Owlflies from Jordan (Neuroptera, Ascalaphidae)

Christian Monnerat¹, Levente Ábrahám²

1 Rue des Sablons 25, CH-2000 Neuchâtel, Switzerland
2 P.O. Box 70, H-7400 Kaposvár, Hungary

http://zoobank.org/F2235015-5CA8-45AC-9D91-70B3041221FB

Corresponding author: Christian Monnerat (christian.monnerat@unine.ch)

Academic editor: Peter Duelli ♦ Received 31 January 2020 ♦ Accepted 8 April 2020 ♦ Published 1 July 2020

Abstract

The authors publish faunistic data on 48 owlfly specimens from Jordan, where only two species were known in the past. Four species (Ascalaphus festivus, Deleproctophylla variegata, Iranoidricerus cf. iranensis, Stylascalaphus krueperi) are new records for Jordan and the two previously recorded species (Bubopsis andromache, Bubopsis hamata) are confirmed. We present an annotated bibliography, the global distribution and information on the life history of each six species. The material reviewed in three collections also provides the first mention of Deleproctophylla variegata for Afghanistan.

Key Words

owlfly, ascalaphid, Hashemite Kingdom of Jordan, Iran, Afghanistan, new records, habitat, collecting methods, maturation

Introduction

In the lacewing (Neuroptera) order, the owlfly family (Ascalaphidae) has approximately 450 valid described species. Half of the species described are from tropical and subtropical Africa (Tjeder 1992, Tjeder and Hansson 1992, Oswald 2019). In the Western Palaearctic, the owlfly fauna is well known compared to other regions of the world in terms of taxonomy (Aspöck et al. 2001). In this region, most species are primarily associated with arid semi-desert and desert habitats (Tjeder 1992). The transitional zone of the Afrotropical and Palaeartic regions is also rich in species. In this paper, we follow the traditional classification system for Ascalaphidae proposed by Aspöck et al. (2001). They listed 41 owlfly taxa (Ascalaphinae: 32 species and 4 subspecies, Haplogleninae: 4 species and 1 subspecies) in their monograph. In recent years, 13 species have been described in the border regions of the Western Palaeartic, namely in Iran (Ábrahám and Mészáros 2002: Pterygidericus pseudoalbardanus, P. persepolisensis, P. sendanensis and P. pakistanensis), in Pakistan (Mészáros and Ábrahám 2005: Stylascalaphus fabiani), on the Arabian Peninsula (Hölzel 2004: Tytomyia arabica, Mansellacsa longicornis, Disparomitus yemenicus, D. hackeri, Spoeckiella gallagheri and A. hyalina) and in Morocco (Ábrahám 2010: Cirrops berbericus; Badano and Pantaleoni 2012: Agaditius trojani). One previously recorded species (Ascalaphus hyalatus (Navás, 1921) (sic!)) proved to be a synonym of Stylascalaphus krueperi (van der Weele, 1909) (Ábrahám 2017). The owlfly fauna of the Western Palaeartic merits further research, as taxonomic uncertainties remain and the distribution of species needs to be mapped.

Jordan is located in the Middle East at the intersection of different biogeographic provinces (Udvardy 1975). Various climatic regimes, ranging from subhumid to arid Mediterranean and Saharan-Mediterranean bioclimates, as well as four phytogeographic regions, Mediterranean, Irano-Turanian, Saharo-Arabian and Sudanian, are described (Al-Eisawi 1996). In Jordan, only two species (Bubopsis andromache and Bubopsis hamata) were known from the literature (Aspöck U. et al. 1979, Dobosz and Ábrahám 2007). The authors gathered new and mainly recent data on the Jordanian owlfly fauna from two museum collections and from material gathered by the first author on recent collecting trips.
Material and methods

Between 2007 and 2015, the first author conducted ten field trips to Jordan at different periods of the year. Trips were undertaken in January (1), April (3), May (1), June (2), August (1), November (1) and December (3). Although those entomological trips mainly focused on dragonflies and were thus largely conducted in aquatic habitats, attention was always paid to neuropterans and many other diverse habitats were visited. Except for one individual, owlflies were collected during the day. Two portable light traps (12V super actinic, model bioform.de) powered by a car battery were used in June 2011 and May–June 2012.

The categories defined for vegetation and climatic regions come from Al-Eisawi (1996), whereas the reference used for the flora is that of Zohary (1966–1972) and considering the update of Danin (2004).

Habitus photographs were taken using a digital camera Canon EOS 6D coupled with Visionary Digital Passport and Helicon Focus version 5.3 in order to compile the pictures.

Abbreviations

Chlist – Checklist, Comb – New combination, Dist – Distribution, Larva descr – Larva description, Mon – Monograph, Odescr – Original description, Rdescr – Redescription, Syn – Synonym, Com – Comment

CCM Private Collection, Christian Monnerat, Neuchâtel (Switzerland);

MHNG Natural History Museum of Geneva (Switzerland);

SCMK Rippl-Rónai Museum, Kaposvár (Hungary)

Results

Only two species of owlflies had previously been observed in Jordan. The authors were able to record four more species from the area. According to the distribution of the species, one (Ascalaphus festivus) comes from the Afrotopical region. Three species (Stylascalaphus krueperi, Bubopsis andromache, Deleproctophylla variegata) are present in the Mediterranean region, while two species (Bubopsis hamata, I ranoidricerus cf. iranensis) were found in Asian eremic regions. The diversity of the fauna is reflected in the location of the country, as it lies in the south-eastern part of the Western Palaearctic, in an area where three distinct biogeographic provinces intersect.

The authors provide an annotated bibliography of species, faunistic data, species distributions and some biological features below.

Ascalaphidae Lefébvre, 1842
Ascalaphinae Lefébvre, 1842

Ascalaphus festivus (Rambur, 1842)

Figs 1–4

Bubo festivus Rambur, 1842 – (ODeskr), Navás 1913b (Tax, Dist).

Ascalaphus festivus (Rambur, 1842) – Walker 1853 (Nom), Hagen 1866 (Tax), Tjeder 1972 (Nom), 1980 (Tax, Dist), Ohm and Hölzel 1982 (Dist), Hörlz 1983 (Tax, Dist), 1998 (Dist), 2004 (Dist), Hözel and Ohm 1990 (Dist), Aspöck and Hözl 1996 (Chlist), Schach 2000 (Dist), 2002 (Dist), Sziraki 1998 (Chlist), 2010 (Dist), Gillette 1999 (Dist), Whittington 2002 (Dist), Güsten 2003 (Dist), Monserrat and Martin 2005 (Dist), Ábrahám and Dobosz 2011 (Dist), Astleitner and Hölzel 2012 (Dist), Pantaleoni et al. 2013 (Dist), Prost 2013 (Tax, Dist), Badano and Pantaleoni 2014 (Larva descr).

Encyoposis (?) festivus (Rambur, 1842) – McLachlan 1873 (Nom).

Helicomitus festivus (Rambur, 1842) – Van der Weele 1909a (Dist), 1909b (Mon), Klapálek 1912 (Dist), Navás 1912a (Dist), 1912b (Chlist), 1913a (Dist), 1914 (Dist), 1915 (Dist), 1919 (Dist), 1924 (Dist) 1925a (Dist), 1925b (Dist), 1926a (Dist), 1927 (Dist), 1928 (Dist), 1929 (Dist), 1930 (Dist), 1930–1931 (Dist), 1931a (Dist), 1931b (Dist), 1931c (Dist), 1933 (Dist), 1934 (Dist), 1936 (Dist), Banks 1930 (Dist), 1938 (Dist), Kimmins 1939 (Dist), 1949 (Redescr, Dist), 1950 (Dist), Fraser 1951a (List), 1951b (Dist), Handschin and Markl 1955 (Dist).

Material examined. 1♀, Jordanien, Cumran a. Toten Meer, 16.x.1966, leg. J. and S. Klapperich, MHNG; 1♂, Jordania Jordan, Oberes Jordantal, vi.1999, leg. G. Müller, SCMK; 1♂, 7.75 km N Wadi Mujib mouth, 31.53664N, 35.56176E, 315 m u.s.l., 4.vii.2009, leg. C. Monnerat, CCM; 3♂♂, 7.75 km N Wadi Mujib mouth, 31.53681N, 35.56141E, 320 m u.s.l., 4.viii.2009, leg. C. Monnerat, CCM; 1♂, 7.75 km N Wadi Mujib mouth, 31.53705N, 35.56176E, 315 m u.s.l., 3.viii.2009, leg. C. Monnerat, CCM; 3♂♂, 1♀, 31.53671N, 35.56131E, 320 m u.s.l., 4.vi.2012, leg. M. Borer, CCM.

Distribution. This species is widely distributed in Africa. According to Prost (2013) it is found in the Republic of South Africa, West Africa (Chad, Niger, Burkina Faso, Mali, Senegal, Ghana and Liberia) and on the northern coast of Africa. Pantaleoni et al. (2013) published surprising records from southern Sardinia (Italy). Aspöck et al. (2001) documented the species on the border region of Southwest Palaearctic (Israel, Saudi Arabia, Oman, Yemen, the United Arab Emirates, Tunisia and the Cape Verde Islands). Its occurrence in Egypt (Navás 1913) was confirmed by Prost (2013). It is a new record for the fauna of Jordan. Further specimens can be found in the collection of SCMK (Kaposvár) from Namibia, Zambia, Tanzania, Kenya and Ethiopia. A closely related taxon from Madagascar is treated by Tjeder (1980) and Prost (2013) as a separate species.
Figures 1–8. 1. Habitus of *Ascalaphus festivus* female. 2. Habitus of *A. festivus* male. 3. Habitat of *A. festivus* near the Dead Sea, August 2009. 4. Habitat of *A. festivus* near the Dead Sea, December 2015. 5. Habitus of *Stylascalaphus krueperi* female. 6. Habitus of *S. krueperi* male. 7. Habitat of *S. krueperi*, Wadi Kufrinja Valley, August 2009. 8. Habitat of *S. krueperi*, Wadi Afra Valley, August 2009. Pictures: all C. Monnerat.
under the name *Ascalaphus africanus* (McLachlan, 1871), which is also mentioned from Mozambique (Prost 2013). In the future, it would be worthwhile to confirm morphologically separated species by genetic testing.

**Comments.** This species was found in a marsh near a hot spring and local water seeps. The vegetation was characterized by scattered date palms (*Phoenix dactylifera*) and covered with *Juncus* and *Saccharum* (Figs 3, 4). Males and females were found during the day sitting on stems and collected with insect nets. The locality to the north of Wadi Mujib near the Dead Sea is the lowest observation point on earth for this species at 316 m b.s.l. and is located in the Sudanian bioclimatic region characterized by tropical influences. The species was found in Oman and Saudi Arabia near wadis, in their flood plains, or in oases (C. Monnerat, personal observation). In Sardinia, *A. festivus* is found in coastal salt marshes (Pantaleoni et al. 2013).

*Stylascalaphus krueperi* (Van der Weele, [1909b])

Figs 5–8

*Helicomitus krüperi* Van der Weele, 1909b (ODeskr).

*Ascalaphus krueperi* (Van der Weele, 1909b) – Aspöck, H. and Hözel 1996 (Dist), Aspöck et al. 2001 (Mon), Sziráki 1998 (Chlist).

*Helicomitus hyacinthus* Navás, 1921 (sic!) (ODeskr).

*Ascalaphus hyacinthus* (Navás, 1921) – Aspöck, H. and Hözel 1996 (Comb, Dist), Aspöck et al. 2001 (Mon), Ábrahám 2010 (Dist, Conn).

*Stylascalaphus krueperi* (Van der Weele, [1909b]) – Ábrahám 2017 (Tax, Rdesc, Dist).

**Material examined.** 1♂, Wadi Kufrinja Valley, 2.9 km E Kurayyima, 32.26954N, 35.62977E, 20 m a.s.l., 6.viii.2009, leg. C. Monnerat, CCM (Fig. 5); 1♂, Hammamat Afra–Burbeita, 16.4 km SEE al Safi, 30.97796N, 35.64034E, 230 m a.s.l., 17.viii.2009, leg. C. Monnerat, CCM (Fig. 6).

**Distribution.** Information on the taxonomic status and distribution of this species, with new records for Morocco, was recently published by Ábrahám (2017). This species represents a new record for the fauna of Jordan.

**Comments.** The habitat in Wadi Kufrinja Valley (Fig. 7) was a pasture on the left flank of a steep-sided valley with low bushes, stones and some rocky outcroppings. There was grazing pressure from sheep and goats. The individual was disturbed, flew off and was later found again, with some difficulty because it was flying quickly, sitting on dry bush stems (Lamiaceae). At Hammamat Afra–Burbeita, a male was found sitting on the dry stem of an annual plant (Asteraceae) on a dry, sandy, rocky slope in Wadi Afra Valley near a strip of marsh (Fig. 8).

*Bubopsis andromache* Aspöck, Aspöck & Hözel, 1979

Figs 9–14

*Bubopsis andromache* U. Aspöck, H. Aspöck and Hölzel 1979 – (ODeskr), Aspöck et al. 1980 (Mon), 2001 (Mon), Pieper and Willmann 1980 (Larva descr), Aspöck H. and Hözel 1996 (Chlist), Letardi 1991 (Dist), Sziráki 1998 (Chlist), Popov, 2004 (Dist), Canbulat 2007 (Chlist), Dobosz and Ábrahám 2007 (Dist).

*bubopsis andromache* firyuzea Sziráki, 2000 – (ODeskr).

**Material examined.** 1♀, Ajlun Reserve, RSCN Lodge, 32.38037N, 35.76356E, 1015 m a.s.l., 9.vi.2011, leg. C. Monnerat, CCM; 1♀, Ajlun Reserve, 32.38140N, 35.76403E, 1020 m a.s.l., 10.vi.2011, leg. C. Monnerat, CCM (Fig. 9); 1♀, 9.5 km W Madaba, 31.72070N, 35.69316E, 520 m a.s.l., 26.v.2012, leg. M. Borer, CCM (Fig. 10); 1♀, Dar al-Basha, 32.63274N, 35.71241E, 260 m a.s.l., 1.vi.2012, leg. M. Borer, CCM; 2♀♀, Wadi Zarqa, 32.16718N, 36.00473E, 465 m a.s.l., 3.vi.2012, leg. C. Monnerat, CCM; 1♀, ar-Rumman, 32.18935N, 35.84772E, 365 m a.s.l., 3.vi.2012, leg. C. Monnerat, CCM; 1♀, Jordan, Jarash Burma env., Al Huna, 15.v.2016, leg. Snizek, SCMK.

**Distribution.** The first specimens of *Bubopsis andromache* were collected by Werner from Samos (Werner 1934), Limnos (Werner 1937) and Lesvos (Werner 1938) before the species was described. Werner published these specimens under the name *Bubopsis hamata*, as reported by Popov (2004). This species is found in Greece, northern Macedonia, southwestern Bulgaria, the Aegean Islands (Crete and Gavdhos, Lesvos, Samos, Kalamnos, Kos and Rhodes), western and southern Asia minor and the eastern Mediterranean region (Israel, Syria, Lebanon) (Aspöck et al. 2001). In Turkey it was collected mainly near the coast. Its occurrence in Jordan was also mentioned by Dobosz and Ábrahám (2007). The subspecies *Bubopsis andromache* firyuzea Sziráki, 2000 is only known from southern Turkmenistan.

**Comments.** For the most part, species of the genus *Bubopsis* are typical hilltopping species that fly before sunset and are attracted to light traps after evening twilight. In the morning it may still be found but less frequently. Yet nearly all the specimens were collected with an entomological net during the day (morning, midday, afternoon), often after being disturbed from rest. Two specimens, however, were attracted by light trap or by building lights (RSCN lodge at Ajlun Reserve). The species was recorded in different habitats, including semi-closed forest (Fig. 11) and open field (Fig. 14). At Ajlun RSCN Reserve, it was found in clearings of *Quercus* sp. forest with *Pistacia palaestina* and *Arbutus andrachne*, small bushes of *Cistus creticus* (Fig. 11), occasionally sitting on dry shrub stems of *Phlomis viscosa*. At ar-Rumman, it was found in open landscape with bushes of *Retama raetam* and Mediterranean Batha vegetation with *Sarcopoterium spinosum*, *Phagnalon rupestre* (Fig. 13) or in still drier habitat without shrubs and mostly with annual herbs, such as in fallow fields (Fig. 14). The species was recorded in the western highlands (northern and central parts) of Jordan between 260 and 1020 m a.s.l., from subhumid to arid Mediterranean bioclimates in Mediterranean and Irano-Turanian vegetation zones.
Figures 9–16. 9. Habitus of *Bubopsis andromache* male (Picture: C. Monnerat). 10. Habitus of *B. andromache* female (Picture: C. Monnerat). 11. Habitat of *B. andromache*, Ajlun RSCN Reserve, Jordan, June 2011 (Picture: C. Monnerat). 12. Habitat *B. andromache*, Dar al-Basha, June 2011 (Picture: C. Monnerat). 13. Habitat *B. andromache*, ar-Rumman, June 2012 (Picture: C. Monnerat). 14. Habitat of *B. andromache*, Wadi Zarqa Valley, June 2012 (Picture: Matthias Borer). 15. Habitus of *Bubopsis hamata* male (Picture: C. Monnerat). 16. Habitat of *B. hamata*, Dana RSCN Reserve, Jordan, June 2011 (Picture: Matthias Borer).
Material examined. 1♂, Dana RSCN Reserve, 30.67809N, 35.5988E, 850 m a.s.l., 4.vi.2011, leg. C. Monnerat, CCM (Fig. 15).

Distribution. Its distribution likely extends from northeastern Africa (Egypt) to West Asia (Iran, Iraq, Syria, Israel, Jordan, Saudi Arabia) (Hölzel 2004). In Turkey, observations suggest that this species is only found in the eastern part of the country (Dobosz and Ábrahám 2007). It is also known from the Caucasus (Azerbaijan, Georgia) and Kopet Dag Mountains (Turkmenistan, Kyrgyzstan). The type locality is in Syria (Van der Weele 1909).

Comments. In Jordan, the specimen found in Dana (Fig. 16) was sitting on a bush of Retama raetam in the late afternoon (17:25 UTC) on a dry, rocky slope. The area has a quick vegetation transition from Mediterranean to Irano-Turanian.

Deleproctophylla variegata (Klug in Ehrenberg, 1834)
Figs 17–23

Ascalaphus variegatus Klug, 1834 – (Odescr), Walker 1953 (Rdescr, Tax, Dist), Hagen 1860 (List), 1866 (Tax), McLachlan 1873 (Tax), Navás 1912b (Mon), Alexandrov-Martynov 1926 (Dist), Aspöck et al. 1980 (Mon).

Theleproctophylla barbara auct.(neec Linnaeus) – Navás 1909 (Dist), 1910 (Dist), 1925b (Dist), 1929 (Dist), Bodenheimer, F. S. 1937 (Dist).

Deleproctophylla variegata (Klug, 1834) – Scott 1929 (Dist), Luppova 1973 (Dist), 1966 (Dist), Aspöck et al. 1980 (Mon), Letardi 1991 (Dist), Aspöck and Hölzel 1996 (Chlist), Kačírek 1998 (Dist), Sziráki 2000 (Dist), Köszegi 2002 (Dist), Whittington 2002 (Dist), Cebulat and Kiak 2005 (Dist), Cebulat 2007 (Chlist), Dobosz and Ábrahám 2007 (Dist), Krivokhatzky et al. 2015 (Dist).

Material examined. 1♂, Jordania Jordan, Oberos Jordantal, vi.1999, leg. G. Müller, SCMK; 1♂, Ayy Alhizman (al-Hazman), 31.11650N, 35.63200E, 1145 m a.s.l., 2.vi.2011, leg. M. Borcer, CCM; 2♂♀, NW Wadi Zarqa, 31°11'34.1"N, 36°00'23.2"E, 540 m a.s.l., 8.vi.2011, leg. M. Borcer, CCM (Fig. 17); 1♂, 1♀, 1.2 km NE Sakhra, 32,37790N, 35,85935E, 1005 m a.s.l., 9.vi.2011, leg. C. Monnerat, CCM; 2♂♀, 1♀, dir. al-´Aluk, 32.18888N, 35.98066E, 520 m a.s.l., 11.vi.2011, leg. C. Monnerat, CCM; 1♂, 3♂♀, 9.5 km W of Madaba, 31.72070N, 35.69316E, 520 m a.s.l, 26.v.2012, leg. M. Borcer, CCM (Figs 18, 22–23); 1♂, 3♂♀, 9.5 km W of Madaba, 31.72070N, 35.69316E, 520 m a.s.l, 26.v.2012, leg. M. Borcer, CCM (Fig. 21); 1♂, 3.vi.2012, Wadi Zarqa, 32.16718N, 36.00473E, 465 m a.s.l., leg. C. Monnerat, CCM; 2♂♀, 3.vi.2012, ar-Runman, 32.18978N, 35.85004E, 430 m a.s.l., leg. C. Monnerat, CCM; 1♀, 8.vi.2012, between Libb and Mugawir, 31.59344N, 35.68667E, 710 m a.s.l., leg. C. Monnerat, CCM.

Distribution. The first described Deleproctophylla species was Deleproctophylla variegata (Klug, 1834), known mainly from the West Palearctic (Europe: Greece (Chios), Asia: Cyprus, Turkey, Caucasus region (Aspöck et al. 2001), Iran (Kurdistan) (Scott 1929), Lebanon (type locality), Israel, Turkmenistan, Uzbekistan (Alexandrov-Martynov 1926), Kyrgyzstan (Krivokhatzky et al. 2015), Iran (Hamadan; SCMK, unpublished data) and Afghanistan (Upper Silesian Museum, Poland, unpublished data)). It is a new record for the fauna of Jordan. There are false distribution records in Navás’s (1912b) monograph from Spain and France that were corrected in the monograph of Monserrat et al. (2012).

Comments. It is a day-active species found in open landscapes, for example in extensive cereal fields of Triticum dicoccoides (Figs 19, 20) and fallow fields with Erucaria hispanica. D. variegata is distributed in Jordan in the north and central part of the western highlands area between 430 and 1145 m a.s.l. in semiarid and arid Mediterranean bioclimates. The pterostigma of the specimens collected near Madaba on 26.v.2012 exhibited a gradient of color ranging from beige to light brown to dark brown (Figs 21–23), due to maturation processes. Such differences in wing cell coloration were the cause of confusion in the systematics of Deleproctophylla, for example between D. dusmeti (Navás, 1914) and D. bleusei Kimmins, 1949, as detailed in Monserrat et al. (2014). In mature specimens of D. bleusei, the pterostigma are whitish to bright yellowish, whereas in D. dusmeti the pterostigma are darker. However, other identification criteria such as the wingspot pattern and the morphology of the genitalia are diagnostic and the pterostigma of mature specimens of D. bleusei are whitish to bright yellowish.
Figures 17–24. 17. Habitus of *Deleproctophylla variegata* male. 18. Habitus of *D. variegata* female. 19. Habitat of *D. variegata*, Alhizman, June 2011. 20. Habitat of *D. variegata*, Wadi Zarqa Valley, June 2011. 21. *D. variegata*, pterostigma of right forewing, MONNECH01_004933. 22. *D. variegata*, pterostigma of right forewing, MONNECH01_004922. 23. *D. variegata*, pterostigma of right forewing, MONNECH01_004921. 24. Habitus of *Iranoidricerus cf. iranensis* male. Pictures: all C. Monnerat.

**Haplogleniinae Newman, 1853**

*Iranoidricerus cf. iranensis* (Kimmins, 1938)  
Fig. 24

*Ptyngidricerus iranensis* Kimmins, 1938 – (ODescr), Tjeder and Waterston 1977 (Tax), Aspöck H. and Hölzel 1996 (Chlist), Sziráki 1998 (Chlist), Aspöck et al. 2001 (Mon).

*Iranoidricerus iranensis* (Kimmins, 1938) – Ábrahám and Mészáros 2002 (Tax), Kemal and Kocak 2006 (Dist), Canbulat 2007 (Chlist), Dobosz and Ábrahám 2007 (Dist), Kemal and Seven 2011 (Dist), Zamani et al. 2019 (Dist, Tax).

**Material examined.** 1♂, Jordanien, Romana, Ost-Jordanien, 4.x.1966, leg J. and S. Klapperich, MHNG (Fig. 24); 1♀, Jordanien, near Amman, 1000 m a.s.l., vii.1999, leg. G. Müller, SCMK.

**Distribution.** Information on the general distribution of this species was published by Ábrahám and Mészáros (2002) and additional data were found in Kemal and Kocak (2006) and Kemal and Seven (2011) for Turkey and Zamani et al. (2019) for Iran. A severely damaged specimen examined by Tjeder with a label “Palestine” considered as questionable referred most probably to this species (Tjeder and Waterston 1977). The specimens examined...
represent new records for the fauna of Jordan. This species is distributed in the mountainous areas from south-eastern Turkey (from 1000 to 1200 m a.s.l.) to western Iran (from 1141 to 2582 m a.s.l.) with a southern disjunct area in Jordan and probably also in neighbouring Palestine.

**Comments.** While no information is available on the collection method used by the Klapperichs, Müller’s specimen was collected by light trapping, as were other specimens (Kemal and Koçak 2006, Kemal and Seven 2011, L. Ábrahám, personal observations). Additional individuals were found by the first author in the Insect Museum at the University of Jordan (Amman) from the area around Amman in Irak al-Amir and as-Salt. Localities are situated in the mountainous area from 800 to 1000 m a.s.l. in a semiarid Mediterranean bioclimate.

**Discussion**

The owlfly fauna of Jordan is at present better understood, with six known species in comparison to the two species previously mentioned in the literature (Aspöck et al. 1979, Aspöck et al. 2001, Dobosz and Ábrahám 2007). However, given its four climatic influences (Al-Eisawi 1996), Jordan has a wide diversity of habitats that should be studied more carefully to improve our understanding of the biology, ecology and distribution of these fascinating insects. Species recorded from neighbouring countries (Tab. 1), such as *Libelloides syriacus* (McLachlan, 1871) and *Puer maculatus* (Olivier, 1789) in Israel, are also potentially present in Jordan, namely in regions with Mediterranean climatic influences. Some species known from the Arabian Peninsula (Oman, Saudi Arabia, United Arab Emirates, Yemen) may also be found, possibly in southern Jordan, where no records are thus far available from large areas such as Wadi Araba, Wadi Rum and the eastern desert. This region is identified as a transition zone between the Palaeartic and Eremit fauna detailed by Por (1975). The Arabian Peninsula has been better explored recently, resulting in the description of several species (Hölzel 2004). Nevertheless, the fauna of Saudi Arabia, which shares large borders with Jordan in the south and the east, remains poorly known. The presence of *Ascalaphus festivus* confirms a relatively large zone of overlap of the afro-tropical faunistic region with the western Palaeartic region, as is the case for *Palpares cephalotes*, distributed from Afghanistan to Senegal. Its presence suggests that other species from the afro-tropical faunistic region may also eventually be found. Light trapping, especially if conducted shortly after twilight, in combination with sight hunting during the day, may maximize the number of species observed.

**Acknowledgements**

The first author thanks Matthias Borer (Natural History Museum Basel) who joined the field trips in 2011 and 2012, collected samples included in the present study and kindly provided the photos in Figures 14 and 16. Also sincere thanks to the Royal Society for the Conservation of Nature (RSCN) and especially Enas Sakkijha (head of research section) and her successor Ehab Eid, for their interest in our research in Jordan. We are grateful to the following curators for access to their collections: Ahmad Katheh-Bader (University of Jordan, IMA) and Peter Schweindinger (MHNG). Many thanks to Marion Podolak for assistance with taking the pictures presented in this article, to Michel Sartori for access to photographic equipment (both from the Cantonal Museum of Zoology, Lausanne), Christophe Poupon (Neuchâtel) for making the color plates, Adrian Möhl (Info flora, Bern) for his help with the identification of vascular plants. Finally, many thanks to Jessica Litman (Natural History Museum Neuchâtel) for her comments and for help with improving the English text of our manuscript. The first author is grateful to the Dr. Joachim Giacomi Foundation for its financial support of three expeditions in 2009. Finally, we gratefully acknowledge the reviewers, Davide Badano and André Prost, for their pertinent comments which helped to improve our manuscript.

**Table 1.** List of Ascalaphidae recorded in Jordan and the neighbouring countries. x = before 2000, X = from 2000, bold = new records, ? = uncertain.

| Species                        | Israel | Lebanon | Palestine | Jordan | Syria | Saudi Arabia | Irak |
|--------------------------------|--------|---------|-----------|--------|-------|--------------|------|
| Ascalaphus festivus            | X      |         |           | X      |       |              |      |
| Ascalaphus dicax               |        |         |           |        |       |              | ?    |
| Bubopsis andromache            | X      |         |           | X      |       |              |      |
| Bubopsis hamata                |        |         |           | X      |       |              |      |
| Deleproctophylla variegata     | X      |         |           | X      |       |              |      |
| Iranoidricerus cf. iranensis   |        |         |           |        | X     |              |      |
| Libelloides macaronius         | X      |         |           |        |       |              |      |
| Libelloides rhomboideus        |        |         |           |        |       |              |      |
| Libelloides syriacus           |        |         |           |        |       |              |      |
| Ptyngidricerus albardanus      |        |         |           |        |       |              |      |
| Puer maculatus                 |        |         |           |        |       |              |      |
| Stylistascalaphus krueperi     |        |         |           | X      |       |              |      |
| Tmesibasis larseni             |        |         |           |        |       |              | X    |
Howarth B, Aspinall S (2002) Bubopsis hamata (Klug) (Neuroptera: Ascalaphidae) – a new owlfly for the UAE. Tribulus: Journal of the Emirates Natural History Group 13(2): 26.

Hölzel H (1989) Insects of Saudi Arabia. Neuroptera: Fam. Ascalaphidae. Fauna of Saudi Arabia 5: 235–239.

Hölzel H (1998) Zoogeographical features of Neuroptera of the Arabian peninsula. In: Pavelius SP (Ed.) Neuropterology 1997. Proceedings of the Sixth International Symposium on Neuropterology (13–16 July 1997, Helsinki, Finland). Acta Zoologica Fennica 209: 129–140.

Hölzel H (2004) Ascalaphidae of the Arabisan Halbinsel (Neuroptera, Ascalaphidae). In: Aspöck U (Ed.) Entomologie und Parasitologie. Festschrift zum 65. Geburtstag von Horst Aspöck. Denisia 13: 213–228.

Kemal M, Seven E (2011) A new genus and a new species of Ascalaphidae from Turkey (Neuroptera: Ascalaphidae). Revue Française d’Entomologie 4: 253–254.

Kemal M, Koçak AÖ (2006) On three rare neopterid species at Van (Planipennia, Ascalaphidae, Nemopteridae). Centre for Entomological Studies, Miscellaneous Papers 87: 5–8.

Khrivokhotsky V, Dobros R, Khavieb GN (2015) Мирмелеонтидные и аскалафы (Neuroptera: Myrmeleontidae, Ascalaphidae) Киргизии [Antlions and owflies (Neuroptera: Myrmeleontidae, Ascalaphidae) of Kyrgyzstan]. Энтомологическое Обозрение 94: 803–818. https://doi.org/10.1134/S0013873815090092

Letardi A (1991) Ascalafidi europei e del Medio Oriente della collezione del Museo di Zoolgia dell’Universita di Roma (Planipennia, Ascalaphidae). Fragmenta Entomologica Roma 23(1): 35–44.

Luppova EP (1966) Novy zaznam o ascalafidach z Afganistanu [=The results of studies of the lacewings (Neuroptera) of Central Asia]. In: Нарзиколов МН [=Narzikulov MN], Лу́пова ЕП [=Luppova EP] (Eds) Фауна и зоогеография насекомых Средней Азии [=Fauna and zoogeography of the insects of Central Asia]. Дониш [=Dushanbe], Душанбе [=Dushanbe], 245–252.

Luppova EP (1973) К фаме аскалафов (Neuroptera, Ascalaphidae) Средней Азии [=On the ascalaphid fauna (Neuroptera, Ascalaphidae) of Central Asia]. Известия Академии Наук Таджикской ССР, Отделение Биологических Наук [=Izvestiya Akademii Nauk Tadzhikskoi SSR, Otdelenie Biologicheskikh Nauk; =Notes of the Academy of Sciences of the Tadzhik SSR, Series Biological Science] 1973 (1): 38–42.

Luppova EP (1987) Отряд Neuroptera – сетьчатохвостые [=Order Neuroptera – lacewings]. Насекомые Средней Азии [=Superfamily Myrmeleontoidae]. In: Медведев ГС [=Medvedev GS] (Ed.) Определитель насекомых европейской части СССР [=Oпределитель насекомых европейской части СССР; =Keys to the insects of the European part of the USSR]. Том 4 [=Vol. 4]. СССР, Казань, Издательство Академии Наук СССР, 1987: 6–25.

Mészáros Z, Ábrahám L (2005) Ascalaphid Studies IV. A New Ascalaphid Species from Asia (Neuroptera: Ascalaphidae). Acta Phytopathologica et Entomologica 40 (1–2): 103–110. https://doi.org/10.1074/0013873815090092

Mirmayedi A (2002) New records of Neuroptera from Iran. In: Sziráki G (ed.) Neuropterology 2000. Proceedings of the Seventh International Symposium on Neuropterology (6–9 August 2000, Budapest, Hungary). Acta Zoológica Academiae Scientiarum Hungaricae 48 (Suppl. 2): 197–201.

Monserrat VJ, Martín E (2005) Orden/Ordem Planipennia [=Superfamily Myrmeleontidae]. In: Medvedev GS [=Medvedv GS] (Ed.) Определитель насекомых европейской части СССР [=Keys to the insects of the European part of the USSR]. Том 4 [=Vol. 4]. СССР, Казань, Издательство Академии Наук СССР, 1987: 6–25.

Smezár’s, Z., Ábrámín L. (2005) Ascalaphid Species from Asia (Neuroptera: Ascalaphidae). Acta Phytopathologica et Entomologica 40 (1–2): 103–110. https://doi.org/10.1556/APhyt.40.2005.1-2.10

McLachlan R (1873) An attempt towards a systematic classification of the family Ascalaphidae. Journal of the Linnean Society of London, Zoology 11: 219–276. https://doi.org/10.1111/j.1096-3642.1871.tb02588.x

Monserrat VJ, Martín E (2005) Orden/Ordem Planipennia [sic]. In: Arechavaleta M, Zurita N, Marerro MC, Martín JL (Eds) Lista preliminar de especies silvestres de Cabo Verde: hongos, plantas y ami-
males terrestres 2005. Consejería de Medio Ambiente y Ordenación Territorial, Gobierno de Canarias, Santa Cruz de Tenerife, 77–78.

Monserrat VJ, Badano D, Acevedo F (2014) Nuevos datos de ascaláphi- dos para la Península Ibérica, con una nueva especie para la fauna europea (Insecta: Neuropterida: Neuroptera: Ascalaphidae). Hetero- opterous. Revista de Entomología 14(2): 147–167.

Morton KJ (1925) Notes on Neuroptera from Palestine, including a de- scription of a new species of Myrmeleontidae. Transactions of the [Royal] Entomological Society of London 73(1925): 403–412. https://doi.org/10.1111/j.1365-2311.1926.tb02643.x

Navás L (1909) Notas neuropterológicas. X. Sobre Ascaláphi. Bulletti de la Institució Catalana d’Història Natural (1): 52–57.

Navás L (1910) Algunos neútrópteros del Museo de Madrid. In: Asocia- ción Española para el Progreso de las Ciencias, Congreso de Valen- cia (held 1910), 1–7.

Navás L (1911) Notas sobre Neuropteros del Museo de Munich. I. Mit- teilungen der Münchener Entomologischen Gesellschaft 2: 22–28.

Navás L (1912a) Notes sur quelques Névroptères d’Afrique. II. Revue de Zoologie Africaines, Bruxelles 1: 401–410.

Navás L (1912b) Sinopsis de los Ascaláphi (Ins. Neur.). Arxius de l’Institut de Ciències, Institut d’Estudis Catalans, Secció de Ciències 1: 45–143. https://doi.org/10.5962/bhl.title.8510

Navás L (1913a) Algunos Neurópteros de Marruecos. Memorias de la [Real] Sociedad Española de Historia Natural 8: 111–122.

Navás L (1913b) Névroptères d’Egypte. Ière série. Bulletin de la Société [Royale] Entomologique d’Egypte 3: 150–159.

Navás L (1914) Notes sur quelques Névroptères du Congo Belge [I]. Revue de Zoologie Africaines, Bruxelles 3: 365–377.

Navás L (1915) Notes sur quelques Névroptères du Congo Belge. III. Revue de Zoologie Africaines, Bruxelles 4: 172–182.

Navás L (1919) Comunicaciones entomológicas. 3. Insectos exóticos. Revista de la [Real] Academia de Ciencias Exactas Fisico-Quimicas y Naturales de Zaragoza (1): 287–306.

Navás L (1924) Névroptères d’Afrique. Annales de la Société Scienti- fique de Bruxelles 43 (pt. 1): 375–380.

Navás L (1925a) Insectes du Congo Belge. Série I. Revue de Zoologie Africaines, Bruxelles 13: 123–132.

Navás L (1925b) Névroptères d’Egypte et de Palestine [première partie]. Bulletin de la Société [Royale] Entomologique d’Egypte 9: 29–36.

Navás L (1926a) Insectes du Congo Belge. Série II. Revue de Zoologie Africaines, Bruxelles 14: 85–90.

Navás L (1926b) Insecta orientalia. IV series. Memorie dell’Accademia Pontificia dei Nuovi Lincei, Rome (2): 111–120.

Navás L (1927) Insectos de la Somalia Italiana. Memorie della Società Entomologica Italiana 6: 85–89.

Navás L (1928) Insectos del Museo de Estocolmo. Revista de la Real Academia de Ciencias Exactas Fisicas y Naturales de Madrid 24: 28–39.

Navás L (1929a) Comunicaciones entomológicas. 11. Insectos de la Cirenaica. Revista de la Real Academia de Ciencias Exactas Fisico-Quimicas y Naturales de Zaragoza (1) 13: 13–28.

Navás L (1929b) Insectes du Congo Belge (Série III). Revue de Zoolo- gie et de Botanique Africaines 21: 123–144.

Navás L (1931c) Insectes del Museo de París. 8.a série. Brotéria (Zoológica) 27: 114–136

Navás L (1933) Insectes du Congo Belge. Série VIII. Revue de Zoolo- gie et de Botanique Africaines 23: 308–318.

Navás L (1934) Comunicaciones entomológicas. 18. Insectos de Mad- agascar. Segunda [II] serie. Revista de la [Real] Academia de Cien- cias Exactas Fisico-Quimicas y Naturales de Zaragoza (1) 18: 42–74.

Navás L (1936) Insectes du Congo Belge. Série IX. Revue de Zoologie et de Botanique Africaines 28: 333–368.

Ohm P, Hözel H (1982) Tiergeographische und ökologische Aspekte der Neuropterafauna der Kapverden. Courier Forschungsinstitut Senckenberg 52:159–165.

Oswald JD (2019) Bibliography of the Neuropterida. http://lacewing. tamu.edu/Biblio/Main [Last accessed 04.04.2019]

Pantaleoni RA, Badano D, Aspóck U, Aspóck H (2013) Ascalaphus festivus (Rambur, 1842) in Sardinia, a new genus of Ascalaphidae for Europe (Neuroptera). Biodiversity Journal 4: 179–182.

Pieper H, Willmann R (1980) Die Larven griechischer Ascalaphiden- Arten (Ins., Planipennia). Stuttgartte Beiträge zur Naturkunde (1980) 3: 11–11.

Popov A (2004) The Ascalaphidae (Neuroptera) of the Balkan Penin- sula. In: Aspóck U (Ed.) Entomologie und Parasitologie. Festschrift zum 65. Geburtstag von Horst Aspóck. Denisia 13: 229–237.

Por FD (1975) An Outline of the Zoogeography of the Levant. Zoologica Scripta (4): 5–20. https://doi.org/10.1111/j.1463-6409.1975.tb00713.x

Prost A (2013) The Genus Ascalaphus (Fabricius, 1775) (Neuroptera, Ascalaphidae) in Africa Acoresane, Suplemento 9: 57–72.

Rambur [J]P (1842) Histoire naturelle des insectes, névroptères. Librairie encyclopédique de Roret. Fain et Thunot, Paris, XVII, 534 pp. [12 pl.]

Schacht W (2000) Insekten aus Gambia, Westafrika (Diptera: Platypezi- dae, Myrmeleontidae, Ascalaphidae sowie Coleoptera: Carabidae, Cicindelidae, Elateridae, Scarabaeidae). Entomofauna 21: 1–4.

Schacht W (2002) Weitere Insekten aus Gambia, Westafrika (Coleopt- era: Buprestidae, Scarabaeidae; Diptera: Asilidae, Astidae, Ta- banidae; Hymenoptera: Apidae, Scoliidae; Planipennia: Ascalaphi- dae, Myrmeleontidae). Entomofauna 23(13): 149–156.

Scott H (1929) An entomological tour in Kurdistan. Entomologist’s Monthly Magazine 65: 69–82.

Şengonca Ç (1979) Beitrag zur Neuropterenfauna der Türkei. Nach- richtenblatt der Bayerischen Entomologen 28: 10–15.

Sziráki Gy (1998) An annotated checklist of the Ascalaphidae spe- cies known from Asia and from the Pacific Islands. Rovartani Kö- zlemények [=Folia Entomologica Hungarica] (N.S.) 59: 57–72.

Sziráki Gy (2000) Data to the knowledge of the Asian Ascalaphidae (Neuroptera), with description of a new subspecies. Rovartani Kö- zlemények [=Folia Entomologica Hungarica] (N.S.) 61: 87–93.

Sziráki Gy (2010) Order Neuroptera, family Ascalaphidae. In: Harten A van (Ed.) Arthropod fauna of the United Arab Emirates. Vol. 4. Dar Al Ummah, Abu Dhabi, 59–65.

Tjeder B (1972) Two necessary alterations in long-established genus nomenclature in Ascalaphidae (Neuroptera). Entomologica Scandi- navica 3: 153–155. https://doi.org/10.1111/j.187631272X00238
Tjeder B (1980) Ascalaphidae (Neuroptera) from Senegal and the Gambia. Entomologica Scandinavica 11: 401–412. https://doi.org/10.1163/187631280794710006
Tjeder B (1992) The Ascalaphidae of the Afrotropical Region (Neuroptera). 1. External morphology and bionomics of the family Ascalaphidae, and taxonomy of the subfamily Haplogleniinae including the tribes Proctolyrini n. tribe, Melambrotini n. tribe, Campylophebini n. tribe, Tmesibasini n. tribe, Allocormodini n. tribe, and Ululomyini n. tribe of Ascalaphidae. Entomologica Scandinavica, Supplement 41: 3–169.
Tjeder B, Waterston AR (1977) Ptyngidricerus venustus n. sp. from Oman and Iran (Neuroptera: Ascalaphidae). Entomologica Scandinavica 8: 87–92. https://doi.org/10.1163/187631277X00152
Tjeder B, Hansson C (1992) The Ascalaphidae of the Afrotropical Region (Neuroptera). 2. Revision of the tribe Ascalaphini (subfam. Ascalaphinae) excluding the genus Ascalaphus Fabricius. Entomologica Scandinavica, Supplement 41: 171–237.
Udvardy MDF (1975) A Classification of the Biogeographical Provinces of the World. IUCN Occasional Paper 18. International Union for Conservation of Nature and Natural Resources, Morges, Switzerland, 49 pp.
vander Weele HW (1909a) Les Planipennia recueillis par le Prof. Voeltzkow a Madagascar et dans les iles environnantes. Bulletin Scientifique [or Biologique] de la France et de la Belgique 42: 61–68. https://doi.org/10.5962/bhl.part.24150
vander Weele HW (1909b) Ascalaphiden. Collections Zoologiques du Baron Edm. de Selys Longchamps, Catalogue Systématique et Descriptif 8: 1–326.
Walker F (1853) List of the specimens of neuropterous insects in the collection of the British Museum. Part II. – (Sialidae – Nemopterides). British Museum, London.
Werner F (1934) Ergebnisse einer zoologischen Studien- und Sammelreise nach den Inseln des Ägäischen Meeres. V. Arthropoden. Sitzungsberichte der Akademie der Wissenschaften in Wien, Mathematische-Naturwissenschaftliche Klasse (Abteilung I) 143: 159–168.
Werner F (1937) Ergebnisse der vierten zoologischen Forschungsreise in die Ägäis (1936). Sitzungsberichte der Akademie der Wissenschaften in Wien, Mathematische-Naturwissenschaftliche Klasse (Abteilung I) 146: 89–118.
Werner F (1938) Ergebnisse der achten zoologischen Forschungsreise nach Griechenland (Euboea, Tinos, Skiathos, Thasos usw.). Sitzungsberichte der Akademie der Wissenschaften in Wien, Mathematische-Naturwissenschaftliche Klasse (Abteilung I) 147: 151–173.
Whittington AE (2002) Resources in Scottish Neuropterology. In: Sziráki G (Ed.) Neuropterology 2000. Proceedings of the Seventh International Symposium on Neuropterology (6–9 August 2000, Budapest, Hungary). Acta Zoologica Academiae Scientiarum Hungaricae 48 (Suppl. 2): 371–387.
Zamani H, Mirmoayedi A, Kahrizi D, Yari K (2019) Cytochrome oxidase subunit I could separate successfully seven predacious morphspecies of Neuropteran insects. Entomological News 128(2): 140–155. https://doi.org/10.3157/021.128.0209
Zohary M (1966–1972) Flora Palaestina. Vol. I, II, III. The Israel Academy of Sciences and Humanities. Jerusalem.