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New data on Noctuidae and Erebidae (Lepidoptera) from Iran, including a new record of *Anumeta dentistrigata* (Staudinger, 1877)

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Abstract

The increase in scientific expeditions has led to the revelation of moth biodiversity across Iran. This research presents new country and provincial species records for two widespread moth families, Noctuidae and Erebidae. The genus *Anumeta* Walker, 1858 (Toxocampinae subfamily) has a Palearctic distribution range of 25 species. It now represents the Erebidae family with one additional species, *Anumeta dentistrigata* (Staudinger, 1877), found in Iran. The external and genital characters of this species are presented, along with information on its distribution, bionomics, and illustrations of the adult and female genitalia. Eight noctuid and erebid species with new provincial records are introduced, and their distribution, bionomics, and remarks, where necessary, are given. Further thorough investigations are needed to explore Iran's rich and yet not wholly known biodiversity, as highlighted by this investigation and previous contributions reporting new records from less explored regions in southern Iran.

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Introduction

Toxocampinae were previously included, without giving any clear autapomorphies, as a subtribe (Goater et al, 2003) and a tribe (Fibiger & Lafontaine, 2005; Lafontaine & Schmidt, 2010) within Catocalinae until when Zahiri et al. (2012) presenting a new phylogeny for Erebidae, treated this taxon, based on molecular phylogenetic analysis as a subfamily within Erebidae. The genera of this subfamily are found mainly in the Palaearctic though the genera with sub-Saharan, Himalayan, Australian and the Nearctic species are present as well (Goater et al., 2003). The recorded larval host plants of this subfamily are mainly plant species from Fabaceae (Goater et al., 2003; Holloway, 2005) with fewer records on Ulmaceae (Goater et al., 2003).

An eremic genus of Toxocampinae subfamily, *Anumeta* Walker, 1858, contains a total of 25 species in the Palaearctic with five European (Fibiger & Hacker, 2005; Goater et al., 2003) and six, so far, Iranian species (Esfandiari et al., 2015; Rajaei et al., 2023; Wiltshire, 1961). Almost all Iranian *Anumeta* species have been recorded from the central and southern Iran provinces (Rajaei et al., 2023) with supposedly preferred desert zonobiomes. In agreement with Landry et al. (2023) conclusions suggesting that many moth species are waiting to be discovered, recent investigations including (Moghadaszadeh Kermani et al., 2023; Shahreyari-Nejad et al., 2023; Shirvani, 2023; Wiesmair et al., 2020) have resulted in new moths discoveries in both faunistic and taxonomic levels.

The results of this paper come from the contributions aiming to reveal the less-known fauna of southern Iran by reporting *Anumeta dentistrigata* (Staudinger, 1877) as new for the fauna of the country. A list of Iranian *Anumeta* species is presented together with their distribution, bionomic and notes where necessary. Adult and female genitalia of *Anumeta dentistrigata* are illustrated, and its external and genital morphology are presented and diagnosed with close relatives. Besides, a distributional list of eight noctuid and erebid moths having new provincial records are given along with their

distribution and bionomic.

Material and Methods

The moth specimens were either collected from the Bidouyeh Protected Area during the years 2016-2018 using portable light traps (powered by 12-volt batteries and 8-watt Black-light UVB tubes) or studied from materials deposited in the Collection of Lepidoptera, Departments of Plant Protection, Shahid Bahonar University of Kerman, Iran. In the collecting sites, geographic coordinates and altitude were acquired using a GPS device. The specimens were conveyed to the laboratory and pinned by proper insect pins then were spread and mounted on the spreading boards. Genitalia slides were prepared by standard techniques (Fibiger, 1997). Adult specimens were photographed using a Canon Power Shot digital camera model A710 IS and the genitalia by an Olympus SZH stereomicroscope with an Omax (18 MP) A35180U3 digital camera. The nomenclature of the species and their systematic order were made according to Rajaei et al. (2023). Collected specimens were deposited in the Collection of Lepidoptera, Departments of Plant Protection, Shahid Bahonar University of Kermani, Iran.

Results

A list of Iranian *Anumeta* species with one newly recorded species from the country is presented. Besides, a distributional list of eight noctuid and erebid species, and new provincial records are presented.

Taxonomic hierarchy

Class Insecta Linnaeus, 1785

Order Lepidoptera Linnaeus, 1785

Family Erebidae Leach, 1815

Genus *Anumeta* Walker, 1858

Anumeta Walker, 1858, List of specimens of Lepidopterous insects in the collection of the British Museum, 15: 1769. Type species: *Anumeta atrosignata* Walker, 1858.

Synonyms: *Palpangula* Staudinger, 1877; Imitator Alphéraky, 1883; Eremonoma Warren, 1913.

***Anumeta asiatica* Wiltshire, 1961,** Journal of the Bombay Natural History Society, 58: 619. L. t.: Iran, Saudi Arabia.

Distribution: South and South-west of Iran. Khuzestan and Sistan-o-Baluchistan (Rajaei et al., 2023).

Bionomics: Adults fly in May and their reported host plant is *Calligonum comosum* (Salem, 2021). This species inhabits arid regions (Kravchenko et al., 2007).

***Anumeta atrosignata* Walker, 1858,** *Anumeta atrosignata* Walker, 1858, List of specimens of Lepidopterous insects in the collection of the British Museum, 15: 1770. L. t.: India, North Hindustan.

Synonym: *arenosa* Brandt, 1939.

Distribution: Sistan-o-Baluchistan and Hormozgan (Rajaei et al., 2023).

Remark: Kerman Province is introduced as the habitat for this new recorded species.

Bionomics: Same as the other *Anumeta* species, this species is an inhabitant of steppe and semi-desert. Specimen examined was taken in November. The early stages are unknown and their recorded host plant is *Calligonum comosum* (Polygonaceae) (Hacker, 2001; Kravchenko et al., 2007).

Material examined: 1 ♂ , Iran, Kerman Province, Manujan, 27º24′ 41″ N 57º30′ 25″ E, 6-XI-2008, leg. M. Shoghali.

***Anumeta spilota* (Erschoff, 1874)**

Leucanistis spilota Erschoff, 1874, in Fedtschenko Reise in Turkestan, 56. L. t.: Transcaspian, Uzbekistan.

Distribution: Sistan-o-Baluchistan and Hormozgan Provinces (Rajaei et al., 2023).

Bionomics: Probably univoltine (Hacker, 2001) species which is usually found in desert and arid regions with early flying adults (in May) and non-described larvae (Goater et al., 2003). The host plant is recorded as *Calligonum comosum* (Polygonaceae) (Salem, 2021).

***Anumeta henkei* (Staudinger, 1877)**

Leucanistis henkei Staudinger, 1877, Stettiner Entomologische Zeitung, 38: 196. L. t.: Russia, Sarepta.

Distribution: Goater et al. (2003) have reported this species from Iran without giving any detail or provincial record.

Remark: Kerman, Fars and Sistan-o-Baluchistan Provinces are new habitats recorded by this report for *A. henkei.*

Bionomics: This species is known as eremic species which flies on the desert habitat (Goater et al., 2003). They can be found on sandy deposits and shallow areas. The species is multivoltine and perhaps with a facultative diapause (Kravchenko et al., 2007). Specimens examined were taken in April and June and the larva is unknown.

Material examined: 6♂♂, 1♀: Iran, Kerman Province, Kazem Abad, 30º26′ 26″ N 56º50′ 30″ E, 1750 m, 15-IV-2011, leg. M. Shoghali. 2♀♀: Iran, Kerman Province, Haftbagh, 30º09′ 50″ N 57º09′ 06″ E, 1800m, 18-IV-2011, leg. E. Ramezani. 2♂♂: Iran, Fars Province, Neyriz, Bahrame-Gur protected area, 28º46′ 09″ N 55º24′ 00″ E, 1600m, 4¬¬-IV-2017, leg. E. Tamanadar. 1♂: Iran, Sistan-o-Baluchistan Province,

Taftan, 28º36′ 328″ N 61º04′ 76″ E, 1800m, 4-VI-2010, leg. E. Kazemi.

***Anumeta fractistrigata* (Alphéraky, 1882)**

Palpangula fractistrigata Alphéraky, 1882, Horae Societatis Entomologicae Rossicae, 17: 96. L. t.: Korgas.

Distribution: Mazandaran and Esfahan (Rajaei et al., 2023).

Bionomics: The adult moths fly in semi-desert areas (Goater et al., 2003).

***Anumeta cestis* (Ménétries, 1848)**

Catephia cestis Ménétries, 1848, Mémoires de l'Académie Impériale des Sciences de Saint-Pétersbourg Sciences Naturelles, 6: 76. L. t.: Russia.

Synonyms: *punctata* Ménétries, 1848; *parvimacula* Rothschild, 1920.

Distribution: Khorasan-e-Razavi (Esfandiari et al., 2015), Hormozgan, Sistan-o-Baluchistan and Esfahan Provinces (Rajaei et al., 2023).

Remark: Kerman is new habitats identified for this species.

Bionomics: This univoltine species flies in desert areas of southern Iran. Adult moths are on the wind from March to June depending on the location.

Material examined: 1 ♀: Iran, Kerman Province, Bampour, 27 °24′ 41″ N 57 °30′ 25″ E, 06-III-2006, leg. A. Shirvani. 1♂: Iran, Kerman Province, Shahid Bahonar university of Kerman, 07-IV-2010, leg. H. Sheykhnejad. 1♂: Iran, Kerman Province, Haftbagh, 30 °09′ 50″ N 57 °09′ 06″ E, 1800m, 18-IV-2011, leg. H. Ramezani.

***Anumeta dentistrigata* (Staudinger, 1877)**

Leucanitis dentistrigata Staudinger, 1877, Entomologische Zeitung, 38: 199. L. t.: Turkmenistan.

Diagnosis: *A. dentistrigata* externally resembles *A. cestis* and *A. henkei* but its size and strongly dentate-waved postmedial line differentiate this species from its close relatives.

External Morphology: wingspan 35-36 mm (Fig. 1), head, collar, and thorax light brownish mixed with white. Antenna long fasciculate ciliate. Forewing broad, slightly triangular, ground color mixture of tortilla and coffee brown scattered with brighter scales, strongly patterned dark fuscous, ante-median line strongly dentate, arrow-like, median area the darkest part, walnut brown, post-median line strongly dentate-waved and slightly angled before costa, outlined with white. Post-median area and its veins get darker towards outer margin, apex with remarkable dark nervures, subterminal line wave-like, creamy white, subterminal area suffused with chocolate brown scales. Terminal line signifies with fuzzy brown, fringes combination of caramel and mottled ginger brown. Underside of forewing milky white, discal spot present, fringes darker apically. Hindwing bronze brown contained a wide smoky post-median band with intensified darker patch extended towards subterminal band between nervures 2 and 4 leaving two white spots along the terminal area, termen apparently brown, fringes characteristically pure white. Underside of hindwing cotton white, small discal spot present, with a mocha brown patch in subterminal band in the exact area as upside of the wing, a series of minute black speck along termen, fringes color as upside.

Female genitalia: Ovipositor short (Fig. 2), broad, subapically with row of stiff setae, papillae anales long-oval, densely hairy, anterior and posterior apophyses long, bar-shaped, equal to length and width, posterior apophyses are widened in distal part. Ostium bursae as long as ductus bursae, longitudinally with a medial sclerotization, ductus bursae sclerotized, funnel shaped. Appendix bursae small, corpus bursae elongated and widened.

Material examined: 2 ♀ ♀: Iran, Kerman Province, Bardsir, Bidouyeh Protected Area, 29º59′ 41″ N 56º58′ 32″ E, 2200 m, 6-IV-2018, leg. M. Ghaemmaghamian.

Bionomics: This species flies from March to May in tropical and semi-arid regions.

Distribution and remark: This species has already been recorded from Kazakhstan (Shovkoon & Trofimova, 2016) and Turkmenistan. Kerman is now known to be home to this newly recorded species.

***Anumeta major* Rothschild, 1913,** Rothschild, 1913, Novitates Zoologicae 20:130. L.t: Algeria.

Distribution: Khuzestan (Rajaei et al., 2023).

Bionomics: Univoltine, early flying species which inhabits arid zones and its adults fly in May.

Genus Drasteria Hübner, 1818

Drasteria Hübner, [1818]. Type species: *Drasteria graphica* Hübner, [1818] by subsequent designation by Hampson, 1926: 38.

Synonyms: *Bolina* Duponchel, [1845] (praeocc.); *Leucanitis* Guenée, 1852; *Syneda* Guenée, 1852; *Synedoida* H. Edwards, 1878; *Aleucanitis* Warren, 1913.

***Drasteria picta* (Christoph, 1877)**

Leucanitis cailino var. *picta* Christoph, 1877, Horae Societatis Entomologicae Rossicae, 12: 257. L.t: [Turkmenistan] Transcaspia, Krasnovodsk.

Distribution: Ardabil, Khorasan-e Razavi, Sistan-o-Baluchistan (Rajaei et al., 2023).

Remark: This species is newly reported from Kerman, Fars, Esfahan, and Khorasan-e Shomali.

Bionomics: Specimens were taken from the collecting sites in April. The larva is unknown.

Material examined: 1♂: Iran, Kerman Province, Sirjan, Khane Sorkh, 29º51′ 21″ N 59º09′ 05″ E, 26-IV-2009, leg. Z. Bidar. 3♂♂, 1♀: Iran, Kerman Province, Saadat Abad, 30º13′ 38″ N 56º55′ 48″ E, 1750m, 20-IV-2011, leg. M. Shoghali. 9♂♂: Iran, Khorasan Shomali Province, Gharebashlu, 37º22′ 49″ N 57º17′ 13″ E, 1370m, 17-IV-2011, leg. Sh. Feizpoor. 1♂: Iran, Kerman Province, Haftbagh, 30º09′ 50″ N 57º09′ 06″ E, 1800m, 18-IV-2011, leg. H. Ramezani. 1♀: Iran, Esfahan Province, Kashan, 33º59′ 51″ N 51º26′ 25″ E, 982 m, 17-IV-2012, leg. P. Poorshabanan. 1 ♂ : Iran, Fars Province, Neyriz, Bahram-e-Gur protected area, 44º35′ 41″ N 51º48′ 39″ E, 2400m, 27-IV-2017, leg. E. Tamannadar. 1♂: Iran, Fars Province, Neyriz, Bahrame-Gur protected area, 39º30′ 34″ N 64º56′ 47″ E, 1800m, 14-IV-2017, leg. E. Tamannadar.

Fig. 1. *Anumeta dentistrigata* female adult. Iran, Kerman Province, Bardsir, Bidouyeh Protected Area.

Fig. 2. *Anumeta dentistrigata* female genitalia. Iran, Kerman Province, Bardsir, Bidouyeh Protected Area.

***Drasteria kabylaria* (A. Bang-Haas, 1906)**

Leucanitis kabylaria, A. Bang-Haas, 1906, Deutsche Entomologische Zeitschrift Iris, 19: 136. L. t.: Tunisia.

Distribution: Hormozgan, Khuzestan and Sistan-o-Baluchistan (Rajaei et al., 2023).

Remark: This species is newly reported from Kerman.

Bionomics: Most probably a univoltine, early flying species which inhabits semi-arid zones and its adults fly in May.

Material examined: 1♂, 1♀: Iran, Kerman Province, Saadat Abad, 30º13′ 38″ N 56º55′ 48″ , 1750m, 20-IV-2011, leg. M. Shoghali. 1♂: Iran, Kerman Province, Haftbagh, 30º09′ 50″ N 57º09′ 06″ E, 1800m, 18-IV-2011, leg. H. Ramezani.

Family Noctuidae Latreille, 1809

Genus *Chrysodeixis* Hübner, [1821]

Chrysodeixis Hübner, [1821], Verzeichniss bekannter Schmettlinge, 252. Type species: *Phalaena* (*Noctua*) *chalcites* Esper, 1789.

Synonyms: *Chrysodeicis* Hübner [1826]; *Chrysodixis* Agassiz, 1846; *Chrysodeixia* Dyar, 1902; *Pseudoplusia* McDunnough, 1944 (subg.); *Neoplusia* Okano, 1963; *Shensiplusia* Chou & Lu, 1974.

***Chrysodeixis chalcites* (Esper, 1789)**

Phalaena (*Noctua*) *chalcites* Esper, 1789, Schmettlinge, 4: 447, pl. 141, Fig. 3. L.t.: Italy.

Synonyms: *chalsytis* Hübner 1790; *bengalensis* Rossi, 1794; *quaestionis* Fabricius, 1794; *verticillata* Guenée, 1852; *integra* Walker, [1858]; *adjuncta* Walker, 1865; *buchholzi* Plötz, 1880.

Distribution: Kordestan, Lorestan, Gilan, Mazandaran, Golestan, Semnan, Khorasan-e Razavi, Qazvin, Alborz, Tehran, Fars, Kohgiluyeh va Boyer-Ahmad, Khuzestan, Hormozgan and Sistan-o-Baluchistan (Rajaei et al., 2023).

Remark: A newly reported species from Kerman Province.

Bionomics: A bivoltine species which flies in late summer and early spring.

The early stages have been described in detail by numerous authors and the reported larval food are from various herbaceous plants (Goater et al., 2003).

Material examined: 1♀: Iran, Kerman Province, Pay-e-Sib, 2800m, 25-IV-2006, leg. A. Shirvani. 2♂♂, 1♀: Iran, Kerman Province, Khabr, 28º49′ 02″ N 56º20′ 02″ E, 2073 m, 20-X-2010, leg. M. Shoghali.

Genus *Brachygalea* Hampson, 1906

Brachygalea Hampson, 1906, Catalogue of the Lepidoptera Phalænæ in the British museum, 6: 108. Type species: *Brachygalea leucorhabda* Hampson, 1906, L.t.: Algeria

***Brachygalea miskoi* Ronkay, 1997**

Brachygalea miskoi Ronkay, 1997, Annales Historico-naturales Musei Nationalis Hungarici, 89:137. L.t.: Iran, Esfahan.

Distribution: Esfahan and Fars (Rajaei et al., 2023; Ronkay, 1997).

Remark: This species is recorded for the first time from Kerman and Khorasan-e Shomali Provinces.

Bionomics: This species is a univoltine spring species, its early stages and food plant are unknown yet. They were collected in March and April.

Material examined: 9♂♂, 2♀♀: Iran, Kerman Province, Kouhbanan, 5km Yazd Road 31º27′ 52″ N 56º16′ 45″ E, 22-IV-2009, leg. M. Shoghali. 4♂♂, 1♀: Iran, Kerman Province, Sirjan, Kerman Road, Khaneh Sorkh 29º51′ 21″ N 56º09′ 05″ E, 26-IV-2009, leg. Z. Bidar. 1♂: Iran, Kerman Province, 25 Km W of Kerman, Honouj, 30º19′ 48.9″ N 56º46′ 36.5″ E, 2300m, 1-IV-2006, leg. A. Shirvani. 5♂♂: Iran, Kerman Province, Sirch Tunnel, 30º09′ 20″ N 57º24′ 17″ E, 27-III-2009, leg. M. Shoghali. 2♂♂: Iran, Kerman Province, Khabr, 28º52′ 45″ N 56º23′ 56″ E, 2400m, 15-III-2010, leg. M. Shoghali. 1♂, 1♀: Iran, Khorasan Shomali Province, Ghuchghale, 38º28′ 29″ N 57º35′ 08″ E, 1270m, 15-IV- 2011, leg. Sh. Feizpoor. 1♂: Iran, Kerman Province, Kazem Abad, 30º26′ 26″ N 56º50′ 30″ E, 1750m, 15-IV-2011, leg. M. Shoghali.

Genus *Thargelia* Püngeler, 1899

Type species: *Scothochrosta distincta* (Christoph, 1884).

***Thargelia distincta* (Christoph, 1884)**

Scotochrosta distincta, Christoph, 1884, Romanoff, Memoires sur les Lepidopteres, l: 124, L.t.: Turkmenistan.

Synonym: *Odontelia megastigma* Warren, 1910

Distribution: Esfahan (Rajaei et al., 2023).

Remark: This species is reported for the first time from Kerman.

Bionomics: This species flies from March to late April in semi-desert and semi- mountainous areas.

Material examined: 2♂♂: Iran, Kerman Province, Saadat Abad, 30º13′ 38″ N 56º55′ 48″ E, 1750 m, 20.IV.2011, leg. M. Shoghali.

Discussion

With *A. dentistrigata* that was taken from Bidouyeh Protected Area, the Iranian fauna of *Anumeta* includes seven species. Bidouyeh Protected Area consists of mountains including Kalleh Gavi and Kuh-e-Siah as well as the salty plain of Bidouyeh and Kabootar Khan. Despite having a desert climate generally, this area is

home to a variety of plants such as Artemisia, *Astragalus*, *Euphorbia*, *Zygophyllum* and *Tamarix* genera, and *Pistacia atlantica* species. The genus *Anumeta* mostly inhabits arid and semi-arid zones of the Palaearctic region. Three out of the seven Iranian *Anumeta* species including *A. cestis*, *A. major* and *A. dentistrigata* are reported to have one generation per year whereas the other four remaining have been proven (Goater et al., 2003) to produce two generations. As for the biology as well as the lifespan of *A. dentistrigata*, due to the lack of data and material doubts remain whether this species flies in the mid-summer or not which need further contributions towards in-depth biodiversity investigations and faunistic studies as well. Members of this genus are mainly distributed in southern Iranian provinces (Rajaei et al., 2023) having arid zonobiomes except *A. fractistrigata* and *A. cestis* which inhabit, besides being reported from southern territories, northern (Mazandaran) and northeastern (Khorasan-e-Razavi) provinces, respectively.

Every contribution (e.g. Esfandiari et al. (2011), Shirvani (2012), Shirvani et al. (2012), Poorshabanan & Shirvani (2022), Rabieh et al. (2013)) that aimed to explore and reveal the biodiversity of Iranian noctuid and erebid moths has resulted in new faunal and taxonomic discoveries in either world or country level. Having reported new provincial and country species records, this research as well as the previous contributions highlights Iran's biodiversity as a rich and simultaneously less known territory which needs further thorough investigations.

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Conflict of interest

The authors declare that they have no conflict of interest.

CRediT author statement

M. Moghadaszadeh Kermani: Laboratory works & preparation of the original draft. **M. Ghaemmaghamian:** Collecting specimens & genitalia slide preparation. **A. Shirvani:** Supervision, methodology, writing, reviewing & editing.

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