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NOTES ON BEETLES RELATED TO PHYLLOPHAGA HARRIS, WITH DESCRIPTIONS OF NEW GENERA AND SUBGENERA

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THE discussions presented and the conclusions reached in the present paper are the result of a critical study of 543 species of phyllophagan beetles from North, South, and Central America and the West Indies. These species are divided among four genera, with subgenera, as follows: (A) *Phyllophaga* Harris, 453 species (distributed in subgenus *Phyllophaga* sensu stricto, 326 species; subgenus *Listrochelus* Blanchard, 56 species; subgenus *Phytalus* Erichson, 51 species; subgenus *Chlaenobia* Blanchard, 12 species; and remaining subgenera, 8 species); (B) *Cnemarachis*, new genus, 85 species (distributed in subgenus *Cnemarachis* sensu stricto, 84 species, and *Abcrana*, new subgenus, 1 species); (C) *Clemora*, new genus, 2 species; (D) *Triodonyx*, new genus, 3 species.

About half of the species of *Cnemarachis* were studied at the United States National Museum, while nearly all the remaining 500 species are represented in my collection.

In addition to the species enumerated above, I have studied well over a hundred species of *Ancylonycha* Dejean (synonyms: *Holotrichia* Hope and *Brahmina* Blanchard), most of them undetermined, and also a large number of species of closely related genera (*Heptaphylla*, *Microtrichia*, *Haplidia*, *Encya*, *Empecta*, *Trematodes*, *Metabolus*, *Hoplochelus*, *Rhizotrogus*, *Lepidiota*, and others), some of which are valid and others apparently inseparable from *Phyllophaga*.

A number of years ago I discovered that all the adult West Indian *Phyllophaga* are distinguished from the continental American forms by possessing spined middle and hind tibiae and by nearly or entirely lacking a tibial carina. In 1937 I called these tibial characters to the attention of Drs. A. G. Böving, E. A. Chapin, Milton Sanderson, and others. From Dr. Böving I learned that he could separate the West Indian larvae from those of the continent and so was pleased when he agreed to accompany the present paper on the taxonomy of the adults with a paper concerning the taxonomy of the larvae.¹ The conclusions reached independently by Dr. Böving and myself, on the limits of the genera discussed herein, are practically identical.

TRIODONYX,² new genus

Male and female practically inseparable as to the external characters (antennal length, robustness of body, abdominal characters, etc.). Male abdomen with the fifth and sixth sternites plane as in the female. Clypeal suture straight or nearly so. Labrum about three-fifths the width of clypeus and slightly projecting in front of clypeus, widely and deeply cleft at middle. Each claw with a very strong median tooth, an obtusely rounded and not at all prominent basal dilation, and a third small but very distinct tooth between the dilation and the median tooth. Anterior tibia tridentate. Hind and middle tibiae each with traces of a transverse carina visible only at each side; inner posterior margin slightly crenate. Spurs of hind tibia free, usually slender. Abdomen convexly rounded, the transverse sutures hardly visible; sixth segment short, free, plane in both sexes. Propygidium with a broad, flat, median longitudinal sulcus, about one-twelfth the width of the pygidium, the margins of the sulcus slightly overhanging. Male genitalia symmetrical, tubular and very large for the size of the insect. Other characters as in *Phyllophaga*.

Genotype.—*Phyllophaga gigantissima* Saylor. The species, described by me in the April 1935 issue of the *Revista de Entomologia* (vol. 5, p. 33), was based on two male specimens; since that time I have seen a small series of both sexes, all from the State of Sinaloa, Mexico.

The genus is distinct from *Phyllophaga*, *sensu stricto*, in the characters given above; the close similarity of the two sexes, especially in the abdominal characters, is surprising.

The two tarsal teeth in addition to the small basal dilation are, to the best of my knowledge, found only in the genotype and in *P. lalanza* Saylor and *P. ecostata* Horn. These three species are the only

¹ Proc. U. S. Nat. Mus., vol. 92, No. 3146.

² *tri*, three + *odous*, tooth + *onyx*, claw.

described ones known to me that belong in *Triodonyx*. *P. ecostata* possesses most of the characters of the new genus (3-toothed tarsal claws, lack of noticeable sexual differences, incomplete tibial carinae, straight clypeal carina) except that the propygidium is plane and not sulcate; in spite of this I believe it best to place *ecostata*, at least for the time being, with *lalanza* and *gigantissima*.

CNEMARACHIS,* new genus

Adults with characters on the whole as in *Phyllophaga*, sensu stricto, but differing as follows: Either middle or hind tibiae or usually both, of both sexes, with an incomplete carina; lateral margins of the middle and hind tibiae usually with obviously serrate edges or with one to several moderately large to large spines; only rarely do the tibiae lack such carinae or spines or teeth. Locality: West Indies.

Genotype.—*Lachnosterna vandinei* Smyth.

The genus includes nearly all the described West Indian species formerly placed in *Phyllophaga*. These have at one time or another been listed under the following generic names: *Ancylonycha* Dejean, *Phyllophaga* Harris, *Lachnosterna* Hope, *Melolontha* Fabricius, and *Phytalus* Erichson. The genus is divided into the following two subgenera:

CNEMARACHIS, sensu stricto, new subgenus

Tarsal claws in both sexes with a distinct median or submedian tooth. Tibia never with a complete or nearly complete carina.

Type of subgenus.—*Lachnosterna vandinei* Smyth, from Puerto Rico. Nearly all the described species of *Cnemarachis* belong in this subgenus. In most of them the lateral tibial teeth are very marked, the antennal club is small and ovate, and the male abdomen is rather gibbose, much as in the females of the continental *Phyllophaga*.

ABCRANA, new subgenus

Tarsal claws entirely simple in the male (female unknown). Hind tibia with a weak, though nearly complete, carina. Middle tibia with carina usually complete, at times much feebler at the middle than at sides.

Type of subgenus.—*Phyllophaga crinitissima* More, monobasic. It occurs in Puerto Rico.

CLEMORA, new genus

The adults are similar to those of the genus *Phyllophaga* but differ from them in the following characters: Hind and middle tibiae each with very incomplete carina; lateral tibial edges with spines; and

* *onema*, tibia + *rachis*, spine.

claws cleft. The genus differs from *Cnemarachis* mainly in the shape of the claws, which in *Cnemarachis* are never cleft.

Genotype.—*Phytalus smithi* Arrow, from Trinidad and Barbados.

The genus is not well separated from the main group of *Cnemarachis*, and were it not for certain larval differences I would rather treat it as a subgenus of *Cnemarachis*.

Phytalus apicalis Blanchard, which occurs commonly in Puerto Rico, also belongs in the genus *Clemora*.

KEY TO THE PHYLLOPHAGAN GENERA OF THE NEW WORLD

1. Tarsal claws each with 2 distinct teeth (pl. 17, fig. 9e) in addition to a basal dilation and apical tooth; hind and middle tibiae of both sexes without a complete carina across each tibia, the carina indicated by a blunt toothlike lobe; propygidium with a moderately broad, well-marked, flat, longitudinal groove extending entire length of segment; no external sexual differences obvious, male abdomen simple as in female. Mexico and United States
Triodonyx, new genus

Tarsal claws with but one tooth in addition to basal angulation and apical tooth; hind and middle tibiae with or without a complete carina; propygidium always plane; sexual differences always evident and usually well marked externally in antennal length and form and in abdominal characters; abdomen always with obvious differences between sexes..... 2
2. Either one, but more commonly both, of hind and middle tibiae of each sex with an incomplete carina (pl. 17, figs. 1-5); lateral margins of tibiae usually with separate edges or well-marked spines, rarely (*crinitissima*, pl. 17, fig. 5) without either carina or teeth or spines. West Indies..... 3

Hind and middle tibiae each of both sexes usually with a complete transverse or oblique carina at about middle (pl. 17, figs. 1-7, 10-13); if absent on hind tibia of male, then there is a complete carina on at least the middle tibia; females always with a complete carina on both middle and hind tibiae; ⁴ lateral margins of tibiae usually without teeth or spines. ⁵ American continental species..... Phyllophaga Harris
3. Claws never cleft, but with a median or submedian tooth. West Indies
Cnemarachis, new genus

Claws distinctly cleft at apex. West Indies..... Clemora, new genus

KEY TO SUBGENERA OF CNEMARACHIS

1. Claws with a distinct median tooth; tibiae never with complete or nearly complete carina (pl. 17, figs. 1-4)..... Cnemarachis, new subgenus

Claws entirely simple, without trace of a median tooth; hind tibia with a weak though nearly complete carina; middle tibia with carina usually complete, at times weakly indicated at middle (pl. 17, fig. 5).
Abcrana, new subgenus

⁴ In rare cases, e. g., *P. inversa* (pl. 17, fig. 10), *ecostata*, and some specimens of *barda*, the carina may be weak or incomplete on both middle and hind tibiae of male, but in such instances the absence of lateral tibial spines or teeth in the males, or the presence of a complete carina of the female, if such is available, will allow ready reference to the proper genus.

⁵ Or, if these are present, as is rarely the case, as in the Mexican species *P. bolacoides* and *scissa* (pl. 17, fig. 7), the tibiae are strongly carinate.

KEY TO THE NORTH AND CENTRAL AMERICAN
SUBGENERA OF PHYLLOPHAGA

1. Claws long and simple except that each has a distinct median, submedian, or basal tooth; vertex never with a transverse carina; males of some species either with one spur connate with tibia or with only a single spur..... 2
Claws either cleft (usually rather narrowly so) or serrate or pectinate or without teeth; vertex with or without a transverse carina; males with tibial spurs free and always two in number..... 4
2. Dorsal surface with dense scales and with or without intermixed hairs. (Female with vestigial wings; male winged, its abdomen with compressed tubercles on each segment.) United States..... Tostegoptera Blanchard
Dorsal surface without scales, vestiture consisting of hairs or lacking entirely..... 3
3. Female with vestigial wings, males with functional (*farcta*) or not functional wings (*cribrosa*); metasternum of female very short, only as long as second abdominal segment; both tibial spurs free in male. United States and Mexico..... Eugastra LeConte
Both sexes fully winged; metasternum in both sexes much longer than second abdominal segment; either both tibial spurs free in male or one connate with tibia or rarely one lacking. North, South, and Central America
Phyllophaga Harris
4. Claws serrate or pectinate, rarely quite simple; vertex usually with a strong to moderately strong transverse carina, rarely without a carina. North and Central America..... Listrochelus Blanchard⁶
Claws never serrate or pectinate or simple, always variously cleft; vertex never carinate..... 5
5. Male with hind claws widely cleft, claws of fore and middle tarsi simple. (Female unknown.) Mexico..... Chirodines Bates
Claws of all tarsi similar or nearly so in both sexes and narrowly to widely cleft..... 6
6. Tarsal segments densely to moderately pilose beneath, less densely so in females (segments broadened in males of several species); color usually light testaceous. North and Central America..... Chlaenobia Blanchard⁷
Tarsal segments sparsely pilose beneath or not pilose (segments never widened in either sex); color variable. North, South, and Central America..... Phytalus Erichson⁸

GENOTYPES OF THE AMERICAN PHYLLOPHAGAN GENERA AND
SUBGENERA

Since the genotype designations of the American genera and subgenera mentioned above are rather scattered, and also since in several cases designations have not heretofore been made, the following summary is presented:

Phyllophaga HARRIS, 1826, Massachusetts Agr. Repos., vol. 10, p. 6. Type: *Melolontha hirticula* Knoch, designated by Glasgow in 1916. Present status: Accepted as a valid genus.

⁶ See Saylor, Proc. U. S. Nat. Mus., vol. 89, pp. 59-130, 1940.

⁷ See Chapin, Smithsonian Misc. Coll., vol. 94, No. 9, 20 pp. 1935.

⁸ See Saylor, Proc. U. S. Nat. Mus., vol. 86, pp. 157-167, 1939.

- Lachnosterna* HOPE, 1837, The coleopterist's manual, vol. 1, p. 100. Type: *Melolontha fervida* Fabricius, by original designation. Present status: Accepted as a synonym of *Phyllophaga*.
- Phytalus* ERICHSON, 1847 (not 1848), Naturgeschichte der Insekten Deutschlands, vol. 3, pt. 1, p. 658. Type: *Melolontha pubereus* Mannerheim, by present designation. Present status: Accepted as a valid subgenus of *Phyllophaga*. (Erichson described the genus but included no species in it. Blanchard in 1850 redescribed the genus and included eight species, the first of which, *pubereus* Mannerheim, is here selected as the genotype.)
- Trichesthes* ERICHSON, 1847 (not 1848), *ibid.*, p. 658. Type: *Melolontha pilosicollis* Knoch, monobasic (this is a synonym of *Melolontha tristis* Fabricius, which is therefore the type). Present status: Accepted as a synonym of *Phyllophaga*.
- Listrochelus* BLANCHARD, 1850, Catalogue de la collection entomologique du Muséum d'Histoire Naturelle de Paris, Coleoptera, p. 141. Type: *Listrochelus laportei* Blanchard, monobasic. Present status: Accepted as a valid subgenus of *Phyllophaga*.
- Chlaenobia* BLANCHARD, 1850, *ibid.*, p. 116. Type: *Chlaenobia ciliatipes* Blanchard, monobasic. Present status: Accepted as a valid subgenus of *Phyllophaga*.
- Trichestes* BLANCHARD, 1850, *ibid.*, p. 141 (unnecessary emendation of *Trichesthes* Erichson). Type: *Melolontha pilosicollis* Knoch, monobasic (this is a synonym of *Melolontha tristis* Fabricius). Present status: Accepted as a synonym of *Phyllophaga*. (Blanchard says "absque character." of Erichson's description, though he credits it to Erichson. This is incorrect since Erichson gives a short description; and Erichson's spelling is to be accepted.)
- Tostegoptera* BLANCHARD, 1850, *ibid.*, p. 149. Type: *Melolontha lanceolata* Say, monobasic. Present status: Accepted as a valid subgenus of *Phyllophaga*.
- Eugastra* LECONTE, 1856, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 3, p. 234. Type: *Tostegoptera cribrosa* LeConte, by present designation (Bloeker in 1937, Bull. Southern California Acad. Sci., p. 83, says that LeConte designated this as genotype in his original description, but that is not the case). Present status: Accepted as a valid subgenus of *Phyllophaga*.
- Endrosa* LECONTE, 1856, *ibid.*, p. 234. Type: *Melolontha quercus* Knoch, by present designation. Present status: Accepted as a synonym of *Phyllophaga*.
- Gynnis* LECONTE, 1856, *ibid.*, p. 262. Type: *Gynnis debilis* LeConte, monobasic. Present status: Accepted as a synonym of *Phyllophaga*.
- Chirodines* BATES, 1888, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 169. Type: *Chirodines zunilensis* Bates, monobasic. Present status: Accepted as a valid subgenus of *Phyllophaga*.

MISCELLANEOUS NOTES ON SOME EXOTIC MELOLONTHINAE

MELOLONTHA MELOLONTHA Linnaeus

The peculiar elongated pygidial process will immediately separate both sexes of this European species from any of the described Melolonthinae of the New World, as also will the blunt mesosternal process prolonged between the middle coxae. Though close to *Polyphylla* in

facies, *Melolontha* has claws as in *Phyllophaga* and not as in *Polyphylla*. The antennal club of *Melolontha melolontha* is 7-segmented in the male and 6-segmented in the female.

APOGONIA CUPRESCENS Blanchard

This Philippine species is typical of the genus and is treated for the purpose of comparing adults of this and the American *Diplotaxis tristis* Kirby. I am unable to separate these two species generically, all salient characters appearing to be nearly identical. The only difference seems to be in the hind and middle tibiae, which are slender in *cuprescens* and entirely lack a transverse carina, whereas in *tristis* these tibiae are slightly more robust and have traces of a transverse carina on each. In the species of *Diplotaxis* from United States the tibial carinae vary from well-marked to nearly absent.

The larvae of the different species of *Apogonia* and *Diplotaxis* can no more be separated generically than their adults can, judged from the descriptions of the larvae of *Apogonia cupreoviridis* Kolbe from Korea,⁹ *Apogonia villosella* Blanchard, and *Apogonia cribricollis* Burm from India¹⁰ and the examination of larvae of *Diplotaxis sordida* Say and *Diplotaxis brevicollis* LeConte from the United States. I do not care at the present time definitely to synonymize these two genera but wish merely to point out the very close relationships of adults and larvae of the two. Whether they may have to be united or further divided will have to await later study of the genotypes.

HAPLIDIA TRANSVERSA Fabricius

This European species is the type of the genus by designation of Hope in 1837. *Haplidia* approaches the West Indian *Cnemarachis* in the characters of the middle and hind tibiae, which in both genera have very incomplete carinae and well-marked marginal spines; it differs from *Cnemarachis* in the less obvious sexual characters, which are evidenced only by the very slightly more robust abdomen, shorter antennal club, and shorter tarsi of the female; the sixth abdominal segment is rounded in both sexes and not differentiated as in the species of *Cnemarachis*. The most distinctive feature, and one separating *Haplidia* from all our American Rhizotrogini except *Listrochelus*, is the presence of a strong arcuate carina on the front below the vertex. In *Listrochelus* the carina is never so distinctly marked; it is always straight, never strongly rounded; and the tibial carinae are always well marked and complete. The claws of *Haplidia transversa* are as in typical continental *Phyllophaga*, that is, long and having a short submedian triangular tooth.

⁹ Murayama, Jozo, For. Stat. Chosen Bull. 11, pp. 33-36, 1931.

¹⁰ Gardner, J. C. M., Indian For. Rec., new ser., Entomology, vol. 1, p. 15, figs. 26-28, 1935.

ANOXIA PILOSA Fabricius

The males of the three European species before me, *pilosa* Fabricius, *villosa* Fabricius, and *orientalis* Krynicky, differ from the male of the American *Polyphylla gracilis* Horn as follows: The terminal segment of the maxillary palpus is broader and strongly impressed dorsally; the tarsi are subequal to or shorter than their respective tibiae; the antenna is 10-segmented with 5-segmented club; and the tarsal tooth is much more strongly inclined to one side.

In the female, *A. pilosa* has a 4-segmented and *P. gracilis* a 5-segmented antennal club, while both have the front tibiae bidentate. The males of all the United States and the Neotropical species of *Polyphylla* differ from the males of the examined *Anoxia* in having bidentate front tibiae, whereas the *Anoxia* males have no external teeth on the front tibiae other than the blunt outer apical angle.

The North American *Thyce fieldi* Fall is the only species of that related genus having unidentate front tibia in the male, and it is doubtful whether the number of teeth on the front tibia offers a character of more than subgeneric value.

RHIZOTROGUS (AMPHIMALLON) SOLSTITIALIS (Linnaeus)

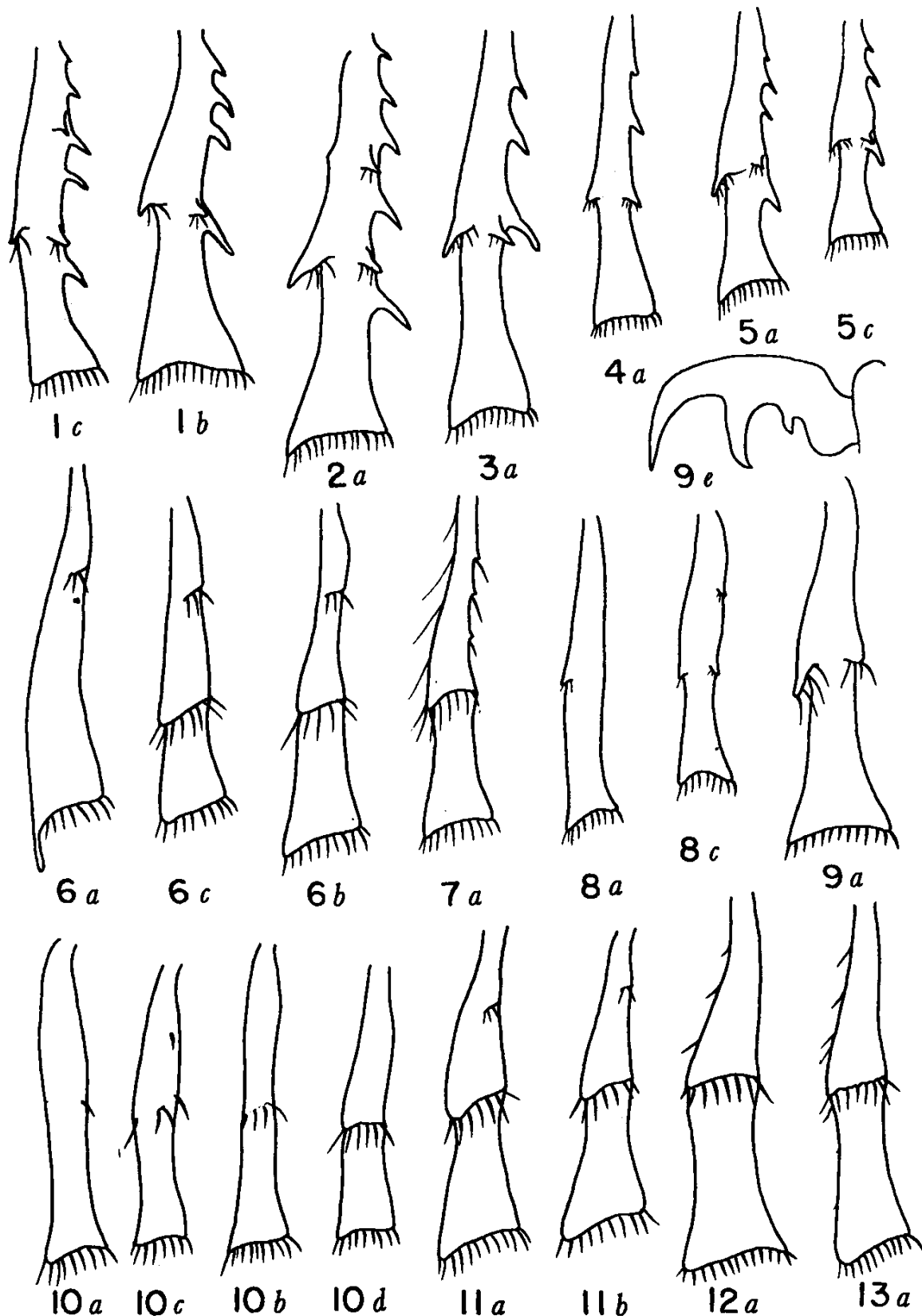
The adult of this European species, although close to the American species of *Phyllophaga*, belongs to a distinct genus. The male *solstitialis* differs from the male of our *Phyllophaga* as follows: The tarsal segments are thicker; the front tibiae are unidentate or second tooth is hardly obvious; the middle tibiae have a very incomplete or no carina; the claws are a little thicker; the sixth abdominal segment is plane and without sexual differentiation; and the genitalia are quite tubular and symmetrical but still approach somewhat closely in form the genitalia of certain neotropical species. The major distinction between *Rhizotrogus solstitialis* and our continental *Phyllophaga* is the lack of distinct sexual differences on the abdomen.

Genus ANCYLONYCHA Dejean

Ancylonycha DEJEAN, Catalogue des coléoptères de la collection de M. le Comte Dejean, ed. 2, p. 160, 1833. (Type: *Melolontha serrata* Fabricius, the third included species; designated by Duponchel, Dict. Univ. Hist. Nat., vol. 1, p. 526, 1849.)

Holotrichia HOPE, The coleopterist's manual, vol. 1, p. 99, 1837. (Type: *Melolontha serrata* Fabricius, by original designation.)

Duponchel designated *M. serrata* Fabricius as genotype of *Ancylonycha*, and since this species is included in the original Dejean set-up, the type designation is valid, and the inclusion of a described species in the genus validates the name *Ancylonycha* Dejean of 1833.



- 1, *Cnemarachis vandinei* (Smyth); 2, *Cnemarachis portoricensis* (Smyth); 3, *Cnemarachis crenaticollis* (Blanchard); 4, *Clemora smithi* (Arrow); 5, *Cnemarachis (Abcrana) crinitissima* (More); 6, *Phyllophaga latifrons* LeConte; 7, *Phyllophaga scissa* (Bates); 8, *Cnemarachis dissimilis* (Chevrolat); 9, *Triodonyx gigantissima* (Saylor); 10, *Phyllophaga inversa* Horn; 11, *Phyllophaga hirticula* (Knoch); 12, *Phyllophaga (Eugastra) cribrosa* LeConte; 13, *Phyllophaga (Tostegoptera) lanceolata* (Say). [a, Lateral view of male hind tibia; b, same of female; c, lateral view of male middle tibia; d, same of female; e, tarsal claw.]

(Blanchard's genotype designation in 1845 of *Holotrichia pubera* Dejean is not valid because "*pubera*" is a nomen nudum.)

Holotrichia, which is in such general use today, falls unfortunately as an absolute synonym of *Ancylonycha* and is not available for use, since Hope designated as genotype *M. serrata* Fabricius, the same species later designated as genotype of *Ancylonycha* by Duponchel. In our catalogs, *Ancylonycha* is listed as a synonym of *Lachnosterma* Hope or *Phyllophaga* Harris and is credited to Blanchard, 1845. In reality, the name *Ancylonycha* traces back to Dejean. In the second edition of his Catalogue, 1833, page 160, the first three species listed under this name are, in order: *pubera* Dejean (a nomen nudum), *Melolontha leucophthalma* Wiedeman, and *Melolontha serrata* Fabricius; listed in addition are 44 other "species." In the 1836 edition of the same Catalogue, on page 177, the first three names are given in the same order as in the 1833 edition, and in all 54 "species" are included, many of them nomina nuda.

ANCYLONYCHA MINDANAONA Brenske

Study of a series of reared adults of this species from Guam shows that the middle tibia is always without transverse carina and that the hind tibial carinae vary from nearly to entirely obsolete. In this character the species is close to the species of the West Indian genus *Cnemarachis*. The male genitalia are much more tubular than in most species of the continental American forms of the genus *Phyllophaga*, and the sexes of *A. mindanaona* are hardly separable because the sixth abdominal segment is not sexually modified. This last character alone, which it shares with the species of *Rhizotrogus*, separates it from the species of our continental *Phyllophaga* to which it is on the whole closely related.

All data given above support the view elsewhere presented¹¹ that the genus *Ancylonycha* cannot be separated in toto from the continental American genus *Phyllophaga* on other than geographical grounds, though many of the species placed by various authors in the genus *Holotrichia* are at least subgenerically differentiated. However, the lack of sufficient material of determined species prevents a more conclusive statement of their relationship at present.

¹¹ Saylor, Rev. Ent., vol. 7, pp. 318-322, 1937.