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**Taxonomic Studies of The Two Families Gomphidae and Macromiidae  
(Odonata: Anisoptera) from Egypt**

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**ABSTRACT**

Even though, works on the taxonomy of Odonata have acquired awareness worldwide, the African continent as well as Egypt is one of the least explored localities. Thus, there is an urgent need to conduct comprehensive taxonomic reviews of the order Odonata in Egypt. In the current work, the dragonflies of the two families Gomphidae and Macromiidae are reviewed. Field trips in 49 localities inside 11 Egyptian governorates did not result in collecting any specimens. Therefore, the study is based only on the materials that are preserved in the main Egyptian reference collections in addition to the previous literature. As a result, a total of two genera and four species for the two families were identified. Taxonomic keys with illustrations of Egyptian genera and species are provided. In addition, diagnosis, world distribution and material examined were given for each species. Also, type genera, type species and type locality are given. The status of the species was discussed.

**INTRODUCTION**

Order Odonata represents approximately 6405 described species worldwide, which belonging to damselflies (suborder Zygoptera), dragonflies (suborder Anisoptera), and Jurassic fossils in suborder Anisozygoptera (Paulson *et al.*, 2023). It is expected that 1000 to 1500 species of Odonates still wait for identification and description (Kalkman *et al.* 2008 and Dijkstra *et al.* 2013).

Family Gomphidae is represented globally by 966 species under 92 genera of which 127 species belonging to 33 genera are distributed in the Palearctic region. On the other hand, the family Macromiidae is represented by 122 species within four genera worldwide with six species under two genera recorded from the Palearctic region (Kalkman *et al.* 2008).

Selys (1887) listed 24 species of the order Odonata in Egyptian fauna, from which four species under two genera (*Onychogomphus hagenii* Selys, *O. lefebvrii* Rambur, *O. pumilio* Rambur, and *Lindenia tetraphylla* Van der Linden) are belonging to family Gomphidae and no records of Macromiidae were reported. In Egypt, the two families were

studied earlier by Andrés (1928) who recorded two genera and two species (*Paragomphus pumilio* Rambur and *Macromia africana* Selys which currently valid as *Phyllomacromia africana* (Selys, 1871)), one in each family. Then, Morton (1929) added a new species; *Mesogomphus sinaiticus* which is currently valid as *Paragomphus sinaiticus* (Morton, 1929) under the family Gomphidae during his expedition in the Sinai Peninsula, Suez, and Palestine. After a while, Shoukry (1979), the first prevalent work on the order, recorded three species under three genera; *Onychogomphus hagenii* Selys, *Paragomphus pumilio* Rambur belonging to the family Gomphidae and *Macromia africana* Selys within Macromiidae. More recently, Boudot *et al.* (2009) listed only the genus *Paragomphus* including the two species; *P. sinaiticus* (Morton) and *P. pumilio* (Rambur) under the family Gomphidae.

In fact, Identification and description of Odonates is a worldwide trend. Bybee *et al.* (2016) stated that the African continent is among the least explored areas and is likely to contain large numbers of anonym species of Odonata. Recently, Fischer *et al.* (2019) mentioned that the available data on the Odonata of Egypt is very poor. This indicated the need for a comprehensive taxonomic review of Odonata of Egypt in order to keep pace with the global directions. Thus, the current work is considered the first contribution and deals with the two families Gomphidae and Macromiidae from Egypt.

## MATERIALS AND METHODS

This work is based on the specimens which were conserved in the subsequent Egyptian reference insect collections: Ain Shams University, Faculty of Science, Department of Entomology (ASUC); Cairo University, Faculty of Science, Department of Entomology (CUC); Ministry of Agriculture, Plant Protection Institute, Identification Section (MAC).

Different body parts were measured with a graduated ruler and a calibrated ocular lens standardized at units (ocular micrometer) using a stereomicroscope at magnifications 100x to 400x.

All pictures of the morphological characters of the keys were captured by a 12-megapixel camera 1080p with magnification power 50x to 1200x supported with 10 adjustable LED lights (8 built-in & 2 side lights).

## RESULTS

### Family Gomphidae Rambur, 1842

Gomphidae Rambur, 1842; Ins. Nev.: 137.

Lindeniidae Yakobson & Bianchi, 1905; Piyamok. Lozhnosyetchatok. Ross. Imp. :775.

**Type Genus:** *Gomphus* (Leach 1815); Edin. Ency. 9:137.

**Diagnosis:** Eyes widely separated from each other; the median lobe of labium without a notch; prementum entire without cleft; both triangles in front and hind wings have the same shape, almost at the same distance from arculus, most of the costal and subcostal (antenodals) not in line, the two primary antenodals present and obvious, thicker than others antenodals, a brace vein usually behind the proximal end of pterostigma; abdomen often club-shaped at the apex.

### Genus *Paragomphus* Cowley, 1934

*Paragomphus* Cowley, 1934: Entomo. 67, 200:205.

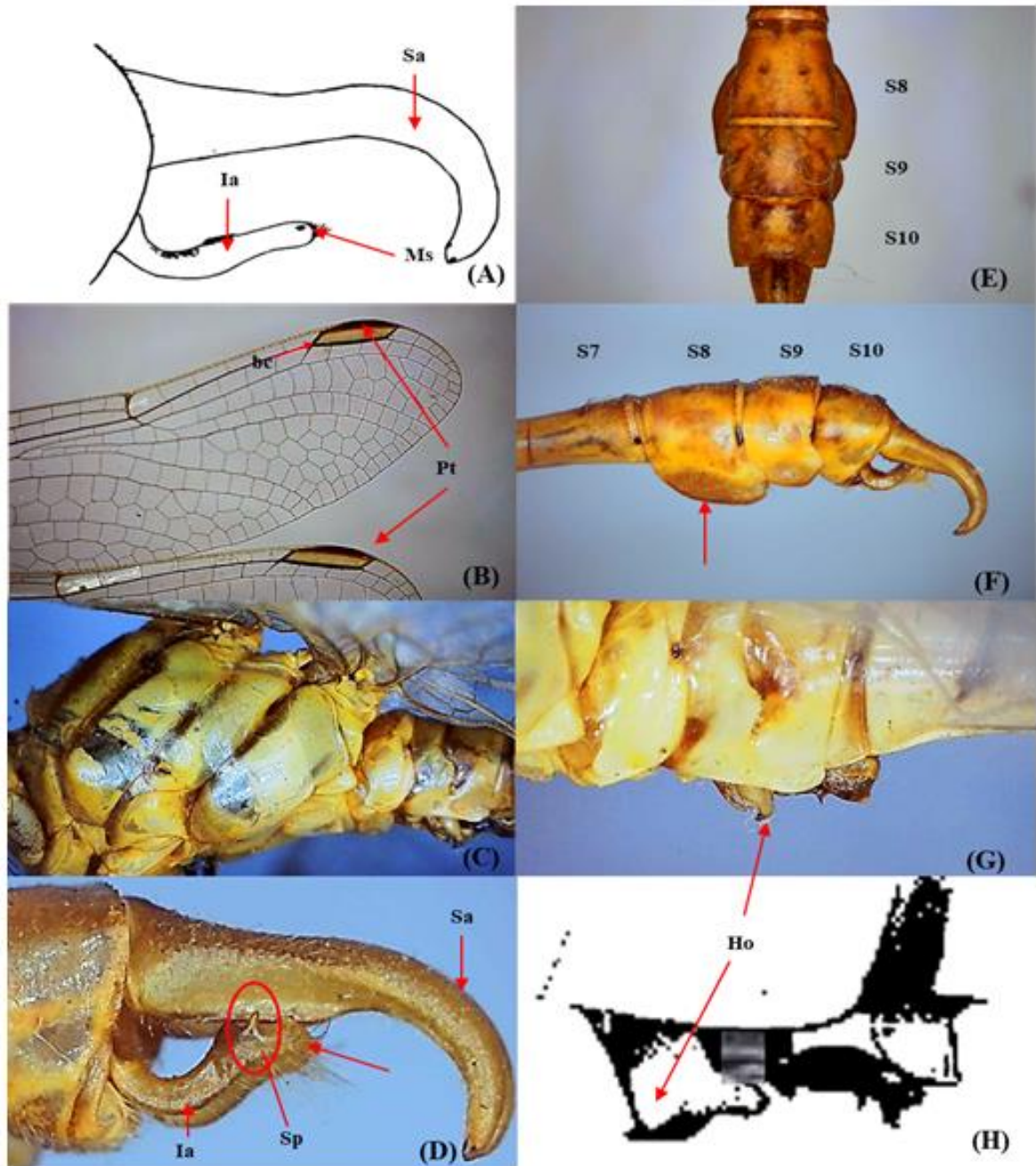
**Type species:** *Gomphus cognatus* Rambur, 1842: Ins. Nev.:137.

**Diagnosis:** Triangles and hyper triangles free of cross veins, the anal loop of hindwing absent, anterior median vein (MA) and first anal vein (IA) diverging at the level of nodus;

hind femur not reaching beyond the base of abdominal segment 2; abdomen with clubbed end, lateral margin of 8<sup>th</sup> and 9<sup>th</sup> foliate, females vulvar scale (8<sup>th</sup> segment) short and broad.

**Key to Egyptian Species of Genus *Paragomphus*:**

1. Pterostigma brown, thorax marked heavily with complete dark blackish or brown stripes laterally, male inferior anal appendages distinctly separated from superior anal appendages (Fig.1-A), with black spot-on mediolateral side ..... *P. sinaiticus* Morton
- Pterostigma pale yellow (Fig.1-B), thorax without complete stripes (Fig.1-C), male inferior anal appendages closely attached to superior anal appendages, without mediolateral spot (Fig.1-D) ..... **2**
2. Abdominal segments 8 and 9 pale brown (Fig.1-E), male foliation pale bordered (Fig.1-F), inferior anal appendages with a lateral spine (Fig. 1-D), lobe of hamule hook-shape (Fig.1-G) ..... *P. pumilio* (Rambur)
- Abdominal segments 8 and 9 dark brown, male foliation dark bordered, inferior anal appendages without lateral spine, lobe of hamule rectangular with truncated apex (Fig.1-H) ..... *P. genei* (Selys).



**Fig. 1.** (A-H). **A.** lateral view of 10<sup>th</sup> abdominal segments of *Paragomphus sinaiticus* showing inferior, superior anal appendages & mediolateral spot; **B-G:** *Paragomphus pumilio*; **B.** close up of tip of wings, **C.** lateral view of synthorax, **D.** lateral view of 10<sup>th</sup> abdominal segments showing length of inferior anal appendages & spine, **E.** dorsal view of the 8<sup>th</sup> and 9<sup>th</sup> abdominal segments, **F.** lateral view of 8<sup>th</sup> abdominal segments showing foliations, **G.** Second abdominal segment, lateral view, showing male 2<sup>nd</sup> genitalia, **H.** Second abdominal segment, lateral view, of *Paragomphus genei* showing male 2<sup>nd</sup> genitalia, after Dijkstra (2020). **Abbreviations:** **bc:** brace vein, **Ho:** hook of hamule, **Ia:** inferior anal appendages, **MS:** mediolateral spot, **Pt:** pterostigma, **S7, S8, S9, and S10:** abdominal segments 7, 8, 9 and 10, **Sa:** superior anal appendages, **Sp:** spine.

***Paragomphus genei* (Selys, 1841)**

*Gomphus genei* Selys, 1841: Rev. Zool. Soc. Cuvier.4, 243:246

*Onychogomphus hagenii* Selys, 1871: Ann. Soc. Entomo. Belg. 14, 9:20

*Mesogomphus bitarsatus* Förster, 1906: Jahrb. Nass. Vere. Natur. 59, 301:344

**Type locality:** Italy (Ghiliani, Sicily).

**Diagnosis:**

**Length:** Body: 37-50 mm, Hind wing: 21-26 mm., Abdomen: 30-36 mm.

Female with a row of small black denticles on the rear of occiput; superior anal appendages slender, at least one-half times the length of segment 10, apices of superior anal appendages parallel dorsally, inferior anal appendages almost as long as or longer than segment 10, not so strongly curved upwards.

**Remark:**

• *Paragomphus genei* is not represented in Egyptian collections. The species is recorded in the Egyptian fauna according to Selys (1887), Ris (1912) and Shoukry (1979). The diagnosis was written according to the original description by Selys (1841).

**World Distribution:** Algeria; Angola; Benin; Botswana; Burkina Faso; Cameroon; Central African Republic; Chad; Comoros; Congo; Côte d'Ivoire; Ethiopia; Ghana; Italy; Jordan; Kenya; Lebanon; Liberia; Malawi; Mali; Morocco; Mozambique; Namibia; Nigeria; Oman; Palestine, Occupied; Portugal; Saudi Arabia; Sierra Leone; Somalia; South Africa (Eastern Cape Province, Gauteng, KwaZulu-Natal, Limpopo Province, Mpumalanga, Northern Cape Province; Spain; Sudan; Syrian Arab Republic; Tanzania; Togo; Tunisia; Uganda; United Arab Emirates; Yemen; Zambia; Zimbabwe.

***Paragomphus pumilio* (Rambur, 1842)**

*Gomphus pumilio* Rambur, 1842: Hist. Nat. des Insec xvii, :534.

**Type Locality:** Egypt.

**Diagnosis:**

**Length:** Body: males 35 - 40 mm., females 35 - 42 mm.

Hind Wing: males 20 - 23 mm., females 22 - 24 mm.

Abdomen: males: 26 - 29 mm., female: 26 - 30 mm.

Male thorax green colour; forewing antenodals 12, hindwing antenodals 9; legs with black spines, fore and mid tibiae with a trace of black lines, hind tibia internally black; male abdomen yellowish and slender, superior anal appendages slender, at least one-half times as long as segment 10, inferior anal appendages strongly curved downward with a bifid apex, almost as long as or longer than segment 10; females subgenital plate with a short medial cleft, anal appendages longer than segment 10, fine and pointed, pale yellow with black tips, vulvar scale somewhat less than one-half length of segment 9, almost triangular in outline.

**Material Examined:**

Bargash, 19.IX.1929 (1♂); Kafr hakim, 4.VII.1930 (1♀); W. Um Elek, 2.IX.1930 (1♀); Luxor, 3. VIII.1945 (2♂); Pyramids, 26.III.1951(1♂); Baraksh, 12. I.1952(1♀); Abukear, 21.IV.1952 (1♂); Pyramids, 20. V.1951 (2♀); Pyramids, 20.VII.1952 (2♀); Gebal Asfar, 21.VII.1952(1♀); Matrouh, VIII.1952 (1♂); Embaba, 13.VII.1953 (1♂). (ASUC).

Abu Rawash, 3.VII.1926 (1♂). (CUC).

Maadi, 16.IX.1912 (3); Ain Shams, 1.V.1914 (1); Helwan, 1.V.1914 (1); Birgash, 22.VI.1914 (1); Maadi, 1.VII.1914 (1); Maadi, 16.V.1915 (1); Cairo, 3.VIII.1917 (1); Ain Mousa, 27.IX.1917 (1); Samalut, 27.V.1918 (1), Abu Rawash, 5.VI.1920 (1); Maadi, 6.VIII.1920 (1); Aswan, 17.V.1921 (1); Luxor, 12.VI.1926 (1); Wadi Degla, 4.VII.1926 (1); Samalut, 23.VIII.1926 (1); Wadi Hoff, 27.V.1926 (1); Abu Rawash, 4.IV.1927 (1); Kafr Hakim, 5.IV.1927 (2); Kafr Hakim, 51.VI.1927 (1); Abu Rawash, 17.VII.1927 (1); Wadi El Nesour, 9.IV.1928 (1); Kirdasa, 11.VIII.1928 (1). (MAC)

**World Distribution:** Egypt; Kenya; Sudan.

***Paragomphus sinaiticus* (Morton, 1929)**

*Mesogomphus sinaiticus* Morton, 1929, Entomo. Mon. Mag. 65, 60:63.

**Type locality:** Sinai, Egypt.

**Diagnosis:**

**Length:** Hind wing males: 29 mm., females 31 mm.

Abdomen: males: 39 mm., female: 36 mm.

Cross veins under pterostigma 4; male abdomen with dark coloration, superior anal appendages slender, with 3-4 scattered blunt black teeth with pale apex; female abdominal segments 8-10 with scarcely dilated margins, anal appendages longer than 10<sup>th</sup> segment.

**Remark:**

- *Paragomphus sinaiticus* is not deposited in Egyptian collections. Measurements and diagnosis were taken after the original description by Morton (1929).

**World Distribution:** Egypt (Sinai); Niger; Oman; Saudi Arabia; Sudan; United Arab Emirates; Yemen (North Yemen).

**Family Macromiidae Needham, 1903**

Macromiidae Needham, 1903: Proc. U. S. natn Mus. 26:764.

Corduliidae (Kirby, 1890): Syn. Cat. Neurop. Odonata: 202.

Type genus: *Macromia* Rambur, 1842: Ins. Nevr. :137.

**Diagnosis:** Eyes meet for a distance; triangles in fore and hind wings dissimilar in shape, triangle in fore wing farther for a distance from arculus than the triangle in hind wing, most costal and subcostal crossveins in line, two primary antenodals absent, all antenodals of the same thickness, hind wing has three or more cubito anal cross veins, no brace vein behind proximal end of stigma; all tibiae with membranous keel on the flexor surface; ovipositor with vestigial lateral valves.

**Genus *Phyllomacromia* Selys, 1878**

*Macromia* Rambur, 1842: Hist. Nat. des Insec xvii, :534.

*Phyllomacromia* Selys, 1878: Bull. Acad. roy. Belg. Serie 2 45, 183:222.

**Type Species:** *Macromia trifasciata* Rambur, 1842: Ins. Nevr., :137.

**Diagnosis:** Legs brownish colour; wings hyaline, supratrangles crossed with 1-6 crossveins, sectors of arculus arising from the lower end of arculus, fused for distance, pterostigma longer than preceding cell, forewing antenodals 10, hindwing anal loop 4-9 cells, without midrib, with 2-8 anal crossing, membranule white; males' abdominal segment 8 with laterally projected foliations, superior anal appendages yellow, inferior anal appendages short, rectangular; female anal appendages short, black, and conical.

***Phyllomacromia africana* (Selys, 1871)**

*Macromia africana* Selys, 1871: Ann. Soc. Entomo. Belg. 14, 9:20.

**Type Locality:** Nubia, Egypt.

**Diagnosis:**

**Length:** Body: males: 43 mm., females: 52 mm.

Hind wing: males: 30 mm., females: 38 mm.

Abdomen: males: 32 mm., females: 31 mm.

Males face, vertex and occipital triangle at least partly pale; synthorax with 3 lateral stripes on each side; membranule thin; abdomen pale with markings on segments 3-6 usually extend onto apical halves, dorsum of segment 10 flat without cones, superior anal appendages yellow, usually paler than inferior anal appendage, border of hamule smoothly curved and narrows gradually towards hook; female wings without smokey faint amber tips.

**Material examined:**

Pyramids, 20.VII.1952 (1♀); Helwan, 27.V.1980 (1♂). (ASUC).

**World Distribution:** Chad, Congo, Egypt, Ghana, Malawi, Mali, Nigeria, Senegal, Sudan, Tanzania, Uganda.

## DISCUSSION

Field trips in 49 different localities within 11 Egyptian governorates (Alexandria, Aswan, Beni Suief, Cairo, Fayoum, Gharbia, Giza, Kafer El Sheikh, Qalyubia, Marsa Matrouh, South Sinai) were conducted in the period from October 2020 to July 2023 but no specimens from the two families were captured. In fact, Riservato *et al.* (2009) in their work on the status of Odonata of the Mediterranean basin listed four species as regionally extinct (according to the IUCN Red List classification system) one of them is *Phyllomacromia africana* (Selys, 1871) as it hasn't been collected since the beginning of the 20<sup>th</sup> century. In addition, Schneider and Schneider (2012) noted that *Phyllomacromia africana* (Selys) (family Macromiidae) and *Paragomphus pumilio* (Rambur) (family Gomphidae) hadn't been sighted and the former may have disappeared since its last report in Andrés (1928). This is in agreement with our results where no specimens were collected during the recent field trips. Pollution and loss of habitat may be the main reasons for these species' disappearance (Riservato *et al.* 2009). Otherwise, recently Fischer *et al.* (2019) collected *Paragomphus pumilio* (Rambur, 1842) from Lake Nasser for the first time in the last 35 year and thus more surveys in different localities and seasons is recommended to accurately determine the status of the species.

Also, Shoukry (1979) synonymized the three species *Onychogomphus genei* *O. costae* Selys, 1885 and *O. lefebvrii* (Rambur, 1842) to *O. hagenii*. The former species is currently synonyms to *Paragomphus genei* according to the World List of Odonata (Paulson *et al.* 2023) and the World Catalogue of Odonata (Steinmann 2013). The latter two species are valid names, but *O. costae* Selys, 1885 is not represented in our fauna as it was not mentioned in the previous works by Selys (1887), Navás (1909), Ris (1912), Andrés (1928), Kimmins (1950), Dumont (1980), Boudot *et al.* (2009), Dijkstra and Boudot (2010) and IUCN (2023). *Onychogomphus lefebvrii* (Rambur, 1842) was mentioned in the list of Selys (1887) without designated locality and it is not yet collected from Egyptian fauna, thus its presence is still uncertain (Dijkstra, 2023). All these species are not represented in our collections and have not been collected since their first record in Egypt.

In this work, the presence of *Lindenia tetraphylla* in our fauna is considered doubtful where Schorr *et al.* (1998) in their review on the species assured that Selys (1887) in his list mentioned the presence of the species in Egypt without any specific locality. In addition, both Andrés (1928) and Dumont (1980) didn't confirm its presence in the Egyptian fauna.

As a result of the previous data, the Egyptian fauna of the family Gomphidae comprises three species within the genus *Paragomphus* Cowley (*P. genei*, *P. pumilio* and *P. sinaiticus*). About Macromiidae, only one species *Phyllomacromia africana* is recorded.

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