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Dung beetles (Coleoptera: Scarabaeidae: Aphodiinae) of the Mpala
Research Centre and environs, Laikipia District, Kenya

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Dung beetles (Coleoptera: Scarabaeidae: Aphodiinae) of the Mpala Research Centre and environs, Laikipia District, Kenya

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Abstract. The dung beetle fauna of the subfamily Aphodiinae occurring in the Laikipia District of Kenya was surveyed. In total, 14 genera and 29 species were found and these taxa are placed in identification keys. Known generic distributions are provided and species collection data listed.

Keywords: Aphodiinae, keys, dung preference, Kenya

Introduction

East Africa is home to one of the largest, most spectacular concentrations of large mammals, both herbivores and their carnivore predators, in the world. The immense amount of dung deposited by these animals forms a resource that supports great dung beetle diversity and biomass.

Dung beetles mostly belong to two subfamilies of Scarabaeidae, Aphodiinae and Scarabaeinae. The former subfamily is dealt with here; the Scarabaeinae will be treated in a subsequent publication.

The dung beetle fauna of Kenya is extremely rich and diverse but, as is true of most African countries, it is far from being well known. Although many specialists have dealt with the coprophagous Scarabaeidae of this region for almost two centuries, the knowledge of taxa of these two subfamilies is still largely incomplete from both systematical and zoogeographical viewpoints. For these reasons we consider it useful to compile a checklist of taxa found recently in central Kenya, and to propose some ecological considerations.

This study was undertaken as part of a collaborative effort between the Smithsonian Institution, Washington, DC (USNM), International Center of Insect Physiology and Ecology, Nairobi (ICIPE), and National Museums of Kenya (NMK), to inventory invertebrates at Mpala Research Centre. Field investigations of dung beetle diversity and habitat preference were conducted during two visits to Mpala Research Centre (MRC) by one of us (RDG) in 2001 (February) and 2002 (May), and by year round sampling conducted by Kadir Abdi, MRC staff, from April 2001 to April 2002. In addition, specimens were available to us from collections made by Scott Miller, Smithsonian Institution, and associates over period of years, and from a collection made by Trond Larsen, Princeton University, in January 2002. The area sampled consisted of MRC, the adjacent Mpala Ranch, and immediate surroundings.

Mpala Research Centre is a biological field station centered on 0.293° N, 36.899° E, and managed by the Kenya Wildlife Service, National Museums of Kenya, Princeton University, and the Smithsonian Institution (Miller and Lazell 2001). It is located 50 km north of the equator, northwest of Mount Kenya, in the semi-arid savanna of the Laikipia Plateau of central Kenya at 1650 m elevation.

Precipitation at MRC normally consists of heavy rains from April to July and light rains in October through November (Keesing 2000). Soil types consist of red, sandy soils; dark soils with a high clay content (“black cotton”); and narrow riverine strips that are a mixture of the previous two types. These riverine strips are highly sandy in some places, usually moist even in periods of drought, and are used by many dung beetle species during dry seasons. Vegetation is dominated by species of acacia, and vegetation composition is quite different between the red and dark soils. For additional information on MRC plant diversity see Young et al. (1998) and Keesing (2000).

In total, 14 genera and 29 species were found during this study. Four of these are new Kenya records: *Lorditomaeus tanganyicanus* Balthasar, *Mesontoplatys bolzi* (Petrovitz), *Pharaphodius resplendens* (Balthasar), and *Plagiogonus clypeodentatus* Bordat.

Materials and Methods

Dung beetle sampling at MRC consisted primarily of three methods; 1) hand collecting individual specimens from dung pats or pellets; 2) pitfall traps baited with dung of various mammal species; and 3) nocturnal collecting for those species attracted to light. The pitfall traps consisted of small bowls (cereal bowls) placed flush with the ground with a small bait container suspended over the bowl by a wire loop. These traps were moved to new sites daily. Dung type was varied at intervals with buffalo, elephant, eland and impala most frequently used. Light collecting used existing lights as well as UV light operated from a 12-volt battery.

The term “epistome” is used here and should be interpreted as referring to that part of the head between clypeus and vertex.

Specimens were either prepared (pinned) at MRC or layered in tissue paper for transport and subsequent preparation.

Taxa are identified in keys to genera and species. Literature references are limited to the most recent and/or most complete taxonomic treatments.

Voucher specimens are deposited in (NMK), (USNM), and (MRC) collections. If a species is represented by a single specimen, that specimen is placed in the NMK, assuring that the NMK has a synoptic specimen set of the taxa included herein.

Systematics

Key to Aphodiini genera of the Laikipia plateau, Kenya

1. Elytra with less than ten striae; epistome with some large setigerous punctures, setae straight; epipleura very broad; color sericeous, brownish yellow, elytra pale, with or without preapical spots; length 5.0-8.0 mm ***Lorditomaeus Péringuey***
- Elytra with ten striae; epistomal setae, epipleura, color, and length variable **2**
- 2(1). Scutellum large, at least as long as 1/6 of sutural margin of elytra or longer **3**
- Scutellum small, at most as long as 1/7 of sutural margin of elytra or shorter **5**
- 3(2). Elytral disc regularly convex; scutellum broad, triangular; claws of male middle tarsi modified, large and unequal; color blackish, elytra mostly reddish brown; length 3.5-5.0 mm ***Macroretrus Péringuey***
- Elytral disc more or less strongly flattened; scutellum long; claws of male middle tarsi not modified; length variable **4**
- 4(3). Relatively larger body size (length 8.0-16.0 mm); elytra feebly flattened on disc; body yellow, sometimes pronotal and elytral disc dark brown, rarely completely blackish; epipharynx with

- anterior margin deeply excised medially, bearing 1 to 6 long spinules *Calocolobopterus Dellacasa*
- Relatively smaller body size (length 5.0-12.0 mm); elytra strongly flattened on disc; pronotum black, with lateral margins yellowish; elytra yellowish with cloudy discal spot dark brown or completely blackish; epipharynx with anterior margin arcuate, spinules entirely lacking or present in varying numbers *Neocolobopterus Landin*
- 5(2). Seventh and ninth elytral interstices joined preapically, raised into a prominent oblique fold; body oval, elongate, glabrous, shiny; dark brown or blackish; length 2.5-4.0 mm *Plagiogonus Mulsant*
- Seventh and ninth elytral interstices normally shaped; body shape and color variable 6
- 6(5). Elytral striae not joined apically; body convex, rather stout, subshiny, glabrous; color blackish or brownish; length 5.0-7.5 mm *Pharaphodius Reitter*
- Elytral striae joined apically; body convex or elongate, shiny or not, color and size variable 7
- 7(6). Scutellum pentagonal 8
- Scutellum triangular 11
- 8(7). Hind tibiae apically fimbriate with short, equal spinules; base of pronotum not bordered; elytra dirty yellowish, usually with discal brownish spot; length 3.0-7.0 mm *Labarrus Mulsant and Rey*
- Hind tibiae apically fimbriate with unequal, elongate spinules; base of pronotum not bordered; elytra yellowish or not 9
- 9(8). Clypeal margin fimbriate; small species, rather stout, brownish black or brownish yellow; sometimes elytra yellowish with a scutellar blackish spot; length 2.5- 4.0 mm *Mesontoplatys Motschulsky*
- Clypeal margin glabrous; color and body size variable 10
- 10(9). Elytral interstices medially tectiform; striae more or less distinctly bordered at each side; color more or less dark brownish; length 3.0-5.0 mm. *Pleuraphodius Schmidt*
- Elytral interstices flat or convex but never tectiform medially; striae not bordered at each side; color reddish brown or reddish; length 4.0-6.0 mm. *Koshantschikovius Schmidt*
- 11(7). Basal margin of pronotum bordered with marginal bead; clypeus widely rounded at sides; color blackish or brownish with reddish elytra; length 3.0-5.0 mm *Nobius Mulsant and Rey*
- Basal margin of pronotum not bordered; clypeus rounded or angulate at sides; color and length variable 12
- 12(11). Elytral intervals with row of more or less long, erect setae on coarse punctures aligned near striae; color blackish or brownish; elytra often with cloudy yellowish or reddish discal spots; length 3.0-6.0 mm *Aganocrossus Reitter*
- Elytral pubescence, if present, recumbent, short; color variable; body length variable 13
- 13(12). Head and pronotum completely pubescent, or at least pubescent on sides; epistome and pronotal disc coarsely densely punctured; distal segment of male labial palpi cylindrical and feebly rounded; color yellowish or more or less dark brown; elytra with or without darker preapical spot; length 2.5-5.0 mm *Trichaphodius Schmidt*
- Head and pronotum glabrous; epistome and pronotal disc finely or very finely punctured; distal segment of male labial palpi elliptical and strongly flattened; color brownish; elytra yellow, more or less variegated with darker spots; length 5.0-6.0 mm .. *Trichaphodioides Paulian*

GENUS *Aganocrossus* (Reitter)*Aphodius* (*Aganocrossus*) Reitter, 1895: 208.*Aganocrossus*: G. Dellacasa et al. 2001: 71.**Distribution:** Afrotropical, Australian, Oriental and Palearctic regions.**Key to Laikipia species of *Aganocrossus***

1. Elytra entirely setose, setae long, erect ***A. vestitus* (Boheman)**
 — Elytra glabrous ***A. meticulosus* (Paulian)**

Aganocrossus meticulosus* PaulianAganocrossus meticulosus* Paulian, 1942: 49.*Aphodius* (*Aganocrossus*) *meticulosus*: Bordat, 1992b: 357

Specimens examined (5): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, Zebra dung (1); *idem*, leg. R. Gordon, African Buffalo dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.VIII.2001, leg. Kadir Abdi, Waterbuck dung (1); Laikipia Plateau, Mpala Research Centre, N00°17'-E36°53' E, 1650 m, 17-20 Sept. 1999, S.E. Mille, T. M. Kuklenski & R.R. Snelling (2). (MRC) (NMK) (USNM).

Geographical distribution: Eastern Africa (Kenya and Tanzania) and Zaire.**Dung preference:** Not known, specimens were found in buffalo and waterbuck dung.***Aganocrossus vestitus* (Boheman), n. comb.***Aphodius vestitus* Boheman, 1857: 359.*Aphodius* (*Aganocrossus*) *vestitus*: Bordat, 1992b: 362.

Specimens examined (17): Laikipia, Impala Ranch, N00°30'-E36°51', 1-13.V.2002, #6, leg. R. Gordon, Impala dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 15-29.II.2001, 1-13.V.2003, #1, leg. R. Gordon, ultra violet light (16). (MRC) (NMK) (USNM).

Geographical distribution: Eastern and southern Africa.**Dung preference:** Apparently a generalist, taken from dung of several mammals including waterbuck, hippo, etc.**GENUS *Calocolobopterus* Dellacasa***Aphodius* (*Calocolobopterus*) G. Dellacasa, 1986: 216.*Calocolobopterus* G. Dellacasa et al., 2001: 110.**Distribution:** Afrotropical Region.**Key to Laikipia species of *Calocolobopterus***

1. Anterior clypeal margin strongly reflexed, clypeal surface with dense, coarse punctures; elytral intervals slightly convex, densely, distinctly punctured ***C. magnicornis* Bordat**
 — Anterior clypeal margin feebly reflexed, clypeal surface with punctures less dense, not coarse; elytral intervals flat, finely, indistinctly punctured ***C. principalis* (Harold)**

***Calocolobopterus magnicornis* (Bordat), n. comb.**

Aphodius (*Calocolobopterus*) *magnicornis* Bordat, 1992c: 101.

Calocolobopterus magnicornis: G. Dellacasa et al., 2001: 110.

Specimens examined (6): Laikipia Plateau, Mpala Research Centre, N00°17'-E36°899', 23-25.V.1998, 1650 m, S.E. Miller & T.M. Kuklenski (4); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, ultra violet light (2). (MRC) (NMK) (USNM).

Geographical distribution: Eastern Zaire, Kenya, Tanzania and Ethiopia.

Dung preference: Not known, all specimens were taken at light.

***Calocolobopterus principalis* (Harold), n. comb.**

Aphodius principalis Harold, 1861: 94.

Aphodius (*Calocolobopterus*) *principalis*: G. Dellacasa, 1986: 220.

Specimens examined (11): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, African Buffalo dung (2); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.V.2001, leg. Kadir Abdi, African Elephant dung (6); *idem*, leg. Kadir Abdi, ultra violet light (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.VIII.2001, leg. Kadir Abdi, Waterbuck dung (1). (MRC) (NMK) (USNM).

Geographical distribution: Afrotropical region.

Dung preference: Probably a generalist, found in dung of buffalo, elephant, and waterbuck, also taken at light.

GENUS *Craterocyphus* Schmidt

Aphodius (*Craterocyphus*) Schmidt, 1913: 129.

Craterocyphus: Paulian, 1942: 62; G. Dellacasa et al., 2001: 71.

Distribution: Afrotropical Region.

***Craterocyphus* sp.**

Specimen examined (1): Laikipia Plateau, Mpala Research Centre, N00°17'-E36°53', 20-22.IV.1999, 1650 m, S.E. Miller & R. O'Meara. (NMK).

Dung preference: No data available.

GENUS *Koshantschikovius* Schmidt

Aphodius (*Koshantschikovius*) Schmidt 1913: 89.

Koshantschikovius: Paulian, 1942: 78; G. Dellacasa et al., 2001: 163.

Distribution: African and Oriental Regions.

***Koshantschikovius* near *substriatus* (Schmidt)**

Aphodius substriatus Schmidt, 1911: 48.

Koshantschikovius substriatus: Paulian, 1942: 79.

Aphodius (Artengruppe *Koshantschikovius*) *substriatus*: Endrödi, 1964: 275.

Specimens examined (15): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon,

Impala dung (5); *idem*, leg. R. Gordon, African Buffalo dung (1); *idem*, leg. R. Gordon, Hippopotamus dung (1); *idem*, leg. R. Gordon, pitfall trap cow dung (2); *idem*, leg. R. Gordon, ultra violet light (5). (MRC) (NMK) (USNM).

Distribution: Ethiopia, Kenya, and (?) Cameroon.

Dung preference: Certainly a generalist, taken from dung of buffalo, elephant, and hippo, also attracted to light.

GENUS *Labarrus* Mulsant and Rey

Aphodius (*Labarrus*) Mulsant and Rey, 1870: 516.

Labarrus: Adám, 1994: 14; G. Dellacasa et al., 2001: 165.

Distribution: Subcosmopolitan.

Key to Laikipia species of *Labarrus*

1. Male head with median tubercle small, indistinct, head flat in both sexes; elytral intervals densely, rather coarsely punctured ***L. meruensis* (Petrovitz)**
 - Male head with median tubercle large, distinct, head convex in both sexes; elytral intervals not noticeably punctate, or with punctures indistinct **2**
- 2(1). Hind tibia with superior apical spur widened at middle, distinctly longer than first tarsal segment; middle tibia with male inferior apical spur feebly broadened and obliquely truncate apically in both sexes ***L. lividus* (Olivier)**
 - Hind tibia with superior apical spur evenly acuminate from base to apex, widest at base, approximately as long as first tarsal segment or slightly longer; middle tibia with inferior apical spur evenly widened, acuminate apically in both sexes ***L. pseudolividus* (Balthasar)**

Labarrus lividus (Olivier)

Scarabaeus lividus Olivier, 1789: 86.

Labarrus lividus: G. Dellacasa et al., 2001: 166.

Specimens examined (1): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, ultra violet light (1). (NMK).

Geographic distribution: Probably cosmopolitan.

Dung preference: This widespread species is a known dung generalist.

Labarrus meruensis (Petrovitz), n. comb

Aphodius (*Nialus*) *meruensis* Petrovitz, 1961: 350

Specimens examined (43): Laikipia, MRC, 1800 m, N00°17'-E36°53', 15-28.II.2001, #1, leg. R. Gordon, ultra violet light (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, Impala dung (3); *idem*, leg. R. Gordon, ultra violet light (28); *idem*, leg. R. Gordon, pitfall trap cow dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (2); *idem*, leg. R. Gordon, Impala dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.XII.2001, leg. Kadir Abdi, Impala, Hippopotamus, Zebra dung (1). (MRC) (NMK) (USNM).

Geographical distribution: Ethiopia, Kenya, Tanzania and Rwanda.

Dung preference: This is a generalist species, found in dung of cattle, elephant, hippo, impala, and zebra.

***Labarrus pseudolividus* (Balthasar)**

Aphodius (Nialus) pseudolividus Balthasar, 1941: 148.

Aphodius (Labarrus) pseudolividus: Bordat, 1990a: 36.

Labarrus pseudolividus: M. Dellacasa et al., 2002: 170.

Specimens examined (12): Laikipia Plateau, Mpala Research Centre, N00° 17'-E36°53', 15-17.I.1999, 17-20.IX.1999, 30-31.V.2001, 1650 m, leg. S. E. Miller & T.M. Kuklenski, S.E. Miller & V. Shitakule, leg. S.E. Miller, T.M. Kuklenski & R.R. Snelling (12). (MRC) (NMK) (USNM).

Geographical distribution: Subcosmopolitan.

Dung preference: This is another known dung generalist, also attracted to light.

GENUS *Lorditomaeus* Péringuey

Lorditomaeus Péringuey, 1901: 436; G. Dellacasa et al., 2001: 176.

Distribution: Afrotropical Region.

***Lorditomaeus tanganyicanus* Balthasar**

Lorditomaeus tanganyicanus Balthasar, 1965: 211.

Specimens examined (1): Kenya, Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, Hippopotamus dung (1). (Specimen lost in shipment).

Geographical distribution: Tanzania. This may be the first Kenya record.

Dung preference: Not known, the only specimen found was taken from hippo dung.

GENUS *Macroretrus* Péringuey

Macroretrus Péringuey, 1908: 632; G. Dellacasa et al., 2001: 179.

Distribution: Afrotropical Region.

***Macroretrus confusus* (Harold)**

Macroretrus confusus Harold, 1862: 154; Bordat et al., 2000: 110.

Specimens examined (46): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, Hippopotamus dung (31); *idem*, leg. R. Gordon, Impala dung (3); *idem*, leg. R. Gordon, Zebra dung (2); *idem*, leg. R. Gordon, ultra violet light (6); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #7, leg. R. Gordon, African Elephant dung (2); *idem*, leg. R. Gordon, Zebra dung (2); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #8, leg. R. Gordon, Giraffe dung (1). (USNM) (NMK) (USNM).

Geographical distribution: Senegal, Ethiopia and Kenya.

Dung preference: Probably a generalist dung feeder, specimens were taken from dung of elephant, hippo, giraffe, and zebra.

GENUS *Mesontoplatys* Motschulsky

Mesontoplatys Motschulsky, 1863: 462; G. Dellacasa et al., 2001: 190.

Distribution: Afrotropical and Oriental Regions.

***Mesontoplatys bolzi* (Petrovitz) n. comb.**

Aphodius (*Mesontoplatys*) *bolzi* Petrovitz, 1967: 211.

Specimens examined (4): Kenya, Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, Impala dung (4). (MRC) (NMK) (USNM).

Geographical distribution: Tanzania, these specimens may be the first Kenya records.

Dung preference: All four specimens were found in impala dung.

GENUS *Neocolobopterus* Landin

Colobopterus (*Neocolobopterus*) Landin, 1974: 235.

Neocolobopterus: G. Dellacasa et al., 2001: 198.

Distribution: Afrotropical Region.

***Neocolobopterus maculicollis* (Reiche), n. comb.**

Aphodius maculicollis Reiche, 1847: 341.

Aphodius (*Neocolobopterus*) *maculicollis*: G. Dellacasa, 1986: 209.

Neocolobopterus maculicollis: Cambefort and Bordat 2003: 572.

Specimens examined (36): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon (14); *idem*, leg. R. Gordon, cattle dung (5); *idem*, leg. R. Gordon, African Buffalo dung (3); *idem*, leg. R. Gordon, pitfall trap Impala dung (1); *idem*, leg. R. Gordon, pitfall trap cow dung (11); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #3, leg. R. Gordon, cattle dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.VIII.2001, leg. Kadir Abdi, Zebra dung (1); *idem*, leg. Kadir Abdi, Waterbuck dung (2). (MRC) (NMK) (USNM).

Geographical distribution: Afrotropical region.

Dung preference: A dung generalist, specimens found in dung of cattle, impala, waterbuck, and zebra.

GENUS *Nobius* Mulsant and Rey

Aphodius (*Nobius*) Mulsant and Rey, 1870: 563.

Nobius: Paulian, 1942: 86; G. Dellacasa et al., 2001: 211.

Distribution: Palearctic and Afrotropical Regions.

***Nobius hepaticus* (Roth, 1851)**

Aphodius hepaticus Roth, 1851: 132

Nobius hepaticus: Paulian, 1942: 87

Aphodius (Artengruppe *Nobius*) *hepaticus* Endrödi, 1960: 207

Specimens examined (10): Laikipia, Impala Ranch, N00°30'-E36°51', 1-13.V.2002, #6, leg. R. Gordon, Impala dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, Impala dung (2); *idem*, leg. R. Gordon, African Buffalo dung (1); *idem*, leg. R. Gordon, ultra violet light (3); *idem*, leg. R. Gordon, pitfall trap cow dung (1). (MRC) (NMK) (USNM).

Geographical distribution: Eastern and central Africa.

Dung preference: A generalist, taken from dung of buffalo, cattle, impala, and also at light.

GENUS *Pharaphodius* Reitter*Aphodius* (*Pharaphodius*) Reitter, 1892: 172.*Pharaphodius*: Paulian, 1942: 31; G. Dellacasa et al., 2001: 241.**Distribution:** Afrotropical, Oriental, and Palearctic Regions, also the Mexican Transition Zone.**Key to Laikipia species of *Pharaphodius***

1. Length less than 5.0 mm ***P. ignotus* (Schmidt)**
 — Length more than 5.0 mm **2**
- 2(1). Elytral intervals flat, striae feebly impressed; dorsal surface pale yellowish brown
 ***P. resplendens* (Balthasar)**
 — Elytral intervals strongly convex, striae strongly impressed; dorsal surface brown, reddish brown,
 or piceous **3**
- 3(2). Clypeal apex abruptly angulate or slightly toothed on each side of median emargination; pronotal
 surface smooth, polished ***P. fiechteri* (Balthasar)**
 — Clypeal apex rounded or slightly angulate on each side of median emargination; pronotal surface
 at least slightly alutaceous, dull or feebly shiny **4**
- 4(3). Posterior pronotal angle slightly sinuate; elytral intervals moderately convex, wide, 3X or more
 width of striae; dorsal color reddish brown ***P. infinitus* (Schmidt)**
 — Posterior pronotal angle broadly rounded; elytral intervals strongly convex, narrow, 2X width of
 striae; dorsal color dark brown to blackish ***P. impurus* Roth**

Pharaphodius* (*s. l.*) *fiechteri* (Balthasar), n. comb.Aphodius* (*Pharaphodius*) *fiechteri* Balthasar, 1941: 127.*Aphodius* (Artengruppe *Pharaphodius*) *fiechteri*: Endrödi, 1960: 125.

Specimens examined (14): Kenya, Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, ultra violet light (4); *idem*, leg. R. Gordon, Hippopotamus dung (1); *idem*, leg. R. Gordon, African Buffalo dung (2); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #3, leg. R. Gordon, Cattle dung (2); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.VIII.2001, leg. Kadir Abdi, Waterbuck dung (1) MRC, 1800 m, N.00°17', E36°53', 15-28.II.2001, #1, leg. R. Gordon, African buffalo dung (5). (MRC) (NMK) (USNM).

Geographical distribution: Eastern Africa.**Dung preference:** A generalist, found in dung of buffalo, cattle, elephant, hippo, and waterbuck, also attracted to light.***Pharaphodius* (*s. l.*) *ignotus* (Schmidt), n. comb.***Aphodius ignotus* Schmidt, 1916: 99.*Aphodius* (Artengruppe *Pharaphodius*) *ignotus*: Endrödi, 1964: 124.

Specimens examined (9): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, ultra violet light (9). (MRC) (NMK) (USNM).

Geographical distribution: Afrotropical region.**Dung preference:** Unknown, all specimens were taken at light.

Pharaphodius (s. l.) impurus (Roth)*Aphodius impurus* Roth, 1851: 131.*Pharaphodius impurus*: Paulian, 1942: 40.*Aphodius (Pharaphodius) impurus*: Bordat, 1990a: 68.

Specimens examined (42): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-30.IV.2002, leg. Kadir Abdi, Hippopotamus dung (2); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, African Buffalo dung (3); *idem*, leg. R. Gordon, ultra violet light (3); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #3, leg. R. Gordon, Cattle dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (1); *idem*, 15-28.II.2001, #1, leg. R. Gordon, Waterbuck dung (12); *idem*, #1, leg. R. Gordon, Hippopotamus dung (7); *idem*, #1, leg. R. Gordon, African elephant dung (10); *idem*, #1, leg. R. Gordon, Giraffe dung (1); Laikipia Plateau, Mpala Research Centre, N00°17' N-E36°53', 1650 m, 17-20.IX.1999, leg. S.E. Miller, T.M. Kuklenski & R.R. Snelling (2). (MRC) (NMK) (USNM).

Geographical distribution: Afrotropical region.

Dung preference: This is a certain generalist species.

Pharaphodius infinitus (Schmidt)*Aphodius (Pharaphodius) infinitus* Schmidt, 1920: 139.*Pharaphodius infinitus*: Paulian, 1942: 40.*Aphodius (Artengruppe Pharaphodius) infinitus*: Endrödi, 1964: 113.

Specimens examined (17): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, ultra violet light (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (10); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.XII.2001, leg. Kadir Abdi (6). (MRC) (NMK) (USNM).

Geographical distribution: Eastern Africa.

Pharaphodius (s. l.) resplendens (Balthasar), n. comb.*Aphodius (Pharaphodius) resplendens* Balthasar, 1941: 128.*Aphodius (Artengruppe Pharaphodius) resplendens*: Endrödi, 1964: 119.

Specimen examined (1): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (1). NMK (specimen damaged in shipment).

Geographical distribution: Somalia. This is the first Kenya record.

Dung preference: Not known, the only specimen collected was take from elephant dung.

GENUS *Plagiogonus* Mulsant*Plagiogonus* Mulsant, 1842: 306; G. Dellacasa et al., 2001: 243.

Distribution: Afrotropical, Oriental, and Palearctic Regions.

Key to Laikipia species of *Plagiogonus*

1. Clypeal apex deeply emarginate medially, lateral angles dentate or abruptly angulate *P. clypeodentatus* (Bordat)

— Clypeal apex feebly emarginate, nearly truncate, lateral angles rounded... *P. tertius* (Bordat)

***Plagiogonus clypeodentatus* (Bordat), n. comb.**

Aphodius (*Plagiogonus*) *clypeodentatus* Bordat, 1990b: 141.

Plagiogonus clypeodentatus: Bordat, 2005: 55.

Specimens examined (5): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon (1); *idem*, leg. R. Gordon, Impala dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #8, leg. R. Gordon, Giraffe dung (3). (MRC) (NMK) (USNM).

Geographical distribution: Somalia. This may be the first Kenya record.

Dung preference: Probably a generalist, taken from dung of giraffe and impala.

***Plagiogonus tertius* (Bordat), n. comb.**

Aphodius (*Plagiogonus*) *tertius* Bordat, 1992a: 136.

Plagiogonus tertius: Bordat, 2005: 54.

Specimens examined (3): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, cattle dung (1); *idem*, leg. R. Gordon, Impala dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, cattle dung (1). (NMK) (USNM).

Geographical distribution: Kenya.

Dung preference: Almost certainly a generalist, found in dung of cattle and impala.

GENUS *Pleuraphodius* Schmidt

Aphodius (*Pleuraphodius*) Schmidt, 1913: 121.

Pleuraphodius: Paulian, 1942: 26; G. Dellacasa et al., 2001: 249.

Distribution: Afrotropical, Oriental, and Palearctic Regions.

Key to Laikipia species of *Pleuraphodius*

1. Length 3.0 mm or less *P. sp. nr. kavani* (Balthasar)
 — Length 4.0 mm or more *P. leo* Paulian

***Pleuraphodius kavani* (Balthasar), n. comb.**

Aphodius (*Trichaphodius*) *kavani* Balthasar, 1935: 69.

Aphodius (Artengruppe *Pleuraphodius*) *kavani*: Endrödi, 1964: 89.

Specimens examined (4): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, Impala dung (1); *idem*, leg. R. Gordon, pitfall trap cow dung (3). (MRC) (NMK) (USNM).

Geographical distribution: Eastern Africa.

Dung preference: Probably a generalist, taken from dung of cattle and impala.

***Pleuraphodius leo* Paulian**

Pleuraphodius leo Paulian, 1942: 30.

Aphodius (*Pleuraphodius*) *leo*: Bordat, 1990a: 75.

Specimens examined (5): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, Hippopotamus dung (1); *idem*, leg. R. Gordon, Impala dung (1); *idem*, leg. R. Gordon, African Buffalo dung, (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (2). (MRC) (NMK) (USNM).

Geographical distribution: Eastern Africa and Madagascar.

GENUS *Trichaphodioides* Paulian

Trichaphodioides Paulian, 1942: 52; G. Dellacasa et al., 2001: 289.

Distribution: Afrotropical Region

Key to Laikipia species of *Trichaphodioides*

1. Elytra completely pubescent, pubescence on disc distinctly visible ***T. cinerascens* (Klug)**
- Elytra with apical and lateral pubescence, disc not pubescent, or if so pubescence not distinctly visible **2**

- 2(1). Ventral surface yellow, if dark then legs pale yellow; elytra pale brownish yellow, with contrasting transverse dark mark on apical declivity of each elytron ***T. schaumii* (Harold)**
- Ventral surface brown or dark brown, legs brown or yellowish brown; elytra brown, with or without obscure transverse mark on apical declivity of each elytron **3**

- 3(2). Dorsal color predominantly reddish brown; elytral intervals alutaceous, shiny; body comparatively short, wide ***T. calcaratus* (Boheman)**
- Dorsal color predominantly dark brown; elytral intervals alutaceous, dull; body comparatively elongate, narrow ***T. pulchellus* (Müller)**

***Trichaphodioides calcaratus* (s. l.) (Boheman)**

Aphodius calcaratus Boheman, 1857: 353.

Trichaphodioides calcaratus: Paulian, 1942: 52.

Specimens examined (21): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #8, leg. R. Gordon, African Elephant dung (18); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon (1); *idem*, leg. R. Gordon, ultra violet light (2). (MRC) (NMK) (USNM).

Geographical distribution: This taxon, *sensu lato*, is known from eastern, central and southern Africa.

Dung preference Unknown, specimens were found in elephant dung and at light.

***Trichaphodioides cinerascens* (Klug)**

Aphodius cinerascens Klug, 1855: 656.

Trichaphodioides cinerascens: Paulian, 1942: 53.

Specimens examined (3): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.III.2001, leg. Kadir Abdi, Burchell's Zebra dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (2). (NMK, two specimen lost in shipment).

Geographical distribution: Eastern, Western, central and southern Africa.

Dung preference: Probably a dung generalist, found in elephant and zebra dung.

***Trichaphodioides pulchellus* (Müller) n. comb.**

Aphodius (*Trichaphodius*) *pulchellus* Müller, 1941: 344.

Specimens examined (72): Laikipia, Impala Ranch, N00°30'-E36°51', 1-13.V.2002, #6, leg. R. Gordon, Impala dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.III.2001, leg. Kadir Abdi, Burchell's Zebra dung (3); Kenya, Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon (1); *idem*, leg. R. Gordon, ultra violet light (25); *idem*, leg. R. Gordon, cattle dung (9); *idem*, leg. R. Gordon, Hippopotamus dung (3); *idem*, leg. R. Gordon, Impala dung (10); *idem*, leg. R. Gordon, African Buffalo dung (1); *idem*, leg. R. Gordon, Zebra dung (1); *idem*, leg. R. Gordon, pitfall trap cow dung (2); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #7, leg. R. Gordon, African Elephant dung (17); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2002, #8, leg. R. Gordon, African Elephant dung (2); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.VIII.2001, leg. Kadir Abdi, Zebra dung (1). (MRC) (NMK) (USNM).

Geographical distribution: Eastern Africa.

Dung preference: A generalist, found in almost all mammal dung examined, and also attracted to light.

***Trichaphodioides schauimi* (Harold), n. comb.**

Aphodius schauimi Harold, 1859: 205.

Aphodius (*Trichaphodioides*) *schauimi*: Bordat, 1994: 18.

Specimens examined (2): Laikipia, MRC, 1800m, N 00°17' E 36°53', 15-28.II.2001, #1, R. Gordon, Hippopotamus dung (1); *idem*, R. Gordon, Waterbuck dung (1). (NMK) (USNM).

Geographical distribution: Nigeria, Ethiopia and Kenya.

Dung preference: Unknown, only two specimens found.

GENUS *Trichaphodius* Schmidt

Aphodius (*Trichaphodius*) Schmidt, 1913: 136.

Trichaphodius: Paulian, 1942: 53; G. Dellacasa et al., 2001: 291.

Distribution: Afrotropical, Oriental and Palearctic Regions

***Trichaphodius humilis* (s. l.) (Roth)**

Aphodius humilis Roth, 1851: 132.

Trichaphodius humilis: Paulian, 1942: 57.

Aphodius (*Trichaphodius*) *humilis*: Bordat, 1989: 305.

Specimens examined (6): Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-31.III.2001, leg. Kadir Abdi, Burchell's Zebra dung (1); Laikipia, MRC, 1800 m, N00°17'-E36°53', 1-13.V.2003, #1, leg. R. Gordon, ultra violet light (5). (MRC) (NMK) (USNM).

Geographical distribution: Eastern, central and southern Africa. The true *T. humilis* should be distributed in southern Africa only.

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Literature Cited

- Ádám, L. 1994.** A check-list of the Hungarian Scarabaeoidea with description of ten new taxa. *Folia Entomologica Hungarica* 55: 5-17.
- Balthasar, V. 1935.** Neue *Aphodius*-Arten aus dem tropischen Afrika. *Casopis Ceskoslovenske Spolecnosti Entomologicke* 32: 67-74.
- Balthasar, V. 1941.** Gli Scarabeidi coprofagi e Trogini dell' Africa Orientale Italiana del Museo di Milano. *Atti della Società Italiana di Scienze Naturali del Museo Civico di Storia Naturale in Milano* 80: 103-154.
- Balthasar, V. 1965.** Revision der Gattung *Lorditoma* Pér. *Revue de Zoologie et de Botanique Africaine, Bruxelles*, 72 (1-2): 173-213.
- Boheman, C. H. 1857.** *Insecta Caffrariae annis 1838-1845 a J. A. Wahlberg collecta descripsit. Coleoptera. Fritze and Norstedt; Stockholm.* 2: 1-395.
- Bordat, P. 1989.** Révision des *Aphodius* sous-genre *Trichaphodius* du groupe humilis Roth de la région afrotropicale. *Annales de la Société Entomologique de France* 25: 295-314.
- Bordat, P. 1990a.** Faune de Madagascar. Insectes Coléoptères Aphodiidae: Aphodiinae et Eupariinae. *Muséum National d'Histoire Naturelle; Paris.* 74: 17-129.
- Bordat, P. 1990b.** Quatre nouvelles espèces d'*Aphodius* de la région afrotropicale. *Annales Historico-Naturales Musei Nationalis Hungarici* 82: 137-144.
- Bordat, P. 1992a.** Cinq nouvelles espèces d'Aphodiidae de la région afrotropicale. *Nouvelles Revue d'Entomologie (N.S.)* 9 (2): 131-140.
- Bordat, P. 1992b.** Révision des *Aphodius*, sous-genre *Aganocrossus* de la région afrotropicale. *Annales de la Société Entomologique de France* 28: 339-364.
- Bordat, P. 1992c.** Résultats de la mission scientifique hongroise «Teleki» en Afrique. *Annales Historico-Naturales Musei Nationalis Hungarici* 84: 93-109.
- Bordat, P. 1994.** Trois nouvelles espèces d'*Aphodius* (*Trichaphodioides*) des savanes africaines au Nord de l'Équateur. *Revue Française d'Entomologie (N.S.)* 16 (1): 17-22.
- Bordat, P. 2005.** Nouvelles espèces d'Aphodiinae de la région afrotropicale (Coleoptera, Scarabaeoidea). *Nouvelle Revue d'Entomologie (N. S.)* 22 (1): 35-61
- Bordat, P., G. Dellacasa, and M. Dellacasa. 2000.** Révision du genre *Macroretrus* Péringuey, 1908 et description d'une nouvelle espèce. *Macroretroides lumareti* n. g., n. sp. *Nouvelle Revue d'Entomologie (N.S.)* 17 (2): 107-122.
- Cambefort, Y., and P. Bordat. 2003.** Coléoptères Scarabaeidae s. str., Aphodiidae et Ceratocanthidae du mont Nimba et des régions limitrophes. *In: M. Lamotte and R. Roy (eds). Le peuplement animal du mont Nimba (Guinée, Côte d'Ivoire, Liberia). Mémoires du Muséum National d'Histoire Naturelle, Paris* 190: 551-580.
- Dellacasa, G. 1986.** A world-wide revision of *Aphodius* sharing a large scutellum. *Frustula Entomologica (N.S.)* 7/8: 173-282.
- Dellacasa, G., P. Bordat, and M. Dellacasa. 2001.** A revisional essay of world genus-group taxa of Aphodiinae. *Memorie della Società Entomologica Italiana* 79 [2000]: 1-482.
- Dellacasa, M., R. D. Gordon, and G. Dellacasa. 2002.** Aphodiinae described or recorded by Bates in *Biologia Centrali-Americana. Acta Zoologica Mexicana (N. S.)* 86: 155-223.
- Endrödi, S. 1960.** XLII. Coleoptera Scarabaeidae: Aphodiinae. Die Aphodiinae von Ost-Afrika. *Mission Zoologique de l'I.R.S.A.C. en Afrique Orientale (P. Basilewsky et N. Leleup, 1957). Résultats Scientifiques. II Partie. Annales du Musée royal du Congo Belge, Tervuren* 88: 67-249.
- Endrödi, S. 1964.** Die Aphodiinae des Congo-Gebietes in Rahmen der Fauna von Zentral-Afrika. *Annales du Musée royal de l'Afrique Centrale, Tervuren* 123: 1-415.

- Harold, E. 1859.** Beitrage zur Kenntniss einiger coprophagen Lamellicornien (Erstes Stuck). Berliner Entomologische Zeitschrift 3: 193-224.
- Harold, E. 1861.** Beitrage zur Kenntniss einiger coprophagen Lemellicornien (Viertes Stuck). Berliner Entomologische Zeitschrift 5: 92-115.
- Harold, E. 1862.** Beitrage zur Kenntniss einiger coprophagen Lamellicornien (Drittes Stuck). Berliner Entomologische Zeitschrift 6: 138-171.
- Klug, J. C. F. 1855.** Diagnosen der neuen Coleopteren aus Mossambique. Berliner Akademie der Wissenschaften 20: 643-660.
- Keesing, F. 2000.** Cryptic consumers and the ecology of an African Savanna. Bioscience 50: 205-215.
- Landin, B. O. 1974.** Taxonomic studies on African Aphodiini. II. The genus *Colobopterus* Mulsant with description of two new species. Entomologica Scandinavica 5: 233-239.
- Miller, S. E., and J. D. Lazell. 2001.** A herpetological reconnaissance of Mpala Research Centre, Laikipia, Kenya. Journal of East African Natural History 90: 103-107.
- Motschulsky, V. 1863.** Essai d'un catalogue des insectes de l'île Ceylan. II Suite. Bulletin de la Société Impériale des Naturalistes de Moscou 36: 421-532.
- Müller, G. 1941.** Nuovi Coleotteri dell'Africa Orientale. Atti del Museo Civico di Storia Naturale di Trieste 14 (23): 319-352.
- Mulsant, E. 1842.** Histoire naturelle des Coléoptères de France. Lamellicornes. Lyon; Paris. 623 p.
- Mulsant, E., and C. Rey. 1870.** *In*: E. Mulsant. Histoire Naturelle des Coléoptères de France. Tribu des Lamellicornes. Annales de la Société d'Agriculture, Sciences et Industries de Lyon 2 [(1869)]: 241-650.
- Olivier, A. G. 1789.** Entomologie, ou histoire naturelle des insectes, avec leurs caractères génériques et spécifiques, leur description, leur synonymie, et leur figure enluminée.... Coléoptères. De l'Imprimerie de Lanneau; Paris. 1: 1-497.
- Paulian, R. 1942.** Coleoptera Scarabaeidae: Aphodiinae. Exploration du Parc National Albert. Mission G. F. de Witte (1933-1935). Institut des Parcs Nationaux du Congo Belge; Bruxelles. 35: 1-143.
- Péringuey, L. 1901.** Descriptive Catalogue of the Coleoptera of South Africa (Lucanidae and Scarabaeidae). Transactions of the South Africa Philosophical Society 12: 1-563.
- Péringuey, L. 1908.** Descriptive Catalogue of the Coleoptera of South Africa. Transactions of the South Africa Philosophical Society 13: 1-752.
- Petrovitz, R. 1961.** Neue und verkannte Aphodiinae aus allen Erdteilen. II Teil. Entomologische Arbeiten aus dem Museum Georg Frey, Tutzing b.M. 12: 344-356.
- Petrovitz, R. 1967.** Neue afrikanische Aphodius-Arten. Bonner Zoologische Beiträge, Bonn (1/2): 207-212.
- Reiche, L. 1847.** *In*: A. Feret and J. G. Galinier: Voyage en Abyssinie dans les provinces du Tigre, du Samen et de l' Amhara. (1839-1843). Tom. I-III. (1847-1848). Entomologie. Paulin; Paris. 3: 259-532.
- Reitter, E. 1892.** Bestimmungs-Tabelle der Lucaniden und coprophagen Lamellicornen des palaearktischen Faunengebietes. Verhandlungen des Naturforschenden Vereins Brünn 30: 140-262.
- Reitter, E. 1895.** Einige neue Coleopteren aus Korea und China. Wiener Entomologische Zeitung 14: 208-210.
- Roth, J. R. 1851.** Diagnosen neuer Coleoptera aus Abyssinien. Archiv für Naturgeschichte 17: 121-133.
- Schmidt, A. 1911.** Neue Aphodiinen und eine synonymische Bemerkung. Societas Entomologica. Organ für den Internationalen Entomologenverein 26: 47-48.
- Schmidt, A. 1913.** Erster Versuch einer Einteilung der exotischen Aphodien in Subgenera und als Anhang einige Neubesreibungen. Archiv für Naturgeschichte Abteilung A 79: 117-178.
- Schmidt, A. 1916.** Namenänderungen und Beschreibung neuer Aphodiinen (Col.). Archiv für Naturgeschichte Abteilung A 82: 95-116.
- Schmidt, A. 1920.** Beitrage zur Kenntnis der Gattungen *Canthon* Hffsg., *Sybox* Boh., *Aphodius* ll., *Simogonius* Har., *Ataenius* Har. Archiv für Naturgeschichte Abteilung A 86: 114-117.
- Young, T. P., B. D. Okello, D. Kinua, and T. M. Palmer. 1998** - KLEE: A long-term multi-species herbivore exclusion experiment in Laikipia, Kenya. African Journal of Range and Forage Science 14: 94-102.

