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TAXONOMIC KEY TO THE EGYPTIAN GENERA AND SPECIES OF SAP BEETLES (CARPOPHILINAE: NITIDULIDAE: COLEOPTERA)

Wedad A. Atwa, Manal E.A.El-Shaier* and Hala M.K.

Zoology and Entomology Department, Faculty of Science, Al-Azhar University (Girls)
* Corresponding Author: manalgalhoum@yahoo.com and manalgalhoum@alazhar.edu.eg

ABSTRACT

Despite the importance of family Nititulidae, in Egypt received scarce taxonomic studies. Subfamily Carpophilinae is represented in Egypt by nine species within two genera Carpophilus (eight species) and Urophorus (one species). The study starts by reviewing the main Egyptian insect collections for target species. To recognizing and facilitate the identification of the member of this subfamily, a taxonomic key to the genera and species is presented together with diagnostic characters of the family and the subfamily. The key based the morphological characters of adults obtained from the preserved materials as well as collected specimens. Habitus figures is also provided for each species.

Keywords: *Taxonomic key, Nitidulidae, Carpophilinae, Carpophilus, Urophorus, Egypt.*

INTRODUCTION

Family Nitidulidae (commonly known as sap beetles) is one of the most diverse group of beetles, belonging to the superfamily Cucujoidea, suborder Polyphaga. It is includes about 230 genera and more than 3000 species worldwide, widely distributed in all zoogeographical regions of the world **[1]**. In Egypt, the family is represented by 29 species within 12 genera **[2].** Recently, **[3]** classified Nitidulidae in four subfamilies (Carpophilinae, Cryptarchinae, Meligethinae and Nitidulinae).

Nitidulidae are widely diverse and exhibit a broad spectrum of feeding habits [**4**]**.** Most species are associated with decaying or fermenting materials and some species are found on sap-flowers or fermenting wounds on trees, hence the common name sap-beetle **[6].** The diversity displayed in nitidulid beetles is reflected in the many examples of novel morphological adaptations and large shifts in general body plan **[5]**. Many species of Nitidulidae recorded by **[7]** as stored products in Canada but concluded that most are of little economic significance because they appear in foods after decomposition has already started. Nititulids are widespread in the intertropical and temperate regions of Africa, Mediterranean basin and in most of the Macaronesian area including Egypt **[8].**

The systematics of the family Nitidulidae has been greatly changed by efforts of many students and essentially improved during the last 20-30 years **[9]**. However, no publications treated a general view on the system of this family. Recently, **[10]** presented Nitidulidae in the Palaearctic "catalogue". Some important aspects of the system of this group are still needed to be considered.

The classifications of the subfamily Carpophilinae are in a continuous state of change. Polyphyly was recognized by **[11]** and he reclassified carpophiline genera into a new subfamily, namely Cillaeinae.

Genus *Carpophilus* Stephens, 1830 is a comparatively large genus inhabiting mainly the Eastern hemisphere **[12]**. This genus can be easily diagnosed by its shortened elytra exposing two abdominal tergites with all uncovered tergites heavily sclerotised. The current subgeneric divisions are not quite convincing as of yet **[10]** and **[11].** The genus requires intensive attention of the taxonomists and a comprehensive revision **[13]**.

Molecular analysis of *Carpophilus* species of the Pacific islands carried out by [**14**] and resolved confusions about delimitation of several existing species. Some of the species are very similar and they are rather difficult to diagnose them externally.

The present work aims to contribute in enriching the taxonomic knowledge about the members of subfamily Carpophilinae as well as to facilitate their identification.

MATERIAL AND METHODS

The present study is based on all records of the species of the subfamily Carpophilinae in Egypt, whether in literature or in the main reference insect collections in Egypt. These collections are: the collection of the Ministry of Agriculture, Plant Protection Research Institute; Collection of Alfieri, Al-Azhar University, Faculty of Agriculture; Collection of Egyptian Entomological Society, Collection of the Faculty of Science, Cairo University and the Collection of the Faculty of Science, Ain Shams University. Recent taxonomic position is provided following **[3].**

RESULTS

Diagnosis of family Nititulidae after [15].

Sap beetles are small insects, characterized by: maxilla lacking galea; antennae typically 11-segmented,with a three-segmented club; antennal insertions moderately to broadly separated; subocular antennal grooves on ventral surface of head present; procoxae transverse with exposed trochanters; prosternum transverse with intercoxal process extending between procoxal cavities, procoxae always separated; typically five visible abdominal ventrites present; tarsal formula 5-5-5.

Diagnosis of Subfamily Carpophilinae Erichson, 1842 after [9].

Antennae consisting of three segments with a sharply differentiated club much more distinct. Pronotum with the hind margin simply and gently curved and the sides less rounded; Elytra shortened and appearing sheared-off at the tip, leaving the abdomen with two or three dorsal segments exposed and hind angles of pronotum more distinct. Subfamily Carpophilinae is represented in Egypt by 9 species within two genera *Urophorus* and *Carpophilus* according to recent researches

Urophorus have only one species namely ***humeralis*** (Fabricius, 1798); formerly placed in the genus *Carpophilus*, this species can be differentiated by having three abdominal tergites rather than two in ***Carpophilus*** **[3],[4]** and **[16]**.

Key to genera and species of subfamily Carpophilinae

1- The last three tergites of abdomen uncovered. (Fig.1)…… ***Urophorus*** **Murray,1864**
……..……***Urophorus humeralis*** **(Fabricius)**
- The last two tergites of abdomen uncovered…..***Carpophilus Stephens*****1830**….....2
2- Thorax considerably narrower in front than behind, its sides rounded….....3
- Thorax transversely subquadrate, not narrower, or not much narrower, in front than behind; sides subparallel, body subcylindrical ……..…….…….……6
3- Elytra bearing pale spots or markings……..…….....…….....4
- Elytra not bearing spots or markings body black, with convex elytra tinged more or less with purplish brown.(Fig.2)…….……..……..***Carpophilus obsoletus*** **Erichson**.
4- Marking on elytra consisting of a single spot or patch on each elytron. These marking sting of a central irregular spot that its posterior margin running obliquely outwards and forwards with the anterior and posterior sides not parallel, inner side smallest. (Fig.3)..... ***Carpophilus bifenestratus*** **Murray.**
- Marking on elytra consisting of more than a single spot or patch on each elytron 5
5 - Each elytron with a pale patch on the shoulder and another at the sutural apical angle.(Fig4)…….. ……..***Carpophilus quadrisignatus*** **Erichson**.
- Each elytron with a pale patch on the shoulder and the whole of the apex pale.(Fig.5)……..…. ……..……..……***Carpophilus hemipterus*** **Linnaeus.**
6- General colour more or less testaceous, subcylindrical, moderate in size, not so much punctate or pubescent, and without a dorsal line. Elytra slightly paler than thorax or abdomen, punctuation coarser. (Fig.6) .....***Carpophilus mutilatus*** **Erichson**.
- General colour brown, fuscous, dark brown or black. Elytra very short …….....……7
7- Whole colour is black.(Fig.7)……..…….... ***Carpophilus truncatus*** **Murray.**
- General colour fuscous, Coarsely pubescent. ……..…….……..…….……..……8
8- Last abdominal segments is rather long.(Fig.8)……..……..***Carpophilus dimidiatus*** **Fabricius**
Last abdominal segments is short.(Fig.9)…….…….. ***Carpophilus nepos*** **Murray.**

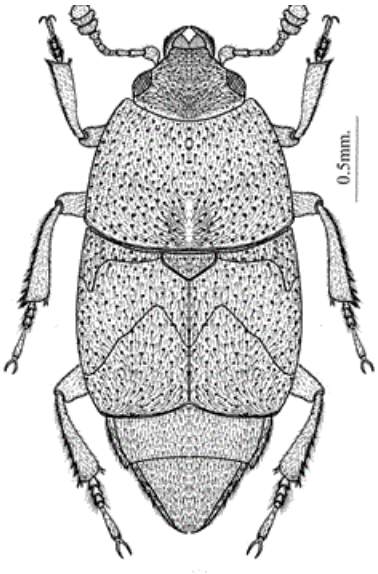

Fig.1. ***Urophorus humeralis*** **(Fabricius)**

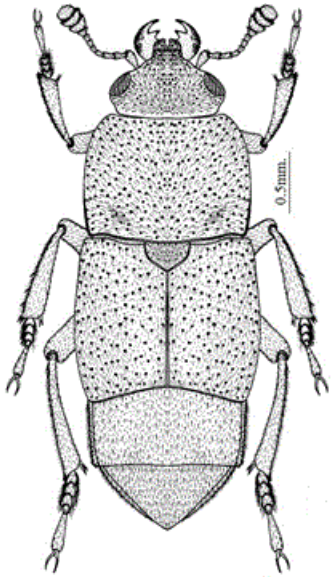

Fig.2. ***Carpophilus obsoletus*** **Erichson**

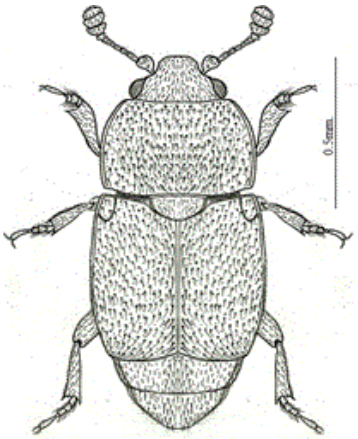

Fig.3. ***Carpophilus bifenestratus*** **Murray**

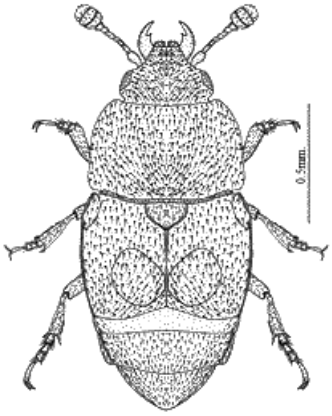

Fig.4.*Carpophilus quadrisignatus* **Erichson**

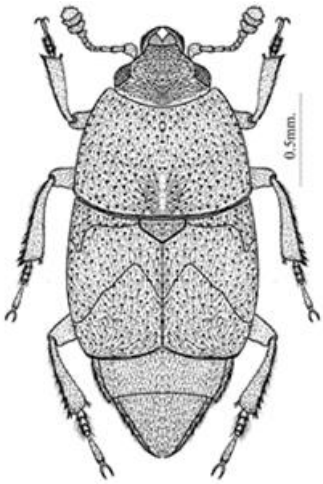

Fig.5. ***Carpophilus hemipterus*** **Linnaeus**

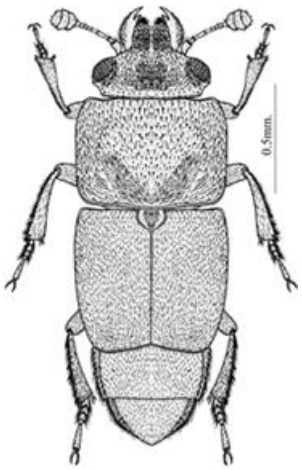

Fig.6 ***Carpophilus mutilatus*** **Erichson**

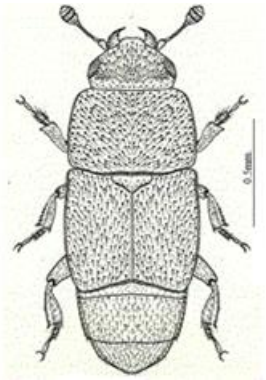

Fig.7. ***Carpophilus truncatus*** **Murray**

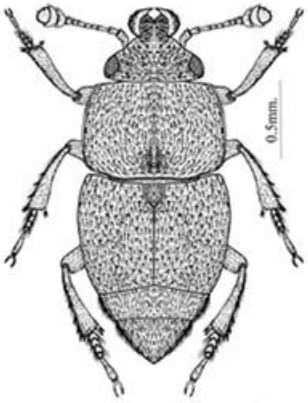

Fig.8. ***Carpophilus dimidiatus*** **Fabricius**

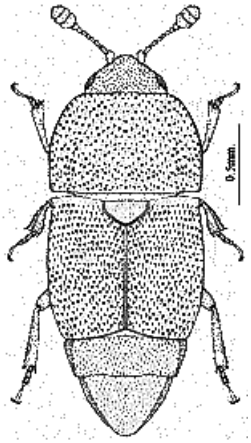

Fig.9. ***Carpophilus nepos*** **Murray**

DISCUSSION

Twelve genera of family Nitidulidae belonging to six subfamilies in Egypt namely: [Cateretinae (*Brachyleptus* and *Brachypterolus*); Meligethinae (*Pria* and *Meligethes*); Nitidulinae (*Nitidula – Oturovana – Anister* and *Xenostrongylus*); Carpophilinae (*Carpophilus*); Cryptarchinae (*Cryptarcha*) and Cybocephalinae (*Cybocephalus* and *Dissia*)] are recorded by **[2]**.

Alfieri's conclusion agreed with **[10]** except in canceling subfamily Cateretinae and genus *Dissia* from the Egyptian list and added genus *Urophorus* (Carpophilinae) and *Aethina* (Nitidulinae).

The present study adopted **[10]** and **[18]** classification and treated eight species of genus *Carpophilus* and single species of genus *Urophorus*.

The species within subfamily Carpophilinae are morphologically similar,**[17**] in her study about species of genera *Carpophilus* and *Haptoncus*, concluded that, the gradation of the characters of one species into those of another is so nearly continuous and she was tempted to think of them as merely phenotypes of the same species. The author suggested that, the solution of such problems requires more laboratory investigations. The present study suggests applying modern taxonomic approaches (e.g. molecular and biochemical approaches) to confirm the taxonomic status of the categories within the subfamily.

Semocarpolus was created by **[9]** as a new subgenus within genus *Parapocadius* and he stated that the new subgenus is seems to be close to genus *Carpophilus* and only differs in having very shallow and indistinct punctures on mesoventrite, a raised median carina of the mesoventrite, almost rectilinear submesocoxal line and undivided fork-sclerite of tegmen.

The present study suggested more future work to confirm or update the classification of subfamily Carpophinae of Egypt and apply different taxonomic characters in addition to the external morphology.

DEDICATION

We express our appreciation to the late Prof. Dr. Ashraf El-Torkey, whose contribution to this work was of great significance. He is among the great pioneer scientists in the field of taxonomy. We express our respect and gratitude for his parental, scientific and moral support. We pray to God to grant him his mercy, may Allah bless his soul, forgive him, make his grave a garden of Paradise and grant him the highest levels of heaven….. Ameen“

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الملخص العربي

مفتاح تصنيفي للأجناس والأنواع التابعة لتحت فصيلة Carpophilinae في مصر

منال السيد الشاعر[1]، وداد احمد عطوه[1]، هاله محي قداده

قسم الحيوان و علم الحشرات ، كلية العلوم فرع البنات ، جامعة الازهر ، القاهرة

فصيلة Nititulidae من الفصائل ذات الاهمية الاقتصادية في العالم حيث تتغذي أفراد هذه الفصيلة علي الخضراوات والفاكهة المتحللة وعلي الفاكهة المجففة والمواد المخزونة و العصارات النباتية وهناك القليل منها والتي تعتبر افات, ولكن لم يحظ افراد تلك الفصيلة بالاهتمام التصنيفي المطلوب في مصر. وقد تم في العمل الحالي تسجيل تسعة أنواع من تحت هذه الفصيلة تندرج تحت جنسين (ثمانية تنتمي لجنس Carpophilus و نوع ينتمي لجنس Urophorus).

استهدفت الدراسة الحالية عمل مفتاح تصنيفي يضم الانواع الموجودة بهذه الفصيلة للمساهمة في تسهيل التعرف عليها وكذلك ذكر الصفات التشخيصية للفصيلة وتحت الفصيلة.

وكذلك الانواع التابعة لتحت الفصيلة Carpophilinae موضوع هذا البحث وهي الاكثر انتشارا و التي تسبب اضرارا للعديد من الفاكهة في العالم.