaeus), *Phymatodes* spp., *Poecilium glabratum* (Charpentier), *Ropalopus clavipes* (Fabricius), and *Saperda populnea* (Linnaeus) (Cerambycidae), *Hylesinus oleiperda* (Fabricius), and *Pissodes harcyniae* (Herbst) (Curculionidae).

Subfamily Tryphoninae Shuckard, 1840

Genus *Cosmoconus* Foerster, 1869

***Cosmoconus meridionator* Aubert, 1963**

Material examined: Ardabil province, Aslanduz, Palangloo, 1♂, 14 June 2015.

General distribution: Armenia, Belarus, Bulgaria, China, Finland, France, Georgia, Germany, Latvia, Lithuania, Mongolia, Norway, Poland, Russia, Sweden, Switzerland, Türkiye, United Kingdom, Ukraine (Yu et al., 2016), Czech Republic (Holý & Zeman, 2018), Iran (new record).

Host records: Unknown.

Genus *Eridolius* Foerster, 1869

***Eridolius gnathoxanthus* (Gravenhorst, 1829)**

Material examined: Golestan province, Gorgan, Ahangar-Mahalleh, 1♂, 1♀, 9 April 2012.

General distribution: Austria, Belarus, Belgium, Bulgaria, Canada, Denmark, Finland, France, Georgia, Germany, Hungary, Ireland, Italy, Lithuania, Mongolia, Netherlands, Norway, Poland, Romania, Russia, Sweden, Switzerland, United States of America, Ukraine, United Kingdom (Yu et al., 2016), Czech Republic (Holý & Zeman, 2018), Iran (new record).

Host records: Recorded by Hedwig (1962) as a parasitoid of the sesiid *Synanthedon tipuliformis* (Clerck).

Genus *Smicroplectrus* Thomson, 1883

***Smicroplectrus quinquecinctus* (Gravenhorst, 1820)**

Material examined: West Azarbaijan province, Khoy, Qarehghosh, 3♀, 11 July 2012.

General distribution: Austria, Belarus, Belgium, Bulgaria, Finland, France, Germany, Ireland, Italy, Mongolia, Netherlands, Poland, Romania, Russia, Spain, Sweden, Switzerland, United Kingdom (Yu et al., 2016), Czech Republic, Slovakia (Holý & Zeman, 2018), Iran (new record).

Host records: Fulmek (1968) reported *Monophadnoides rubi* (Harris) (as *M. geniculatus*) (Hymenoptera: Tenthredinidae) as a host for *S. quinquecinctus*. *Nematus lucidus* (Panzer) (Hymenoptera: Tenthredinidae) was also reported as another host for *S. quinquecintus* (Zwakhals and Blommers, 2022).

Comments: Yu et al. (2016) listed South Korea as a distributional region for *S. quinquecinctus* but Kasparyan, Balueva, Lee, & Kang (2017) excluded it from the fauna of the country.

Note: This is the first record of *Smicroplectrus quinquecinctus* for the Middle East.

DISCUSSION

Based on the results of this faunistic research, 18 new species records of Ichneumonidae are added to the fauna of Iran, of which six species are recorded for the first time for the fauna of the Middle East: *Dusona polita*, *Eridolius gnathoxanthus*, *Megastylus* (*Dicolus*) *pectoralis*, *Plectiscidea* (*Plectiscidea*) *canaliculata*, *Plectiscidea* (*Fugatrix*) *communis* and *Smicroplectrus quinquecinctus*. Several contributions on Iranian ichneumonids during recent years indicate that the family Ichneumonidae is one of the hymenopteran families which are studied rather well in this country (see Yu et al., 2016; Karimi et al., 2023). Additionally, reports of new country records in most papers which are gradually published prove that there is still a long way to go to complete the species diversity of this family in Iran, as well as in other countries of the Middle East. However, with attention to the extent of Iran with 31 provinces incorporate diverse ecosystems, it is expected that several new records and new species of these efficient parasitoids will be collected through extensive samplings in all regions of Iran, especially the areas where have not been sampled systematically so far. Faunistic studies are the basis of entomological research, and on the other hand valid identification of the pests and their natural enemies are the first and most important step in progress of biological control programs and integrated pest management (IPM). Although Malaise traps are generally considered to be the best means of obtaining large, general samples of Ichneumonidae from most habitats (Fitton, Shaw & Gauld, 1988), this method does not allow the determination of parasitoid-host relationships. Therefore, the collecting and raising ichneumonids' hosts larvae and pupae of Lepidoptera and Coleoptera from various ecosystems will be necessary.

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REFERENCES

Aubert, J.F. (1963). Les Ichneumonides du rivage Méditerranéen français (5e série, Départment du Var). *Vie et Milieu*, 14, 847-878.

Bennett, A.M.R. (2015). Revision of the world genera of Tryphoninae (Hymenoptera: Ichneumonidae). *Memoirs of the American Entomological Institute*, 86, 1-395.

Broad, G.R., Shaw, M.R., & Fitton, M.G. (2018). Ichneumonid Wasps (Hymenoptera: Ichneumonidae): Their Classification and Biology. *Handbooks for the identification of British Insects*, 7(12), 1-424.

Brock, J.P. (2017) The banchine wasps (Ichneumonidae: Banchinae) of the British Isles. In: *Handbooks for the Identification of British Insects*. *Telford. Royal Entomological Society and Field Studies Council*, 150 pp.

Cameron, P. (1901). On a collection of Hymenoptera made in the neighbourhood of Wellington by Mr. G.V. Hudson, with descriptions of new genera and species. *Transactions of the New Zealand Institute*, 33, 104-120.

Crowley, L.M. & Broad, G.R. (2023). The genome sequence of an ichneumon wasp, *Alloplasta piceator* (Thunberg, 1822). [version 1; peer review: 1 approved with reservations] *Wellcome Open Research* 2023, 8:167 https://doi.org/10.12688/wellcomeopenres.19206.1

Fabricius, J.C. (1775). Systema Entomologiae, sistens Insectorum classes, ordines, genera, species. Flensburgi et Lipsae, 832 pp.

Fitton, M.G., Shaw, M.R., & Gauld, I.D. (1988). Pimpline Ichneumon-flies, Hymenoptera Ichneumonidae, Pimplinae. Handbooks for the Identification of British Insects Vol. 7, Part 1. *Royal Entomological Society*, London, 110 pp.

Foerster A. (1868). Monographie der Gattung *Campoplex* Grav. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien*, 18, 761-876.

Foerster A. (1869). Synopsis der Familien und Gattungen der Ichneumonen. *Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens*, 25(1868), 135-221.

Foerster, A. (1871). Uebersicht der Gattungen und Arten der Familie der Plectiscoiden. *Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens*, 28, 71-123.

Fulmek, L. (1968). Parasitinsekten der insektengallen Europas. *Beiträge zur Entomologie*, 18(7/8), 719-952.

Gauld, I., Sithole, R., Gomez, J.U., & Godoy, C. (2002). The Ichneumonidae of Costa Rica, 4. *Memoirs of the American Entomological Institute*, 66, 1-768.

Gmelin, J.F. (1790). *Caroli a Linne Systema Naturae* (ed. XIII). Tom I. G.E. Beer, Lipsiae, pp. 2225-3020. [pp. 2674-2722]

Gravenhorst, J.L.C. (1820). Monographia Ichneumonum Pedemontanae Regionis. *Memorie della Reale Academia dell Scienze di Torino*, 24, 275-388.

Gravenhorst, J.L.C. (1829). *Ichneumonologia Europaea*. Pars II. Vratislaviae, 989 pp.

Hedwig, K. (1962). Mitteleuropäische Schlupfwespen und ihre Wirte. *Nachrichten Naturwissenschaftlichen Museums der Stadt Aschffenburg*, 68, 87-97.

Holmgren, A.E. (1858). Försök till uppställning och beskrifning af de i sverige funna Tryphonider (Monographia Tryphonidum Sueciae). *Kongliga Svenska Vetenskapsakademiens Handlingar*, N.F.1 (2) (1856), 305-394.

Holmgren, A.E. (1859). Conspectus generum Ophionidum Sueciae. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar*, 15(1858), 321-330.

Holmgren, A.E. (1860). Försök till uppställning och beskrifning af de i Sverige funna Ophionider. (Monographia Ophionidum Sueciae). *Kongliga Svenska Vetenskapsakademiens Handlingar*, 2(8), 1-158.

Holý, K. & Zeman, V. (2018). Catalogue of Ichneumonidae (Hymenoptera) of Czech and Slovak Republics. *Acta Musei Moraviae, Scientiae biologicae*, 103(1), 1-119.

Huber, J.T. (2009). Biodiversity of Hymenoptera, pp. 303-323. In: Foottit, R.G., & Adler, P.H. (eds.), Insect biodiversity: Science and society. *Wiley-Blackwell, West Sussex*, UK, 632 pp.

Karimi, S., Ghassemi-A., Hosseinzadeh, A., Lotfalizadeh, H., & Riedel, M. (2023). A new genus and two new species with some new records of the subfamily Campopleginae (Hymenoptera: Ichneumonidae) from Iran. Egyptian *Journal of Biological Pest Control,* 33. 117. https://doi.org/10.1186/541938-023-00761-5

Kasparyan, D.R., Balueva, E., Lee, J.-W., & Kang, G-W. (2017). Review of the genera *Smicroplectrus* Thomson, 1883 and *Exyston* Schiodte, 1839 (Hymenoptera: Ichneumonidae: Tryphoninae) of South Korea. *Proceedings of the Zoological Institute RAS*, 321(2), 105-114.

Klopfstein, S., Santos, B.F., Shaw, M.R., Alvarado, M., Bennett, A.M.R., Dal Pos, D., Giannotta, M., Herrera Florez, A.F., Karlsson, D., Khalaim, A.I., Lima, A.R., Mikó, I., Sääksjärvi, I.E., Shimizu, S., Spasojevic, T., van Noort, S., Vilhelmsen, L., & Broad, G.R. (2019a). Darwin wasps: new name heralds renewed efforts to unravel evolutionary history of Ichneumonidae. *Entomological Communications* 1: ec01006. https://doi.org/10.37486/2675-1305.ec01006

Klopfstein, S., Riedel, M., & Schwarz, M. (2019b). Checklist of ichneumonid parasitoid wasps in Switzerland (Hymenoptera, Ichneumonidae): 470 species new for the country and an appraisal of the alpine diversity. *Alpine Entomology*, 3, 51-81.

Kolarov, J. (1995). A catalogue of the Turkish Ichneumonidae (Hymenoptera). *Entomofauna*, 16(7), 137-188.

Meier, N., Gordon, M.L., van Noort, S., Reynolds, T., Rindos, M., Di Giovanni, F., Broad, G. R., Spasojevic, T., Bennett, A.M.R., Dal Pos, D., & Klopfstein, S. (2024). Species richness estimation of the Afrotropical Darwin wasps (Hymenoptera, Ichneumonidae). *PlosOne,* 19(7): e0307404. https://doi.org/10.1371/journal.pone.0307404

Quicke, D.L.J. (2015). The braconid and ichneumonid parasitic wasps: Biology, systematics, evolution and ecology. Wiley Blackwell, Chichester, 688 pp.

Ratzeburg, J.T.C. (1848). Die Ichneumonen der Forstinsecten in forstlicher und entomologischer Beziehung. *Zweiter Band, Berlin*, 238 pp.

Riedel, M., Pénigot, W., Schwarz, M., Diller, E., Johansson, N., & Japoshvili, G. (2023). Darwin wasps (Hymenoptera: Ichneumonidae) of the Kintrishi National Park Sakartvelo (Georgia), with descriptions of six new species. *Linzer biologie Beiträge*, 55(1), 61-153.

Riedel, M., Florez, A.H., & Schmidt, S. (2024). Revision of the Palaearctic species of *Scopesis* Förster (Hymenoptera, Ichneumonidae, Ctenopelmatinae). *Linzer biologische Beiträge*, 56(1), 201-252.

Schiødte, G. (1838). Ichneumonidarum ad faunam Daniae pertinentium, genera et species novae. *Revue Zoologique par la Société Cuvierienne*, 1, 139-141.

Shaw, M.R., Horstmann, K., & Whiffin, A. (2016). Two hundred and twenty-five species of reared western Palaearctic Campopleginae (Hymenoptera: Ichneumonidae) in the National Museums of Scotland, with descriptions of new species of *Campoplex* and *Diadegma*, and records of fifty-five species new to Britain. *Entomologist's Gazette*, 67, 177-222.

Sime, K.R. & Brower, A.V.Z. (1998). Explaining the latitudinal gradient anomaly in ichneumonid species richness: evidence from butterflies. *Journal of Animal Ecology*, 67, 387-399.

Takasuka, K. & Broad, G. (2024). A bionomic overview of spider parasitoids and pseudo-parasitoids of the ichneumonid wasp subfamily Pimplinae. *Contributions to Zoology*, 93(1), 1-106.

Taschenberg, E.L. (1865). Die Schlupfwespenfamilie Cryptides (Gen. V. Cryptus Gr.) mit besonderer Berücksichtigung der deutschen Arten. *Zeitschrift für die Gesammten Naturwissenschaften*, 25(1 & 2), 1-142.

Thomson, C.G. (1883). XXXII. Bidrag till kännedom om Skandinaviens Tryphoner. *Opuscula Entomologica*, Lund, IX, 873-936.

Thunberg, C.P. (1822). Ichneumonidea, Insecta Hymenoptera illustrata. *Mémoires de l'Académie Imperiale des Sciences de Saint Petersbourg*, 8, 249-281.

Townes, H.K. (1969). The genera of Ichneumonidae. Part 1. *Memoirs of the American Entomological Institute*, 11, 1-300.

Townes, H.K. (1970a). The genera of Ichneumonidae, Part 2. *Memoirs of the American Entomological Institute*, 12, 1-537.

Townes, H.K. (1970b). The genera of Ichneumonidae, Part 3. *Memoirs of the American Entomological Institute*, 13, 1-307.

Townes, H.K. (1971). The genera of Ichneumonidae, Part 4. *Memoirs of the American Entomological Institute*, 17, 1-372.

Varga, O. (2024). Checklist of the Ichneumonidae (Insecta, Hymenoptera) of Ukraine. *Zootaxa*, 5456(1): 1-131.

Verheyde, F., Hoekstra, P., Libert, P.N., Meijer, H., de Ketelaere, A., Vandaudenard, T., Belgers, D., & Brosens, E. (2021). Two hundred five ichneumonid wasps reported for the first time in Belgium and Netherlands (Hymenoptera: Ichneumonidae). *Belgian Journal of Entomology*, 122, 1-142.

Viereck, H.L. (1914). Type species of the genera of Ichneumon flies. *United States National Museum Bulletin* No. 83, 186 pp.

Wahl, D.B. (1993). Family Ichneumonidae, pp. 395-442. *In*: Goulet, H., & Huber, J.T. (eds.), *Hymenoptera of the world*: *An identification guide to families*. Canada Communications Group, Ottawa, 668 pp.

Wesmael, C. (1849). Revue des Anomalons de Belgique. *Bulletin de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique*, 16(2), 115-139.

Yu, D.S., van Achterberg, C., & Horstmann, K. (2016). Taxapad 2016, Ichneumonoidea 2015, Database on flash-drive. Ottawa, Ontario, Canada.

Zwakhals, C.J. & Blommers, L.H.M. (2022) Trypholinae (Hymenoptera: Ichneumonidae) reared from sawflies (Hymenoptera: Symphyta) in the Netherlands. *Entomologische Berichten*, 82(1), 9-18.