JOSÉ CARLOS OTERO ^a - HASSAN GHAHARI ^bAN UPDATED CATALOGUE OF THE IRANIAN ZOPHERIDAE
(COLEOPTERA TENEBRIONOIDEA)^a *Departamento de Biología Animal, Facultad de Biología, Universidad de Santiago de Compostela, Spain*^b *Department of Plant Protection, Yadegar-e-Imam Khomeini (RAH) Shahre Rey Branch, Islamic Azad University, Tehran, Iran*

Corresponding Author: Hassan Ghahari; hghahari@yahoo.com

Carlos Otero J., Ghahari H. – An updated catalogue of the Iranian Zopheridae (Coleoptera Tenebrionoidea).

A checklist for the Iranian Zopheridae (Coleoptera: Tenebrionoidea) is proposed. Based upon a literature review, a total of 22 species within 13 genera, and two subfamilies Colydiinae (20 species) and Zopherinae (two species) are listed as the fauna of Iran.

KEY WORDS: Ironclad beetles, fauna, distribution, Iran

INTRODUCTION

The family Zopheridae comprises about 1,700 species and 190 genera worldwide (ŚLIPIŃSKI & LAWRENCE, 2010), and 257 species within 45 genera in Palaearctic region (ŚLIPIŃSKI & SCHUH 2008). The most important of morphological characters are: antennae 9-11 articulated with terminal one, two or three antennomeres clubbed; antennal insertions concealed; mesocoxal cavities closed; tarsal formula 5-5-4 (in most Zopherinae) or 4-4-4 (in most Colydiinae) (apparently 3-3-3 in several colydiine genera); heteromeroid trochanters, and a tenebrionoid aedeagus (male genitalia) (LORD *et al.*, 2011; LEE *et al.*, 2017).

Adults live under bark or in rotten wood, their source of nutrition is less certain but some species (practically, adults of Usechini Horn, 1867, Phellopsini Ślipiński & Lawrence, 1999 and some Zopherini Solier, 1834) feed on fruiting bodies of polypore fungi (Phellopsini) (ŚLIPIŃSKI & LAWRENCE 1999; IVIE 2002).

The fauna of Iranian Zopheridae was poorly studied, and the first works were done by MAŘAN (1954) included one species and then DAJOZ (1973) with two species. WĘGRZYNOWICZ (1999) and KATLAV *et al.* (2015) recorded two and one species, respectively. SAMIN *et al.* (2018a, b) recorded six species of Zopheridae for the fauna of Iran which four of them were new country records. The aim of this paper is summarise the published data on Iranian Zopheridae.

Iran forms a large part of the Iranian plateau covering an area of 1,623,779 km². Climatologically, Iran is a predominantly arid and semi-arid country, but the northern slopes of the Alburz ranges and the Caspian lowland receive 800 to 2000 mm annual rainfall, making them the most humid parts of the country. The Dasht-e Kavir and Dasht-e Lut deserts are the driest areas with an annual precipitation of less than 150 mm. The highlands receive between 250 and 800 mm (ZEHZAD *et al.*, 2002; HAKIMZADEH KHOEI *et al.*, 2011).

MATERIALS AND METHODS

The distribution data are summarised by province. Subfamilies, tribes, genera and species are listed alphabetically. The following data are included in the catalogue for each species: (1) valid name, (2) published Iranian records synthesized by province (classified by alphabetical order of Iranian province names) and the relevant references, (3) Additional specimens examined by the authors are listed with full label information, 4) synthetic distribution on a world scale. Data about classification, nomenclature and distribution data are mainly based on ŚLIPIŃSKI & SCHUH (2008). When accurate data about local distribution in Iran are lacking in a quoted reference, the mention “Iran (no locality cited)” is used. The provinces of Iran are shown in Fig. 1. Additionally, the chorotype used in this paper, “Caucasus” is described as below:

Caucasus: A region located at the border of Europe and Asia, between Black Sea and Caspian Sea, includes also portions of north-western Iran and north-eastern Turkey.

RESULTS

Twenty-two species of Zopheridae subdivided two subfamilies Colydiinae and Zopherinae, and 13 genera, *Aulonium* Erichson, 1845 (two species), *Colydium* Fabricius, 1792 (two species), *Orthocerus* Latreille, 1796 (one species), *Bitoma* Herbst, 1793 (two species), *Colobicus* Latreille, 1807 (two species), *Corticus* Germar, 1824 (one species), *Endophloeus* Dejean, 1834 (two species), *Langelandia* Aubé, 1842 (two species), *Lastrema* Reitter, 1882 (one species), *Niphopelta* Reitter, 1882 (one species), *Nosodomodes* Reitter, 1922 (one species), *Synchita* Hellwig, 1792 (three species) and *Pycnomerus* Erichson, 1842 (two species) are listed for Iran. *Langelandia* (*Agelandia*) *wittmeri* Dajoz, 1973 is endemic to Iran.

Fig. I - Map of Iran with boundaries of provinces.

Family Zopheridae Solier, 1834
 Subfamily Colydiinae Erichson, 1842
 Tribe Colydiini Erichson, 1842
 Genus *Aulonium* Erichson, 1845
Aulonium ruficorne Olivier, 1790

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

General distribution: Algeria, Armenia, Azerbaijan, Bulgaria, Croatia, France, Germany, Greece, Hungary, Iran, Israel, Italy, Lebanon, Macedonia, Montenegro, Morocco, Romania, Serbia, Spain, Russia (South European Territory), Tunisia, Turkey, Turkmenistan, Ukraine.

Aulonium trisulcum Geoffrey, 1785

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

General distribution: Armenia, Austria, Belgium, Bosnia Herzegovina, Czech Republic, France, Germany, Great Britain, Hungary, Iran, Italy, Macedonia, Netherlands, Norway, Poland, Russia (Central European Territory, North European Territory, South European Territory), Slovakia, Sweden, Switzerland, Ukraine.

Genus *Colydium* Fabricius, 1792
Colydium elongatum Fabricius, 1787

Distribution in Iran: Golestan (WĘGRZYNOWICZ, 1999; RAHIMINEJAD *et al.*, 2015).

New material examined: Razavi Khorasan province, Neyshabur, 36°12'N 58°45'E, 3 exx., 19.vii.2013.

General distribution: Albania, Algeria, Armenia, Austria, Azerbaijan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Georgia, Germany, Great Britain, Hungary, Iran, Italy, Lithuania, Macedonia, Montenegro, Morocco, Netherlands, Poland, Romania, Russia (Central European Territory, South European Territory), Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Tunisia, Turkey, Ukraine.

Comments: The mite *Metapygmephorellus colydius* Rahiminejad & Hajiqanbar, 2015 (Acari: Heterostigmata) is associated with (phoretic) *Colydium elongatum* (RAHIMINEJAD *et al.*, 2015).

Colydium filiforme Fabricius, 1792

Distribution in Iran: Mazandaran (WĘGRZYNOWICZ, 1999).

General distribution: Austria, Azerbaijan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, Croatia, Czech Republic, France, Georgia, Germany, Greece,

Hungary, Iran, Italy, Latvia, Liechtenstein, Norway, Poland, Russia (South European Territory), Slovakia, Spain, Sweden, Switzerland.

Tribe Orthocerini Blanchard, 1845

Genus *Orthocerus* Latreille, 1796

Orthocerus clavicornis (Linnaeus, 1758)

Distribution in Iran: Mazandaran (SAMIN *et al.*, 2018b).

New material examined: Guilan province, Lahijan, 37°14'N 50°02'E, 2 exx., 11.vi.2014.

General distribution: Austria, Belgium, Bosnia Herzegovina, Byelorussia, "Caucasus", Croatia, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, Ireland, Italy, Latvia, Liechtenstein, Mongolia, Montenegro, Netherlands, Norway, Poland, Romania, Russia (Central European Territory, East Siberia, Far East), Serbia, Slovakia, Spain, Sweden, Switzerland, Turkey.

Tribe Sychitini Erichson, 1845

Genus *Bitoma* Herbst, 1793

Bitoma crenata Fabricius, 1775

Distribution in Iran: Hamadan (SAMIN *et al.*, 2018a), Mazandaran (KATLAV *et al.*, 2015).

General distribution: Albania, Algeria, Armenia, Austria, Azerbaijan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Great Britain, Greece, Hungary, Italy, Kazakhstan, Latvia, Liechtenstein, Malta, Macedonia, Mongolia, Moldavia, Montenegro, Netherlands, Norway, Poland, Romania, Russia (Central European Territory, East Siberia, Far East, North European Territory, South European Territory, West Siberia), Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tunisia, Turkey, Ukraine.

Comments: *Dolichocybe silvani* Rahiminejad and Hajiyanbar, 2011 (Acari: Dolichocybidae) is parasite of *Bitoma crenata* (KATLAV *et al.*, 2015).

Bitoma iranica Mařan, 1954

Distribution in Iran: Northern Khorasan (Kopetdag), Tehran (Elburz) (MAŘAN, 1954).

General distribution: Azerbaijan, Iran.

Genus *Colobicus* Latreille, 1807

Colobicus hirtus Rossi, 1790

Distribution in Iran: Bushehr (SAMIN *et al.*, 2018a). New material examined: Hamadan province, Nahavand, 34°14'N 48°14'E, 3 exx., 4.vi.2014.

General distribution: Afghanistan, Austria, Bosnia Herzegovina, Bulgaria, China (Northern Territory), Croatia, Czech Republic, France, Germany, Great Britain, Greece, Hungary, Italy, Japan, Liechtenstein, Montenegro, Morocco, Poland, Russia (Central European Territory, Far East, North European Territory, South European Territory, West Siberia), Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine.

Colobicus parilis Pascoe, 1860

Distribution in Iran: Golestan (SAMIN *et al.*, 2018b).

General distribution: Afghanistan, China, France, India, Japan, Nepal, Taiwan.

Genus *Corticus* Germar, 1824

Corticus brevipennis Reitter, 1882

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

New material examined: West Azarbaijan province, Oshnavieh, 37°03'N 45°05'E, 1 ex., 26.viii.2014.

General distribution: Azerbaijan, Iran, Russia (South European Territory), Turkey.

Genus *Endophloeus* Dejean, 1834

Endophloeus exsculptus Germar, 1847

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

General distribution: Armenia, Azerbaijan, Georgia, Hungary, Iran, Russia (South European Territory), Turkey, Ukraine.

Endophloeus markovichianus (Piller & Mitterpacher, 1783)

Distribution in Iran: Semnan (SAMIN *et al.*, 2018b). New material examined: Isfahan province, Ardestan, 33°27'N 52°26'E, 2 exx., 7.ix.2013.

General distribution: Algeria, Austria, Bosnia Herzegovina, Bulgaria, Croatia, France, Great Britain, Greece, Hungary, Italy, Macedonia, Morocco, Poland, Portugal, Romania, Russia (South European Territory), Slovakia, Slovenia, Spain, Tunisia, Turkey, former Yugoslavia.

Genus *Langelandia* Aubé, 1842

Subgenus *Agelandia* Reitter, 1882

Langelandia (Agelandia) merklana Reitter, 1890

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI and SCHUH, 2008).

General distribution: Iran, Turkey.

Langelandia (Agelandia) wittmeri Dajoz, 1973

Distribution in Iran: Golestan (Gole Lovae) (DAJOZ, 1973).

General distribution: Endemic to Iran.

Genus *Lastrema* Reitter, 1882

Lastrema verrucicollis Reitter, 1880

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

New material examined: East Azarbaijan province, Kaleybar, 38°54'N 47°03'E, 1 ex., 12.vii.2012.

General distribution: Azerbaijan, Iran, Russia (South European Territory), Turkey.

Fig. II - Comparison of species richness of Zopheridae in Iran and adjacent countries (adapted from ŠLIPINSKI & SCHUH, 2008).

Genus *Niphopelta* Reitter, 1882
Niphopelta imperialis Reitter, 1882

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

General distribution: Azerbaijan, "Caucasus", Georgia, Iran, Russia (South European Territory), Ukraine

Genus *Nosodomodes* Reitter, 1922
Nosodomodes diabolicus Schaufuss, 1862

Distribution in Iran: Ardabil (SAMIN *et al.*, 2018a).

General distribution: Armenia, Bulgaria, Greece, Macedonia, Montenegro, Romania, Serbia, Turkey.

Genus *Synchita* Hellwig, 1792
Synchita iranica (Dajoz, 1973)

Distribution in Iran: Guilan (Assalem) (DAJOZ, 1973 as *Cicones iranica* Dajoz, 1973).

General distribution: Armenia, Iran.

Synchita mediolanensis Villa & Villa, 1833

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

General distribution: Algeria, Austria, Azerbaijan, Bulgaria, Cyprus, Czech Republic, France, Germany, Greece, Hungary, Iran, Italy, Portugal, Romania, Russia (South European Territory), Slovakia, Spain, Switzerland, Turkey, Ukraine.

Synchita separanda Reitter, 1882

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

General distribution: Armenia, Austria, Bosnia Herzegovina, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Great Britain, Hungary, Iran, Italy, Norway, Poland, Romania, Russia (Central European Territory, North European Territory, South European Territory), Slovakia, Sweden, Switzerland, Turkey, Ukraine.

Subfamily Zopherinae Solier, 1834
 Tribe Pycnomerini Erichson, 1845
 Genus *Pycnomerus* Erichson, 1842
Pycnomerus sulcicollis Germar, 1824

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

General distribution: Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Iran, Romania, Russia (South European Territory), Turkey.

Pycnomerus terebrans Olivier, 1790

Distribution in Iran: Iran (no locality cited) (ŠLIPINSKI & SCHUH, 2008).

New material examined: West Azarbaijan province, Salmas, 38°11'N 44°44'E, 2 ex., 27.vi.2014.

General distribution: Austria, Azerbaijan, Bosnia Herzegovina, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Iran, Italy, Montenegro, Poland, Portugal, Russia (Central European Territory, South European Territory), Serbia, Slovakia, Slovenia, Switzerland, Turkey.

DISCUSSION

Upon this checklist and regarding to the species diversity of Zopheridae in Palaearctic region (257 species) indicates that the fauna of Iranian Zopheridae has poorly been studied (8.5% of Palaearctic species). Also, all the recorded species in this paper were collected from only 17 provinces among the 31 Iranian provinces, which this means that most regions of Iran have not been sampled so far. Since Iran is a large country with various geographical regions and climates, we expect higher species diversity compared to what is summarised in this paper. Iran is located at or near the crossroads of three distinct biogeographical regions and could have faunal elements from any of them. Clearly, most will be Palaearctic but Oriental will definitely be present in the southeast, and possibly there will be a few Afrotropical things there too but is not too many since it is north of the Arabian Peninsula. Therefore, it is plausible that a more systematic and continuous sampling activity will result in new discovers (new species, new country records, and new distribution data). Furthermore, exact localities of eight species remain unknown (no location cited) and require confirmation. In addition to Iran, the fauna of adjacent countries, Russia and Turkey, with 26 and 25 species respectively (ŠLIPINSKI & SCHUH, 2008), are still poorly studied too (Fig. II). Of course there is not any comprehensive study beside the checklist of ŠLIPINSKI & SCHUH (2008) from the Palaearctic catalogue on Zopheridae of these countries. Also, Russia and Turkey share the highest number of species with Iran, with 15 and 14 species, respectively, followed by Azerbaijan (11 species), Armenia (nine species), Afghanistan (two species), and Turkmenistan (one species).

ACKNOWLEDGEMENTS

The research was supported by Islamic Azad University (Yadegar-e Imam Khomeini (RAH) Shahre Rey Branch) and Universidad de Santiago de Compostela. We are grateful to Dr. M.A. Ivie (Montana State University) for providing some papers, and two anonymous reviewers for insightful comments.

REFERENCES

- DAJOZ R., 1973 – *Coléoptères Colydiidae paléarctiques nouveaux ou peu connus*. - Cahiers des Naturalistes, 29: 79–84.
- HAKIMZADEH KHOEI M., KAYA M., ALTINDAG A., 2011 – *New records of Rotifers from Iran with biogeographic considerations*. - Turkish Journal of Zoology, 35: 395–402.
- IVIE M.A., 2002 – Chapter 103. *Colydiidae* Erichson 1845, pp. 445–453. In: American beetles. Vol. 2. Polyphaga: Scarabaeoidea through Curculionoidea.; Arnett R.H. Jr, Thomas M.C., Skelley P.E., Frank J.H. (eds.); CRC Press, Boca Raton, FL, 880 pp.
- KATLAV A., HAJIQANBAR H. & TALEBI A.A., 2015 – *A contribution to the knowledge of heterostigmatic mites (Acari: Prostigmata) in western Mazandaran province, northern Iran*. - Acarologia, 55(3): 311–320.
- LEE S.-G., KIM I.-K., LIM J., 2017 – *Two Zopheridae (Coleoptera: Tenebrionoidea) species new to Korea and a key to the Korean genera*. - Animal Systematics, Evolution and Diversity, 33(3): 189–194.
- LORD N.P., NEARNS E.H., MILLER K.B., 2011 – *Ironclad ID: Tool for Diagnosing Ironclad and Cylindrical Bark Beetles (Coleoptera: Zopheridae) of North America north of Mexico* [Internet]. - The University of New Mexico and Center for Plant Health Science and Technology, USDA, APHIS, PPQ, Accessed 24 Feb 2017, <http://cerambycids.com/ironcladid/>
- MAŘAN J., 1954 – *Nový palearktický druh rodu Bitoma Herbst z entomologických sbírek Národního musea v Praze*. *Bitoma iranica* m. nov. spec. (Col., Colydiidae). - Časopis Československé Společnosti Entomologické, 50 [1953]: 132–133.
- RAHIMINEJAD V., HAJIQANBAR H., KHAUSTOV A.A., TALEBI A.A., 2015 – *A new genus and two new species of the family Pygmephoridae (Acari: Heterostigmata) associated with beetles (Insecta: Coleoptera)*. - Annals of the Entomological Society of America, 108(5): 893–901.
- SAMIN N., HÁVA J., CARLOS OTERO J., HAWKESWOOD T.J., JĘDRYCKOWSKI W.B., KUBISZ D., SAKENIN H., BUNALSKI M., 2018a – *New record and new distributional data of Coleoptera (Insecta) of Iran*. - Boletín de la Asociación española de Entomología, 42 (3-4): 259–274.
- SAMIN N., BUNALSKI M., KUBISZ D., HÁVA J., NAVAEIAN M., OTERO J.C., HAWKESWOOD T.J., ZHOU H., SAKENIN H., JĘDRYCKOWSKI W.B., 2018b – *Contributions to the knowledge of the distribution of select Coleoptera families from Iran*. - Wiadomości Entomologiczne, 37(4) 197–209.
- ŠLIPINSKI S.A., LAWRENCE J.F., 1999 – *Phylogeny and classification of Zopheridae sensu novo (Coleoptera: Tenebrionoidea) with a review of the genera of Zopherninae (excluding Monommatini)*. - Annales Zoologici, 49: 1–53.
- ŠLIPINSKI S.A., SCHUH R., 2008 – *Family Zopheridae*, pp. 78–87. In: Catalogue of Palaearctic Coleoptera. Volume 5. Tenebrionoidea; Löbl, I. & Smetana, A. (eds.). - Apollo Books, Stenstrup, 670 pp.
- ŠLIPINSKI S.A., LAWRENCE J.F., 2010 – *Zopheridae Solier, 1834, 411–422*. In: Handbook of zoology. Athropoda: Insecta. Coleoptera, beetles. Vol. 2. Morphology and systematics (Elateroidea, Botrichiformia, Cucujiformia partim); Leschen, R.A.B., Beutel, R.G. & Lawrence, J.F. (eds), - Walter de Gruyter, GmbH & Co. KG, Berlin/New York, 786 pp.
- WĘGRZYNOWICZ P., 1999 – *A revision of the genus Colydium Fabricius, 1792 (Coleoptera: Zopheridae: Colydiinae)*. - Annales Zoologici (Warszawa), 49(3): 265–328.
- ZEHZAD B., KIABI B.H., MADJNOONIAN, H., 2002 – *The natural areas and landscape of Iran: an overview*. - Zoology in the Middle East, 26: 7–10.