Proposal of a new subfamily Apphianinae subfam. nov. of the family Dermestidae (Coleoptera: Bostrichiformia)

Jiří HÁVA

Private Entomological Laboratory & Collection,
Ryznerova 37/37, CZ-252 62 Únětice u Prahy, Prague-west, Czech Republic
e-mail: jh.dermestidae@volny.cz

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Abstract. A new subfamily Apphianinae of the family Dermestidae (Coleoptera) is described and compared with all known Dermestidae subfamilies. The new subfamily can be identified by the first visible abdominal ventrite, which is divided basally by the hind coxae. Key are provided for adults of the Dermestidae subfamilies.

INTRODUCTION

The family Dermestidae Latreille, 1804 (Insecta, Coleoptera) represents a group of mostly necrophagic, erophilic beetles which scavenge on dried, protein-rich materials, such as dried fish, meat or hides (Peacock 1993, Zhantiev 2009), belongs to superfamily Bostrichoidea (Zhang et al. 2018, Beutel et al. 2019, McKenna et al. 2019) and currently contains about 1905 species and subspecies worldwide (Háva 2015, 2024).

The age of the family fits into the Middle Jurassic and Cretaceous periods (McKenna et al. 2019). The oldest species are known from the Middle Jurassic period (Deng et al. 2017), and from Lower Cretaceous Lebanese amber (Kirejtshuk et al. 2009).

According to Lawrence & Newton (1995), Lawrence et. al. (1999a, b), Zhantiev (2000), Háva (2003e) and Háva (2004h), the cladistic-based analysis of higher categories within the family Dermestidae suggest that only four subfamilies should be recognized: Dermestinae (including Marioutinae and Thorictinae), Trinodinae, Orphilinae and Megatominae (including Attageninae and Thylodriadinae).

According to Lawrence & Ślipiński (2005), Kiselyova & McHugh (2006), Bouchard et al. (2011), Háva (2015e) the cladistic-based analysis of higher categories within the family Dermestidae suggest that six subfamilies should be recognized: Dermestinae (including Marioutinae), Thorictinae, Trinodinae (including Thylodriinae), Orphilinae, Attageninae and Megatominae.

According to Motyka et al. (2022) the cladistic-based analysis of higher categories within the family Dermestidae suggest that six subfamilies should be recognized: Dermestinae, Thorictinae, Trinodinae, Orphilinae, Attageninae and Megatominae.

According to Zhou et al. (2022) the cladistic-based analysis of higher categories within the family Dermestidae suggest that six subfamilies should be recognized: Dermestinae (including Thorictinae), Trinodinae, Orphilinae, Attageninae, Trogoparvinae and Megatominae. The present article follows Zhou et. al. (2022) except for the synonymy of the subfamily Thorictinae.

A new subfamily Apphianinae of the family Dermestidae (Coleoptera) is here described and compared with all known subfamilies. The new subfamily can be identified by the first visible abdominal ventrite, which is divided basally by the hind coxae.

TAXONOMY

Family Dermestidae Latreille, 1804

Subfamily Apphianinae subfam. nov.

= Apphianini Háva in Zahradník & Háva, 2014: 313 (as tribe).

Type genus: *Apphianus* Beal, 2005.

Diagnosis. The character clearly distinguishing this subfamily from all other known Dermestids is the structure of the first visible abdominal ventrite, which is divided basally by the hind coxae (Beal 2005, Háva in Zahradník & Háva 2014).

1 (2) First visible abdominal ventrite divided basally by the hind coxae (Figs. 3, 7a) .... Apphianinae **subfam. nov.**
2 (1) First visible abdominal ventrite is not divided basally by the hind coxae (Figs. 9-11)
3 (6) Head without median ocellus
4 (5) Hind coxa contiguous, transverse, with coxal plate, body size 6-11 mm ..... Dermestinae
5 (4) Hind coxa spherical, without coxal plate, body size 1.3-2.5 mm ..... Thorictinae
6 (3) Head with median ocellus
7 (8) Prosternum not forming a „collar", therefore mouth-parts free ..... Attageninae
8 (7) Prosternum forming a „collar", under which mouth-parts fit when head is retracted
9 (10) Pronotum with strong raised ridge near side margin on basal half ..... Trinodinae
10 (9) Pronotum without strong raised ridge near side margin on basal half
11 (12) Metaxocal lamina extending to side of body; hind coxa transverse, contiguous, lateral margins reaching to sides of body ..... Orphilinae
12 (11) Metacoxal lamina not extending to side of body; hind coxa transverse, less frequently, conical, separated
13 (14) Antennae with 2-10-antennomered club, pronotal fossa closed or opened, prosternum forming "collar", metaventrite with or without postcoxal lines, andomen with five freely articulated ventrites, first and second tarsomeres of hind tarsi not subequal ..... Megatominae
14 (13) Antennae with serrate to pectinate 5-6-antennomered club, pronotal fossa closed, prosternum forming "collar", metaventrite with postcoxal lines, abdomen with five freely articulated ventrites, first and second tarsomeres of hind tarsi subequal ..... Trogoparvinae

Etymology. The subfamily is named for the type genus *Apphianus* Beal, 2005.

Genus *Apphianus* Beal, 2005

Type species: *Apphianus yuccae* Beal, 2005 (by monotypy).

Species *Apphianus yuccae* Beal, 2005
(Figs. 1-8)

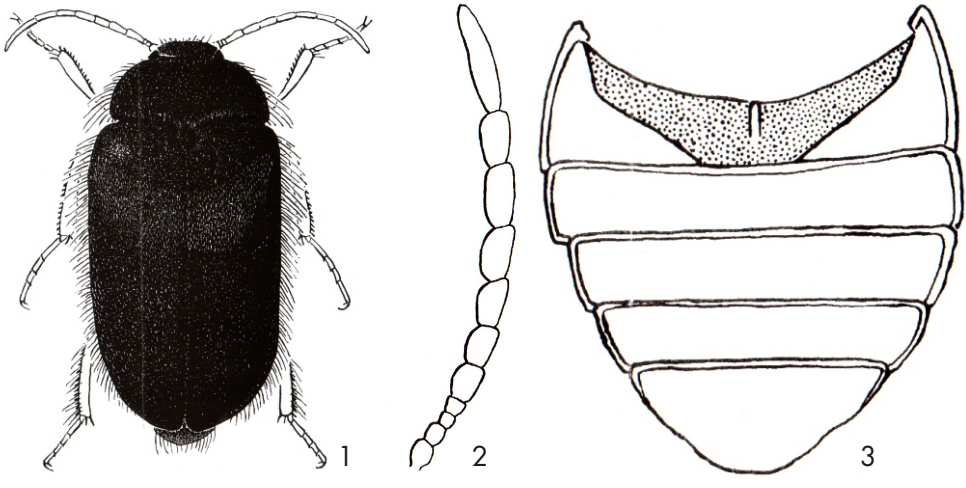
Apphianus yuccae Beal, 2005: 489.
Apphianus yuccae: Háva in Zahradník & Háva, 2014: 313.

Type material. Holotype (♂): Short Canyon, Kern Co., California, about 2 km west of junction of Highways 14 and 395, 3,300 feet elevation 35°71´N 117°90´W, taken in antifreeze pitfall trap, R. S. Beal, 30.iv.2002 to 27.i.2003. Holotype deposited in (CAS) California Academy of Sciences, San Francisco, U.S.A. Male genitalia missing.

Description. Original Beal´s description: "General facies as illustrated. Integument of dorsal and ventral surfaces dark brown. Dorsal setae short, recumbent, golden brown except for large,

subbasal area of short, golden, recumbent setae; some irregularly-spaced, suberect, golden setae present on posterior ″ of elytra, and long, golden, erect setae on lateral margins of pronotum and elytra; longest setae 0.38 mm in length; ventral surfaces densely covered with short, appressed, golden brown setae except on posterior lateral margins of abdominal sterna, where setae equal ½ length of segment. Head with frons nearly on same plate as dorsal surface of pronotum but fronto-clypeal region reflexed ventrad at about 90° angle at level of base of antennae. Labrum emarginate. Eyse not prominent; eye not projecting strongly from side of head. Antenna with 7-segmented club; terminal segment flat, leaflike. Median ocellus distinct. Scutellum visible, about 5/6 as long as antennal segment 10. Prosternum reduced; Lateral process in front of front coxae about as wide as length of segment 4 of antenna; prosternal process narrow becoming razor-thin between front coxae. Front coxae prominent and nearly contiguous at apices. Coxal cavities open behind. Hind coxae not quite contiguous, not immovably fused to metasternum, terminating at lateral margin of metasternum and not meeting epimeron. Dorsal margins and apex of tibiae armed with short, stout spines; hind tibia also with fine setae about 5x length of spines (subequal in engthto setae on margin of elytron). Abdomen with 5 externally visible sterna; visible sternum 1 divided by hind coxae. Morphological sternum 8 thinly sclerotized, without modifications except for small apical emargination. Terga IX and X as illustrated. Phallus (not figured) with bridge connecting lateral lobes not continuous at middle; base of aedeagus with short, broad apomedes. Length from head to apex of elytra: 3.03 mm (length of pronotum and elytra combined: 2.97 mm); width across humeri: 1.58 mm."

Distribution. Endemic species known only from U.S.A.: California.

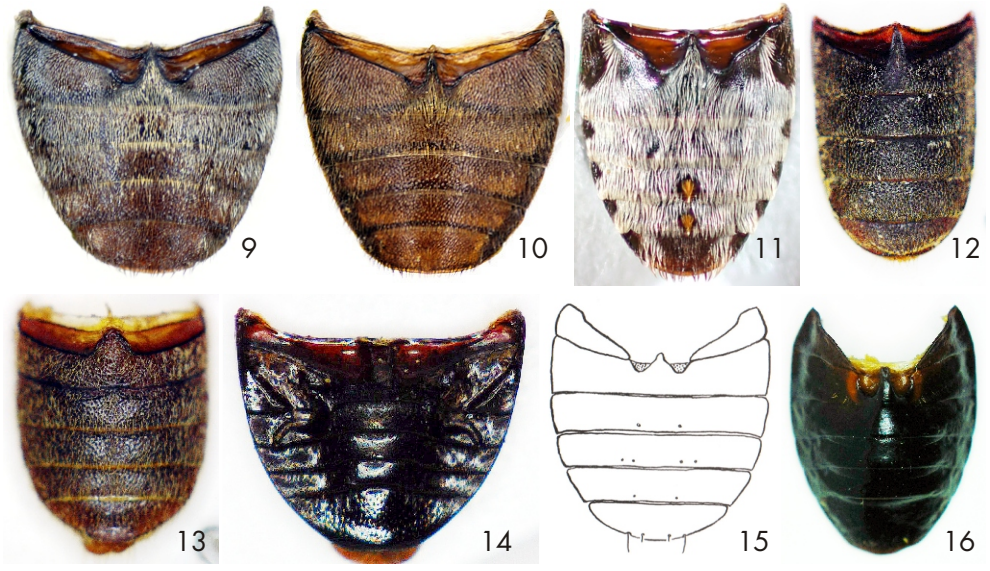


Figs. 1-3. *Apphianus yuccae* Beal, 2005 (holotype): 1- habitus, dorsal aspect; 2- antenna of male; 3- abdomen (all according to Beal 2005).

DISCUSSION

The Bostrichoidea (including Dermestidae, Ptinidae, Bostrichidae and Endecatomidae) is monophyletic and is the sister group to the Scarabaeoidea+Elateriformia according to Lawrence et al. (2011), and more recently according to Zhang et al. (2018) and McKenna et al. (2019). Bostrichoidea was strongly supported as the sister group of the hyperdiverse Cucujiformia series in all analyses. The character on the first visible abdominal ventrite is in the superfamily

Figs. 4-8. Holotype of *Apphianus yuccae* Beal, 2005: 4- habitus; 5- head, pronotum and antennae; 6- body lateraly; 7a,b- abdomen (in glue); 8a,b- labells.
(CASTYPE19135, https://monarch.calacademy.org/collections/list.php?taxa=Apphianus%20yuccae&thes=1&type=1&db=all&page=1)



Figs. 9-16. Abdomen: 9- *Attagenus* sp. (Dermestidae: Attageninae); 10- *Katkaenus* sp. (Dermestidae: Attageninae); 11- *Dermestes* sp. (Dermestidae: Dermestinae); 12- *Bostrichoplites* sp. (Bostrichidae); 13- *Clada* sp. (Ptinidae: Anobiinae); 14- *Nosodendron* sp. (Nosodendridae, Nosodendroidea); 15- *Bembidion* sp. (Carabidae, Adephaga); 16- *Carabus* sp. (Carabidae, Adephaga).

Bostrichoidea is very unusual and closely related to superfamily Adephaga, family Carabidae (Lawrence et al. 2011). The first abdominal ventrite continues beneath the coxae as a partially slightly sclerozized membrane. In Carabidae there is no membrane beneath the coxae connecting the two sides of the first abdominal ventrite (Figs. 15-16). The abdominal ventrites in

the families Dermestidae, Bostrichidae, Ptinidae and Nosodendridae (Figs. 9-14) are not divided basally by the hind coxae. The genus *Apphianus* externally resembles the dermestid genus Egidyella Reitter (tribe Egidyellini) but differs by the following characters: abdomen with 7 ventrites, first visible abdominal ventrite not divided basally by the hind coxae, antennal club with 6 or 7 antennomeres; genera belonging to the tribe Attagenini differ by the following characters: abdomen with 5 ventrites, first visible abdominal ventrite not divided basally by the hind coxae (Fig. 9), antennal club with 3 antennomeres. After personal communication with R. S. Beal (2008) regarding the systematic position of the species *Apphianus yuccae* it was decided to assign this species and genus from tribe Apphianini (Attageninae) to a new subfamily based on the described and depicted characters.

SUBFAMILIES AND TRIBAL DIVISION OF DERMESTIDAE

Superfamily **Bostrichoidea** Latreille, 1802

Dermestidae Latreille, 1804

Apphianinae subfam. nov.
Attageninae Laporte de Castelnau, 1840
  Attagenini Laporte de Castelnau, 1840
  †Cretodermestini Deng, Ślipiński, Ren & Pang, 2017
  †Eckfeldattagenini Háva, 2015
  Egidyellini Semenov-Tian-Shanskiy, 1914
Dermestinae Latreille, 1804
  Dermestini Latreille, 1804
  Marioutini Jacobson, 1913
  †Paradermestini Deng, Ślipiński, Ren & Pang, 2017
Megatominae Leach, 1815
  Anthrenini Gistel, 1848
  Megatomini Leach, 1815
Orphilinae LeConte, 1861
  Orphilini LeConte, 1861
  Ranolini Háva in Zahradník & Háva, 2014
Thorictinae Agassiz, 1846
  Thaumaphrastini Anderson, 1949
  Thorictini Agassiz, 1846
Trinodinae Casey, 1900
  †Cretonodini Kirejtshuk & Azar in Kirejtshuk et al., 2009
  Thylodriini Semenov-Tian-Shanskiy, 1909
  Trinodini Casey, 1900
  Trinoparvini Háva in Kirejtshuk, Háva & Nel, 2010
Trogoparvinae Zhou et al., 2022

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REFERENCES

BEAL R. S. 2005: A new genus and species of the tribe Attagenini (Coleoptera: Dermestidae) from the Mojave Desert of California. *The Coleopterists Bulletin* 59: 489-492.

Beutel R. G., Pohl H., Yan E.V., Anton E., Liu S-P., Ślipiński A., McKeena D. & Friedrich F. 2019: The phylogeny of Coleopteridae (Hexapoda) - morphological characters and molecular phylogenies. *Systematic Entomology* 44: 75-102.

Bouchard P., Bousquet Y., Davies A. E., Alonso-Zarazaga M. A. Lawrence J. F., Lyal Ch. H. C., Newton A. F., Reid Ch. A. M., Schmitt M., Ślipiński S. A. & Smith A. B. T. 2011: Family-group names in Coleoptera (Insecta). *ZooKeys* 88: 1-972.

Deng C., Ślipiński A., Ren D. & Pang H. 2017: The oldest Dermestid beetle from the Middle Jurassic of China (Coleoptera: Dermestidae). *Annales Zoologici* 67(1): 109-112.

Háva J. 2004: World keys to the genera and subgenera of Dermestidae (Coleoptera), with descriptions, nomenclature and distributional records. *Acta Musei Nationalis Pragae, Series B, Natural History* 60: 149-164.

Háva J. 2014: Dermestidae. In: Zahradník P. & Háva J.: Catalogue of the world genera and subgenera of the superfamilies Derodontoidea and Bostrichoidea (Coleoptera: Derodontiformia, Bostrichiformia). *Zootaxa* 3754(4): 301-352.

Háva J. 2015: *World Catalogue of Insects. Volume 13. Dermestidae (Coleoptera)*. Leiden/Boston: Brill, xxvi + 419 pp.

Háva J. 2024: *Dermestidae World (Coleoptera)*. - World Wide Web electronic publication (open in 2004): http://www.dermestidae.wz.cz (version 2018, update January 2024)

Kirejtshuk A. G., Azar D., Tafforeau P., Boistel R. & Fernandez V. 2009: New beetles of Polyphaga (Coleoptera, Polyphaga) from Lower Cretaceous Lebanese amber. *Denisia* 86: 119-130.

Kiselyova T. & McHugh J. 2006: A phylogenetic study of Dermestidae (Coleoptera) based on larval morphology. *Systematic Entomology* 31: 469-507.

Lawrence J. F. & Ślipiński A. 2005: Three new genera of Indo-Australian Dermestidae (Coleoptera) and their phylogenetic significance. *Invertebrate Systematics* 19: 231-261.

Lawrence J. F., Ślipiński A., Seago A. E., Thayer M. K., Newton A. F. & Marvaldi A. E. 2011: Phylogeny of the Coleoptera based on morphological characters of adults and larvae. *Annales Zoologici* 61(1): 1-217.

Liu Z., Zhou Yu-L., Szito A. & Ślipiński A. 2022: The Australian hide, larder and carpet beetles (Coleoptera: Dermestidae): A revision at the generic level. *Annales Zoologici* 72(4): 837-926.

McKenna D. D., Shin S., Ahrens D., Balke M., Beza-Beza C., Clarke D. J., Donath A., Escalona H. E., Friedrich F., Letsch H., Liu S., Maddison D., Mayer Ch., Misof B., Murin P. J., Niehuis O., Peters R. S., Podsiadlowski L., Pohl H., Scully E. D., Yan E. V., Zhou X., Ślipiński A. & Beutel R. G. 2019: The evolution and genomic basis of beetle diversity. *PNAS* 116(49): 24729-24737.

Motyka M., Kusy D., Háva J., Jahodářová E., Bílkova R., Vogler A. P. & Bocak L. 2022: Mitogenomic data elucidate the phylogeny and evolution of life strategies of Dermestidae (Coleoptera). *Systematic Entomology* 47(1): 82-93.

Peacock E. R. 1993: Adults and larvae of hide, larder and carpet beetles and their relatives (Coleoptera: Dermestidae) and of derodontid beetles (Coleoptera: Derodontidae). Handbooks for the identification of British Insects 5: 1-144.

Zhang S-Q., Che L-H., Li Y., Liang D., Pang H., Ślipiński A. & Zhang P. 2018: Evolutionary history of Coleoptera revealed by extensive sampling of genes and species. *Nature Communications* 9(205): 1-11.

Zhantiev R. D. 2009: Ekologija i klassifikacija zhukov-kozheedov (Coleoptera, Dermestidae) fauny Palearktiki. [Ecology and classification of dermestids (Coleoptera, Dermestidae) of the Palaearctic fauna.] *Zoologicheskiy Zhurnal* 88: 176-192 (in Russian, English summary).

Zhou Yu-L., Nicholls J. A., Liu Z-H., Hartley D., Szito A., Ślipiński A. & Zwick A. 2022: Molecular phylogeny of Dermestidae (Coleoptera) reveals the polyphyletic nature of *Trogoderma* Latreille and the taxonomic placement of the khapra beetle *Trogoderma granarium* Everts. *Insect Systematics and Diversity* 6(6): 1-24.

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