

1-1-2012

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### Recommended Citation

SHIRVANI, ASGHAR; SHOGHALI, MOHAMMAD ALI; and FEIZPOOR, SHAMSI (2012) "A survey of the Perigrapha Lederer (Lepidoptera, Noctuidae, Hadeninae) species of Iran," *Turkish Journal of Zoology*. Vol. 36: No. 6, Article 4. <https://doi.org/10.3906/zoo-1111-15>  
Available at: <https://journals.tubitak.gov.tr/zoology/vol36/iss6/4>

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## A survey of the *Perigrapha* Lederer (Lepidoptera, Noctuidae, Hadeninae) species of Iran

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Received: 14.11.2011 • Accepted: 25.03.2012

**Abstract:** Four species of the genus *Perigrapha* Lederer are reviewed in Iran. Two species, *P. annau* Varga & Ronkay, 1991 and *P. flora* Hreblay, 1996, are reported for the first time from the fauna of Iran. Adult and genitalia images are illustrated and identification keys for the external and genital features are given.

**Key words:** *Perigrapha*, Iran, new records, identification key

### Introduction

The tribe Orthosiini Guenée, 1837, with 7 genera (*Panolis* Hübner, [1821], *Dioszeghyana* Hreblay, 1993, *Orthosia* Ochsenheimer, 1816, *Anorthoa* Berio, 1980, *Harutaeographa* Yoshimoto, 1993, *Perigrapha* Lederer, 1857, and *Egira* Duponchel, 1845), is represented by early-flying, univoltine species that prefer mountainous and semimountainous regions in Iran. The classification and taxonomic rank of species groups within this tribe has been a matter of different interpretations. Beck (1999) defined 2 different tribes of Noctuinae for the members of Orthosiini, but this classification, based on the study of local fauna, was not realistic enough to be accepted. The last comprehensive survey of the tribe Orthosiini was published by Ronkay et al. (2001), where they studied a large number of species of the so-called perigraphoid generic complex displaying

large-scale variation in morphological features and relegated them as members of 3 genera, *Anorthoa*, *Harutaeographa*, and *Perigrapha*.

*Perigrapha*, a Holarctic genus belonging to the perigraphoid generic complex with hairy eyes typical for the subfamily Hadeninae (sensu Hampson), comprises 3 subgenera, *Opacographa* Hreblay, 1996, *Rororthosia* Beck, 1999, and *Perigrapha* Lederer, 1857. This genus is represented in Europe by the last 2 subgenera and 4 species (Ronkay et al., 2001). Species of *Opacographa* prefer more xerothermic montane steppes than the members of the other subgenera. The larvae of the tribe Orthosiini are polyphagous, feeding on broad-leaved trees and conifers, shrubs, and low herbs; they pupate in strong cocoons in the soil to pass the winter (Ronkay et al., 2001). Some features of the male genitalia are shared with certain species of *Egira* and *Anorthoa*

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(e.g., helical vesica with terminal cornuti field) and a few *Orthosia* taxa (e.g., helical vesica with distal diverticulum), which indicates the close relationship among these genera (Hreblay, 1994; Hreblay, 1996). Although most genera of Orthosiini have mainly been reported from forested regions of southeastern Asia, some certain species of *Perigrapha* inhabit open desert and semidesert biotopes in the Middle East as well as Central Asia. *Perigrapha* is represented in neighboring countries of Iran with 5 species in Turkey (Kemal et al., 2007), 3 species in the Caucasus (Koçak et al., 2008), and 3 species in Afghanistan (Koçak and Kemal, 2012). As the species of this genus are univoltine and are early-flying moths that are not commonly caught, the number of reported species in Iran is relatively low. It is worth mentioning that another reason for this low species number could be the lack of the preferred habitat. For the time being, 2 species belonging to the genus *Perigrapha* have been reported from Iran (Wiltshire, 1941; Hacker, 1990; Benedek and Ronkay, 2001).

The purpose of this paper is to review the species of the genus *Perigrapha* in Iran. Two species, *P. annau* Varga & Ronkay, 1991 and *P. flora* Hreblay, 1996, are reported for the first time for the fauna of Iran. Distribution of each species is given together with notes on the bionomy. Adult and genitalia images and identification keys are presented for the species occurring in Iran.

## Materials and methods

Adult specimens examined in this study were collected using both portable light traps (powered by 12-V batteries and 8-W black light UVB tubes) and an electric motor generator (in order to light the UV bulbs to attract moth species) in a number of expeditions carried out in different provinces of Iran. Geographic data of each location, including geographic coordinates and altitude, were acquired using a GPS device. Besides the collected species, some material was obtained from the entomology collection of Shahid Bahonar University in Kerman. The genitalia of specimens were dissected, stained (using either chlorazol black or eosin yellowish), and mounted in Euparal mounting medium. Photographs of the adult specimens and genitalia were taken with a Canon digital camera (model: Power Shot A710).

## Results and discussion

### Checklist of Iranian *Perigrapha*

Genus *Perigrapha* Lederer, 1857

Subgenus *Rororthosia* Beck, 1999

Species group: *rorida*

*P. gyurirani* Benedek & Ronkay, 2001

Subgenus *Perigrapha* Lederer, 1857

Species group: *annau*

*P. annau* Varga & Ronkay, 1991

Subgenus *Opacographa* Hreblay, 1996

Species group: *cilissa*

*P. flora* Hreblay, 1996

*P. mithras* (Wiltshire, 1941)

Key to the Iranian *Perigrapha* species based on external features

1. Forewing with conspicuous suborbicular patch, reniform stigma serrate ..... *annau*
  - Stigmata field simple ..... 2
2. Wingspan large (about 45 mm), cross lines double, sharply defined ..... *flora*
  - Wingspan medium-large (33–40 mm), cross lines simple ..... 3
3. Subterminal line well defined, wide .... *gyurirani*
  - Subterminal line simple ..... *mithras*

Key to the Iranian *Perigrapha* species based on male genitalia

1. Ampulla short, slightly curved ..... *annau*
  - Ampulla very long, strongly curved ..... 2
2. Cucullus wide-fork-shaped, vesica medially dilated ..... *flora*
  - Cucullus either vulture-head-like or knob-shaped, vesica tubular ..... 3
3. Valva broad, cucullus small, knobbed . *gyurirani*
  - Valva narrow, cucullus tapering, vulture-head-like ..... *mithras*

***Perigrapha gyurirani*** Benedek & Ronkay, 2001

*Perigrapha gyurirani* Benedek & Ronkay, 2001, *Folia Entomologica Hungarica* **62**: 194. L.t. (Locus typicus = type locality): Iran, Fars.

Diagnosis: None of its other Iranian congeners look externally like *P. gyurirani*. The uniformly grayish beige to grayish brown coloration and the sharply defined and sinuous subterminal line are unique features of this species.

The male genitalia of this species also show distinct features, which made the identification much easier. The very small cucullus, the medially more dilated valva, and the very strong ampulla distinguish *P. gyurirani* from related taxa. The general plan of the aedeagus and vesica of this species almost resembles those of 3 genera (tubular vesica bearing diverticula and terminating in apical spinules). Compared to *P. flora* and *P. mithras*, the vesica of *P. gyurirani* lacks the finger-like diverticulum, while the more dilated vesica and weaker spinulose field of this species are diagnostic in comparison with *P. annau*.

The female genitalia of *P. gyurirani* differ from those of *P. mithras* by their U-shaped ostium bursae and short appendix bursae (the ostium bursae of the latter species is simple and the appendix bursae is long and helicoids). The female genitalia of *P. annau* is, as of yet, undescribed, and that of *P. flora* was not found on our expeditions. The complete diagnosis and comparison of *P. gyurirani* with its other relatives was given by Benedek and Ronkay (2001).

Description: Wingspan 37–40 mm (Figures 1a and 1b). Antennae bipectinate, head, tegula, thorax, and forewing grayish beige to grayish brown. Head small, eye globular, pubescence of thorax dense, downy. Forewing wide, posterior margin medially suffused with brown scales; antemedial and postmedial lines missing. Noctuid maculation complete, orbicular stigma less distinct, outlined with fine line, reniform stigma well presented by brown, encircled by fine brownish line. Subterminal line conspicuous, brown, terminal line fine, beige, fringes as the ground color. Hindwing dirty white, discal spot present, veins covered with beige, terminal line fine.

Male genitalia (Figures 1c and 1d): Uncus short, slender, tapering, tegumen weak, narrow, penicular lobe missing; juxta semiquadrangular with truncate apex. Valva broad, medially dilated, constricted below bird-head-like cucullus, sacculus strong, sclerotized, clavus absent. Clasper strong, sclerotized, dilated distally, ampulla very long, curved with apex pointed. Vinculum long, narrow, V-shaped. Aedeagus long, curved, carina with ventrolateral sclerotized

bar. Vesica broadly tubular, basally constricted, and rugulose with dorsolateral and ventral scobinate fields, medial part with small diverticulum, distal end armed by a field of spinules.

Female genitalia (Figure 1e): Ovipositor short, papillae anales hairy, apophyses slender. Ostium bursae sclerotized, ventral plate widely incised, forming U-shaped opening. Ductus bursae heavily sclerotized in its posterior end, anterior end membranous; appendix bursae semiglobular with fine ribs. Corpus bursae saccate, membranous with two long signum stripes.

Material examined: 2 ♀: Iran, Prov. Kerman, 25 km W of Kerman, Honouj, 2300 m, 30°19'48.9"N, 56°46'36.5"E, 21.03.2006, leg. A. Shirvani. 6 ♂: Iran, Prov. Esfahan, Damane, Darre bid, 2840 m, 33°04'58"N, 50°26'28"E, 07.05.2011, leg. P. Poorshabanan.

Bionomics and distribution: Univoltine early-flying species, adults are on the wing from mid-March to early May. The original materials of this species were collected from the medium-high and high altitudes of Fars and Lorestan (Benedek and Ronkay, 2001) provinces. The preferred habitat of *P. gyurirani* is dry and cold altitudes with scarce vegetation. Adult specimens are attracted to artificial lights in low numbers and the number of collected individuals for this species is low. Early stages and larval food plants are still unknown. This species is known only from the south of Iran (Fars, Lorestan, Kerman, and Esfahan provinces).

#### *Perigrapha annau* Varga & Ronkay, 1991

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

Diagnosis: The external morphological features of this species (stigmata on the forewing together with special shape of suborbicular and reniform stigmata) show conspicuous differences, making this species quite different from its other congeners among Iranian species. Special shape of bird-head-like cucullus and shorter and weaker ampulla are characteristic features that make the male armature of this species different from those of other species.

Description: Wingspan 36–37 mm (Figures 1f and 1g). Antennae strongly bipectinate, head, tegula, thorax, and forewing dark brown. Head small,



Figure 1. Adults and genitalia of *Perigrapha* spp.: a) male and b) female of *P. gyurirani*; c) male armature, d) male vesica, and e) female genitalia of *P. gyurirani*; f) female and g) male of *P. annau*; h) male armature and i) male vesica of *P. annau*.

eye globular, collar, and tegula with black lines, thorax robust. Forewing triangular with acute apex, small basal dash present, stigmata field paler than ground color, pinkish beige, orbicular stigma small, suborbicular path large, reniform stigma serrate in outer edge. Antemedial and postmedial lines complete. Subterminal line obsolete, terminal line fine, fringes pinkish beige. Hindwing suffused with dark brown, subterminal line present, discal spot missing, fringes as forewing.

Male genitalia (Figures 1h and 1i): Uncus short, widened, tegumen broad, penicular lobe absent; juxta subdeltoidal with median crest. Valva evenly curved

in ventral margin, constricted below bird-head-like cucullus, sacculus long, sclerotized, clavus missing. Clasper narrow, sclerotized, ampulla long, curved with apex pointed, vinculum V-shaped. Aedeagus thick, carina with ventrolateral fine bar. Vesica curved, tubular, medioventrolaterally constricted and rugulose with small diverticulum, distal end with a dense row of spinules.

Female genitalia: Undescribed as of yet.

Materials examined: 2 ♂: Iran, Prov. Khorasan Shomali, Gharebashlu, 1370 m, 37°22'49"N, 57°17'13"E, 17.04.2011, leg. Sh. Feizpoor.





Figure 2. Adults and genitalia of *Perigrapha* spp.: a) male and b) female of *P. mithras*; c) male armature, d) male vesica, and e) female genitalia of *P. mithras*; f) male of *P. flora*; g) male armature and h) male vesica of *P. flora*.

Remarks: Comparing the 2 specimens of *P. annau*, the stigmata field on the forewing shows differences in the shape of the serrate edge of reniform stigma, but the genitalia characteristics are the same. In spite of the external variability among different populations of a species, delimiting the populations into different species is problematic, because some species are rare species and are only known by their unique type materials (e.g., *P. annau*, *P. mithras*).

Bionomics and distribution: Univoltine early-flying species, adults are on the wing in April. Like its type material, the specimens of this species were taken in April from foothills showing early flying activity. Adults come to artificial light; larvae and their food plants are still unknown. This species

inhabits low-medium altitudes with shrubby and bushy vegetation. *P. annau* lives in Turkmenistan (Varga and Ronkay, 1991) and northeastern Iran.

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

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

Diagnosis: The diagnostic characteristics of this species are discussed under *P. flora*.

Description: Wingspan 33–36 mm (Figures 2a and 2b). Antennae bipectinate, stronger in female. Head, collar, tegula, and thorax ochreous gray. Forewing ochreous gray mixed with reddish scales especially in median area, shape of forewing triangular with acute apex, darker in posterior margin. Antemedial

and postmedial lines light, orbicular and reniform stigmata large, lighter than ground color, centered with dark. Subterminal line conspicuous, fine, fringes ochreous. Hindwing unicolorous, brown, discal spot missing, veins covered with darker scales, fringes pinkish ochreous white.

Male genitalia (Figures 2c and 2d): Uncus short, deeply widened, tegumen broad and low, penicular lobe absent; juxta deltoid heart-shaped with slight median crest. Valva long, costal margin sclerotized. Sacculus triangular, sclerotized, clavus missing. Clasper rod-shaped, sclerotized, ampulla very long, curved with apex pointed, cucullus vulture-head-shaped, vinculum V-shaped. Aedeagus long and thick, tapering, carina is missing. Vesica long, tubular, helicoid, slightly dilated in a distance between 2 finger-like diverticula, distal end with a dense row of spinules.

Female genitalia (Figure 2e): Ovipositor short, papillae anales weak, apophyses slender, posterior apophysis more than twice as long as anterior apophysis. Ostium bursae broad, sclerotized. Ductus bursae long, sclerotized ventrally; appendix bursae long, ribbed, helicoid, and widened. Corpus bursae semiglobular, membranous.

Materials examined: 1 ♂, 1 ♀: Iran, Prov. Kerman, Khabr, 2400 m, 28°52'45"N, 56°23'56"E, 15.03.2010, leg. M. Shoghali.

Bionomics and distribution: The specimens were taken from Khabr National Park, Kerman Province, southern Iran. The type material of *P. mithras* was collected in the first half of April in a mesomountainous region (1800 m). This species inhabits medium-altitude foothills covered by bushes. Adults, flying in March, are attracted to light; the early stages are undescribed and their host plants still unknown. This species is only known from the south of Iran, including Fars (Wiltshire, 1941) and Kerman provinces.

#### *Perigrapha flora* Hreblay, 1996

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

Diagnosis: The closest relative of this species is *P. cilissa* Püngeler, 1917. The main differences between these 2 relatives can be seen in the male genital structure, in which the vesica of *P. flora* is much

dilated medially with long terminal cornuti field while that of *P. cilissa* lacks a swollen vesica bearing a shorter terminal cornuti field. Compared to *P. mithras*, the bigger size and more sharply defined cross lines of *P. flora* distinguish clearly between the 2 related species. The distinctive features of the male genital armature make the identification easier; the peculiar vulture-head-shaped cucullus is typical for *P. mithras*, which differs from the wide fork-shaped cucullus of *P. flora*.

The female genitalia of *P. flora* differ from those of *P. cilissa* and *P. mithras* by having a stronger and thicker proximal part (as seen in Hreblay, 1996, p. 87).

Description: Wingspan 45 mm (Figure 2f). Antennae strongly bipectinate, head, tegula, thorax, and forewing pinkish ochreous light brown. Head small, eye globular, pubescence of head and collar pinkish, those of tegulae and thorax mixed with blackish hairs, collar with median transverse dark line. Forewing long, rectangular, darker in posterior margin, antemedial and postmedial lines light, double. Orbicular and reniform stigmata large, pinkish. Subterminal line conspicuous, fine, fringes pinkish ochreous. Hindwing unicolorous, ochreous, discal spot obsolescence, veins covered with darker scales, subterminal line weak, fringes pinkish ochreous.

Male genitalia (Figures 2g and 2h): Uncus short, widened, tegumen broad, penicular lobes absent; juxta rectangular, longer than wide. Valva curved in ventral margin, constricted below bifurcate cucullus, costal margin convex medially. Sacculus triangular, sclerotized, clavus missing. Clasper short, bent, sclerotized, ampulla very long, curved, with apex pointed, vinculum V-shaped. Aedeagus long, tapering, carina with dorsal weak bar. Vesica tubular, helicoid, dilated in medial part with finger-like diverticulum, distal end with a cornuti field appearing as dense row of spinules.

Materials examined: 1 ♂: Iran, Prov. Kerman, Jiroft, Mardahak.

Remarks: As previously mentioned under *P. annau*, members of this genus are usually recorded by their unique specimens. In the case of *P. flora*, only one specimen was collected in our several

expeditions, which makes the comparison with the typical population(s) of the species most troublesome. Comparing the genitalia of our single specimen with the figures given by Hreblay (1996), it seems that this specimen appears to be much closer to *P. flora* than to *P. cilissa*, but the question still remains whether this is a distinct species or not; to reach a final decision, more specimens must be studied.

Bionomics and distribution: Univoltine early-flying species, adults are on the wing in April. This species was taken from a desert and semidesert lowland location with poor vegetation in the south

of Iran. *P. flora* is known from Turkmenistan and Turkey (Hreblay, 1996; Kemal et al., 2007). Imagoes come to artificial light; early stages and their host plants are, as of yet, unknown.

### Acknowledgments

Our sincere thanks to Mr M. Feizpoor and Mr J. Feizpoor for their kind help in the collection of our material from Khorasan Shomali Province. This study was financially supported by the Shahid Bahonar University of Kerman.

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