

**TAXONOMIC AND PHYLOGENETIC
STUDIES
ON FAMILY: TABANIDAE
(DIPTERA: BRACHYCERA)
IN EGYPT**



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By

Gawhara Magdy Mohammad Abu El-Hassan Ramadan

B.Sc.

Supervisors

Prof. Dr. Salwa Kamal Mohammad, Professor of Insect Taxonomy, Entomology Department, Faculty of Science, Ain Shams University.

Prof. Dr. Hassan Hamadna Allah Fadi, Professor of Insect Taxonomy, Entomology Department, Faculty of Science, Ain Shams University.

Dr. Haitham Badrawy Mosa, Lecturer, Entomology Department, Faculty of Science, Ain Shams University.

Entomology Department

Faculty of Science

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مقدمة من الطالبة

جوهرة مجدى محمد أبو الحسن رمضان

بكالوريوس علوم

لجنة الإشراف

أ.د. سلوى كمال محمد/ أستاذ علم تصنيف الحشرات بقسم علم
الحشرات - كلية العلوم - جامعة عين شمس
أ.د. حسن حمدنا الله فضل/ أستاذ علم تصنيف الحشرات بقسم علم
الحشرات - كلية العلوم - جامعة عين شمس
د. هيثم بدراوى موسى / مدرس علم الحشرات بقسم علم الحشرات
- كلية العلوم - جامعة عين شمس

قسم علم الحشرات

كلية العلوم

جامعة عين شمس

2011

Abstract

Name: Gawhara Magdy Mohammad Abu El-Hassan Ramadan

This work studied the morphology, taxonomy and phylogeny of the Egyptian tabanid taxa.

- A comprehensive colored atlas of tabanid morphology of 22 available species within 6 genera are provided including different plates of head, antennae, mouthparts, frontal patterns, wings, abdomens and genitalia. In addition, colored images of the habitus of the available species are included.

- A taxonomic review of Tabanidae including valid names, keys, diagnosis, synonyms and distributions for each species is given. Genus *Neavella* Oldroyd is recorded for the first time from Palaearctic region (Egypt). Also, herein two new species (*Neavella silvioides* and *Atylotus shagrensis*) are described. In addition, four species (*Tabanus arenivagus* Austen, *T. leucostomus* Loew, *Neavella albipectus* (Bigot) and *Chrysops flavipes* Meigen) are recorded from Egypt for the first time.

- Phylogeny based on cladistic analysis "at the specific and generic levels" of Tabanidae is conducted using 22 available taxa based on morphological characters to provide a phylogenetic frame work and to understand the relationships among these tabanids.

Key words: Taxonomy, morphology, phylogeny, cladistic analysis, Tabanidae, distribution, Egypt.

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I. INTRODUCTION

Tabanidae (horse flies, deer flies and clegs) is a cosmopolitan family belongs to the superfamily Tabanoidea, suborder Brachycera, and comprises about 4400 world-wide species within 144 genera. They are important in medical and veterinary significance [Colless & McAlpine, 1991; Kettle, 1992; Erdogmus, 2005 and Evenhuis *et al.*, 2008].

The members of this family are medium to large sized, stout built and broad flattened in shape with large head. They are usually black, grey or brown and often colored in orange or yellow; antennae stylate, flagellum with 3-8 flagellomeres; costal vein extending all around the wing margin and R₄ & R₅ forming a very wide fork on apical margin; tarsi with pad-like empodium [Axtell, 1976 and Scudder & Cannings, 2006].

Tabanids are the largest blood-sucking flies. Adults feed during full day light; both sexes feed on nectar as energy supply while only females are telmophages (cut through the skin of a host and feed from a pool of blood), taking frequent and rapid blood meals (a protein source necessary for egg development) from many different hosts such as horses, cattle, dogs or deer. The intermittent method of feeding of these flies leads to the loss of blood and greatly enhances the possibility of the mechanical transmission of diseases, such as Surra,

Anthrax, and Tulerimia. Some tabanids can biologically transmit diseases such as Loaiasis and Elaeophorosis. Human may be attacked when animal hosts are not available [Pechuman, 1972; Kazimirova *et al.*, 2002 and Mullens, 2009].

Tabanid flies are strong fliers and capable of flying over 50 Km. They are common in the warmer months and found with greatest numbers along the marshes and streams. Eggs of horse flies are deposited in masses covered with a jelly like material on leaves, rocks, debris or foliage near the water edges or in moist areas. The larvae drop to the surface of the water or burrow into the wet soil, and then they feed on small animals or sometimes cannibalism each others. When the larvae complete their development, they move into drier earth for pupation [Hays, 1956 and Triplehorn & Johnson, 2005].

Despite most studies in different parts of the world deal with taxonomy and distribution of horse flies, it is poorly known in the Middle East [Al Dhafer *et al.*, 2009]. In Egypt, no comprehensive work on the taxonomy has been produced since Efflatoun (1930) who recorded fifteen species within two genera of tabanid flies in his monograph of Tabanidae. In (1967), Styescal and El-Bialy listed 64 families of order Diptera including 30 species and one variety under four genera of Tabanidae. Lastly, Ahmed in his work on blood sucking

flies (1991) recorded only 15 tabanid species within four genera. Accordingly, this study is planned to revise, update and clarify the taxonomic status of the tabanid subfamilies, genera and species.

Also, this work includes the application of cladistic taxonomy as one of the current trends in the phylogenetic studies to clarify the uncertainties in Linnaean systematics and to solve the problems of classification as well as to investigate the ranking of different taxa.

Cladistic is a method of hypothesizing relationships among group of organisms based on the principle of shared derived characters, called synapomorphies. It is originated in the work of the German entomologist Willi Hennig (1966), who referred to it as "phylogenetic systematic", and it is applied in the field of biological systematic. It has been used in the classification of different insect orders such as Coleoptera, Phthiraptera, Diptera, Orthoptera, Heteroptera and Hymenoptera [Liebherr & Zimmerman, 1998; Smith, 2001; Badrawy, 2006; Song & Wenzel, 2008; Weirauch, 2008; Ohl & Spahn, 2010].

In fact, the modern phylogenetic based revisionary taxonomic work of Tabanidae has lagged behind other dipteran groups and a little is known about this group world-

wide and no recent global monographic coverage (Mackerras, *et al.*, 2008).

This work applied the cladistic method to use taxa and clade side by side to yield a taxonomy that unambiguously places problematic groups in the evolutionary tree in a way that is consistent or not consistent with current knowledge in conventional taxonomy.

The present work aims to study the following points:

- 1- Collection of the tabanid flies from different localities in Egypt.
- 2- Identification of the collected specimens and those preserved in the main Egyptian Reference Collections.
- 3- Taxonomic review of all taxa according to the recent taxonomic status tracing changes of names, synonyms and diagnosis.
- 4- Morphological studies of the most available species to determine the main phenotypic features of the family.
- 5- Constructing keys with illustrations of Egyptian genera and species of the family.
- 6- Choosing and coding the morphological characters.
- 7- Determining the degree of affinities and similarities between different family taxa using the cladistic method.
- 8- Constructing a cladogram to document the cladistic relationships between the family members.

II. LITERATURE REVIEW

II.1- Morphological and taxonomic studies:

Latreille (1811) described *Pangonius fasciatus* as a new species of family Tabanidae from Egypt.

Loew (1858) gave the descriptions of 43 species of genus *Tabanus* Linnaeus from Europe including 14 new species; one of them (*T. pulchellus*) is represented in the Egyptian fauna.

Loew (1860) diagnosed the three genera (*Pangonius* Latreille, *Chrysops* Meigen and *Tabanus* Linnaeus) of family Tabanidae and described three new tabanid species.

Jaennicke (1865) studied 44 species of European Tabanidae and gave short diagnoses to all species including *Tabanus autumnalis* Linnaeus.

Jaennicke (1867) in his work "Neue exotische Dipteren", described 133 new species which belonging to 14 families of order Diptera including 9 tabanid species.

Walker (1871) listed the species of order Diptera which were collected from Egypt and Saudi Arabia. He described six new tabanid species two of them collected from Sinai (Egypt) (*Tabanus terminalis* and *T. pallescence*).

Bezzi (1903) catalogued the Diptera of the Palaearctic region and divided the family Tabanidae into two subfamilies (Pangoniinae & Tabaninae), seven genera and 203 species; among them 11 species within two genera (*Tabanus* Linnaeus and *Atylotus* Osten-Sacken) were recorded in Egypt. He provided the synonyms and geographical distribution for each species.

Hine (1904) revised the tabanids from Western United States and Canada. The author gave the keys to five genera and 67 species.

Lundbeck (1907) reported the main characters of the family Tabanidae in Denmark. He separated the family into two subfamilies including five genera and 30 species. Also, the author constructed the keys to all taxa and diagnosed all genera including the three genera *Chrysops* Meigen, *Haematopota* Meigen and *Tabanus* Linnaeus.

Kertész (1908) presented a world catalogue of the Diptera and divided the family Tabanidae into two subfamilies (Pangoniinae & Tabaninae), 33 genera and 1415 species. He gave the synonyms and geographical distribution to each species and mentioned that eight species are represented in the Egyptian fauna.

Surcouf (1909) summarized the morphology and the biology of family Tabanidae from Africa and divided 176 species of genus *Tabanus* Linnaeus into 17 species-groups. Keys, descriptions and drawings were given for all species of the genus.

Verrall (1909) studied the brachyceran flies of Great Britain including family Tabanidae. He classified the family into two subfamilies, constructing keys to subfamilies, genera and species referring to the synonyms of each species. The author diagnosed the three genera [*Chrysops* Meigen (subfamily Pangoniinae) and *Tabanus* Linnaeus & *Haematopota* Meigen (subfamily Tabaninae)] and described 25 species including *Tabanus autumnalis* Linnaeus. In addition, he gave the important morphological terms of the wing venation and stated that the presence or absence of R₄

appendix is not important morphological character at the species level.

Austen (1911a) described two new tabanid species; *Tabanus mordax* and *T. camelarius* which were collected from Khor Arbat, Anglo-Egyptian Sudan.

Austen (1911b) described another new tabanid species; *Tabanus kingi* from Khor Arbat, Anglo-Egyptian Sudan.

Szilády (1915) designated *Ochrops* as a new subgenus of the genus *Tabanus* Linnaeus depending on four new species (*T. (O.) austeni*, *T. (O.) farinosus*, *T. (O.) karybenthinus* & *T. (O.) miser*) and after that he placed the two species (*Tabanus agrestis* Wiedemann, 1828 & *T. agricola* Wiedemann, 1828) under the new subgenus. The author figured the antennae, palpi, head and the abdominal patterns of the six species.

The same author in (1917) revised 36 species of genus *Chrysops* Meigen from the Palaearctic region and provided the diagnoses and drawings of wing venation, frontal view of head as well as eyes and abdominal patterns for all species.