



A catalogue of Orthosiini Guenée (Lepidoptera, Noctuidae, Hadeninae) of Iran, with a new species record

Pedram Poorshaban

Department of Plant Protection, Faculty of Agriculture, Shahid Bahonar University of Kerman, Kerman, Iran.

✉ pm.poorshaban@gmail.com  <https://orcid.org/0000-0001-5252-2204>

Asghar Shirvani

Department of Plant Protection, Faculty of Agriculture, Shahid Bahonar University of Kerman, Kerman, Iran.

✉ shirvani@uk.ac.ir  <https://orcid.org/0000-0002-4647-1030>

ABSTRACT. The tribe Orthosiini Guenée, 1837, one of the six tribes of Hadeninae subfamily is represented by 17 genera worldwide. Of those, three genera including *Orthosia* Ochsenheimer, 1816, *Perigrappa* Lederer, 1857 and *Egira* Duponchel, 1845 have recorded in Iran. Here, we present a Catalogue of Orthosiini of Iran including 15 species of this tribe with their provincial distribution in Iran. Identification keys for the Iranian species are provided as well. *Perigrappa cilissa* Püngeler, 1917 is recorded for the first time from Iran. The external and genital characteristics of the newly recorded species are given, beside the illustrations of the adults and their genitalia.

Key words: fauna, Lepidoptera, moth, Identification key, new record, checklist

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INTRODUCTION

The tribe Orthosiini Guenée, 1837, one of the six tribes (Fibiger & Lafontaine, 2005) of Hadeninae, is conspicuously heterogeneous in both external and genital morphology (Wiesmair et al., 2020) and represented by 17 genera worldwide including *Panolis* Hübner, [1821], *Pseudopanolis* Inaba, 1927, *Dioszeghyana* Hreblay, 1993, *Orthosia* Ochsenheimer, 1816, *Anorthoa* Berio, 1980, *Harutaegrapha* Yoshimoto, 1993, *Perigrappa* Lederer, 1857, *Xylopolia* Sugi, 1982, *Egira* Duponchel, 1845, *Kisegira* Hreblay & Ronkay, 1999, *Lithopolia* Yoshimoto, 1993, *Egiropolia* Ronkay & Ronkay, 2001, *Orthopolia* Ronkay & Ronkay, 2001, *Houlberthosia* Ronkay, Ronkay, Gyulai & Hacker, 2010, *Megaegira* Ronkay, Ronkay, Gyulai & Hacker, 2010, *Protegira* Ronkay, Ronkay, Gyulai & Hacker, 2010; and *Nepalopolia* Ronkay, Ronkay, Gyulai & Hacker, 2010 (Ronkay & Ronkay, 2001; Ronkay et al., 2001, 2010; Wu & Yen, 2018). The great majority of the genera of the tribe occur in the Himalayan-Sino-Pacific region from Pakistan to northern Indochina, Tibetan plateau, the western and Central Chinese mountainous regions, Taiwan, and the southern parts of Japan (Ronkay et al., 2010).

The large Holarctic-Oriental genus *Orthosia* with more than sixty (Volynkin & Titov, 2014; Wiesmair et al., 2020) described species occurs mostly in eastern and south-eastern Asia. Ronkay et al. (2001) treated the European *Orthosia* (s.l.) species as the members of four subgenera, *Orthosia* Ochsenheimer, *Monima* Hübner, [1821], *Cororthosia* Berio, 1980 and *Semiophora* Stephens, 1829.

Corresponding authors: Shirvani, P. E-mail: shirvani@uk.ac.ir

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However, the subgeneric classification proposed in the literature must be approved by complete revision of the generic groups. The genus *Orthosia* (s.l.) is known from Iran with eight species: *O. cruda* ([Denis & Schiffermüller], 1775), *O. gracilis* ([Denis & Schiffermüller], 1775), *O. miniosa* ([Denis & Schiffermüller], 1775), *O. cerasi* (Fabricius, 1775), *O. imitabilis* Hreblay, 1993, *O. incerta* (Hufnagel, 1766), *O. habeleri* Wiesmair, Shirvani & Ronkay, 2020 and *O. sordescens* Hreblay, 1993 (Hreblay, 1993; Ronkay et al., 2001; Wiesmair et al., 2020).

The members of the tribe Orthosiini are characterised by the special spines on the anterior lobe of the larval hypopharynx that confine the posterior portion of the lobe (Fibiger & Lafontaine, 2005). Having shared character states the three genera, *Perigrapha*, *Harutaeographa* and *Anorthoa* comprise a generic complex characterized typically by the early-flying univoltine species, of those, *Perigrapha* s. str. is typical of the open habitats appearing in semi-desert and xerothermic grasslands (Ronkay et al., 2001). The genus *Perigrapha* includes 52 species and 56 subspecies in Eurasia (Volynkin & Matov, 2014) and its members are classified in three subgenera including *Opacographa* Hreblay, 1996, *Rororthosia* Beck, 1999, and *Perigrapha* Lederer, 1857. This genus with five species (Shirvani, 2012; Shirvani et al., 2012) was reviewed in Iran by Shirvani et al. (2012). With more than forty species, the members of the Holarctic genus, *Egira* Duponchel, are classified into five large species groups (Ronkay et al., 2001). The distribution range of the genus is from the West Palearctic, Morocco, to Turkey, South Siberia, Sino-Himalayan region, Nepal, Thailand and Japan (Benedek et al., 2015). In Iran, this genus is represented by one species, *E. anatolica* (Hering, 1933) inhabiting xeric open biotopes.

In this paper, we report *P. cilissa* Püngeler, 1917 as a new record for the fauna of Iran. The external and the genitalia characteristics of adult and their illustrations, bionomics, and the distributional ranges of the species are presented and discussed.

MATERIAL AND METHODS

The material examined were collected by the light traps powered by 12-volt batteries and 8-watt black light UVB tubes. Adult genitalia were extracted by routine method and then mounted on proper slides for further examinations. Adult and genitalia slides were photographed using a Canon digital camera (model Power Shot A710). Ronkay et al. (2001) and Fibiger and Hacker (2005) were followed for the systematic and nomenclature of the taxa. The specimens are deposited in the Collection of Noctuidae, Department of Plant Protection, Shahid Bahonar University of Kerman, Kerman, Iran.

RESULTS

Taxonomic hierarchy

Class Insecta Linnaeus, 1785

Order Lepidoptera Linnaeus, 1785

Family Noctuidae Latreille, 1809

Subfamily Hadeninae Guenée, 1837

Tribus Orthosiini Guenée, 1837

Genus *Orthosia* Ochsenheimer, 1816

Type species: *Noctua instabilis* [Denis & Schiffermüller], 1775 (= *Phalaena incerta* Hufnagel, 1766)

syn.: *Cuphanoa* Hübner, 1816; *Orthoa* Billberg, 1820; *Taeniocampa* Guenée, 1839; *Cyphona* Agassiz, 1846; *Microrthosia* Berio, 1980.

Subgenus *Orthosia* Ochsenheimer, 1816

Type species: *Noctua instabilis* [Denis & Schiffermüller], 1775 (= *Phalaena incerta* Hufnagel, 1766)

***Orthosia incerta* (Hufnagel, 1766)**

Phalaena incerta Hüfnagel, 1766, *Berlinisches Magazin*, 3:298. Germany.

syn.: *instabilis* [Denis & Schiffermüller], 1775; *collinita* Esper, [1790]; *contracta* Esper, [1790]; *trigutta* Esper, [1790]; *angustus* Haworth, 1803; *fuscatus* Haworth, 1803; *nebulosus* Haworth, 1803; *subsetaceus* Haworth, 1803; *olivacea* Warren, 1909; *subcarnea* Warren, 1909.

Distribution: Euro-Siberian species also occurring in the Near East, Asia Minor, Korea, Japan (Ronkay et al., 2001), and Iran (Tehran - Ebert & Hacker, 2002).

***Orthosia habeleri* Wiesmair, Shirvani & Ronkay, 2020**

Orthosia habeleri Wiesmair, Shirvani & Ronkay, 2020, *Nota Lepidopterologica*, 43:19. Iran.

Distribution: Iran (Kerman - Wiesmair et al., 2020).

Subgenus *Monima* Hübner, [1821]

Type species: *Noctua miniosa* [Denis & Schiffermüller], 1775

***Orthosia miniosa* ([Denis & Schiffermüller], 1775)**

Noctua miniosa [Denis & Schiffermüller], 1775, *Ankündigung Eines Systematischen Werkes von den Schmetterlingen der Wienergegend*, 88. Austria.

syn.: *rubricosa* Esper, [1786]

Distribution: Holo-Mediterranean-Iranian, occurring also in Asia Minor and Transcaucasia (Ronkay et al., 2001). Ronkay et al. (2001) recorded this species from Iran without giving any provincial distribution in detail.

***Orthosia cerasi* (Fabricius, 1775)**

Noctua cerasi Fabricius, 1775, *Systema Entomologiae*, 600. England, Germany.

syn.: *stabilis* ([Denis & Schiffermüller], 1775)

Distribution: This species inhabits all parts of Europe and occurs in Near East, Turkey, Caucasus (Hreblay, 1993; Ronkay et al., 2001), and Iran (Mazandaran, Chalous - Hreblay, 1993).

***Orthosia cruda* ([Denis & Schiffermüller], 1775)**

Noctua cruda [Denis & Schiffermüller], 1775, *Ankündigung Eines Systematischen Werkes von den Schmetterlingen der Wienergegend*, 77. Austria.

Distribution: Holo-Mediterranean, *O. cruda* occurs in Near East, Maghreb countries, Turkey, Iraq, Caucasus and Kazakhstan (Hreblay, 1993; Ronkay et al., 2001). Wiesmair et al. (2020) recorded this species from Iran without giving any provincial distribution in detail.

***Orthosia imitabilis* Hreblay, 1993**

Orthosia imitabilis Hreblay, 1993, *Acta Zoologica Hungarica*, 39(1-4):76. Turkmenistan.

Distribution: Turkmenistan and Iran (Mazandaran, Chalous - Hreblay, 1993).

***Orthosia sordescens* Hreblay, 1993**

Orthosia sordescens Hreblay, 1993, *Acta Zoologica Hungarica*, 39(1-4):79. Russia.

Distribution: Turkmenistan and Caucasus (Hreblay, 1993). Wiesmair et al. (2020) recorded this species from Iran without giving any provincial distribution in detail.

Subgenus *Cororthosia* Berio, 1980

Type species: *Noctua gracilis* [Denis & Schiffermüller], 1775

***Orthosia gracilis* ([Denis & Schiffermüller], 1775)**

Noctua gracilis [Denis & Schiffermüller], 1775, *Ankundung Eines Systematischen Werkes von den Schmetterlingen der Wienergegend*, 76. Austria.

Distribution: Euro-Siberian, outside Europe it is known from Turkey, Caucasus and Transcaucasia (Ronkay et al., 2001). Wiesmair et al. (2020) recorded this species from Iran without giving any provincial distribution in detail.

Genus *Perigrapha* Lederer, 1857

Type species: *Noctua i-cinctum* [Denis & Schiffermüller], 1775.

syn.: *Opacographa* Hreblay, 1996; *Rororthosia* Beck, 1999.

Subgenus *Opacographa* Hreblay, 1996

Type species: *Perigrapha cilissa* Püngeler, 1917

cilissa*-group**Perigrapha cilissa* Püngeler, 1917**

Perigrapha cilissa Püngeler, 1917, *Mitteilungen der Münchner Entomologischen Gesellschaft* 8:19. Turkey.

Distribution: Turkey, Cyprus (Fritsch et al., 2014; Hacker et al., 1986), and Iran (Kerman - **new record**).

***Perigrapha mithras* (Wiltshire, 1941)**

Monima mithras Wiltshire, 1941, *Journal of the Bombay Natural History Society*, 42:474. Iran.

Distribution: Iran (Fars - Wiltshire, 1941; Kerman - Shirvani et al., 2012).

***Perigrapha flora* Hreblay, 1996**

Perigrapha flora Hreblay, 1996, *Esperiana*, 4:73. Turkmenistan.

Distribution: Turkmenistan, Turkey (Hreblay, 1996; Kemal et al., 2007), Iran (Kerman - Shirvani et al., 2012).

Subgenus *Rororthosia* Beck, 1999

Type species: *Perigrapha rorida* (Frivaldszky, 1835)

rorida*-group**Perigrapha gyurirani* Benedek & Ronkay, 2001**

Perigrapha gyurirani Benedek & Ronkay, 2001, *Folia Entomologica Hungarica Rovartani Közlemenyek*, 62:194. Iran, Fars.

Distribution: Iran (Fars, Lorestan, Kerman and Isfahan - Benedek & Ronkay, 2001; Shirvani et al., 2012).

Subgenus *Perigrapha* Lederer, 1857

Type species: *Perigrapha i-cinctum* ([Denis & Schiffermüller], 1775)

nyctotimia*-group**Perigrapha annau* Varga & Ronkay, 1991**

Perigrapha annau Varga & Ronkay, 1991, *Acta Zoologica Academiae Scientiarum Hungaricae*, 37(3–4):279. Turkmenistan.

Distribution: Turkmenistan (Varga & Ronkay, 1991), Iran (Khorasan-e Shomali - Shirvani et al., 2012).

***Perigrapha benedeki* Ronkay, Ronkay, Gyulai & Hacker, 2010**

Perigrapha benedeki Ronkay, Ronkay, Gyulai & Hacker, 2010, *Esperiana*, 15:144. Iran.

Distribution: Iran (Fars - Ronkay et al., 2010).

Genus *Egira* Duponchel, 1845

Type species: *Phalaena (Noctua) conspicillaris* Linnaeus, 1758.

syn.: *Xylomyges* Guenée, 1852; *Xylomiges* Grote, 1874; *Xylomania* Hampson, 1905.

Egira anatolica (Hering, 1933)

Xylomyges anatolica Hering, 1933, *Internationale Entomologische Zeitschrift*, 26:412. Turkey, Ankara.

Distribution: Italy, Turkey, Iraq, Armenia, Turkmenistan, Serbia, Cyprus (Beshkov & Nahirnić, 2016; Fibiger et al., 1999; Ivinskis & Miatleuski, 1999; Ronkay et al., 2001), and Iran (Tehran - Ebert & Hacker, 2002; Isfahan and Fars - Current study).

Key to the Iranian species of the genus *Orthosia* based on the characters of the adults and the male genitalia (Hreblay, 1993; Ronkay et al., 2001; Wiesmair et al., 2020)

- 1 Male antennae biserrate with long fasciculate cilia, female antennae filiform, carina without apical thorn, corona and pollex well developed. *gracilis*
- Male antennae bipectinate, female antennae biserrate or filiform (if male antennae biserrate and female antennae filiform then corona absent and carina bears apical thorn). 2
- 2 Carina with long apical thorn, uncus scaphoid. 3
- Carina without apical thorn, uncus slender or broad. 4
- 3 Pollex present, aedeagus curved, apical thorn longer. *incerta*
- Pollex absent, aedeagus more straight, apical thorn shorter. *habeleri*
- 4 Hindwing of both sexes whitish, antennae of both sexes pectinate, cucullus very short, uncus slender. *miniosa*
- Hindwings not whitish, antennae different in sexes, cucullus and uncus variable. 5
- 5 Orbicular and reniform stigmata large, uncus broad, deltoidal, cucullus rounded. *cerasi*
- Orbicular and reniform stigmata small, uncus thin, cucullus triangular. 6
- 6 Female antennae filiform, ampulla short, vesica without cornuti field. *imitabilis*
- Female antennae finely biserrate, ampulla long, vesica with cornuti field. 7
- 7 Orbicular stigma tiny, small, pollex reduced to a lobe. *cruda*
- Orbicular stigma large, broad, pollex acute. *sordescens*

Key to the Iranian species of the genus *Perigrapha* based on the characters of the adult and the male genitalia (Ronkay et al., 2010; Shirvani et al., 2012)

- 1 Complex of stigmata laced (like a twisted thread), reniform stigma serrate, ampulla short, slightly curved. 2
- Stigmata field simple, ampulla very long, strongly curved. 3
- 2 Forewing narrow, stigmata field large, hindwing's transverse line running closer to outer margin, cuculli more asymmetrical with more pointed apex. *benedeki*
- Forewing wider, stigmata field more laced, hindwing's transverse line not as mentioned in the preceding entry, cuculli less asymmetrical. *annau*
- 3 Wingspan large (40–45 mm), cross lines double, sharply defined, cuculli wide-fork-shaped, vesica either tubular or medially dilated. 4
- Wingspan medium-large (33–40 mm), cross lines simple, cuculli either vulture-head-like or knob-shaped, vesica tubular. 5
- 4 Vesica medially dilated. *flora*
- Vesica tubular with basal diverticulum. *cilissa*
- 5 Subterminal line wide, valvae broad, cucullus, knobbed. *gyurirani*
- Subterminal line simple, valvae narrow, cucullus tapering, vulture-head-like. *mithras*

Perigrapha cilissa Püngeler, 1917

Perigrapha cilissa Mitteilungen der Münchner Entomologischen Gesellschaft 8:19. Turkey.

Material examined. 1♂ and 4♀♀, Iran, Isfahan, Khansar, 2533 m., 33°1'44"N 50°21'35"E, 25.iv.2012, leg. P. Poorshabanan. 1♂, Iran, Isfahan, Fereydon Shahr, Sardab, 2557 m., 32°56'47"N 50°60'4"E, 01.v.2012, leg. P. Poorshabanan. 5♂♂, Iran, Isfahan, Damane, Kord-e Olia, 2363 m., 32°55'45"N 50°40'30"E, 08.iv.2012, leg. P. Poorshabanan. 5♂♂ and 1♀, Iran, Fars, Neyriz, Bahram-e Gur Protected Area, (1800–2400 m.) 27.iv.2016, leg. E. Tamannadar.

Diagnosis. *Perigrapha cilissa* (Figs 1A–B) externally resembles *Perigrapha flora* Hreblay, 1996 (Fig. 1C) but the structure of the genitalia differ in both species. Compared to *P. flora*, the vesica in *P. cilissa* (Figs 2A–B) is not dilated medially and bears shorter cornuti terminally, in the female, the ductus bursae is shorter and thinner in *P. cilissa* than that of *P. flora*. *Perigrapha cilissa* is larger compared to *P. mithras* (34–36 mm) (Fig. 1D), with quite different genitalia structure (Figs 2F–H).

Description. Wingspan 40–45 mm. *Male*: body robust, head, thorax, wings and abdomen, variable from whitish cream, light brown to dark brown. Antennae strongly bipectinate, the pubescence of thorax well developed and dense. Forewings long, triangular, inner margin more or less dark-shaded, cross lines dentate, orbicular and reniform stigmata large. Hind wings as forewing ground color. *Female*: as like as male, antennae finely biserrate.

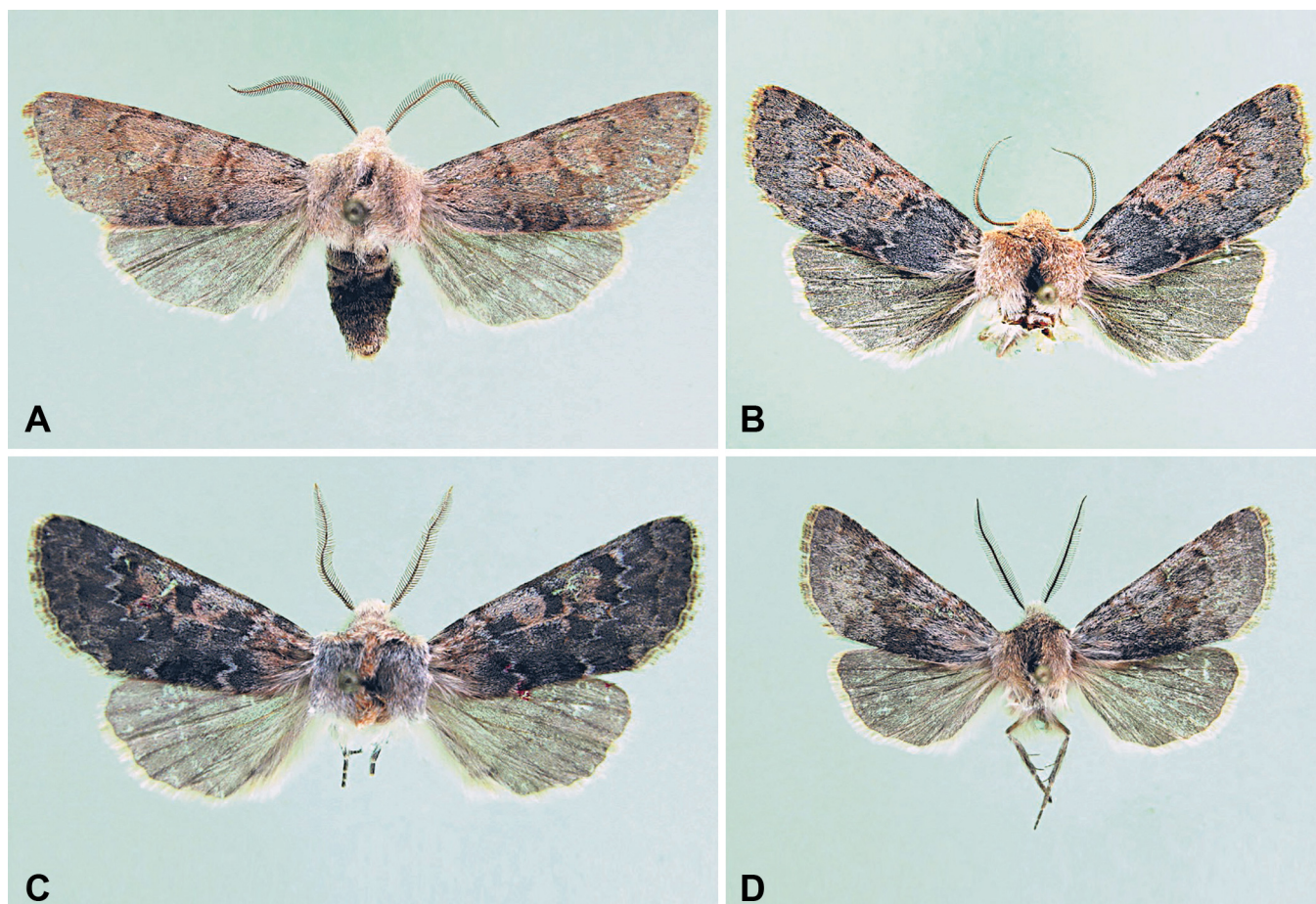


Figure 1. *Perigrapha* spp. adults: **A.** *Perigrapha cilissa* Püngeler, 1917, male; **B.** *P. cilissa* female; **C.** *P. flora* Hreblay, 1996, male; **D.** *P. mithras* (Wiltshire, 1941), male.

Male genitalia (Figs 2A–B). Uncus short, slightly widened, tegumen low and wide, penicular lobe obsolescent, juxta semi-rectangular, vinculum long, v-shaped. Valva long tapering, costal margin bent outward medially, constricted below cucullus, clavus dentate, sacculus broad, sclerotized, clasper small, sclerotized, button-like, ampulla very long, curved, pointed, cucullus bifurcate as semi-circle, corona absent.

Female genitalia (Fig. 2C). Ovipositor short, gonapophyses slender, posterior apophyses slightly longer than anterior one, ostium bursa broad. Ductus bursa long, sclerotized, wider proximally, appendix bursa long, helicoid, widened, connected to ductus bursa by sclerotized wrinkles, corpus bursae long, ovoid, membranous, four signa in different sizes present.

Bionomics and distribution. Univoltine, adults fly early spring in the cold semi-mountainous areas (1800–2600 m.). The habitats of this species are covered by *Astragalus* sp., scallion (*Allium* sp.), and red tulip (*Tulipa* sp.). This species has only been reported from Turkey (Hreblay, 1996) up to present time. This species is reported, for the first time, from Iran.

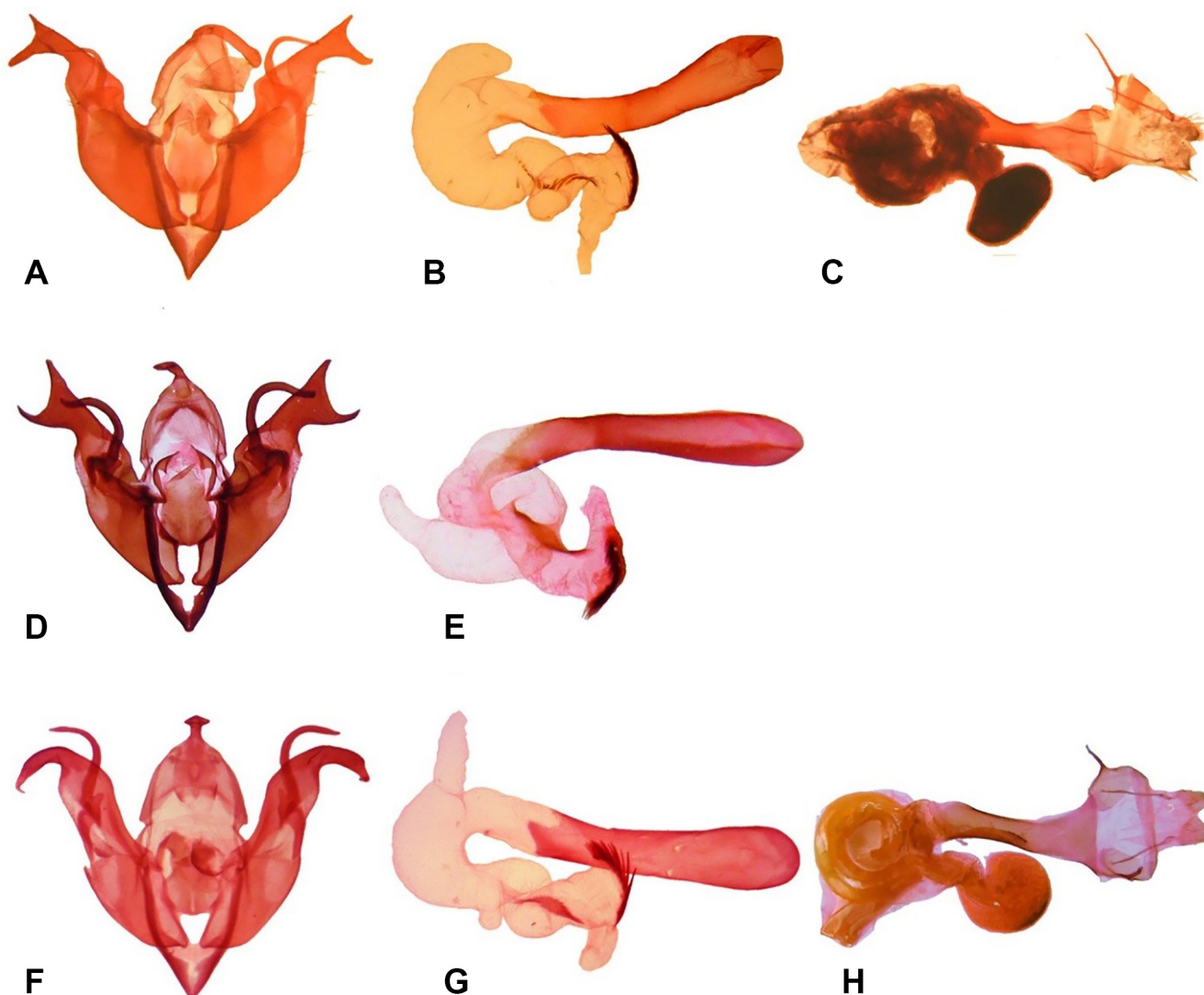


Figure 2. *Perigrapha* spp. genitalia: **A.** *Perigrapha cilissa* Püngeler, 1917, male armature; **B.** *P. cilissa*, male vesica; **C.** *P. cilissa*, female; **D.** *P. flora* Hreblay, 1996, male armature; **E.** *P. flora*, male vesica; **F.** *P. mithras* (Wiltshire, 1941), male armature; **G.** *P. mithras*, male vesica; **H.** *P. mithras*, female.

DISCUSSION

The tribe Orthosiini is represented, in Iran, by three genera, *Orthosia*, *Perigrapha* and *Egira* and by 15 species totally. The large univoltine, Holarctic-Oriental genus, *Orthoia*, comprising more than sixty species worldwide, and the majority of them occurring in eastern and south-eastern Asia (Wiesmair et al., 2020). Of these, eight species are known from Iran, though the presence of four species, *O. miniosa*, *O. cruda*, *O. sordescens* and *O. gracilis* is doubtful as their collected localities are not well specified in the literatures. Opposed to the common habitat of the genus *Orthosia* (mostly prefer humid and most often woody biotopes - Wiesmair et al., 2020), the members of this genus, most inhabit dry higher montane biotopes in Iran. With the largest number, the subgenus *Monima* sensu Ronkay et al. (2010) includes five out of eight Iranian *Orthosia* species. The west and central Palaearctic members of *Orthosia* fly in the spring and overwinter as pupa with polyphagous larvae on trees, shrubs and low herbs (Ronkay et al., 2001).

Since Hreblay (1996) re-described the genus *Perigrapha* and described 11 new species of this genus, the number of *Perigrapha* species is increased as with the increase of the so-called early spring faunal expeditions in the Central and eastern Asia. Compared to the rich Holarctic fauna, the genus *Perigrapha* is represented in Iran, so far, by six species that inhabit xerothermic biotopes. The Iranian members of *Perigrapha* are univoltine with early-flying adults that are not commonly caught by the light traps (Shirvani et al., 2012) and the pupa is reported (Ronkay et al., 2001) as the overwintering stage. Comparing the genitalia characteristics of *P. flora* with those illustrated by Hreblay (1996), Shirvani et al. (2012) reported this species as new from Iran stating that the more specimens are needed for more accurate decision. Having collected a large number of materials, now we conclude that not only the Iranian fauna includes the *P. flora* but also comprises the *P. cilissa* as well. The authors believe that the molecular investigations based on the DNA barcoding analysis are advised in order to identify and diagnose the cryptic-sympatric species of closely related taxa with individual variations.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: P. Poorshabanan: Collection and preparation of the specimens; A. Shirvani: Identification the specimens, preparing the diagnostic characters, preparation of the draft, corrections on the final contents of the manuscript and proofreading. All authors reviewed the results and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

Not applicable.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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کاتالوگ قبیله (Lepidoptera, Noctuidae) Orthosiini Guenée در ایران و یک گزارش جدید گونه

پدرام پورشبانان و اصغر شیروانی*

بخش گیاهپزشکی، دانشکده کشاورزی، دانشگاه شهید باهنر کرمان، ایران

* پست الکترونیک نویسندگان مسئول مکاتبه: shirvani@uk.ac.ir

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چکیده: آرایه Orthosiini Guenée, 1837 یکی از شش قبیله در زیرخانواده Hadeninae است که دارای ۱۷ جنس در دنیا می‌باشد. از این جنس‌ها، سه جنس شامل *Egira* Duponchel, و *Orthosia* Ochsenheimer, 1816, *Perigrapha* Lederer, 1857 از ایران گزارش شده‌اند. کاتالوگ قبیله Orthosiini در ایران شامل ۱۵ گونه همراه با پراکنش گونه‌ها در استان‌های مختلف همراه با کلید شناسایی گونه‌های مختلف در ایران آرایه شد. گونه *Perigrapha cilissa* Püngeler, 1917 برای اولین بار از ایران گزارش و ویژگی‌های ریخت‌شناسی خارجی و اندام‌های زادآوری همراه با تصاویر مربوط شرح داده شد.

واژگان کلیدی: فون، بال پولکیان، شب‌پره، کلید شناسایی، گزارش جدید، فهرست