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Faunal Affinities of Arizona Phyllophaga, with Notes and Descriptions of New Species
(Coleoptera, Scarabaeidae)

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Source: *Journal of the Kansas Entomological Society*, Vol. 31, No. 2 (Apr., 1958), pp. 158-173

Published by: Allen Press on behalf of Kansas (Central States) Entomological Society

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semicylindrical, partially keeled medially, scobinate patches present dorso-laterally; proximal end of aedeagus slightly longer and less robust than corresponding part in *theodora* and *atristrigata*.

Female genitalia (see fig. 7) similar to those of *theodora* (genitalia of the female of *atristrigata* destroyed by dermestids and not available for comparison), but with the caudal margin of the sternal plate of the seventh segment more distinctly notched, the vagina larger and more rectangular, and the ductus bursae shorter.

Type. Holotype, male, Palmerlee, Cochise County, Arizona, U. S. N. M. type number 64131, and one female paratype, Huachuca Mountains, Arizona, July 24-31, in the United States National Museum.

Remarks. This species may be easily separated from *theodora* and *atristrigata* by the absence of a medial dash between the median shade and the antemedial band of the forewing and by the distinctive male genitalia. The species is respectfully named in memory of Dr. R. H. Beamer.

FAUNAL AFFINITIES OF ARIZONA *PHYLLOPHAGA*, WITH NOTES AND DESCRIPTIONS OF NEW SPECIES (Coleoptera, Scarabaeidae)

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The Arizona *Phyllophaga* as a whole are very different in their characteristics from the majority of the 200 species of the genus known to occur in the United States. Not until an investigation of the Mexican fauna was commenced did it become apparent that the affinities of the Arizona species are almost totally with that fauna which, in turn, has a close relationship to the Central and South American elements. Previous studies by Horn (1887), Sim (1928), Böving (1942), and Luginbill and Painter (1953), treating *Phyllophaga* s. str. or large sections of the genus in the United States, did not take into account these affinities, but Chapin (1935) and Saylor (1939, 1940, 1942), in their treatments of the then considered genera or subgenera *Chlaenobia*, *Phytalus*, and *Listrochelus*, did see these relationships.

The present study is designed to show that most of the 43 species of *Phyllophaga* known to occur in Arizona are representatives of larger groups occurring in Mexico. Indeed, one half of the Arizona species occur also in Mexico. Included in this report is a key to nine groups which also includes the subgenus *Listrochelus*. References to the literature and other aids are given for the recognition of each species in Arizona, and two new Arizona records, four new species, and some new synonymy are included.

In the course of my studies on *Phyllophaga*, many Arizona records have been assembled, and the types of nearly all species known from that state

have been examined. I am indebted to many institutions and individuals for submitting collections for study. Dr. R. H. Beamer and many students and staff members at the University of Kansas have collected *Phyllophaga* extensively in Arizona. I am especially grateful to Dr. Floyd G. Werner and Dr. George D. Butler of the University of Arizona (UA) for the opportunity of studying collections made by them during the past few years, some localities having been visited at my suggestion. To Dr. J. N. Knull of Ohio State University (OSU), Dr. Mont A. Cazier and his associates at the American Museum of Natural History (AMNH) and to various collectors associated in the past or at present with the University of California (UC) and the California Academy of Sciences (CAS), I am grateful. Mr. Owen Bryant of Montara, California, the United States National Museum, and my colleague, Dr. Richard B. Selander, have contributed significantly to these records. Through an arrangement with Dr. George A. Butler, most of the *Phyllophaga* records which were assembled for Arizona are to be published elsewhere, but certain pertinent records are included in the present report.

The identification of certain species considered in the synonymy has been made possible through the very generous gesture of Dr. K. Delkeskamp of the Humboldt University in Berlin who sent me for study the types of many of the Tropical American *Phyllophaga* described by J. Moser between 1918 and 1924. The study of this important collection has made it possible to accelerate an investigation of the Neotropical fauna and has affected the interpretations of names for several of the species described from the United States.

The following key to the groups of *Phyllophaga* represented in Arizona is based in part on secondary sexual characters of the male abdomen and tarsal claws, especially of *ravida* Blanch. In the group discussions these features are supplemented by descriptions or reference to the male genitalia. Other characters showing similarities between the sexes in most groups include the number of antennal segments, presence or absence of dorsal hairs, and characteristics of the tarsal claws.

Key to Subgenera and Groups of Arizona *Phyllophaga*

Males

1. Lower margin of tarsal claw usually pectinate (as in fig. 1) or denticulate, the pectination or denticles extending nearly full length of claw; head usually transversely ridged next to anterior margin of pronotumsubgenus *Listrochelus*
 Lower margin of tarsal claw rarely finely denticulate, denticles, if present, between apex of tooth of claw and base of claw; claw usually toothed as in figs. 2 to 5; head without transverse ridge next to anterior margin of pronotumsubgenus *Phyllophaga*—2
2. Body black in Arizona species; metasternum short; crepuscular
*cribroso* group
- Body not black; metasternum long; nocturnal 3
3. Claws on middle pair of legs dissimilar, the lower tooth of one claw offset (fig. 2a), the opposite claw with lower tooth in middle of mar-

- gin (fig. 2b) *ravida* group
 All tarsal claws similar 4
4. Antenna 9-segmented; dorsum hairy *multipora* group
 Antenna 10-segmented 5
5. Anterior margin of last abdominal sternite elevated, the apex or
 crest of elevation narrowly emarginate or bearing a flattened bilobed
 process *anodentata* group
 Last abdominal sternite without modifications 6
6. Pronotum strongly narrowed anteriorly and posteriorly, the dorsal
 surface coarsely and irregularly punctured; last one, or two abdominal
 sternites sloping toward apex of abdomen; tarsal claw cleft as in fig.
 3 *blanchardi* group
 Pronotum parallel or nearly so in basal half, the dorsal surface more
 finely and evenly punctured; last abdominal sternites not as described
 above; tarsal claws variable 7
7. Tarsal claw distinctly cleft (fig. 4) *obsoleta* group
 Claw with a vertical tooth on lower margin (fig. 5) 8
8. Dorsum evenly covered with hairs *setidorsis* group
 Dorsum usually glabrous, at most with a few hairs arranged in
 narrow longitudinal groups *ignava* group

SUBGENUS *Listrochelus*

This subgenus in the United States was adequately treated by Saylor (1940) for identification purposes and includes the following species from Arizona, in addition to twenty-five species known only from Mexico: *arizona* Saylor, *cochisa* Saylor, *cushmani* Saylor, *chapini* Saylor, *duncani* Barrett, *disparilis* Horn, *eligia* n. sp., *falsa* LeConte, *fimbripes* LeConte, *flavipennis* Horn, *granti* Saylor, *huachuca* Saylor, *luginbilli* Saylor, *mucorea* LeConte, *nogales* Saylor, *opacicollis* Horn, *plena* Fall, *scoparia* LeConte, *tarsalis* Schaeffer, *timida* Horn, *trochanter* Saylor, *wickhami* Saylor, and *snowi* Saylor. With *Listrochelus*, I would reunite the Arizona *juvenilis* Fall (1929) described as a *Listrochelus* but not included in the subgenus by Saylor. The tarsal claws of *juvenilis* are finely denticulate and its position in *Listrochelus* is probably as satisfactory at present as in any other group of the genus. The species was redescribed and illustrated by Luginbill and Painter (1953). The male genitalia are variable in this subgenus and present no distinctive features for group recognition.

Phyllophaga (Listrochelus) luginbilli Saylor

Phyllophaga (Listrochelus) luginbilli Saylor 1941:145.

Saylor described this species from one male collected at Grant[s], New Mexico, June 14, 1939. In addition to examining the type I have identified two males from Magdalena, New Mexico, Strickler, collector (KSC), and three males collected in the Huachuca Mountains, Arizona, July 12, 1953, by D. J. and J. N. Knull (OSU). The first illustrations of the male genitalia (figs. 6 and 7) are included with the presentation of these new records.

Phyllophaga (Listrochelus) nogales Saylor, new status*Phyllophaga (Listrochelus) falsa nogales* Saylor 1940:99.

This is a distinct species and not a subspecies of *falsa* LeConte as described by Saylor. Saylor distinguished *nogales* from typical *falsa* by its pruinose instead of glabrous pronotum, absence of clypeal hairs (present in *falsa*), and the narrower first posterior tarsal segment (about three times longer than apical width in *nogales*, two times longer in *falsa*). He could find no differences in the male genitalia. Close examination of the genitalia has disclosed that the angled apex of each paramere in *nogales* is dorsoventrally flattened and rounded on the apical margin (not so pointed as shown for *falsa* in Saylor's figure 9a in his 1940 revision). The left horn-like process on the aedeagus of *falsa* is strongly angled or toothed, but this process is nearly evenly rounded in *nogales*. I have examined representatives of *nogales* only from Nogales, the Huachuca Mountains and the Santa Rita Mountains in Arizona.

Phyllophaga (Listrochelus) eligia n. sp.

MALE. Length 14.5 mm.; width 7 mm. Color brownish yellow, pronotum a little paler than elytra; disc of elytra, pronotum, and head shining, glabrous, a few short nearly erect hairs on ridge above each eye. Antenna ten-segmented, three-segmented club 1.3 times longer than combined length of six preceding segments, 1.6 times longer than clypeal length at middle. Clypeus 2.4 times wider at base than median length, sides straight and convergent, anterior margin straight, strongly reflexed in anterior one third; surface of clypeus and front smooth, with punctures generally irregularly spaced, some separated by distances equal to about four times their diameters, punctures more closely placed at sides of head; vertex conspicuously angled but not forming a carinate ridge, a few punctures behind ridge, especially on sides. Pronotum about 1.62 times wider than long, widest at middle, posterior angles strongly rounded, lateral margins broadly, not deeply crenulate, with about ten long mesally directed hairs arising from punctures between crenulations; discal punctures a little smaller than those on head and about as closely placed; narrow median longitudinal area almost without punctures. Elytra as finely but more evenly punctured than pronotum, punctures separated by about three times their diameters; discal costae vague. Pygidium very strongly convex, almost impunctate, surface glabrous except for a few short hairs near the subtruncate apex. Abdomen broadly and very shallowly depressed, nearly devoid of punctures except on sides and adjacent to posterior margins of sternite, these punctures with stiff hairs of varying lengths; last sternite about one half length of penultimate sternite, shallowly and narrowly longitudinally depressed at middle, depressions widening posteriorly with sides rounded to posterior margin of outer sclerotized surface of segment; last two segments with many semi-erect long coarse hairs especially near posterior margins. Metasternum finely and closely punctured, thickly covered with long hairs, two to three times longer than greatest width of middle femur. Anterior tibia with outer swelling toward base distinct but short; tarsal segments not produced on inner margins at apexes, each segment, except first posterior,

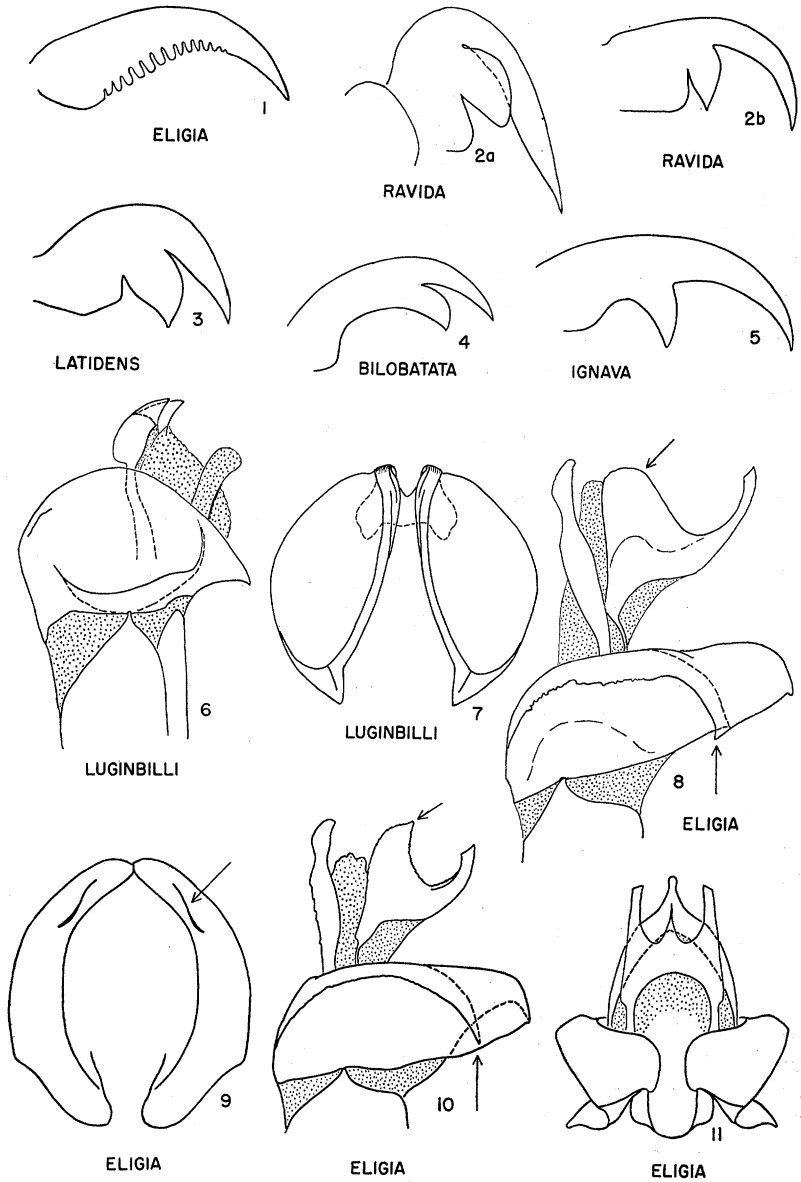


PLATE I

Fig. 1. *Phyllophaga eligia* n. sp. Male, tarsal claw of left front leg. Fig. 2a, *P. ravida* Blanch. Male, outer tarsal claw of left middle leg; 2b. Inner claw of same leg. Fig. 3. *P. latidens* Schffr. Male, outer tarsal claw of left middle leg. Fig. 4. *P. bilobatata* Saylor.

with a fine carina extending total length of lower margin, first posterior segment with short and inconspicuous carina; each tarsal claw (fig. 1) conspicuously pectinate below on a single margin and without intercalated larger and longer tooth, number of pectinations varying from ten to thirteen, one or more pectinations often closely joined; posterior tibial spurs jointed, slender, the longer spur much longer than first posterior tarsal segment measured from apex to basal constriction; apexes of posterior tibiae each with fourteen and sixteen spinules. Genitalia (fig. 8) with each paramere deeply excavated on side toward blunt apex, parameres narrowly joined at their bases (fig. 9), well separated at apexes; aedeagus (figs. 8, 10, 11) bearing four flat vertical lobes; thin lateral margins of parameres with many very fine uneven teeth.

FEMALE. Length 12-12.5 mm. Similar to male in most features except as follows: antennal club a little shorter than funicle or clypeus at middle; pygidium much less convex; abdomen evenly convex, last sternite unmodified; anterior tibia with short but distinct upper tooth or swelling; each tarsal claw bearing a short tooth beyond middle, the margin behind tooth distinctly pectinate; apexes of posterior tibiae each with sixteen to eighteen spinules.

Holotype male, Mojarachic, Chihuahua, Mexico, 6900 ft., 1938, I. Knobloch; paratype male, Montezuma Pass, Huachuca Mts., Arizona, July 11, 1957, G. D. Butler, on *Juniperus*; paratype female, same data; paratype female, west slope Patagonia Mts., Santa Cruz Co., Ariz., August 9, 1955, G. D. Butler and F. G. Werner, on *Juniperus pachyphloea*. Type in collection of United States National Museum, paratypes in collections of Illinois Natural History Survey and University of Arizona.

Variation. The fifth and sixth antennal segments of the female from the Huachuca Mountains are fused on one side; all other individuals have these segments distinct and the antenna is believed to be normally ten-segmented for the species. The paratype male is distinctly smaller than the type, measuring 12.5 mm. in length and 6 mm. in width. It differs also by having the antennal club 1.8 times longer than clypeal length at middle, clypeus 2.3 times wider at base than median length, pronotum 1.4 times wider than median length, last abdominal sternite more deeply grooved, one anterior tibia with outer swelling toward base nearly absent, first posterior tarsal segments without carinae, and posterior tibiae each with fifteen apical marginal spinules. Several differences occur in the male genitalia between the type and paratype, the lateral margins of each paramere of the paratype (fig. 10, see arrow) being much less angulate than in the type (fig. 8), the dorsal margin of paramere near base (fig. 9, see arrow) with a short ridge, each lateral sclerotized lobe of aedeagus (fig. 10) strongly angulate.

Female, tarsal claw of left front leg. Fig. 5. *P. ignava* Horn. Male, tarsal claw of left front leg. Fig. 6. *P. luginbilli* Saylor. Male genitalia, left lateral view. Fig. 7. *P. luginbilli* Saylor. Male genitalia, caudal view. Fig. 8. *P. eligia* n. sp. Male genitalia of type, left lateral view. Fig. 9. *P. eligia* n. sp. Male genitalia of paratype, caudal view. Fig. 10. *P. eligia* n. sp. Male genitalia of paratype, left lateral view. Fig. 11. *P. eligia* n. sp. Male genitalia of paratype, ventral view.

The pectinate tarsal claws (fig. 1), the presence of one marginal series of pectinations on the claw, the presence of a distinct transverse ridge on the vertex of the head, and the symmetrical male genitalia place this species in the subgenus *Listrochelus* and in the *cavata* complex which includes the Mexican or United States *laportaei* Blanchard (1850), *cavata* Bates (1888), *micros* Bates (1888), *meadei* Saylor (1940), *cochisa* Saylor (1940), and *planeta* Reinhard (1950). From these species the male of *eligia* may be distinguished by the four-lobed aedeagus and the peculiarly excavated lateral surface of the paramere. The female differs from females of other species of this complex by the simple unmodified last abdominal sternite and pygidium.

SUBGENUS *Phyllophaga*
Cribrosa group

This group of seven described species, usually black and crepuscular, is based on *cribrosa* LeConte found in New Mexico, Texas, and Oklahoma. Other species occur in the Southwest and Northern Mexico. Crepuscular species have very short metasterna with corresponding reduction of meta-thoracic wings. In all species examined the parameres are joined at their apexes (see illustrations of *cribrosa* by Luginbill and Painter, 1953) forming an angulate lobe. Females of a small black species have been examined in the University of Kansas collection from Flagstaff, Arizona, collected July 8, 1941 by Burt Hodgden. These have been tentatively identified as the Texas *epigaea* Wickham (1903) pending a revision of the group.

Ravida group

P. ravida Blanchard (1850) and *dentex* Bates (1888), widely distributed in Mexico, are the only representatives of this group found in the United States, and both occur in Arizona. Nearly a dozen species belong to the group which is distributed northward from Central America. *P. ravida* and *dentex* were treated by Luginbill and Painter (1953), each in a different section of the genus although their close relationship was noted. In addition to the male claw characteristics described in the key to groups, the parameres of the male genitalia are joined at their apexes somewhat as in the *cribrosa* group.

Phyllophaga ravida Blanchard

Ancylonycha ravida Blanchard 1850:136.

Lachnosterna heterodoxa Horn 1887:289. New synonymy.

Phyllophaga ravida is widely distributed in Mexico and Central America, and in the United States it has been taken at Nogales, Arizona, and Laredo, Texas (Sanderson, 1942). Horn described *heterodoxa* from both sexes stating that his representatives were collected in southern Arizona or possibly in Chihuahua, Mexico. His species was distinguished from *ravida* by its less robust shape, less coarsely punctured body, and more shining dorsum. The species is variable in all these features, and an examination of the type of *heterodoxa* and many specimens of *ravida* from Mexico indicates this synonymy. Luginbill and Painter (1953) considered this species under the name *heterodoxa*.

Multipora group

The *multipora* group, of which the Mexican *multipora* Bates (1888) is a typical representative, contains about twenty species distributed from South America to Mexico. In addition to the key characters for recognizing members of this group, the dorsum generally is hairy, and the parameres of the male genitalia are joined at their apexes, the ventral part of the parameres usually with one or two pairs of teeth or angulations. *P. rossi* Saylor, described from Patagonia, Arizona, is the only known United States representative of the group. Although closely resembling small individuals of *lenis* Horn (*anodentata* group), *rossi* may be distinguished by having nine instead of ten antennal segments, and it does not have the bilobed process on the last abdominal sternite of the male as in *lenis*. The photograph of the male genitalia by Luginbill and Painter is unsatisfactory for the recognition of this species, but the illustrations by Saylor (1939) are adequate.

Anodentata group

Nearly twenty-five species belong to this group, which ranges from South America into the southern United States. The Central American and Mexican *anodentata* Bates (1888) is a characteristic member. The anterior margin of the last abdominal sternite of the male is elevated and bears a distinct emargination or a flat bilobed process near the crest, this process generally extending toward the posterior margin of the sternite. In some species, the posterior margin of the fifth sternite is slightly lobed at the middle and is closely adpressed to the elevated anterior margin of the last sternite. The male genitalia are similar to those of many species in the *setidorsis* group, having the parameres joined at their apexes and bearing one or two pairs of short lobes. Three species of the group range from Mexico into the Southwest, all occurring in Arizona. Two species, *lenis* Horn and *vetula* Horn, were discussed by Luginbill and Painter. A third species, *setifera* Burmeister, is an addition to the known *Phyllophaga* fauna of the United States.

Key to Arizona species of the *anodentata* group

Males

1. Width of head between eyes approximately 6 or 7 times wider than each eye; anterior margin of clypeus slightly emarginate*vetula* Horn
 Width of head between eyes 2½ to 3½ times wider than each eye; anterior margin of clypeus rounded 2
2. Anterior margin of last abdominal sternite of male strongly reflexed posteriorly and bearing two closely placed flattened lobes produced to about middle of sternite; upper margin of joined parameres evenly rounded above paired ventral teeth (pl. 19, fig. 4, Luginbill and Painter, 1953)*lenis* Horn
 Anterior margin of last abdominal sternite strongly raised, carinate, and finely notched but not produced caudad at middle; upper margin of joined parameres (fig. 20) strongly toothed on each side
*setifera* Burmeister

Phyllophaga setifera Burmeister*Ancylonycha setifera* Burmeister 1855:335.*Lachnosterna setifera* Burmeister. Bates 1888:198.

This species was described from Mexico and subsequently recorded by Bates from Panama, Guatemala, British Honduras, Veracruz, and Oaxaca. G. D. Butler collected a male on *Acacia* in Sabino Canyon, Tucson, Arizona, July 25, 1955, a new record for the United States. *P. setifera* is the same size as *vetula* and resembles a rubbed individual of that species by not having the long hairs near the base and apex of the elytron as in well preserved *vetula*. The male genitalia of the last two species have the same general pattern in which there are two pairs of ventral and dorsal processes on the parameres, but these two sets of processes are more widely separated in *setifera* (fig. 20).

Blanchardi group

Three of this extensive group of some fifty species, characterized by the Mexican *blanchardi* Arrow (1933), occur in Arizona; *gravidula* Moser (see Sanderson, 1937, under *perita* Sanderson), *latidens* Schffr., and *beckeri* Moser. These three species were treated by Luginbill and Painter, the latter under the name *inopia* Sanderson. The male abdomen of members of this group usually is strongly convex, the last one or two sternites sloping upward. The parameres generally are separated at their apexes, and many species have variously shaped processes or lobes arising from the upper margins.

Phyllophaga beckeri Moser*Lachnosterna beckeri* Moser 1921:248.*Phyllophaga inopia* Sanderson 1942:51. New synonymy.

An examination of the type male and several paratypes of *beckeri* Moser indicates this synonymy. *P. inopia* was described from the Chiricahua and Huachuca Mountains in Arizona, and *beckeri* from Promontorio, Mexico, without indication of the state. The locality, Promontorio, occurs in Sonora, Chihuahua, and Durango, and representatives of *beckeri* have been examined from the latter two states. Moser did not relate or illustrate his species, and it was not possible to identify *beckeri* until the type was studied.

Obsoleta group

The group is a heterogeneous one and as here restricted includes about twenty Mexican and Central American species, and possibly others from South America. The group is typified by *obsoleta* Blanchard, the only species of *Phyllophaga* known having a distribution range from South America to the United States. *P. pallida* Horn, *sonora* Saylor, *bilobatata* Saylor, and *obsoleta* Blanchard occur in the United States as well as in Mexico. The first three are found in Arizona. Saylor (1939) included these three species, also *trichodes* Bates (*sandersonia* Saylor), *georgiana* Horn, and *omani* Sanderson, in the no longer recognized subgenus *Phytalus*. I am excluding these last three species from the *obsoleta* group because, unlike *obsoleta* and allies, one of the two apical spurs of the posterior tibia of the male is rigidly joined to the tibia. From the *Chlaenobia* section of the genus (Chapin, 1935) I would also transfer to the *obsoleta* group those species

having a ten-segmented antenna. The *obsoleta* group as now limited, although not necessarily on phyletic grounds, includes species having the following combination of male characters: both spurs of the posterior tibia jointed; antenna ten-segmented, club shorter than stem; each tarsal claw cleft (fig. 4), the claws generally similar on all legs and rarely with very fine denticles on lower margins of lower tooth of each claw. The male genitalia are extremely variable, representing many subgroups and complexes.

Blanda complex of the *Obsoleta* group

Within the *obsoleta* group as defined here is a complex of three undescribed species distinguished collectively by the pruinose dorsum, few to many conspicuous hairs on at least the head, and a very short last abdominal sternite, measuring less than half the length of penultimate sternite; tibial spurs not strongly curved; clypeus distinctly emarginate; pygidium of female slightly convex. One of the species is described from Arizona, the other two from Guerrero and Nayarit in Mexico. In addition to differences in the genital parameres, these species also exhibit some remarkable developments in their aedeagi. In each individual studied the aedeagus was found to be invaginated in the basal piece of the genitalia. In order to examine these structures in dried specimens, it is necessary to clear the genitalia in KOH and to evaginate the aedeagus by manipulation with a blunt pointed, hooked pin. The aedeagus of a freshly collected specimen no doubt could be inflated using the method described by Sanderson (1939), but the incompletely extended structures illustrated in the present report probably show most of the useful taxonomic features of these three species.

Key to species of the *Blanda* complex

1. Pygidium shining; dorsum with extremely minute hairs, these confined to the very small but widely separated elytral punctures, and to a small area next to each eye; parameres not fused at apexes, each pointed (figs. 12, 16), and without a transverse ridge*blanda* n. sp.
Pygidium almost entirely pruinose, shining only at extreme apex; dorsum with conspicuous hairs, these sometimes restricted to the anterior pronotal region; parameres (figs. 17, 18) lightly fused at apexes, each blunt apex having a transverse ridge (figs. 13, 14) 2
2. Elytra with short but distinct semi-erect hairs in addition to some long coarse hairs near scutellum; pronotum with some long erect coarse hairs on disc in addition to coarse hairs near anterior margin
Elytra with very minute hairs, these almost all confined to the punctures, at most a few longer and coarser hairs at elytral base; coarser hairs on pronotum confined to a band behind anterior margin; upper margin of paramere (fig. 13) nearly evenly convex*epulara* n. sp.
3. Long basal elytral hairs distinctly longer than greatest width of scutellum; upper margin of paramere (fig. 13) nearly evenly convex*epulara* n. sp.
Long basal elytral hairs shorter than scutellar width; upper margin of paramere (fig. 14) broadly concave before apex*beameri* n. sp.

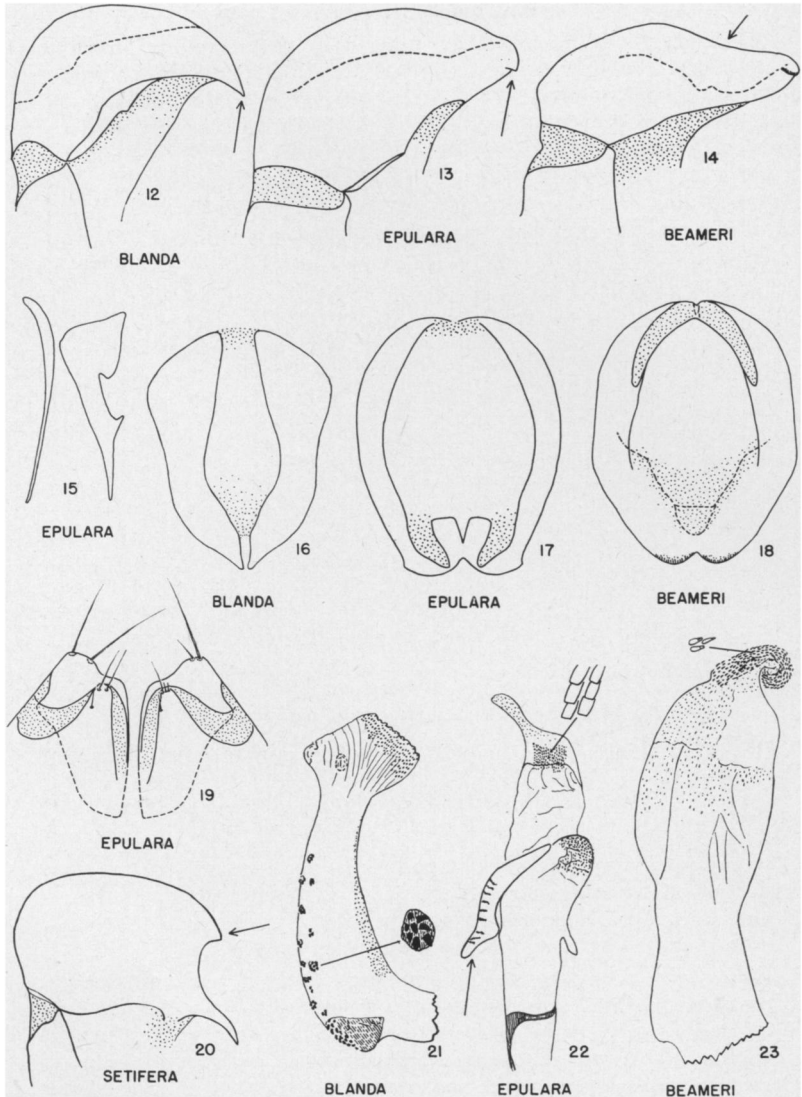


PLATE II

Fig. 12. *Phyllophaga blanda* n. sp. Male genitalia, left lateral view. Fig. 13. *P. epulara* n. sp. Male genitalia, left lateral view. Fig. 14. *P. beameri* n. sp. Male genitalia, left lateral view. Fig. 15. *P. epulara* n. sp. Female anal plates. Fig. 16. *P. blanda* n. sp. Male genitalia, caudal view. Fig. 17. *P. epulara* n. sp. Male genitalia, caudal view. Fig. 18. *P. beameri* n. sp. Male genitalia, caudal view. Fig. 19. *P. epulara* n. sp. Female genitalia. Fig. 20. *P. setifera* Burm. Male genitalia, left lateral view. Fig. 21. *P. blanda* n. sp. Male genitalia, aedeagus. Fig. 22. *P. epulara* n. sp. Male genitalia, aedeagus. Fig. 23. *P. beameri* n. sp. Male genitalia, aedeagus.

Phyllophaga blanda n. sp.

MALE. Length 18 mm.; width 9 mm. Color of elytra buffy brown, head and pronotum dark brownish red, head darker than pronotum; pronotum and elytra pruinose, essentially glabrous, a few very short pronotal hairs on sides seen at magnification of $20\times$, and a few longer hairs near each eye. Antenna ten-segmented, the three-segmented club exactly equal in length to stem, and approximately twice length of clypeus at middle. Clypeus narrowed and rounded, distinctly but not deeply emarginate at middle, the front margin very narrowly and inconspicuously reflexed; surface moderately finely and closely but not confluent punctured; punctures of front more irregular in size, some of them larger than clypeal punctures, more irregularly spaced. Pronotum 1.8 times wider than median length; side margins behind middle straight but slightly divergent, very slightly crenulate, the posterior angles rectangular; side margins in front of middle straight, strongly convergent, with two or three seta-bearing indentations; punctures finer than those on head, slightly irregularly distributed, separated by distances averaging two to four times their diameters. Elytra as finely punctured as pronotum, the surface somewhat irregular and with one or two very vague costae. Pygidium moderately convex, more strongly so near apex, about one fifth wider than long, surface glabrous, shining, the punctures small, somewhat obscure, separated approximately by their own diameters. Abdomen flattened and shining at middle throughout its length, slightly concave, with minute depressed hairs on sides, fifth sternite essentially unpunctured and unmodified, last sternite about one third length of fifth, convex in anterior half, narrowly transversely grooved in posterior half. Metasternum finely and moderately closely punctured, thickly covered with hairs approximately equal in length to greatest width of middle femur. Anterior tibia tridentate, each of first four anterior tarsal segments acutely produced on inner margin at apex, the point on first segment less than half apical width of segment; all tarsal claws of same shape, cleft, upper tooth slightly longer than lower, lower tooth slightly wider than upper; both posterior tibial spurs jointed, slender, the longer spur four fifths length of first posterior tarsal segment measured from apical margin of segment to subbasal constriction; apices of posterior tibiae with seventeen and eighteen spinules. Parameres of genitalia narrowly separated at bases and apices (fig. 16); upper margin (fig. 12) evenly convex, apex of each paramere pointed; aedeagus (fig. 21) with an elongate irregular group of small spine clusters on membrane, with a heavily sclerotized lobe at the base of the group bearing numerous small spines.

Holotype male, Sycamore Canyon near Ruby, Arizona, Santa Cruz County, August 10, 1955, F. G. Werner and G. D. Butler, at light; paratype male, Nogales, Arizona, July 30, 1957, D. J. and J. N. Knull. Type in collection of the Illinois Natural History Survey, paratype in Ohio State University collection.

Phyllophaga epulara n. sp.

MALE. Length 18 mm.; width 9 mm. Color of elytra buffy brown, pronotum dark brownish red, head darker; pronotum, elytra and pygidium

pruinose. Antenna ten-segmented, the three-segmented club slightly shorter than combined length of six preceding segments, slightly longer than length of clypeus at middle. Clypeus narrowed and rounded, conspicuously emarginate, the front margin very narrowly reflexed; surface with moderate punctures separated from one half to their own diameters; some punctures on front larger than those on clypeus, generally more closely spaced except near clypeo-frontal suture; front with a few hairs, some nearly one half median length of clypeus. Pronotum 1.8 times wider than median length; side margins slightly divergent toward base but nearly evenly rounded from base to apex and with about a dozen crenulations; posterior angles almost rectangular, anterior angles not produced; discal punctures finer and shallower than those on head, separated by distances of one to four times their diameters but averaging about twice; each puncture with a short depressed hair, some hairs fully twice as long as width of puncture; in addition to these small punctures about twenty-five larger punctures in anterior one fourth of pronotum, each bearing a very coarse seta some of which are one third median pronotal length. Elytra more finely punctured than pronotum, punctures not closely placed, each with a minute depressed hair about equal in length to small pronotal hairs; also a few longer but depressed hairs close to anterior margin of elytron; disc of elytron with one vague costa; apex of each elytron slightly emarginate. Pygidium moderately and evenly convex, very finely punctured, some punctures separated by five times their widths, each with a very short, depressed hair. Abdomen very slightly convex at middle, glabrous at middle, evenly pruinose, fifth sternite unmodified, last sternite about one third length of fifth, transversely grooved at middle. Metasternum finely punctured, thickly covered with short hairs, some nearly equal in length to greatest width of middle femur. Anterior tibia tridentate, first two tarsal segments with very inconspicuous internally produced apices; all tarsal claws of same shape, cleft, upper and lower teeth of equal length and approximately equal width; both posterior tibial spurs jointed, slender, the larger slightly longer than first posterior tarsal segment; apices of posterior tibiae with nineteen and twenty-two spinules. Parameres of genitalia weakly joined at bases (fig. 17), distinctly joined at apices; upper margin (fig. 13) nearly evenly convex, apex of each paramere with transverse ridge; aedeagus (fig. 22) bearing conspicuous footlike lobe; apical region of aedeagus with many small imbricated spines.

Holotype male, Acahuizotla, Guerrero, Mexico, 3800 ft., June 7, 1952, C. M. Rowell; paratype male, Acapulco, Guerrero, Mexico, July 1, 1951, P. D. Hurd (UC). Type in collection of Illinois Natural History Survey, paratype in collection of University of California. Two additional individuals which possibly represent this species bear the following data: male, Tamazula, Jalisco, Mexico, July 10, 1957, R. & K. Dreisbach; paratype female, Mazamitla, Michoacan, Mexico, July 24, 1953, D. Rockefeller Mex. Exp. 1953, C. & P. Vaurie (AMNH). Each differs strikingly from the type and paratype male by having, in addition to many short depressed evenly distributed dorsal hairs, several long erect hairs on the pronotal disc, in the scutellar region of the elytra, on the apical elytral declivity, and near the lateral margin of each elytron. The genitalia of the male from Tamazula

is like that of the type in all respects. The pygidium of the female is slightly convex, uniformly pruinose except for a shining spot at apical one third, and very finely but not closely punctured, each puncture bearing a short semi-erect hair. Female genitalia (fig. 19); femal anal plates (fig. 15).

Phyllophaga beameri n. sp.

MALE. Length 16.5 mm.; width 8.5 mm. Color of elytra buffy brown, head and pronotum dark reddish brown, head darker than pronotum; pronotum, elytra, and pygidium predominantly pruinose. Antenna ten-segmented, three-segmented club 1.3 times longer than combined length of six preceding segments, about 1.6 times longer than clypeus at middle. Clypeus narrowed and rounded to front margin which is conspicuously emarginate, the margin very narrowly reflexed; surface with moderate punctures separated by about one half their diameters, a little more widely spaced at middle near suture; punctures each with a short erect hair, the longest about one third length of clypeus at middle; punctures on front of same size as those on clypeus and slightly more closely placed, each having a short semi-erect hair to a long erect hair, the latter conspicuously longer and coarser than those on clypeus, some hairs three fourths median length of clypeus. Pronotum 1.7 times wider than long, slightly widest at middle, nearly evenly convex from the almost rectangular base to the unproduced apical angle; margin finely crenulate, especially in basal half and with about fifteen marginal setae; discal punctures a little finer and shallower than those on head, separated by distances from one to three times their diameters, averaging nearly twice; each of most punctures with a moderately long subdepressed hair, the longest about one tenth median pronotal length; in addition to these hairs, many irregularly longer, coarser, and darker hairs arising behind the anterior margin and on the sides, the longest of these hairs one fourth median pronotal length. Elytra a little more finely punctured than pronotum, the punctures separated by twice their diameters, each puncture bearing a distinct but short semi-erect hair, also a few long coarse setae in basal and apical regions of elytra; a single vague costa on disc; apex of each elytron straight or nearly so, not at all emarginate. Pygidium very slightly convex, finely but distantly punctured, each puncture with a short erect hair, hairs variable in length; apex of pygidium glabrous. Abdomen evenly but not strongly convex, pruinose, but not closely punctured, each puncture with a short semi-erect, curved hair, fifth sternite unmodified, last sternite almost one half length of fifth, transversely grooved in posterior one half. Metasternum finely and moderately closely punctured, thickly covered with hairs some of which are nearly equal in length to greatest width of middle femur. Anterior tibia tridentate, each of first three anterior tarsal segments slightly produced at apex on inner margin; all tarsal claws of same shape, cleft, upper and lower teeth of equal length, the lower distinctly wider at base than upper; posterior tibial spurs jointed, rather broad toward base, the longer equal in length to first posterior tarsal segment; apexes of posterior tibiae with twenty-five and twenty-six spinules. Parameres of genitalia (fig. 18) weakly united basally, more broadly joined at apexes; upper margin (fig. 14) slightly but broadly emarginate; apex of each paramere with transverse ridge; aedeagus as in fig. 23.

Holotype male, 16 miles NW Tepic, Nayarit, Mexico, July 19, 1953, University of Kansas Mexican Expedition. Type in collection of University of Kansas. This species is dedicated to the memory of Dr. R. H. Beamer, my companion on many May beetle collecting trips.

Setidorsis group

This is one of the largest groups of New World *Phyllophaga* containing about sixty species of which one third are known to occur in the United States. Other members of the group, including the characteristic Mexican *setidorsis* Bates (1888), are distributed through Mexico, Central and South America. The only Arizona representative is *inflexa* Barrett, which, unlike most Arizona *Phyllophaga*, appears to be more closely related to several eastern species than to the Mexican elements. It was treated by Luginbill and Painter (1953). Several types of male genitalia are found in this group, but in nearly all species the parameres are joined at their apexes; many species have one or two pairs of teeth on the ventral side as in the *anodentata* group.

Ignava group

The *ignava* group in Arizona, in addition to *ignava* Horn, includes *lobata* Fall, *fucata* Horn, and *opaca* Moser (*iroides* Fall), all occurring in Mexico. These four species were treated by Luginbill and Painter (1953) in two "classes". In addition to these species, nine or ten others occur in Texas and New Mexico, and about fifteen species have been recognized principally from Mexico and Central America.

Phyllophaga opaca Moser

Lachnosterna opaca Moser 1918:165.

Phyllophaga iroides Fall 1929:112. New synonymy.

P. iroides, described from the Huachuca Mountains in Arizona, was compared with *submucida* LeConte, a southern species not known to occur in Arizona. *P. opaca* was described from Mexico without additional information and it was not compared with other species. The types of both species have been examined and are identical in all respects. The species was treated by Luginbill and Painter (1953) under the name *iroides*.

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THE GENUS *BONZIA* IN THE NEW WORLD (Acarina, Cunaxidae)¹

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The new world species described below is intermediate between *Cunaxa* v. Heyden, 1826 and *Bonzia* Oudemans, 1927. *Bonzia*, as defined for the two European species, *B. halacaroides* Oudem., 1927 and *B. sphagnicola* Willmann, 1939, is characterized by Thor and Willmann (1941) and Baker and Hoffman (1948) as having a many-branched spine on the dorso-medial surface of the third palpal segment (telofemur), palpi shorter than the chelicerae, a pair of geniculate setae on the anterolateral margins of the hypostome (fig. 2), one pair of eyes, and the leg coxae fused with the venter of the podosoma to form one large ventral plate. However, this new species possesses only one of the above characters, the branched spine on the palpal telofemur, while the other features mentioned above are as in other genera, especially *Cunaxa*. Only the branched spine on the palpal telofemur now appears to be a unique structure for *Bonzia*. Considering the characters of this New World species and those of the two Old World species, it appears desirable to redefine the genus *Bonzia*.

¹Contribution number 965 from the Department of Entomology, University of Kansas.