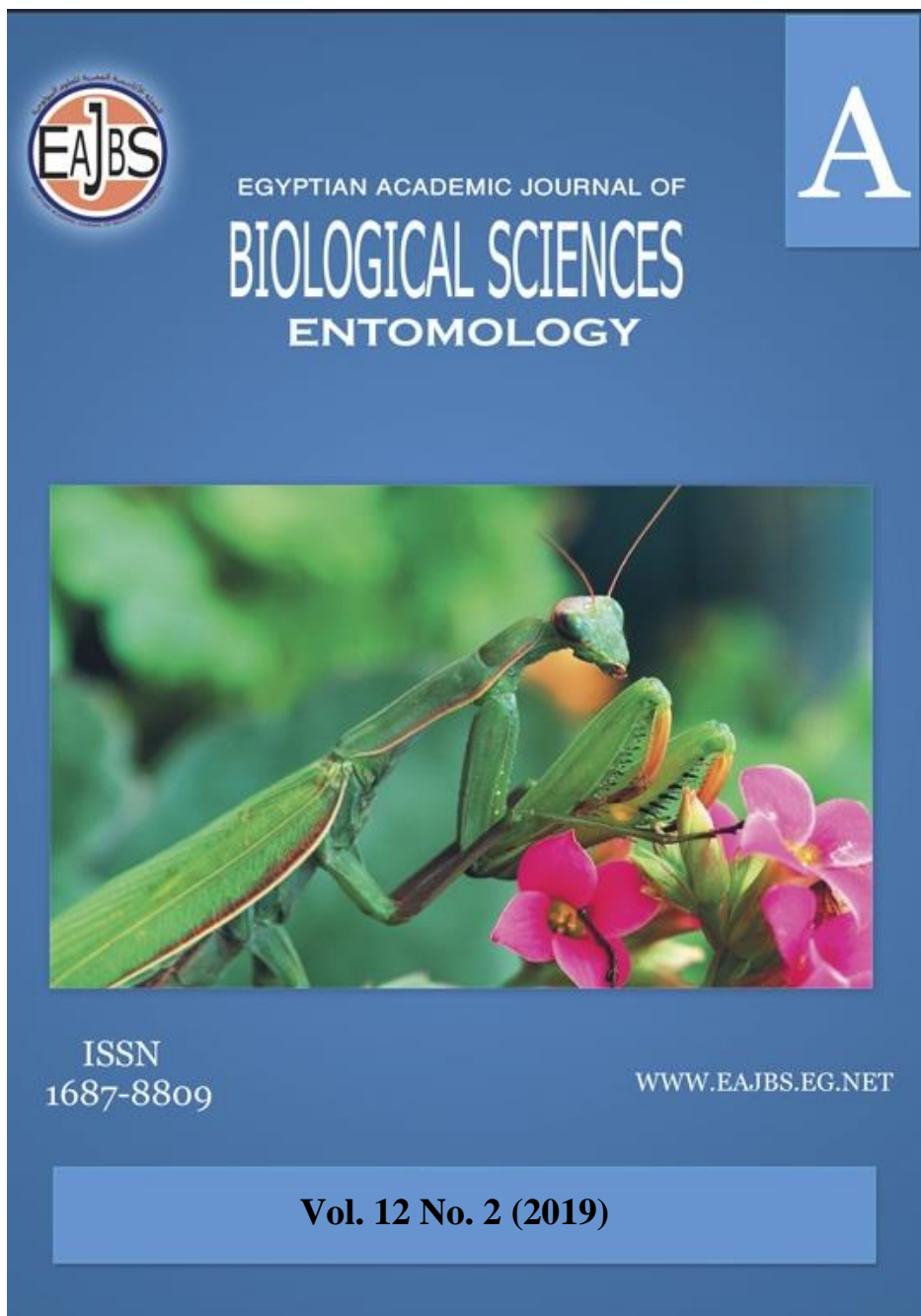


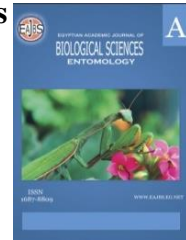
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Review of Subfamily Palparinae (Neuroptera: Myrmeleontidae) from Egypt

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ABSTRACT

The Egyptian fauna of subfamily Palparinae is revised. Four genera and nine species are recognized. A key to genera and species with illustrations is provided. Diagnosis, specimens examined and distributions are given for each species.

INTRODUCTION

Family Myrmeleontidae (antlions) are the most species-rich family of the order Neuroptera, including 2000 species distributed in all tropical and temperate regions of the world (Oswald, 2018). In the Palaearctic region, 213 species are recorded (Aspöck *et al.* 2001). This group comprises small to large, slender and soft-bodied insects having variable wing patterns (Chandra *et al.*, 2014).

Family Myrmeleontidae suffered from many taxonomic changes since 1899. As a final point Michel *et al.* (2017) classified this family into four subfamilies: Acanthaclisinae, Myrmeleoninae, Palparinae and Stelopteryginae according to a molecular dataset based on seven mitochondrial and nuclear gene markers. The first three subfamilies are represented in the Egyptian fauna.

The subfamily Palparinae constitutes the largest and most decorative species with darkly spotted wings. This subfamily is characterized by the following characters: fore wing with long posterior cubital vein reach to the margin of the wing and branched, 1st anal vein and posterior cubital vein not connected; hind wing with three anal veins and pronotum shorter than wide apart from some exceptions (Ábrahám, 2012).

In Egypt, order Neuroptera was studied early by Navás (1926), who recorded five species within genus *Palpares* Rambur 1842: *P. cephalotus* (Klug, 1834); *P. libelluoides* (Linnaeus, 1767); *P. hispanus* Hagen, 1860; *P. geniculatus* Navás, 1912 & *P. dispar* Navás, 1912. After that, Hölzel (1982) studied the neuropteran fauna of Saudi Arabia and mentioned three species of *Palpares* distributed in Egypt including *P. angustus* McLachlan, 1898. Then, on completing his study on the fauna of Saudi Arabia, the same author (1988) reported two species; *Stenares irroratus* Navás, 1912 and *Gonicercus klugi* (Kolbe, 1898) in (Sinai) Egypt.

Recently, Aspöck *et al.* (2001) in their catalogue of Palearctic Neuroptera mentioned only six species to be distributed in Egypt discarding *P. libelluoides* and *P.*

hispanus. After a while, Stange (2004) in his world catalogue of antlions mentioned the eight previously recorded species in Egypt (*Goniocercus klugi*, *Palpares angustus*, *P. cephalotes*, *P. dispar*, *P. geniculatus*, *P. hispanus*, *P. libelloides* and *Stenares irroratus*). More recently, El-Hamouly & Fadl (2011) presented an annotated checklist of the order Neuroptera in Egypt. They listed nine species within the genera *Palpares*, *Goniocercus* Insom and Carfi, 1988 and *Parapalpares* Insom & Carfi, 1988 belonging to subfamily Palparinae where they added *Goniocercus walkeri* (McLachlan, 1894) and *Parapalpares solidus* (Gerstaecker, 1893) to the Egyptian fauna.

From the above, it is clear that the taxonomic position of subfamily Palparinae in Egypt has not been revised since Navás (1926). So the present work intended to revise and elucidate the taxonomic status of subfamily Palparinae in the Egyptian fauna.

MATERIALS AND METHODS

The specimens for this study are preserved in the following main Egyptian reference collections: Ain Shams University collection, Faculty of Science, Entomology Department (ASUC); Cairo University collection, Faculty of Science, Entomology Department (CUC); Collection of the Entomological Society of Egypt (EESC) and Ministry of Agriculture, Plant Protection Institute, Section of Identification (MAC). General morphology follows Hölzel (1988) and Hölzel & Ohm (1991). Specimens were examined under a LABOMED, CZM4 dissecting, binocular microscope. Colored images were taken by a digital camera (Sony Dsc-W610). Palpi were macerated in 10% KOH (potassium hydroxide) at room temperature, later rinsed in acetic acid and water then examined and drawn using a stereomicroscope at magnification 100–400x. Colored map for local distribution of each species was provided (Fig. 1).

RESULTS

Subfamily Palparinae Banks, 1911.

Type genus: *Palpares* Rambur 1842.

Key to the Egyptian taxa of Subfamily Palparinae

- 1- Costal area of fore wing with 2 rows of cells (Fig. 2a).....(*Stenares*)
.....*S. irroratus* Navás, 1912.
- Costal area of fore wing with a single row of cells (Fig. 2b).....2.
- 2- Male ectoproct arched and bending upwards, at most as long as abdominal tergite VIII (Fig. 2c) (*Parapalpares* Insom and Carfi, 1988).....3.
- Male ectoproct not as above.....4.
- 3- Distal palpomere of labium notched at apex, with club-shaped for about 1/3 of its length, palpimacula short, elongated oval-shaped, wider at the apex (Fig. 2d); pronotum bright brown with dark median stripes; wings narrow (Fig. 2e).....
.....*Parapalpares dispar* (Navás, 1912).
- Distal palpomere of labium rounded at apex, with club-shaped for about 1/2 of its length, palpimacula long, not wider at the apex (Fig. 2f); pronotum brown with dark transverse band; wings broad (Fig. 2g).....*Parapalpares solidus* (Gerstaecker, 1893).
- 4- Ectoproct large, sharply bent, with an angle of about 90° open dorsally, thickly covered by long and thin setae, the distal part of the ectoproct is laterally flattened, basal and distal portion of the same length (Fig. 2h); wing-pattern as in (Fig. 2i); distal palpomere of labium rounded at the apex, with club-shaped for about 1/5 of its length, palpimacula slit-like, short, extending beyond the apex (Fig. 2j).....(*Goniocercus*)
.....*G. klugi* (Kolbe, 1898).

- Ectoproct not as above (Fig. 2k)..... (*Palpares* Rambur 1842).....5.
- 5- Hind wing with a small band on the cubital fork (Fig. 3a); distal palpomere of labium truncated at the apex, with club-shaped for about 1/4 of its length, palpimacula heart shaped (Fig. 3b).....*Palpares geniculatus* Navás, 1912.
- Hind wing with a large band on the cubital fork (Fig. 3c); distal palpomere of labium as in (Figs. 3d & 3g).....6.
- 6- Abdomen yellow, with a broad black, transverse band on each segment, wings short broad (Fig. 3e)*Palpares hispanus* Hagen, 1860.
- Abdomen either without dark stripe or with continuous black stripes7.
- 7- Distal palpomere of labium rounded at apex, with club-shaped for about 1/3 its length, palpimacula slit-like, reaching the apex (Fig. 3d); hind wing with two stigmal bands, with a row of spots at submarginal area; male abdomen with heavily brownish hairs in the anterior half (Fig. 3f).....*Palpares cephalotes* (Klug, 1834).
- Distal palpomere of labium as in (Fig. 3g); hind wing with one stigmal band and with scattered spots at submarginal area; abdomen not as above (Fig. 3h).....8.
- 8- Hind wing with a median band not reached near the inner margin; abdomen with longitudinal dark stripes (Fig. 3h); distal palpomere of labium rounded at apex, with club-shaped for about 1/5 of its length, palpimacula slit-like (Fig. 3g).....*Palpares libelluloides* (Linnaeus, 1767).
- Hind wing with median band reached near the inner margin; abdomen without dark stripes (Fig. 3i).....*Palpares angustus* McLachlan, 1898.

I- Genus: *Goniocercus* Insom and Carfi, 1988

Type species: *Palpares laticaudatus* Navás, 1915

1- *Goniocercus klugi* (Kolbe, 1898) (Figs. 2h – 2j)

Myrmeleon papilionoides var. *klugi* Kolbe, 1834.

Palpares klugi Kolbe, 1898.

Palpares walkeri reticulatus Stitz, 1912.

Trichocercus klugi (Kolbe): Insom & Carfi 1989.

Goniocercus klugi (Kolbe): El-Hamouly and Fadl, 2011

Diagnosis:

Length: ♂ body 43 mm. ♀ body 50 mm. Fore wing 44-46 mm. Hind wing 43-45 mm. Antennal base provided with long and heavily black and white bristles; wings broad with distinct and yellowish pterostigma, fore wing with numerous small brown spots distributed in all wing, bands in fore wing not reached the margin; hind wing with small band on the cubital fork, median and stigmal bands separated, median band not reached the inner margin of the wing; the 2nd anal vein in hind wing simple, not branched, with slightly oblique cross vein reached to 1st one; fore tibial spurs as long as the two basal tarsal segments and shorter than the two basal tarsal segments in hind leg; abdomen brown in color, shorter than each wing, the 1st three abdominal segments clothed by long whitish bristles and hairs; male ectoproct short 4 mm long.

Local distribution: Coastal Strip.

World distribution Egypt, Ethiopia, India, Oman, Palestine, Saudi Arabia, Sudan.

Specimen examined:

Salloum (N. Coast) 11.6.1916 (1) (MAC).

II- Genus: *Palpares* Rambur 1842.

Type Species: *Myrmeleon libelluloides* Linnaeus, 1767.

2- *Palpares angustus* McLachlan, 1898 (Fig. 3i)

Palpares angustus oranensis Mclachlan, 1898.

Palpares angustus gloriosa Navás, 1913.

Palpares martini Weele, 1907.

Palpares angustus McLachlan: Ábrahám, 2017.

Diagnosis:

The 3rd anal vein of fore wing with 3 branches and 4 cross veins; hind wing moderately narrow, with 4 spots along costal margin and two spots on submarginal area, apex of it with small band, 2nd anal vein of hind wing provided with one oblique cross vein reached to 1st one and two cross veins to 3rd anal vein, stigmal and median band of hind wing separated, median band of it reached near the inner margin, with large band on the cubital fork; all legs black in color; Abdomen dark in color.

Local distribution: unknown

World Distribution: Algeria, Egypt, Libya, Saudi Arabia, Somalia, Syria.

Remarks: the status of this species in Egypt is unconfirmed. It is not represented in the Egyptian collections. Klapálek (1912) reported it as *Palpares martini* from Egypt (Ábrahám, 2017). Also, it was mentioned by Hölzel, 1982 in his work of Saudi Arabian species as distributed in Egypt. The diagnostic characters are according to Banks 1913.

3- *Palpares cephalotes* (Klug, 1834) (Figs. 2b, 3c - 3d, 3f & 3j)

Myrmeleon cephalotes Klug, 1834.

Palpares sollicitus Walker, 1853.

Myrmeleon subducens Walker, 1853: McLachlan 1867.

Palpares cephalotes (Klug): Banks, 1913.

Palpares cephalotes (Klug): El-Hamouly and Fadl, 2011.

Diagnosis:

Length: ♂ body 77 mm. ♀ body 67 mm. Fore wing 70 mm. Hind wing 66 mm. Antennae with black setae at base; fore and hind wings long, pterostigma indistinct; hind wing with large band on the cubital fork; The pattern of speckling of wings varied; spots in female wings more extensive than in those of males, coxae of all legs clothed by long heavily whitish bristles and hairs; femora, tibia and tarsi are subequal in length, fore tibial spurs length equal to the two basal tarsal segments and shorter in hind leg; abdomen brown, segments 1-5 in male densely covered with long hairs, segments 1-3 in female abdomen covered with few bristles; male ectoproct shorter than segment 8.

Type locality: Egypt: Bani Suif

Local Distribution: Upper and Lower Egypt and Gabal Elba.

World Distribution: Algeria, Afghanistan, Egypt, Ethiopia, Iran, Saudi Arabia, Sudan.

Specimen examined:

Kerdasa 25.7.1924 (1), Mansoriah 4.8.1931 (2) (MAC). Kerdasa 8.1914 (4) (EESC). Gabal Asfar 8.7.1953 (2), Aswan 19.8.1994 (2), Red Sea 18.10.1994 (1) (ASUC).

4- *Palpares geniculatus* Navás, 1912 (Figs. 2k & 3a - 3b)

Palpares geniculatus Navás, 1912.

Palpares geniculatus Navás: El-Hamouly and Fadl, 2011.

Diagnosis:

Length: ♂ body 63 mm. ♀ body 50 mm. Fore wing 57-62 mm. Hind wing 55-59 mm. Antennae with long black setae at base; wings wide, pterostigma distinct and yellowish; fore wing with small dots and few bands; hind wing with large and numerous bands, stigmal band of hind wing branched; femora of all legs slightly longer than tibiae, tibiae as long as tarsi, fore tibial spurs as long as the two basal tarsal segments and shorter than two basal tarsal segments in hind leg; abdominal segments 1-3 heavily clothed by long whitish hairs; male ectoproct very long.

Local distribution: Lower Egypt and Costal Strip.

World distribution: Algeria, Egypt, Libya, Morocco, Tunisia.

Specimen examined:

Saloum 18.8.1917 (2), Marriout 20.8.1924 (1) (MAC). Marsa Matrouh 15.8.1930 (2)

(EESC). Marsa Matrouh 26.8.1930 (1), Abbassia 4.10.1936 (3) (CUC).

5- *Palpares hispanus* Hagen, 1860 (Figs. 3e & 3k)

Palpares hispanus turcicus Koçak, 1976

Palpares hispanus Hagen: Ábrahám, 2017.

Diagnosis:

Length: ♀ body 41 mm. Fore wing 55 mm. Hind wing 53 mm.

Body yellow, vertex with distinct brown strip; antennae with heavily and distinctly long black setae and bristles at base; wings very broad and long; fore wing much spotted with numerous small spots, submarginal area of hind wing spotted, 2nd anal vein simple with an oblique cross vein reached to 1st one; tibiae of all legs slightly shorter than femora and as long as tarsi; femora and tibiae pale brown in color, tarsi dark brown; fore tibial spurs as long as or longer than the two basal tarsal segments and shorter in hind leg; abdomen yellow in color, each segment with a broad black transverse band, with interrupted longitudinal strip dorsally; male ectoproct longer than length of 7 & 8 abdominal segment together.

Local distribution: Lower Egypt

World distribution: Algeria, Egypt, Iran, Palestine, Portugal, Spain.

Specimen examined:

Fayoum 13.9.1916 (1) (MAC).

6- *Palpares libelluloides* (Linnaeus, 1767) (Figs. 3g - 3h)

Palpares libelluloides Linnaeus, 1764.

Hemerobius libelloides Linnaeus, 1764.

Myrmeleon libelluloides v. *nigriventris* Costa, 1855.

Myrmeleon nordmanni Kolenati, 1856.

Palpares libelluloides v. *nigripes* Navás, 1913.

Palpares libelluloides (Linnaeus): Mirmoayedi et al, 2015.

Diagnosis:

Body yellow in color; antennae with heavily and long bristles at base; wings wide and short, pterostigma distinct and yellowish, fore wing with numerous small brown spots distributed in all wing, 3rd anal vein in fore wing very short and curved, hind wing with numerous small spots a submarginal area, 2nd anal vein simple, not branched, with an oblique cross vein reached to 1st anal vein; abdomen yellowish above and with 3 more or less distinct black longitudinal stripes dorsally and black or blackish brown ventrally; male ectoproct longer than length of 7 & 8 abdominal segment together.

Local Distribution: Coastal Strip.

World Distribution: Algeria, Egypt, Ethiopia, France, Libya, Morocco, Palestine, Spain, Portugal, Saudi Arabia, Tunisia.

Specimen examined:

Salloum 11.6.1916 (1) (MAC).

III- Genus: *Parapalpares* Insom & Carfí, 1988

Type species: *P. latipennis* Rambur, 1842.

7- *Parapalpares dispar* (Navás, 1912) (Figs. 2c – 2e)

Palpares dispar Navás: El-Hamouly and Fadl, 2011.

Parapalpares dispar (Navás): Mirmoayedi et al, 2015.

Diagnosis:

Length: ♂ body 70 mm. ♀ body 57 mm. Fore wing 46-50 mm. Hind wing 44-47 mm. Antennal base bare; wings narrow, pterostigma distinct and yellowish, fore wing with 3rd anal vein branched; hind wing with 2nd anal vein simple provided with 3 cross veins, hind wing with a small band on the cubitus fork and with dark band at its apex; femora, tibiae and tarsi of all legs subequal in length, tibial spurs of fore leg longer than the two basal

tarsal segments, as long as the two tarsal segments in hind leg; male ectoproct longer than segment 7 & 8 and covered with heavily and long whitish bristles and hairs laterally.

Local distribution: Upper & Lower Egypt, Sinai and Eastern & Western desert.

World distribution: Egypt, Palestine, Saudi Arabia.

Specimen examined:

Oasis 5.9.1913 (1), Wadi Degla 4.8.1923 (1), Kerdasa 25.7.1924 (1), Abu Rawash 12.8.1924 (1), Kerdasa (on sugar cane) 10.8.1930 (1), Sinai 8.11.1930 (1) (**MAC**). Hurgada 8.1935 (2) (**EESC**). Ghardaqa 20.7.1935 (1), Gedeirat 20.7.1935 (5) and 20.7.1936 (2) (**CUC**).

8- *Parapalpars solidus* (Gerstacker, 1893) (Figs. 2f - 2g)

Palpars solidus Gerstacker, 1893

Palpars zugmayeri Navás, 1912.

Palpars klapaleki Navás 1912

Palpars validus Navás, 1927.

Parapalpars solidus (Gerstacker): Mirmoayedi *et al.*, 2015.

Diagnosis:

Length: ♀ body 41 mm. Fore wing 46 mm. Hind wing 43.5 mm.

Body light and dark brown; pronotum brownish with dark transverse band; wings broad and long; hind wing very strongly banded with 3 large bands with apex have solid large dark band, 2nd anal vein simple, provided with 3 cross veins, stigmal band very broad and reached across submarginal row of spots in hind wing; legs long, dark brown, with dark hairs, tibial spurs longer than 2nd tarsal segment; male ectoproct short, slightly longer than the 8th abdominal segment.

Local distribution: Upper Egypt.

World distribution: Afghanistan, Egypt, India.

Specimen examined:

Aswan 19.8.1994 (2), Qena 15.9.1993 (1), Red Sea 18.10.1994 (1) (**ASUC**). Locality only listed as Egypt (1) (**MAC**).

Remarks: This species is confirmed to be a new record in Egypt.

IV- Genus: *Stenares* Hagen, 1866

Type species: *Myrmeleon hyaena* Dalman, 1823.

9- *Stenares irroratus* Navás, 1912 (Figs. 2a & 3l)

Stenares irroratus Navás: Aspöck *et al.*, 2001.

Diagnosis:

Length: Fore wing 62 mm. Hind wing 58 mm.

Head yellow in color, palpi dark, labial palp long with obtuse apex, antennae black; thorax black with long white hairs; Legs entirely brownish-black, with black hairs, spur longer than the first two tarsal segments; wings long, hyaline, slightly tinted white, stigma yellowish, apex subacute, fore wing costal area with 2 rows of cells, venation brown and white color, radius with dark dots, hind wing rarely stained with several drops and points at its external edge; abdomen with dark bands.

Local distribution: Sinai.

World distribution: Egypt, Madagascar, Nigeria.

Remarks: This species is not represented in the Egyptian collections. It was reported from Egypt by Hölzel, 1988, the diagnostic characters according to Navás, 1912.

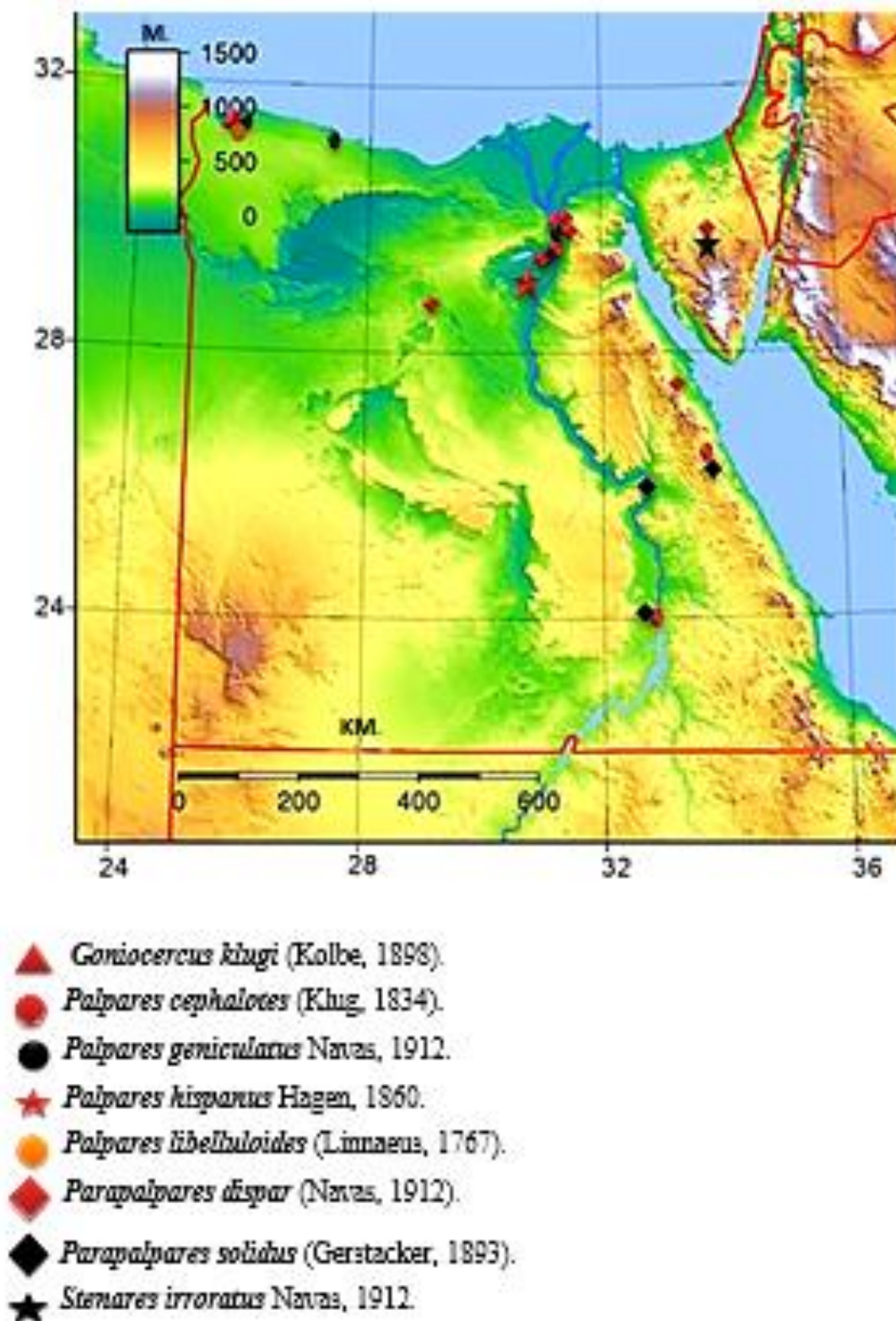


Figure 1: Map of local distribution of Palparin species.



Figure 2: **a.** *Stenares irroratus* Navás, costal area of fore wing after Ábrahám and Harten 2014; **b.** *Palpares cephalotes* (Klug), costal area of fore wing; **c. - e.** *Parapalpars dispar* (Navas): **c.** Male ectoproct, lateral view, **d.** Distal palpomere of labium, dorsal view, **e.** Habitus, male; **f. & g.** *Parapalpars solidus* (Gerstaecker): **f.** Distal palpomere of labium, dorsal view, **g.** Habitus, female; **h. - j.** *Gonicercus klugi* (Kolbe), **h.** Male ectoproct, lateral view, **i.** Habitus, male, **j.** Distal palpomere of labium, dorsal and lateral views; **k.** *Palpares geniculatus* Navas, Male ectoproct, lateral view.

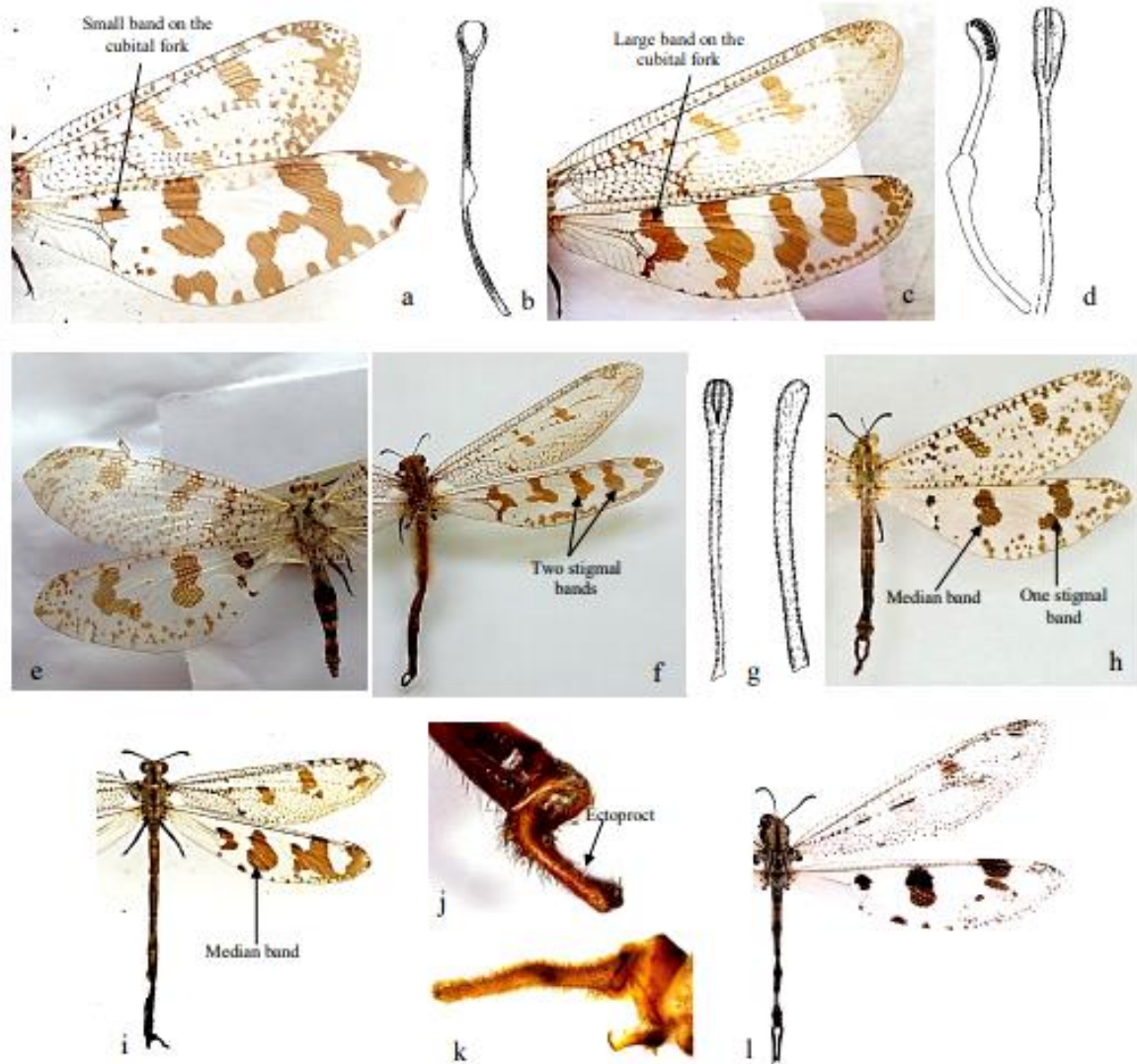


Figure 3: a. & b. *Palpares geniculatus* Navas: a. Fore and hind wings, b. Distal palpomere of labium, dorsal view; c. - d. & f. & j. *Palpares cephalotes* (Klug): c. Fore and hind wings, d. Distal palpomere of labium, dorsal and ventral views, f. Habitus, male, j. Male ectoproct, lateral view; e. & k. *Palpares hispanus* Hagen: e. Habitus, female, k. Male ectoproct, lateral view after Krivokhatsky *et al* 2017; g. & h. *Palpares libelluloides* (Linnaeus): g. Distal palpomere of labium, dorsal and ventral views, h. Habitus, male; i. *Palpares angustus* McLachlan, habitus, male after Abraham, 2017; l. *Stenares irroratus* Navás, habitus, male after Ábrahám and Harten 2014.

DISCUSSION

Generally, the tribe Palparini is in need a comprehensive taxonomic work worldwide to can stand of the status of the genera and species. Insom & Carfi (1988) divided genus *Palpares* into several genera, but their work cannot be regarded as a comprehensive revision of the genus due to the low number of species examined (Mansell, 1992). Also in their key, they used the shape of distal palpomere of labium with genitalia to differentiate between different genera, but due to the variation in the shape of distal palpomere and associated palpimacula character in the species of the same genus, the application of this character is accepted only at species level.

El-Hamouly & Fadl (2011) presented an annotated checklist of the order Neuroptera in Egypt and mentioned *Goniocercus walkeri* to be distributed in Egypt depending on two specimens collected from Qena (1993) & Red Sea (1994) and deposited in ASUC. But through the examination of these specimens it was appear to follow *Parapalpares solidus* not *Goniocercus walkeri*. This identification is also confirmed by Dr. Levente Ábrahám (personal communication), so this species (*Goniocercus walkeri*) is not represented in the Egyptian fauna. Also, in their list El-Hamouly & Fadl (2011) mentioned *Parapalpares solidus* among the Egyptian species but not referring to that it is recorded for the first time. In our study, we confirmed that this species is a new record from the Egyptian fauna and represented by four specimens collected from Aswan, Qena and Red sea as mentioned in the material examined.

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