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Three new synonymies in *Phyllophaga* Harris, 1827 (Coleoptera: Scarabaeidae), with lectotype and neotype designations

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Abstract. In the course of working on new species of North American *Phyllophaga* Harris, 1827 (Coleoptera: Scarabaeidae: Melolonthinae) some synonyms have been found and are proposed here. **New synonymies:** *Phyllophaga knausii* (Schaeffer, 1907) is synonymized with *Phyllophaga sociata* (Horn, 1878); *Phyllophaga chippewa* Saylor, 1939 is synonymized with *Phyllophaga rugosa* (Melsheimer, 1845); and *Phyllophaga falta* Sanderson, 1950 is synonymized with *Phyllophaga bipartita* (Horn, 1887). Lectotypes are here designated for the following species: *Listrochelus knausii* Schaeffer, *Listrochelus sociatus* Horn, and *Lachnosterna bipartita* Horn. A neotype for *Ancylonycha rugosa* Melsheimer is here designated from the Horn Collection.

Key words. Melolonthinae, Melolonthini, North America, taxonomy.

Introduction

Phyllophaga Harris, 1827 (Coleoptera: Scarabaeidae: Melolonthinae) is a diverse New World genus of over 850 valid species, with more than 200 of these occurring in the United States and Canada (Evans and Smith 2009). While the U.S. fauna is relatively well-known and identification guides are available (Chapin 1935; Saylor 1939a, 1940; Reinhard 1950a, 1950b; Luginbill and Painter 1953; Lago et al. 1979; Woodruff and Beck 1989; Warner and Morón 1992; Harpootlian 2001; Ratcliffe and Paulsen 2008), several species in the western U.S. remain undescribed. While examining type material for future descriptive work, some synonymies were discovered and are proposed here.

Materials and Methods

Label data. Label information is given verbatim in quotes, a slash+space (/) indicates line breaks and space+double slash+space (//) indicates a different label. Labels are typed on white paper unless otherwise indicated by information between brackets ([ ]).

Specimens examined. Types of all six species were studied, and additional specimens from the following collections were examined to determine variation:

FSCA	Florida State Collection of Arthropods, Gainesville, FL, USA
INHS	Illinois Natural History Survey, Champaign, IL, USA
MCZ	Museum of Comparative Zoology, Cambridge, MA, USA
USNM	United States National Museum of Natural History, Washington, D.C., USA

Specimens were examined with a Leica S6D microscope. Photographs were taken on a Leica Z16 APO microscope using a JVC KY-F75U digital camera and stacked with Syncroscopy Automontage software, version 5.01.005. Images were compiled into plates using GIMP 2 software (version 2.10.12).

Results and Discussion

Phyllophaga rugosa (Melsheimer, 1845)

Figures 3–4, 9–10

Ancylonycha rugosa Melsheimer 1845: 140. **Neotype**: MCZ, **here designated**, male.
Phyllophaga rugosa (Melsheimer): Haldeman and LeConte 1853: 59; Glasgow 1916: 371.
Lachnosterna rugosa (Melsheimer): LeConte 1856: 252.
Phyllophaga chippewa Saylor 1939b: 455. **New synonymy**. Type: USNM, male.

Ancylonycha rugosa was described by Melsheimer (1845) from Virginia. Haldeman and LeConte (1853) included it in *Phyllophaga* in their revision of Melsheimer's catalogue. LeConte (1856) used the generic name *Lachnosterna* for this species and most other *Phyllophaga* (sensu stricto). Saylor (1939b) described *Phyllophaga chippewa* from a single male collected in Schley, Minnesota (Fig. 10), and compared it with *Phyllophaga knochii* (Schoenherr and Gyllenhal). While *P. chippewa* does belong in Group IX of Horn's (1887) revision, as stated by Saylor (1939b), there are some significant differences between this species and *P. knochii*, including pronotal punctation and clypeal emargination. The parameres of *P. chippewa* are mostly developed, looking normally sclerotized, but the base of the genitalia (Fig. 4) is clearly underdeveloped and misshapen. The genitalia appear to be a deformity of *P. rugosa*, as stated by Luginbill and Painter (1953). After examination of the type, *P. chippewa* is externally within the variation of *P. rugosa* and the collection locality is also within the range of *P. rugosa* (Pike et al. 1977). Being the type of *P. chippewa* remains the only known specimen, I concur with Luginbill and Painter (1953) in considering it a deformed specimen of *P. rugosa* and here formally synonymize the two species.

A search for Melsheimer's type of *A. rugosa* turned up no specimens and is presumed lost. A neotype of *A. rugosa* is here designated to fix the name to a single specimen to allow comparison to other types. The specimen chosen is a dissected male (Fig. 3) from North Carolina in the Horn Collection. Label data (Fig. 9) are as follows: "N. C // ♂ // HornColl/ H [handwritten] 5774 // MCZ-ENT 00711292 // [on red] NEOTYPE/ *Ancylonycha rugosa*/ Melsheimer, 1845/ Det: K. E. Schnepp 2018".

Phyllophaga sociata (Horn, 1878)

Figures 1–2, 7–8

Listrochelus sociatus Horn 1878: 146. **Lectotype**: MCZ, **here designated**, male.
Phyllophaga sociatus (Horn): Saylor 1938: 131.
Listrochelus knausii Schaeffer 1907: 67. **New synonymy**. **Lectotype**: USNM, **here designated,** male.
Phyllophaga knausi (Schaeffer): Blackwelder and Arnett 1974: 58.

Horn (1878) described *Listrochelus sociatus* from "Nevada, Idaho and Oregon" without specific locality or type designation. In 1938, Saylor moved *L. sociatus* from *Listrochelus* to *Phyllophaga* without explanation. In 1907, Schaeffer described *Listrochelus knausii*, apparently without seeing the types of *L. sociatus*, stating "By description *knausii* is very close to *sociatus*, near which it has to be placed, but the latter species is said to have the posterior tibiae stout, resembling those of *Ligyrus*." Schaeffer's types of *L. knausii*, a male and female, have been dissected, possibly by Schaeffer or Milton Sanderson. Both of Schaeffer's types of *L. knausii* are from Stockton, Utah and no holotype has been designated. To fix the name to a single specimen I am designating the male (Fig. 2) with the following data (Fig. 8) as the lectotype: "[handwritten label] Stockton/ V.14. Utah // [handwritten label] Warren/ Knaus // [handwritten label] Listrochelus/ knausii/ type ♂ Schaef // [in red] Type [handwritten] ♂ // [handwritten label with two red border lines] Listrochelus/ knausii/ Schaef. // [on red] Cotype/ No [handwritten] 42585/ U.S.N.M. // BROOKLYN/ MUSEUM/ COLL. 1929 // [on red] LECTOTYPE/ Listrochelus knausii/ Schaeffer, 1907/ Det: K. E. Schnepp 2018".

Similarly, no type has been designated for *Listrochelus sociatus* Horn. After examining the type series, a male lectotype (Fig. 1) is here designated to fix the name to a single specimen to allow comparison to other types. Label data (Fig. 7) are as follows: "Nev. // [on blue] PARA-TYPE/ [handwritten] 3635.2 // MCZ-ENT/ 00522248 // [on red] LECTOTYPE/ *Listrochelus sociatus*/ Horn, 1878/ Det: K. E. Schnepp 2018".

Sanderson's *Phyllophaga* notes are available for study at the FSCA. In them, he clearly recognized *P. knausii* as being synonymous with *P. sociata*, but no formal synonymy has been made. After studying the types, I concur with Sanderson and here formally synonymize *P. knausii* with *P. sociata*.

***Phyllophaga bipartita* (Horn, 1887)**
Figures 5–6, 11–12

Lachnosterna bipartita Horn 1887: 242. **Lectotype**: MCZ, **here designated**, male.
Phyllophaga biparita (Horn): Glasgow 1916: 373.
Phyllophaga falta Sanderson 1950: 92. **New synonymy**. Type: INHS, male.

Lachnosterna bipartita was described by Horn (1887) from "Kansas, Louisiana and Texas." Glasgow resurrected *Phyllophaga* in 1916 and included this species in the genus. *Phyllophaga falta* was described by Sanderson (1950) from a single male collected in Fayetteville, Arkansas (Fig. 12). Externally, *P. falta* is similar to *P. fervida* (Fabricius), as stated by Sanderson (1950), with the only notable difference being the origin of a ridge on the penultimate sternite of the male. This is, however, the same ridge found in some individuals of *P. bipartita*. There is a wide variation in development of this ridge, from virtually non-existent to heavily sclerotized and projecting to the apex of the segment. Externally, there are no differences between *P. falta* and some individuals of *P. bipartita*. There is considerable variation in the development of sclerotized parts of the male genitalia of *P. bipartita*, as stated by Luginbill and Painter (1953) and Ratcliffe and Paulsen (2008), including projections on the parameres as well as the internal sac. Southwestern populations of *P. bipartita* have the left paramere (when viewed with parameres face on, as in Fig. 5) lacking a strongly hamate structure, instead they look similar to the right paramere. Specimens from the central and eastern portion of this species range have an enlarged hook structure, as well as having a forward projecting process of varying size on the right paramere. The internal sac of *P. bipartita* is also quite variable, some have a pair of heavily sclerotized patches with a series of spinules on the apex, while others have a lightly sclerotized strip with no spinules where these patches would be. There are also two patches of short spines of varying development on the bottom of the sac at the base; some specimens have patches not unlike those in *P. falta*. These patches are occasionally strongly developed and each appear as a single large, dark, spinose section. There are also specimens that fall between these two extremes. *Phyllophaga falta* (Fig. 6) appears to be one of the many variations of *P. bipartita*, just with strongly reduced parameres. Since the type of *P. falta* falls within the range of external variation of *P. bipartita*, the two species are here synonymized.

After examining the type series of *L. bipartita*, a male lectotype (Fig. 5) is here designated to fix the name to a single specimen to allow comparison to other types. Label data (Fig. 11) are as follows: "Kan. // ♂ // [handwritten label] L./ bipartita/ Horn // MCZ-ENT/ 00008066 // Jan.–Jul. 2005/ MCZ Image/ Database // [on red] TYPE No. [handwritten] 3673/ [handwritten] Lachnosterna/ [handwritten] bipartita/ G. H. Horn // [on red] MCZ TYPE/ [handwritten] 8066 // [on red] LECTOTYPE/ *Lachnosterna bipartita*/ Horn, 1887/ Det: K. E. Schnepp 2018".

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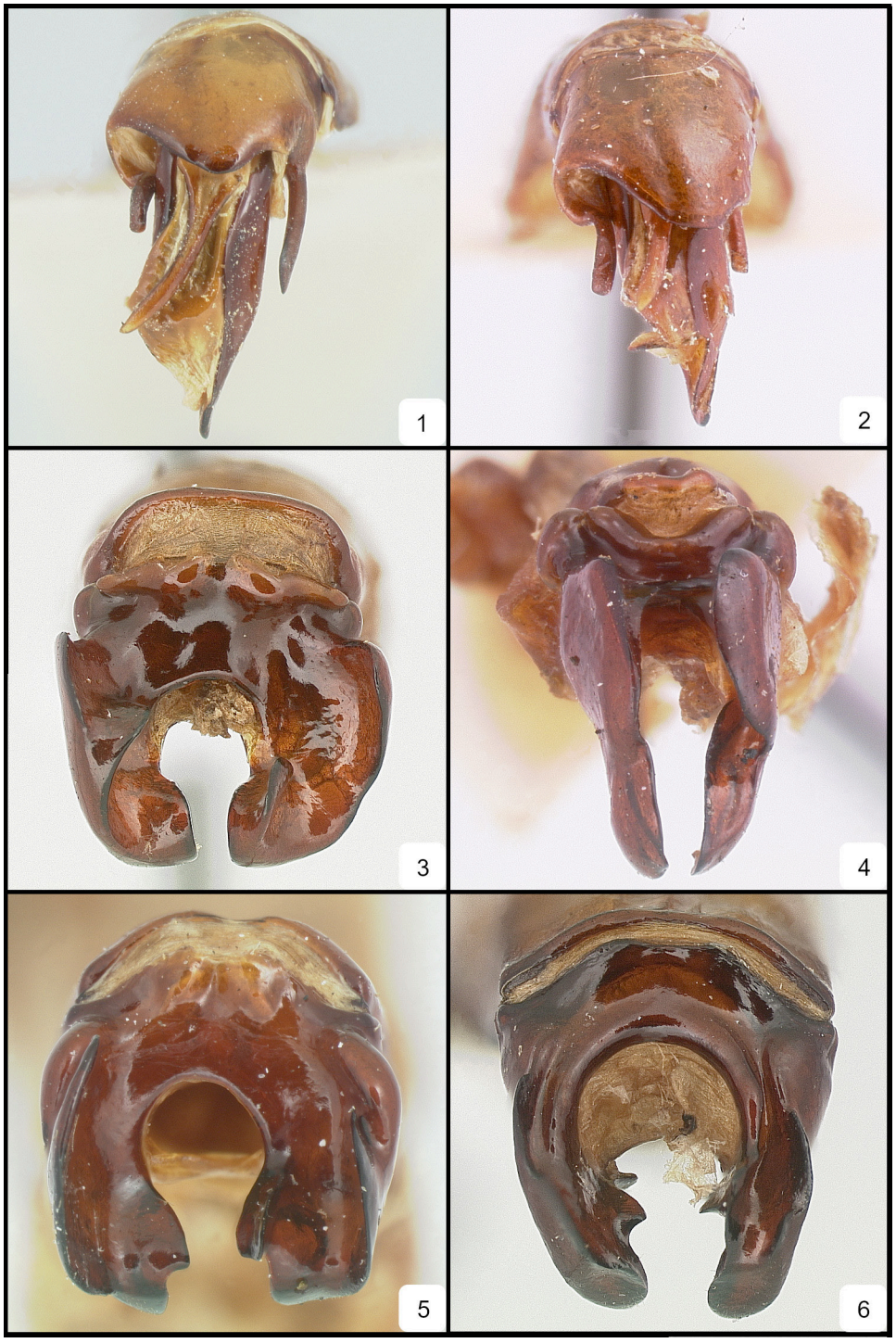

Figures 1–6. Male genitalia of *Phyllophaga* type specimens. **1)** *Phyllophaga sociata*, lectotype. **2)** *Phyllophaga knausii*, lectotype. **3)** *Phyllophaga rugosa*, neotype. **4)** *Phyllophaga chippewa*, holotype. **5)** *Phyllophaga bipartita*, lectotype. **6)** *Phyllophaga falta*, holotype.

Figures 7–12. Specimen labels of *Phyllophaga* type specimens. **7)** *Phyllophaga sociata*, lectotype. **8)** *Phyllophaga knausii*, lectotype. **9)** *Phyllophaga rugosa*, neotype. **10)** *Phyllophaga chippewa*, holotype. **11)** *Phyllophaga bipartita*, lectotype. **12)** *Phyllophaga falta*, holotype.