

JOURNAL

OF THE

New York Entomological Society

VOL. LII

MARCH, 1944

No. 1

A REVISION OF THE NEARTIC SILPHINI AND NICROPHORINI BASED UPON THE FEMALE GENITALIA (COLEOPTERA, SILPHIDÆ)

BY ROSS H. ARNETT, JR.

ITHACA, NEW YORK

The use of the female genitalia as a basis for identification of genera and species of Coleoptera has been greatly neglected. In some groups of beetles, however, the female genitalia apparently offer more diversity of form among species than do those of the male. Tanner in 1927 pointed out a growing necessity for a study of the genitalia of beetles for specific descriptions. The genitalia are naturally more constant within a species than other parts and they give the taxonomist a better concept of a species, and its subspecific forms and categories.

The purpose of this study is to present the comparative morphology of the female genitalia of the Nearctic Silphini and Nicrophorini. It is hoped that the drawings, the key to the genitalia and the synopsis will be an aid to identification. No basic conclusions have been made as to relationships, although certain tendencies have been indicated.

ACKNOWLEDGMENTS.—I wish to express my sincere appreciation and thanks to Professor J. C. Bradley of Cornell University, under whose direction this work was done, for his many suggestions and criticisms. I am also greatly indebted to Mr. V. S. L. Pate of Cornell University for help in preparing the paper itself and to Mr. J. G. Franclemont for aid in developing a technique for the study of the genitalia.

I am indebted to Professor M. H. Hatch of the University of Washington and to the United States National Museum for their generous loan of material for which I thank them sincerely.

Finally, I wish to thank Mr. E. D. McDonald, Jr. and Mr. Rudolph Schuster for their aid in making the drawings, and to my wife Mary both for aid in typing the paper and for her continual encouragement.

METHODS.—The methods used in this study are somewhat different from those used by Tanner. The beetle was first relaxed in hot water and the genitalia removed with a pair of forceps and boiled in caustic potash. They were then put in water and the mid-ventral membrane cut, the two lateral plates (the paraprocts) flattened out on each side of the dorsal plate (the procotiger) and the coxite bent out to the side of the valvifer so that the whole organ was flattened out. It was then mounted in balsam. This enables projection drawings to be made. It is essentially the same method as that used in studying the male genitalia of Lepidoptera.

SEXUAL DIFFERENCES.—In the female Silphini, the sutural angles of the elytra are very acute, whereas in the males they are generally but not always rounded. The hind femora are greatly enlarged in the males of *Silpha littoralis* L. and normal in size in the female sex. Little sexual differences is evident in *Thanatophilus truncata* Say.

In the Nicrophorini studied, the males have the eyes situated well forward on the head, the clypeus large and the fore tarsal pulvilli expanded, whereas in the females the eyes are placed well towards the back of the head, the clypeus is appreciably smaller and the fore tarsal pulvilli are simple.

SPECIES STUDIED

NEARTIC SPECIES.—A list of the species considered in this paper follows. Only a few forms of subspecific rank have been studied. Of those studied, however, some changes have had to be made in their ranking. Of the others, the opinion of other authors has been followed in considering their rank. In the case of *Nicrophorus pulsator* Gistel, and *Silpha tyrolensis* Leach, the evidence of their existence in the Nearctic region is insufficient and they have not been included here.

NEARTIC SILPHINI AND NICROPHORINI

*Silphini**Silpha* L.*littoralis* L.form *surinamensis* Fab.ab. *bizonatus* Port.-*disciocollis* Brulle*analisis* Chev.*æquinoctialis* Gistel*braziliensis* Dej.*cayennensis* Berg. (nec
Sturm.)var. *elongata* Port.var. *discreta* Port.*Thanatophilus* LeachSubgenus *Oiceoptoma* Leach*americana* L.*peltata* Catesbyab. *affinis* Kby.*terminata* Kby.*canadensis* Kby.acc. *brunnipenis* Hatch*noveboracensis* Forst.*marginalis* Fab.*marginata* Kby.*quadripunctata* L.*quadripunctulata* Muller*quadrinaculata* Samouellevar. *sempunctata* Gerh.ab. *bifasciata* Schulze.*inaequalis* Fab.subsp. *rugulosa* Port.*subrugata* Cherv. nom.

nud.

acc. *bicolorata* Hatch*ramosa* Say*cervaria* Mann.*ænescens* CaseySubgenus *Thanatophilus* s. str.*lapponica* Hbst.*tuberculata* Germ.subsp. *caudata* Say*californica* Mann.subsp. *granigera* Cherv.*trituberculata* Kby.*sagax* Mann.*coloradensis* Wick.*obalskii* Port.*truncata* Say*mexicana* Cherv. in litt.*Blitophaga* Reitt.*opaca* L.*hirta* Schaff.*villosa* Naezen*tomentosa* Villersvar. *samnitica* Fiorivar. *binotata* Port.*bituberosa* Lec.*Nicrophorini**Nicrophorus* FabriciusSubgenus *Necrocharis* Portevin*carolinus* Fab.*mediatus* Fab.ab. *mysticallis* Ang.ab. *scapulatus* Port.ab. *dolosus* Port.ab. *floridæ* Hatchab. *krautwurini* Hatchab. *lunulatus* Hatchab. *nebraskæ* HatchSubgenus *Nicrophorus* s. str.*orbicollis* Say*halli* Kby.*quadrisignatus* Cast.

humator Fab.

sulactus Fisch.

paratype of *grandior*

Angell

var. *atricornis* Meier.

ab. *maculosus* Meier.

ab. *rubropleuralis* Delah.

delahoni Schilsky i. litt.

ab. *signiceps* Delah.

subsp. *tenuipes* Lewis

sayi Cast.

lunulatus Gistel

lunatus Lec.

luniger G. & H.

marginatus Fab.

requiscator Gistel

montezumæ Matt.

ab. *cordiger* Port.

ab. *sanjuanæ* Hatch

ab. *engelhardti* Hatch

ab. *leachi* Hatch

vespilloides Hbst.

mortuorum Fab.

fractus Port.

ab. *andrewesi* Port.

ab. *aurora* Motch.

hebes Kby.

pygmæus Kby.

vespilloides Lec. (nec.

Hbst.)

defodiens Mann.

disjunctus Wil.-Ellis

ab. *humeralis* Hatch

ab. *tristis* Port.

ab. *steinfeldi* Smirnov.

ab. *maculatus* Wil.-Ellis

ab. *altumi* Westh.

ab. *subfasciatus* Port.

ab. *subinterruptus* Pic.

var. *borealis* Port.

var. *sylvaticus* Reitt

ab. *sylvivagus* Reitt

ab. *ruber* Hatch

ab. *nearticus* Hatch

ab. *nicolayi* Hatch

ab. *oregonesis* Hatch

subsp. *defodiens* Mann.

nunemacheri Hatch (nec.

Port.)

ab. *binotoides* Hatch

binotatus Hatch (nec.

Port.)

ab. *conversator* Walk.

defodiens var. *b.* Mann.

lateralis Port.

pollinctor Lec. (nec.

Mann.)

ab. *pacificæ* Hatch

ab. *walkeri* Hatch

conversator Port. (nec.

Walk.)

ab. *gaigei* Hatch

ab. *kadjakenis* Port.

ab. *mannerheimi* Port.

ab. *binotatus* Port.

plagiatus Mots.

vespillo L.

vulgaris Fab.

cadaverinus Gravenh.

curvipes Duftschm.

ab. *faureli* Fauconnet

ab. *varendorffi* Westh.

ab. *bolsmanni* Westh.

ab. *æthiops* Scheicher

ab. *minor* Westh.

ab. *germani* Hatch

americanus Oliv.
 grandis Fab.
 virginicus Frol.
melsheimeri Kby.
hybridus Hatch & Angell
 var. *minesotianus* Hatch
nigritus Mann.
 var. *ruficornis* Mots.
pustulatus Hers.
 bicolor Newn.
 tardus Mann.
 ab. *coloradensis* Hatch
 ab. *noveboracensis* Hatch
 ab. *fasciatus* Port.
 ab. *unicolor* Port.
investigator Zett.
 ruspator Er.
 infodiens Mann.
 confossor Mots.
 microcephalus Thoms.
 pustulatus Horn. (nec.
 Hers.)
 labiatus Mots.
 vestigator Gyll. (nec.
 Hers.)
 subsp. *investigator* Zett.
 ab. *suturalis* Mots.
 infodiens var. *b.* Mann.
 ab. *funeror* Reitt.
 ab. *funerator* Faur.
 var. *variolosus* Port.
 ab. *intermedius* Reitt.
 ab. *jamezi* Hatch
 ab. *lutescens* Port.
 subsp. *maritimus* Guer.
 aleuticus Guer.
 pollintor Mann.
 sibiricus Mots.

infodiens var. *c.* Mann.
 ab. *martini* Hatch
 ab. *clarencei* Hatch
 ab. *sitkensis* Hatch
 ab. *massetti* Hatch
 ab. *grahami* Hatch
 ab. *charlottei* Hatch
 ab. *particeps* Fisch
 ab. *japani* Hatch
tomentosus Web.
 velutinus Fab.
 ab. *communis* Hatch
 ab. *elongatus* Hatch
 ab. *angustefasciatus* Port.
 ab. *splendens* Hatch
 ab. *brevis* Hatch
 var. *aurigaster* Port.
germanicus L.
 listerianus Fourer
 ab. *speciosus* Schultze
 ab. *bimaculatus* Steph.
 ab. *frontalis* Fisch.
 ab. *fassifer* Reitt.
 ab. *apicalis* Kraatz
 var. *ruthenus* Mots.
 grandior Ang.
guttula Mots.
 subsp. *guttula* Mots.
 ab. *ruficornis* Mots.
 ab. *sanfranciscæ* Hatch
 ab. *punctatus* Hatch
 ab. *shastæ* Hatch
 ab. *hypomerus* Hatch
 ab. *lajollæ* Hatch
 ab. *vandykei* Ang.
 ab. *quadriguttatus* Ang.
 ab. *kuschei* Hatch

mexicanus Matt.

hecate Bland

ab. *wallisi* Hatch

ab. *californiæ* Hatch

ab. *intermedius* Hatch

ab. *disjunctus* Port.

ab. *woodgatei* Hatch

ab. *phoenix* Hatch

ab. *novamexicæ* Hatch

ab. *rubripennis* Port.

ab. *rubrissimus* Hatch

ab. *immaculosis* Hatch

obscurus Kby.

melsheimeri Lec.

ab. *discontinus* Hatch

ab. *ruber* Hatch

EXOTIC FORMS AND THEIR RELATIONSHIP TO NEARTIC SPECIES.—

The following list of species are exotic forms of which the female genitalia have been studied. The first name in each group is that of the type for the genus or subgenus, or it is a typical nearctic species of that group. The next names are those studied with the generic or subgeneric name as used by other authors following it, if it differs from the names employed in this paper.

Silpha littoralis L.

Silpha cayennensis Sturn.

Silpha biguttata Phil.

Necrodes biguttata Phil.

Paranecrodes biguttata
Phil.

Thanatophilus (*Oiceoptoma*)
americana L.

Thanatophilus thoracica
L.

Silpha thoracica L.

Thanatophilus japonica
Mots.

Silpha japonica Mots.

Thanatophilus obscura L.

Silpha obscura L.

Thanatophilus carinata
Hbst.

Silpha carinata Hbst.

Thanatophilus lærigata
Fab.

Silpha lærigata Fab.

Thanatophilus perforata
Gbl.

Silpha perforata Gbl.

Thanatophilus atrata L.

Silpha atrata L.

Thanatophilus nigrata

Creutz

Silpha nigrata Creutz

Thanatophilus granulata
Oliv.

Silpha granulata Oliv.

Thanatophilus (*Thanatophi-*
lus) *truncata* Say

Thanatophilus sinuatus
Fab.

Silpha sinuatus Fab.

Thanatophilus terminata
Hum.

Silpha terminata Hum.

Thanatophilus rugosus L.

Silpha rugosus L.

Blitophaga opaca L.

Blitophaga oblonga Kust.

Silpha oblonga Kust.

Blitophaga souverbiei
Fairm.

<i>Silpha souveriei</i> Fairm.	Reitt.
<i>Blitophaga orientalis</i> Brulle	<i>Nicrophorus rotundicollis</i> Port.
<i>Silpha orientalis</i> Brulle	<i>Nicrophorus didymus</i> Brulle
<i>Nicrophorus (Nicrophorus)</i> <i>vespillo</i> L.	<i>Nicrophorus interruptus</i> Steph.
<i>Nicrophorus prædator</i>	

SYNOPSIS OF THE NEARTIC SILPHINI AND NICROPHORINI.—The following synopsis is meant to serve as a means of correlating the external characters with those of the genitalia.

TRIBES

- Antennæ apparently of ten segments, the second segment being very short and more or less hidden in the tip of the first; elytra short and not covering more than the basal five tergites *Nicrophorini*
- Antennæ clearly of eleven segments, the second not shortened; elytra, if short, covering more than the basal five tergites *Silphini*

Genera *Silphini*

- A. Occipital ridge prominent; eyes usually large and prominent; form usually elongate; labrum broadly emarginate; prothoracic spiracle sometimes exposed *Silpha* L.
- AA. Occipital ridge usually not prominent; eyes not large and prominent; labrum broadly or narrowly emarginate; prothoracic spiracle rarely exposed.
- B. Eyes normal, protruding somewhat from the head; labrum broadly or somewhat narrowly emarginate, but never very narrowly emarginate unless the head is elongate; head normal or elongate, not short, round or compact *Thanatophilus* Leach
- BB. Eyes very small, not or only very slightly protruding from the head; head short, round, and compact; labrum very narrowly emarginate *Blitophaga* Reitt.

SILPHA

- Pronotum oval, black; elytra usually with red apical spots forming a bar, sometimes with red basal markings or sometimes immaculate *littoralis* L.
- Pronotum transverse, yellowish-brown with a black central area; elytra immaculate *discicollis* Brulle

THANATOPHILUS

Sub-genera

- Labrum broadly or narrowly emarginate; pronotum rarely tomentose, if tomentose, then orange with a black central area; head and mouth parts often elongate *Oiceoptoma* Leach

Labrum always very broadly emarginate; pronotum usually tomentose, if not, then elytra without prominent costæ; head and mouth parts never elongate *Thanatophilus* s. str.

Sub-genus *Oiceoptoma*

- A. Pronotum orange or yellow with a black central area.
 - B. Elytra rugose *americana* L.
 - BB. Elytra smooth.
 - C. Costæ prominent *novaboracensis* Frost.
 - CC. Costæ obscure, elytra tan with four black spots and the scutellum black *quadripunctata* L.
- AA. Pronotum black.
 - D. Elytra smooth *inæqualis* Fab.
 - DD. Elytra rugose *ramosa* Say

Sub-genus *Thanatophilus*

- A. Pronotum tomentose; elytral costæ prominent.
 - B. Intervals of the elytral costæ tuberculate *lapponica* Hbst.
 - BB. Intervals of the elytral costæ flat.
 - C. Two inner elytral costæ subequal throughout.
 - trituberculata* Kby.
 - CC. Two inner elytral costæ nearly obsolete at the base.
 - coloradensis* Wick
- AA. Pronotum glabrous, costæ obscure *truncata* Say

BLITOPHAGA

- Surface pubescent; form more elongate *opaca* L.
- Surface sparsely pubescent; form more oval *bituberosa* Lec.

NICROPHORUS

- A. Pronotum oboval, without distinct sculpturing and very narrowly margined (subgenus *Necrocharis*) *carolinus* L.
- AA. Pronotum orbicular, transverse or cordate with distinct sculpturing and widely margined on the sides and back (subgenus *Nicrophorus* s. str.).
 - B. Pronotum orbicular, widely margined at the sides and the base.
 - orbicollis* Say
 - BB. Pronotum not orbicular.
 - C. Pronotum sinuate at the sides, base nearly as wide as the apex, sides and base widely margined, not cordate.
 - D. Metasternal epimeron tomentose.
 - E. Hind tibia curved.
 - F. Metatrochanter spine small and divergent; pronotum disc orange, margin black; front orange *americanus* Fab.
 - FF. Metatrochanter spine large and convergent; pronotum black; front black *sayi* Lap.

- EE. Hind tibia straight.
 - G. Spine of the metatrochanter obscure; elytra immaculate *nigritis* Mann.
- GG. Spine of the metatrochanter prominent.
 - H. Spine divergent; elytra with orange fascæ *pustulatus* Hersch.
 - HH. Spine convergent; elytra immaculate. *humator* Fab.
- DD. Metasternal epimeron glabrous.
 - I. Elytra immaculate; hind tibiæ usually curved. *germanicus* L.
 - II. Elytra with orange fasciæ; hind tibia straight.
 - J. Three terminal segments of the antennæ black *vespilloides* Hbst.
 - JJ. Three terminal segments of the antennæ orange.
 - K. Metasternal pubescence brown; abdominal pubescence black. *mexicanus* Matth.
 - KK. Metasternal pubescence yellow; abdominal pubescence brown. *investigator* Zett.
- CC. Pronotum with base much narrower than the apex, sides strongly sinuate, cordate.
 - L. Metasternal epimeron glabrous *melsheimeri* Kby.
- LL. Metasternal epimeron tomentose.
 - M. Thorax tomentose.
 - N. Thorax entirely tomentose. *tomentosus* Web.
 - NN. Thorax tomentose apically only. *vespillo* L.
- MM. Thorax glabrous.
 - O. Basal segment of the antennal club black.
 - P. Hind tibia straight; disc of the pronotum punctate *guttula* Mots.
 - PP. Hind tibia arcuate; disc of the pronotum nearly smooth. *obscurus* Kby.
 - OO. Basal segment of the antennal club orange.
 - Q. Hind tibia arcuate *marginatus* Fab.
 - QQ. Hind tibia straight.
 - R. Ventral surface of the posterior tibia densely yellow tomentose *hecate* Bland.
 - RR. Ventral surface of the hind tibia sparsely black tomentose *hybridus* Hatch & Ang.

GENERAL MORPHOLOGY OF THE GENITALIA.—The same terminology as that adopted by Tanner, which seems to be a usable interpretation of the relationship of the parts, has been used here.

The dorsal plate or proctiger (Pl. I, Fig. 3, p.) forms the upper surface of the genitalia. It has a terminal process (Pl. II, Fig. 8, pro.) sometimes elongate and spatulate, and may be bent at various angles. Frequently it has terminal hairs. It apparently serves as the dorsal guide. The paraprocts (Pl. I, Fig. 3, pp.) are lateral plates forming the sides and bottom of the organ. They sometimes bear setæ. The paraproct bears the valvifer (Pl. I, Fig. 3, vf.) which in turn bears the coxite (Pl. I, Fig. 3, c.). The valvifer is sometimes modified into a lateral guide (Pl. II, Fig. 8, l.g.) appearing claw-like and lobed (Pl. II, Fig. 8, l.) or it may be unmodified and possess setæ. The coxite is a hollow process which supports the stylus (Pl. I, Fig. 3, sty.) either terminally or laterally on the margin. The stylus is of various sizes and length and in some species it is expanded at the apex.

The proctiger is interpreted as a part of the tenth abdominal tergite. The paraprocts are probably parts of the ninth tergite with the styli, coxites and valvifers as appendages of the ninth segment. In this study only the ninth and tenth segments have been considered. The eighth segment consists of two more or less unmodified plates, the tergite and sternite.

KEY TO THE NEARTIC SILPHINI AND NICROPHORINI BASED ON THE FEMALE GENITALIA

1. Valvifer at most only slightly lobed, not developed into a curved process; proctiger never extended and lobed, (*Silphini*) (2).
Valvifer with a well developed curved process and the proctiger usually extended and lobed. (*Nicrophorini* one genus *Nicrophorus* Fab.) (14).
2. Stylus apical or lateral; coxite without a lateral projection (3).
Stylus lateral; coxite with a lateral projection. (*Blitophaga* Reitt.) (12).
3. Stylus always apical, stout, the diameter nearly that of the coxite; coxite stout and more or less uniform throughout. (*Silpha* L.) (4).
Stylus apical or lateral, if apical, then very small, much smaller than the coxite and the coxite is much wider at the base than at the apex. (*Thanatophilus* Leach.) (5).

SILPHA

4. Coxite with two lateral connecting ridges; stylus broader at the apex.
littoralis L.
 Coxite without ridges; stylus more uniform throughout.
discicollis Brulle

THANATOPHILUS

5. Stylus apical or lateral, if lateral then the coxite beyond the stylus is not greatly flattened or lobed. Subgenus *Oiceoptoma* Leach (6).
 Stylus always lateral; coxite beyond the stylus greatly flattened and slightly lobed. Subgenus *Thanatophilus* s. str. (10).
 6. Stylus apical *4-punctata* L.
 Stylus lateral (7).
 7. Stylus long and angulate, nearly reaching the apical end of the coxite.
americana L.
 Stylus short and not angulate, and much shorter than the portion of the coxite beyond the insertion of the stylus (8).
 8. Apical portion of the coxite beyond the base of the stylus twice the length of the stylus or less (9).
 Apical portion of the coxite beyond the base of the stylus much more than twice the length of the stylus *ramosa* Say
 9. Bridge (Pl. I, Fig. 3, br.) between the coxite and the valvifer wide; proctiger broadly rounded apically; stylus round at the apex.
novaboracensis Forst.
 Bridge between the coxite and the proctiger narrow; proctiger more angular apically; stylus angulate at the apex *inaequalis* Fab.
 10. Stylus greatly enlarged at the apex, more than twice the width of the basal portion *truncata* Say.
 Stylus enlarged at the apex, but much less than twice the width of the basal portion (11).
 11. Coxite with a prominent basal spine below the insertion of the stylus.
coloradensis Wick.
 Coxite without a prominent basal spine below the insertion of the stylus (12).
 12. Stylus inserted on the ventral surface of the coxite so that there is apparently a lateral flap covering the base of the stylus.
lapponica Hbst.
 Stylus inserted on the lateral surface of the coxite.....*trituberculata* Kby.

BLITOPHAGA

13. Stylus as long as the lateral lobe of the coxite *bituberosa* Lec.
 Stylus much shorter than the lateral lobe of the coxite *opaca* L.

NICROPHORUS

14. Coxite with a terminal claw as long or longer than the stylus. (Subgenus *Neocrocharis* Port.) *carolinus* L.

- Coxite without a terminal claw, or if apparently present, then always much less than the length of the stylus. (Subgenus *Nicrophorus* s. str.) (15).
15. Proctiger lobe short and broad (16).
 Proctiger lobe long and narrow, without an apical spatula. *marginatus* Fab.
 Proctiger lobe medium in length and width, with or without an apical spatula (18).
16. Proctiger lobe bifurcate *orbicollis* Say
 Proctiger lobe not bifurcate (17).
17. Proctiger lobe truncate, without prominent apical ridge *humator* Oliv.
 Proctiger lobe round, with prominent apical ridge. (Pl. II, Fig. 8, r.) *sayi* Lap.
18. Proctiger without an apical spatula *vespilloides* Hbst.
 Proctiger with an apical spatula (19).
19. Coxite with a basal-lateral lobe; lobe of the claw of the valvifer longer than wide *vespillo* L.
 Coxite without a basal-lateral lobe; lobe of the claw of the valvifer always broader than long (20).
20. Coxite emarginate on the inner lateral margin *americanus* L.
 Coxite not emarginate (21).
21. Lobe of the proctiger sub-truncate (22).
 Lobe of the proctiger round (24).
22. Lobe of the proctiger greatly curved dorsally-ventrally (23).
 Lobe of the proctiger slightly curved dorsally-ventrally *nigritus* Mann.
23. Spatula of the proctiger lobe broad *melsheimeri* Kby.
 Spatula of the proctiger lobe narrow *hybridus* Hatch & Ang.
24. Lobe of the valvifer claw obscure (25).
 Lobe of the valvifer claw prominent (27).
25. Coxite very narrow *hecate* Bland.
 Coxite broad (26).
26. Proctiger lobe greatly curved dorsally-ventrally (28).
 Proctiger lobe slightly curved dorsally-ventrally (29).
27. Lobe of the claw of the valvifer with setæ, spatula ridged. *germanicus* L.
 Lobe of the claw of the valvifer without setæ, spatula not ridged. *pustulatus* Hers.
28. Apical margin of the base of the valvifer concave and nearly parallel with the basal margin *mexicanus* Matt.
 Apical margin of the base of the valvifer nearly straight and not parallel with the basal margin *tomentosus* Web.
29. Spatula of the proctiger lobe oval *guttula* Mots.
 Spatula of the proctiger lobe round (30).
30. Valvifer, exclusive of the lobe, square *obscurus* Kby.
 Valvifer, exclusive of the lobe, trapizoidal *investigator* Zett.

DISCUSSION OF THE NEARTIC SILPHINI AND NICROPHORINI

GENERAL.—The tendencies pointed out here are based only on the species considered in this study and without comparison with other beetles.

On the basis of the female genitalia alone, the Silphini appear to be the more primitive of the two tribes and have been treated so here. But this conclusion is based on the assumption that simplicity of form, as seen in the Silphini, indicates primitiveness rather than reduction. The Nicrophorini are so closely linked together that it is difficult to tell anything about their phylogeny.

Silphini

The proctiger is simple, never lobed, usually with setæ; the paraproct is simple, essentially the same as that of the Nicrophorini, but with setæ. The valvifer at most is lobed only, usually with setæ; the coxite exhibits the greatest variation of the organ. It may have a basal lobe, or be uniform throughout. The stylus is attached to the coxite either terminally or laterally. The stylus is usually uniform in shape, but in some groups it is enlarged at the apex.

Silpha L.

Type: *Silpha littoralis* L., designated by Latreille 1810.

In this genus the stylus is terminal and stout, and is wider at the apex than at the base. The coxite is stout and uniform throughout. The proctiger, paraprocts and the valvifers are unmodified.

Silpha littoralis L.

This species is supposedly European, but the characters used to separate it from the Nearctic *surinamensis* Fab. do not adequately separate the two. In the collection of the author there are specimens with immaculate elytra, and the genitalia of the two forms show no differences. Therefore *surinamensis* Fab. is a form of *littoralis* L. and not a distinct species. The genitalia of this species has a setigerous proctiger. The coxite is stout and with two ridges on the outer lateral surface which connect at the apex.

Silpha discicollis Brulle.

Proctiger with setæ; coxite without lateral ridges; stylus less enlarged at the apex.

Thanatophilus Leach

Type: *Silpha rugosa* L.

Coxite blade-like, flattened or uniformly triangular; stylus terminal or lateral, uniform throughout or enlarged at the apex.

Subgenus *Oiceoptoma* Leach

Type: *Silpha thoracica* L.

Coxite uniformly triangular with the stylus terminal, varying to coxite slightly flattened apically and the stylus lateral; stylus uniform throughout. Species as described in the key and synopsis.

Subgenus *Thanatophilus* s. str.

Coxite flattened at the apex, appearing blade-like and strongly curved on the outer side; stylus lateral and enlarged at the apex. The characters of the species are as presented in the key and synopsis.

Blitophaga Reitt.

Type: *Silpha opaca* L.

Coxite with basal lobe or tooth, terminal portion narrow and flattened; stylus small and lateral between the basal lobe and the apex of the coxite, never longer than the basal lobe. The characters of the species are as presented in the key and the synopsis.

Nicrophorini

The greatest difference between this tribe and the Silphini is in the modification of the proctiger. Here the proctiger is usually greatly extended and generally spatulate at the apex, nearly always with setæ. Also, the valvifer is quite different in appearance from that of the Silphini. It is greatly enlarged and extended, flattened and claw-shaped. The coxite is uniform, bearing the stylus terminally in all cases except *Nicrophorus carolinus* L. which has a lateral stylus. The paraproct is without setæ, but at times is ridged. The species of this genus are very closely related with the exception of *Nicrophorus carolinus*

L. which shows characters differing from the others and is placed in the subgenus *Necrocharis* Port.

Nicrophorus Fab.

Characters the same as those of the tribe. Type: *Nicrophorus vespillo* L., designated by Latreille, 1810.

Subgenus *Necrocharis* Port.

Type: *Nicrophorus carolina* L., one species only with characters as in the key and the synopsis.

Subgenus *Nicrophorus* s. str.

The species of the subgenus are all so closely related that they cannot be separated into species groups. The characters used in describing the species are inadequate. Color pattern has little or no value in separating the majority of the species. Their relationships depend entirely on what set of characters are used. Many aberrations have been described, but this is quite unnecessary and becomes extremely confusing, especially when they are not illustrated. Because of the great variation in the color pattern, almost any population can be described as a new aberration. Some changes have been made in the status of certain forms. Undoubtedly, when other forms are examined, more changes will be necessary. The following changes have been made on the basis of the characters presented in the key and synopsis:

Nicrophorus melsheimeri Kby. is a distinct species and not a synonym of *investigator* Zett.

Nicrophorus nigritus Mann. is a distinct species and not a subspecies of *investigator* Zett.

Nicrophorus hecate Bland. is a distinct species and not a subspecies of *guttula* Mots.

CONCLUSIONS

1. The female genitalia of Silphini and Nicrophorini present characters which serve to separate the species of the groups.
2. The two tribes have basically the same type of female genitalia, but they are two very distinct groups of genera.
3. Silphini tends to be more primitive than Nicrophorini.

4. The genera *Silpha*, *Thanatophilus*, *Blitophaga* and *Nicrophorus* are distinct groups of species.

5. The color patterns of *Nicrophorus* are not good specific characters and aberrations based on those characters are worthless.

6. The form and sculpturing of the elytra of *Silphini* do not show relationships between the species.

7. *Nicrophorus* offers no distinct species groups, and the species of the genus are very closely related.

BIBLIOGRAPHY

HATCH, M. H. Studies on the Silphinae. Jour. N. Y. Ent. Soc., XXXV, 331-370, 1927. Coleopterorum Catalogus, Part 95, Junk, Berlin, 1928.

HATCH AND REUTER. Coleoptera of Washington, Silphidae. Univ. of Wash. Publ. in Biol., 1: 147-162, 1934.

HORN, G. H. Synopsis of the Silphidae of the U. S. with reference to the genera of other countries. Trans. Am. Ent. Soc., 8: 219-322, pl. V-VII, 1880.

LATREILLE, P. H. Considerations Generales sur l'ordre Naturel des Animaux. Paris, 1810.

LENG, C. W. Catalogue of the Coleoptera of America, North of Mexico and suppl. 1-4. Sherman, Mount Vernon, N. Y., 1920.

SCEGOLEVA-BAROVSHAJA, T. Les Necrophorini (Coleoptera, Silphidae) de la faune de l'U.R.S.S. Travaux de l'Institut Zool. de l'Academie des sciences de l'U.R.S.S., 1: 161-191, 1932.

SEMENOV-TIAN SHANSKIJ, A. P. De Tribu Necrophorini (Coleoptera, Silphidae) classification et de ejus distributione geographica. Travaux de l'Inst. Zool. de l'Academie des Science de l'U.R.S.S., 1: 149-160, 1932.

TANNER, V. M. A Preliminary Study of the Genitalia of Female Coleoptera. Trans. Am. Ent. Soc., 53, 5-50, 1927.

ABBREVIATIONS ON PLATES

p.	proctiger	spa.	spatula
pp.	paraprocts	l.	lobe
sty.	stylus	r.	ridge
c.	coxite	br.	bridge
vf.	valvifer	pro.	process
l.g.	lateral guide		

PLATE I

- Figure 1a. *Silpha* L. Elytra of female.
Figure 1b. *Silpha* L. Elytra of male.
Figure 2a. *Nicrophorus* Fab. Head of male.
Figure 2b. *Nicrophorus* Fab. Head of female.
Figure 3. *Thanatophilus quadripunctata* L.
Figure 4. *Silpha littoralis* L.
Figure 5. *Silpha discicollis* Brulle.
Figure 6. *Thanatophilus americana* L.
Figure 7. *Thanatophilus novaboracensis* Forst.
Figure 8. *Thanatophilus inæqualis* Fab.
Figure 9. *Blitophaga bituberosa* Lec.
Figure 10. *Thanatophilus trituberculata* Kby.

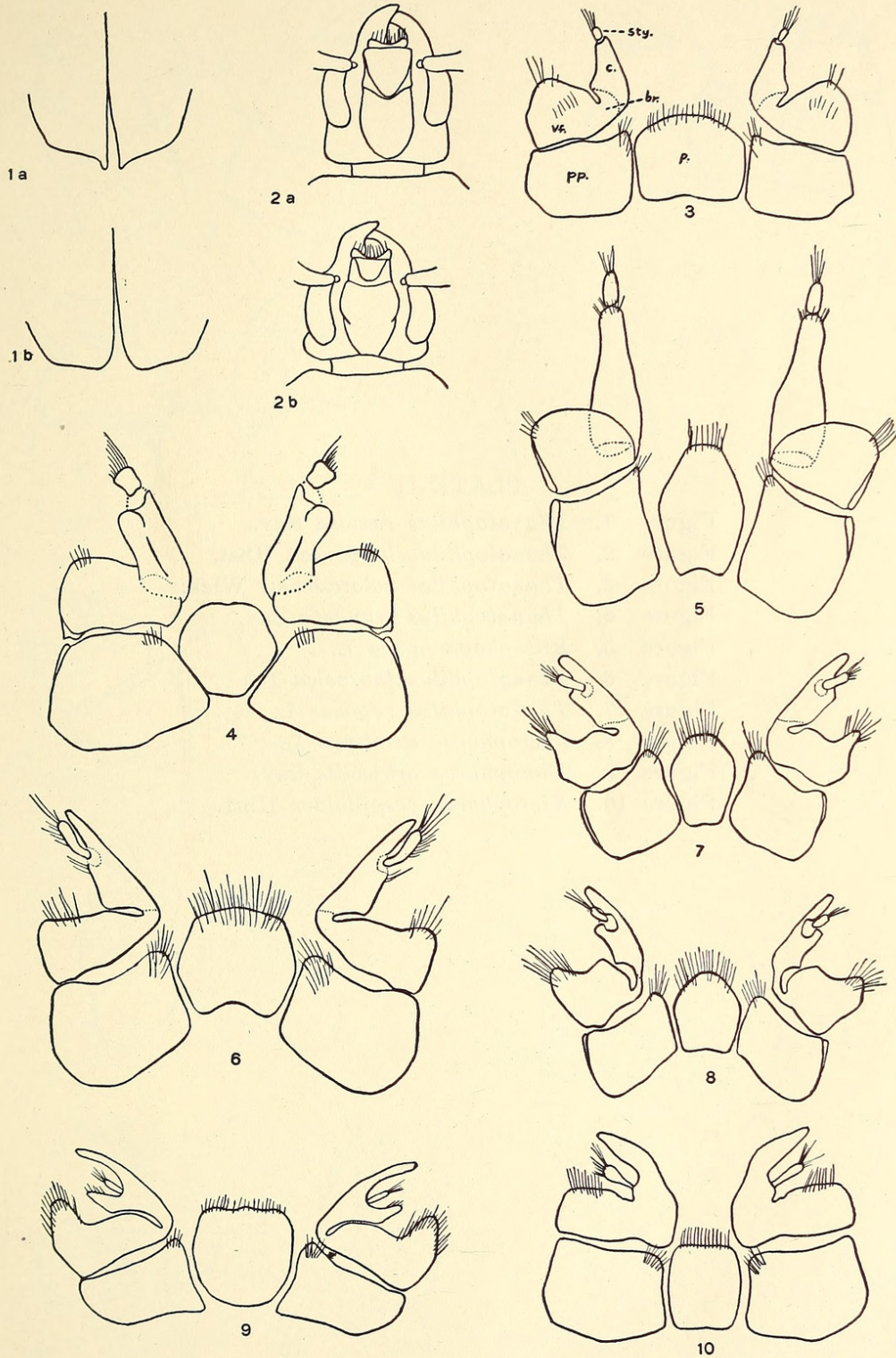


PLATE II

- Figure 1. *Thanatophilus ramosa* Say.
- Figure 2. *Thanatophilus lapponica* Hbst.
- Figure 3. *Thanatophilus coloradensis* Wick.
- Figure 4. *Thanatophilus truncata* Say.
- Figure 5. *Blitophaga opaca* L.
- Figure 6. *Thanatophilus thoracica* L.
- Figure 7. *Thanatophilus rugosus* L.
- Figure 8. *Nicrophorus carolinus* L.
- Figure 9. *Nicrophorus orbicollis* Say.
- Figure 10. *Nicrophorus vespilloides* Hbst.

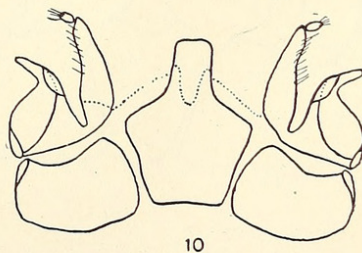
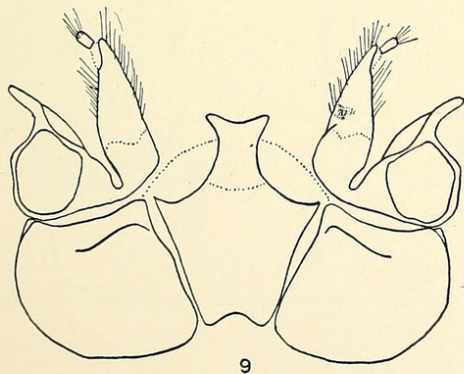
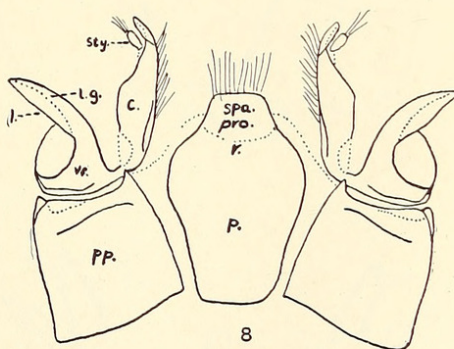
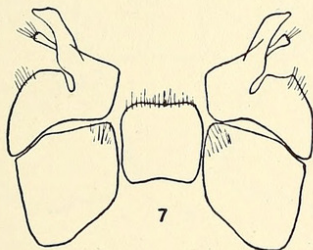
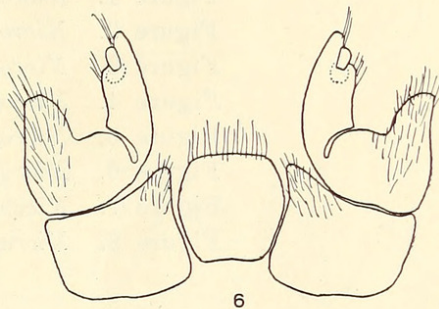
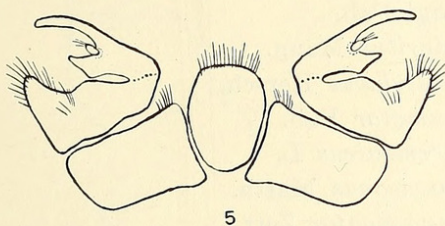
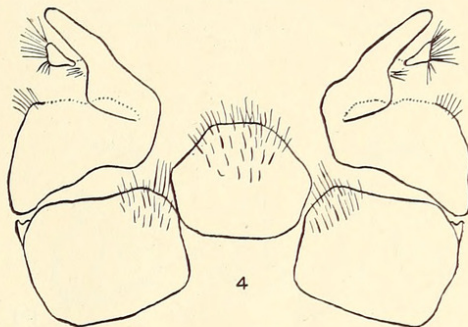
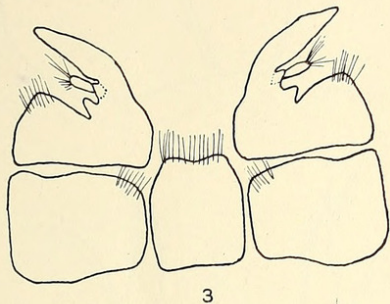
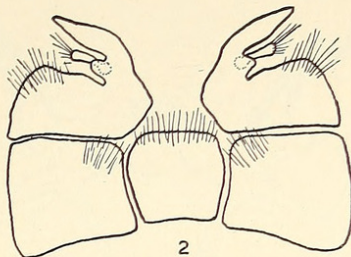
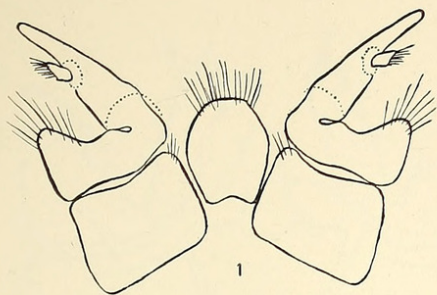
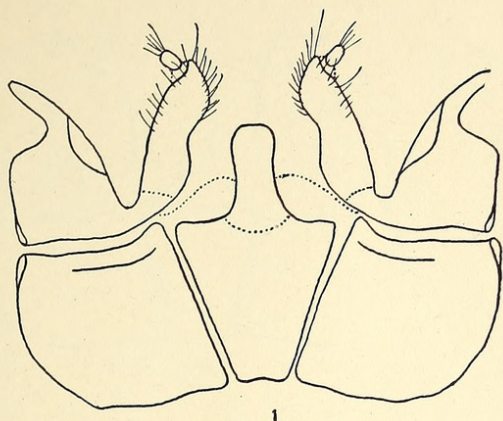
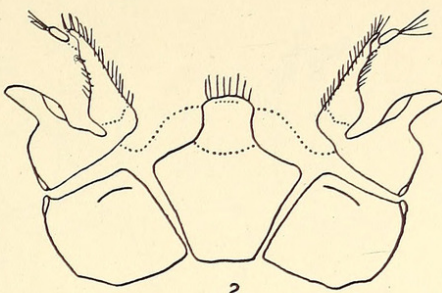


PLATE III

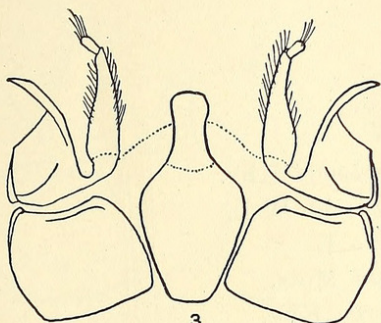
- Figure 1. *Nicrophorus americana* Fab.
Figure 2. *Nicrophorus sayi* Fab.
Figure 3. *Nicrophorus nigritus* Mann.
Figure 4. *Nicrophorus pustulatus* Hersch.
Figure 5. *Nicrophorus humator* Fab.
Figure 6. *Nicrophorus germanicus* L.
Figure 7. *Nicrophorus mexicanus* Matth.
Figure 8. *Nicrophorus investigator* Zett.



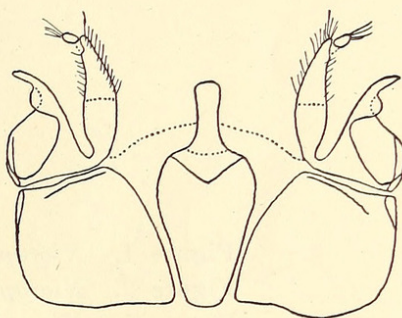
1



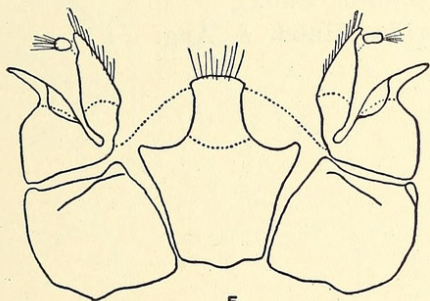
2



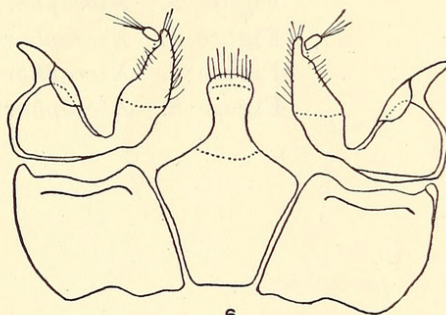
3



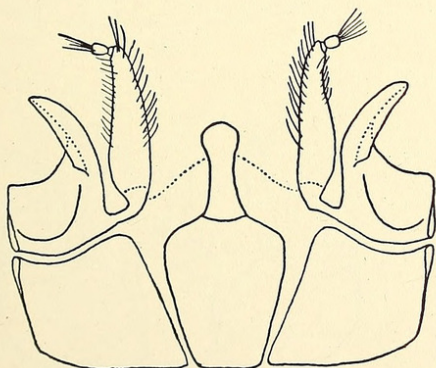
4



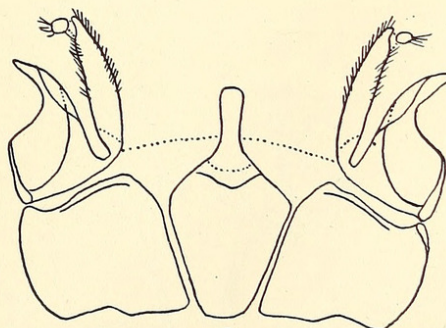
5



6



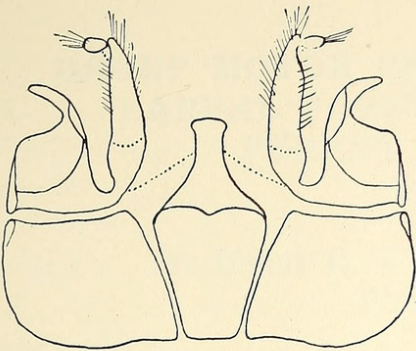
7



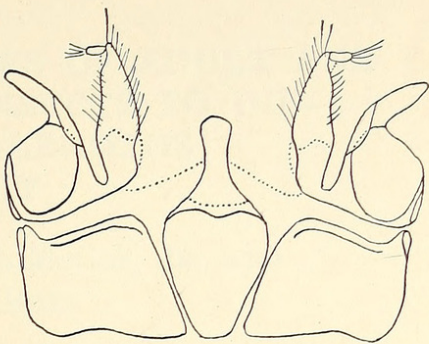
8

PLATE IV

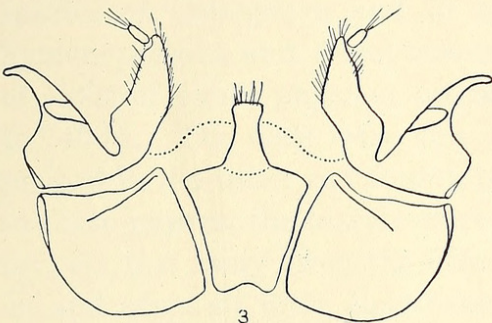
- Figure 1. *Nicrophorus melsheimeri* Kby.
Figure 2. *Nicrophorus tomentosus* Web.
Figure 3. *Nicrophorus vespillo* L.
Figure 4. *Nicrophorus guttula* Mots.
Figure 5. *Nicrophorus obscurus* Kby.
Figure 7. *Nicrophorus hecate* Bland.
Figure 6. *Nicrophorus marginatus* Fab.
Figure 8. *Nicrophorus hybridus* Hatch & Ang.



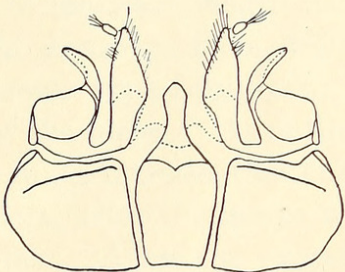
1



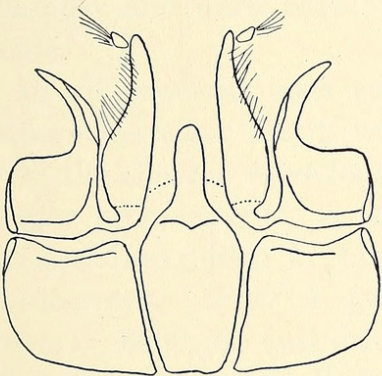
2



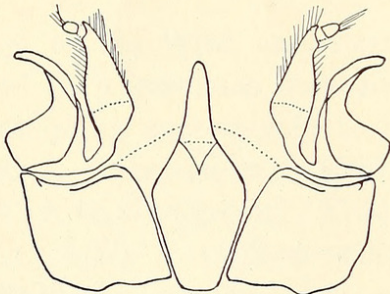
3



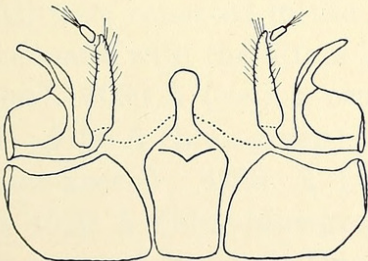
4



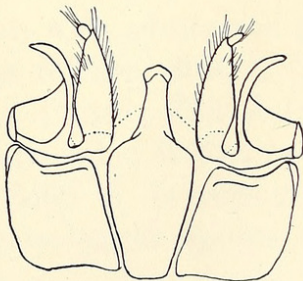
5



6



7



8



Arnett, Ross H. 1944. "A Revision of the Nearctic Silphini and Nicrophorini Based upon the Female Genitalia (Coleoptera, Silphidæ)." *Journal of the New York Entomological Society* 52, 1–25.

View This Item Online: <https://www.biodiversitylibrary.org/item/206071>

Permalink: <https://www.biodiversitylibrary.org/partpdf/179328>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: In Copyright. Digitized with the permission of the rights holder

Rights Holder: New York Entomological Society

License: <http://creativecommons.org/licenses/by-nc/3.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.