

A revision of the New World species of *Norrbonia*
(Diptera: Sphaeroceridae), including all American species
previously placed in *Borborillus*

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Abstract

The New World species formerly placed in *Borborillus* Duda (Sphaeroceridae: Copromyzinae) are transferred to *Norrbonia* Papp. These are: *N. lacteipennis* (Malloch), n. comb., *N. fumipennis* (Stenhammar), n. comb., *N. frigipennis* (Spuler), n. comb., *N. scripta* (Malloch), n. comb., and *N. sordida* (Zetterstedt). *Norrbonia fulvipennis*, *N. singusta*, *N. mexicana*, *N. triglabra*, and *N. yukonensis* are described as new. *Borborus articus* Malloch is synonymized with *N. fumipennis*, and *Borborus singularis* Spuler is synonymized with *N. scripta*. All ten New World species of *Norrbonia* are keyed, illustrated and described. Their relationships are discussed and a cladogram is provided. Species in two of the defined clades are kleptoparasitic on dung rolling scarab beetles.

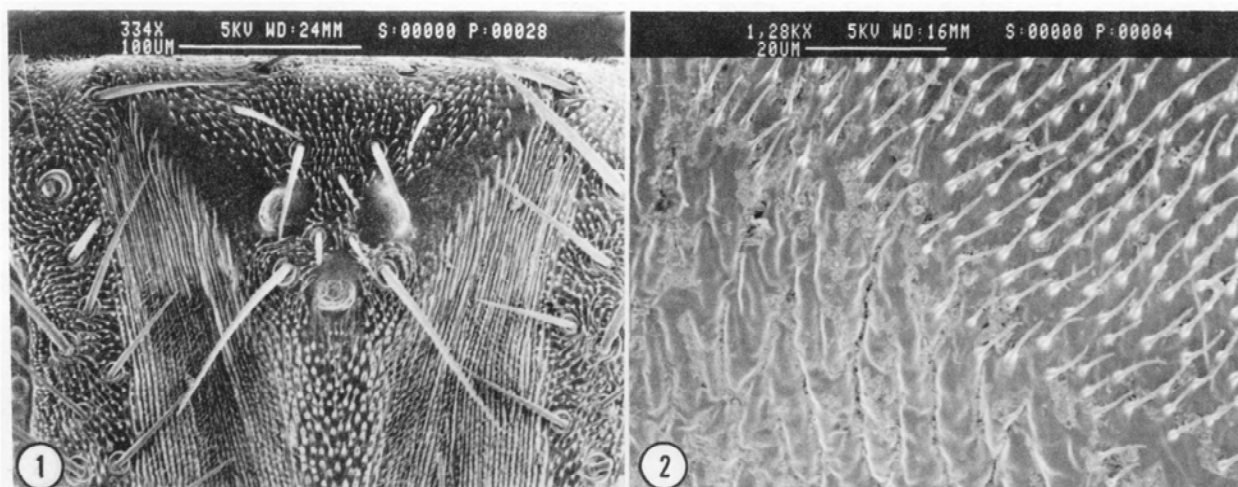
Introduction

Most Holarctic species of Sphaeroceridae with a closed basal cubital cell, an apicoventral spur on the hind tibia, a single row of postocular bristles, and only four scutellar bristles until now have been included in the genus *Borborillus* Duda. Papp (1988) recently discovered that the type species of *Borborillus*, the European species *B. uncinatus* (Duda), as well as *B. vitripennis* (Meigen), are not closely related to most other Holarctic species placed in *Borborillus*, but are instead related to a primarily Afrotropical group that includes *Metaborborus* Vanschuytbroeck, *Gymnometopina* Hedicke, *Dudaia* Hedicke, and *Afroboborus* Curran. The name *Borborillus* therefore cannot be used for the North American species previously placed in that genus. These species, in addition to most of the Old World species previously in *Borborillus*, should now be treated within the genus *Norrbonia* Papp, proposed for *N. indica* Papp and a number of Afrotropical species revised by Papp (1988).

Materials and methods

Morphological terminology follows that of McAlpine (1981). As in most Copromyzinae, the pattern of microtrichia on the frons, gena, and thoracic pleuron varies considerably among the species of *Norrbonia*, and is useful to distinguish them (Figs. 4-25). This character is more difficult to use in *Norrbonia* than in most other copromyzine genera, however, because in some species (e.g. *N. lacteipennis* (Malloch), Figs. 1-2) the cuticle is more striated or rugose than normal, and the bare areas are therefore not as shiny and do not contrast as well with the microtrichose (or pruinose) areas. In some species, the exact size and shape of the bare areas are difficult to see with the light microscope and were confirmed only by using scanning electron microscopy.

When discussing the genal bare area we are referring mainly to the anterior part that extends along the ventral margin of the eye. There is always a vertical bare area along the posterior edge of the gena from the ventral margin to behind the eye. The extreme ventral margin also usually has a separate



Figures 1-2. *Norrbomia lacteipennis*. 1, high magnification of ocellar region; 2, border of microtrichose and bare areas on anepisternum (shows rugose area of cuticle and why borders of microtrichose areas are difficult to see in some species).

very narrow bare area. The anterior part of the bare area on the frons lateral to the ocelli, if present, is often difficult to see because of cuticular striations (Fig. 1). This bare area therefore often appears to be smaller than it really is. We refer to the slender sclerotized basal part of the spermatheca that extends to the slightly expanded, membranous spermathecal duct as the spermathecal neck. The spermathecae also have cylindrical basal or apical apodemes.

In the Material examined sections, specimens listed without museum acronyms are deposited in the University of Guelph collection. Acronyms for other institutions are as follows: American Museum of Natural History (AMNH); BMNH - Natural History Museum, London (formerly British Museum (Natural History)); CAS - California Academy of Sciences; CNC - Canadian National Collection; FMNH - Field Museum of Natural History; FSCA - Florida State Collection of Arthropods; GUE - University of Guelph; INHS - Illinois Natural History Survey; MCZ - Museum of Comparative Zoology, Harvard University (MCZ); NRS - Naturhistoriska Riksmuseet, Stockholm; OhSU - Ohio State University; UKaL - Snow Entomological Museum, University of Kansas; USNM - National Museum of Natural History, Smithsonian Institution; WSU - Washington State University; ZIL - Zoological Institute, Lund; ZMHU - Zoologisches Museum an der Humboldt-Universität. Because of the large number of specimens examined of *N. frigipennis* and *N. sordida*, we have not listed complete collection data for these species.

Genus *Norrbomia* Papp

Norrbomia Papp 1988:394. Type species, *N. indica* Papp, by original designation.

(in part) *Copromyza* (*Borborillus*): Richards 1965:720, 1967:2.

(in part) *Borborillus*: authors.

Generic diagnosis. Relatively small Copromyzinae (ca. 2-4 mm long). **Head:** Face deeply concave, often with pale, membranous medial strip. Postocular bristles in single row. **Thorax:** Scutellum short, with 4 marginal bristles only. Fore first tarsomere of male with stout, dark, curved, apicoventral spur. Mid tibia with anteroventral bristle below middle and ring of preapical and apical bristles. Hind tibia with curved, ventrally directed, apicoventral spur, thin preapical dorsal bristle and anteroventral bristle below middle. **Male abdomen:** Hypandrium with long apodeme and well developed arms; synsternite 6+7 without medial posterior lobe; postphallic sclerite (sclerite between subepandrial sclerite ("sternite 10") and basiphallus) absent; basiphallus with well developed epiphallus; epandrium with lateral clefts; cercus long, distally modified and connected to epandrium; surstylus with flattened inner lobe. **Female abdomen:** 2 spermathecae, each with slender sclerotized neck at least as long as main part of spermatheca (except in *N. hispanica* (Duda)) and with large basal or apical apodeme.

Table 1. List of characters and states used in phylogenetic analysis of *Norrbonnia*. State 0 is hypothesized as plesiomorphic.

1. Basiphallus - 0) slender, length usually more than 3.5x width (in lateral view); 1) short and stout, length usually less than 3.0. (++)	17. Hypoproct - 0) anterior margin not strongly concave, without separate sclerite; 1) anterior margin strongly concave, with separate bifid sclerite. (+++)
2. Male cercus - 0) simple and small; 1) modified, usually large. (+++)	18. Epandrium setation - 0) dorsal and lateral setae similar; 1) dorsal setae less than half as long as most lateral setae. (++)
3. Spermatheca neck - 0) absent or shorter than main part of spermatheca; 1) as long as main part of spermatheca. (++)	19. Base of male cercus and bordering part of epandrium - 0) without cluster of bristles; 1) with cluster of numerous bristles. (++)
4. Surstylus - 0) without bladeliike mesal lobe; 1) with bladeliike mesal lobe. (+++)	20. Tarsi color - 0) similar to tibiae; 1) paler than tibiae. (+)
5. Distiphallus - 0) without basal sclerite; 1) with basal sclerite. (+++)	21. Female sternite 4 - 0) entire; 1) bipartite; 2) tripartite; 3) quadripartite or secondarily bipartite. States 1, 2 and 3 are hypothesized as independently derived from state 0. (++)
6. Distiphallus basal sclerite - 0) divided; 1) undivided. (+++)	22. Female tergites 6 and 7 - 0) entire to moderately trilobed posteriorly (incisions extended less than 2/3 distance to anterior margin); 1) very deeply lobate posteriorly (incisions extended more than 2/3 distance to anterior margin). (++)
7. Spermatheca basal apodeme - 0) small or absent; 1) large. (+++)	23. Female tergite 8 - 0) not bipartite; 1) bipartite. (+)
8. Frons microtrichial pattern - 0) with bare spots bordering ocelli; 1) entirely microtrichose; 2) entirely bare. States 0 and 2 are assumed to be independently derived from state 0. (+)	24. Epiproct - 0) not elongate, not bilobed anteriorly; 1) elongate, bilobed anteriorly. (+)
9. Hind tibia - 0) with stout anteroapical bristle; 1) without stout anteroapical bristle. (+)	25. Hypoproct - 0) anterior edge not bilobed, anteromedial part not concave; 1) anterior edge bilobed, anteromedial part concave. (+)
10. Epiproct setation - 0) more than 1 pair; 1) 1 pair. (+)	26. Kleptoparasitic on scarab beetles - 0) no; 1) yes. (++)
11. Distiphallus basal sclerite - 0) lateral parts not sheathlike; 1) lateral parts sheathlike. (+++)	27. Bristles of posteroventral part of surstylus - 0) short to moderately long; 1) extremely long. (++)
12. Spermatheca shape - 0) spheroid; 1) teardrop shaped. (+++)	28. Male cercus - 0) single lobed or not with inner lobe longer than outer lobe; 1) bilobed or notched, with long inner and short outer lobe. (+++)
13. Female sternites 6 and 7 - 0) anteriorly without transverse groove; 1) anteriorly with transverse groove. (+++)	29. Pleura of female segments 6 and 7 - 0) simple; 1) rugose or striate. (++)
14. Surstylus, posteroventral part - 0) without row of stout bristles; 1) with distinct row of long, stout, inwardly directed bristles. (+++)	30. Wing - 0) not white; 1) white. (+)
15. Anepisternum bare area - 0) small to moderate sized, dorsal margin more or less level with or ventral to ventral margin of spiracle; 1) large, dorsal margin level with or dorsal to dorsal margin of spiracle; 2) entirely bare. States 0 and 2 are assumed to be independently derived from state 0. (+)	
16. Male cercus - 0) not raised posteriorly; 1) raised posteriorly, with knob or ridge. (++)	

Biology. *Norrbonnia* species are probably all coprophagous. Some species, such as the cosmopolitan, synanthropic *N. sordida* (Zetterstedt), appear to be associated with ungulate dung under a wide range of conditions, yet are not as abundant as some Limosiniinae (Sphaeroceridae) associated with similar habitats. *Norrbonnia fumipennis* (Stenhammar) and *N. singusta*, n. sp., have been collected from mammal burrows, and the former bred from them. *Norrbonnia yukonensis*, n. sp., probably also occurs in mammal burrows. Perhaps the most interesting and best known of the *Norrbonnia* species are those that are kleptoparasitic on the dung caches of Scarabaeidae (Coleoptera). Members of the *lacteipennis* group have long been noted as riding on adult scarabs (Moulton 1880, Knab 1915, Steyskal 1971). Sivinski (1983, 1984) described the behavior and life history of two members of this group, *N. frigipennis* (Spuler) and *N. fulvipennis*, n. sp. (the latter as *Borborillus singularis*). *Norrbonnia scripta* (Malloch) also has been found

associated with scarabs (see Comments under that species).

Relationships. We present here an analysis of the relationships of *Norrbonnia* to other genera of the tribe Copromyzini. Although we have not studied all of the Old World species, we discuss some tentative hypotheses of relationships among the species of *Norrbonnia*, with emphasis on the New World fauna.

Characters are listed in Table 1, and the distributions of the character states are shown in Tables 2 and 3. The matrix in Table 2 was analyzed using Hennig86 (Farris 1988). Resulting trees are shown in Fig. 3, with homoplasies indicated by (*), and reversals by (-). Two runs were made using the implicit enumeration option (ie*). The first analysis, in which the characters were equally weighted, produced two equally parsimonious trees 25 steps in length (Fig. 3A-B). In the second analysis, each character was assigned a weight of 1, 2 or 3, as indicated by the number of pluses in Table 1 and Fig.

Table 2. Character state distributions in species groups of *Norrbonmia* and in related genera. Numbers of characters and states refer to Table 1.

		Character numbers																			
		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	2
Taxa		1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
<i>Crumomyia</i>		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
<i>Richardsia</i>		1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
<i>Achaetothorax</i>		1	1	0	0	0	0	0	2	0	1	0	0	0	0	0	2	0	0	0	0
<i>indica</i> gr.		1	1	1	1	1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0
<i>costalis</i> gr.		1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0
<i>scripta</i> gr.		1	1	1	1	1	1	1	0	0	1	0	0	1	1	1	0	0	0	0	0
<i>frigipennis</i> gr.		1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	1	1

3. Weights were assigned according to the system of Marshall (1987). Characters coded (+++) are high weight, usually unique, characters; those coded (+) are low weight attributes for which polarity or homology are more likely to be misinterpreted, or which are commonly subject to homoplasy in other genera of Sphaeroceridae. Trees 3C-D were the only trees that resulted from the second analysis. Using unweighted characters, trees 3C-D are 26 steps in length, one step longer than trees 3A-B. But using weighted characters, trees 3C-D are 51 steps long, whereas trees 3A-B are each 54 steps long. In Fig. 3D it is equally parsimonious for character 10, state 1 to be an independent apomorphy in *Richardsia*, in *Achaetothorax*, and in the *frigipennis* + *scripta* groups, rather than as shown on the tree, but this does not change the tree topology or length.

In both of the above analyses, we coded *Crumomyia* as having state 0 for characters 8 and 15, although states 0 and 1 of both characters occur in the genus. We consider the states coded 0 more likely to be plesiomorphic for *Norrbonmia* because they occur in *Richardsia*. Also, *Alloborborus* Duda, which is the sister group of *Crumomyia*, has state 0 of character 8 and an intermediate condition between states 0-1 of character 15. If the polarity of one or both characters is reversed by changing the state for *Crumomyia*, trees with the same relationships as Fig. 3C-D result if the characters are weighted. If the characters are unweighted, various trees result, including some with *Richardsia* rather than *Achaetothorax* as sister group of *Norrbonmia*.

Table 3. Character state distributions in New World species of the *scripta*, *costalis* and *frigipennis* species groups of *Norrbonmia*. Numbers of characters and states refer to Table 1.

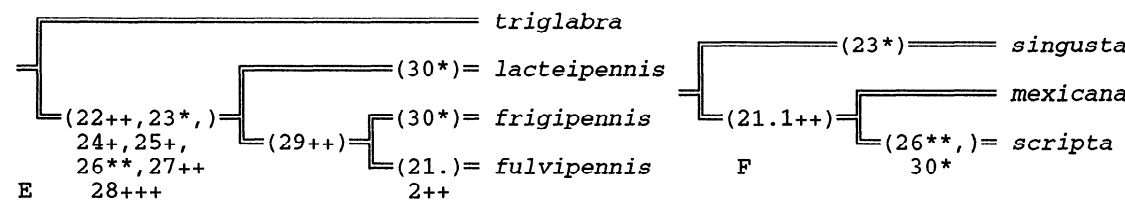
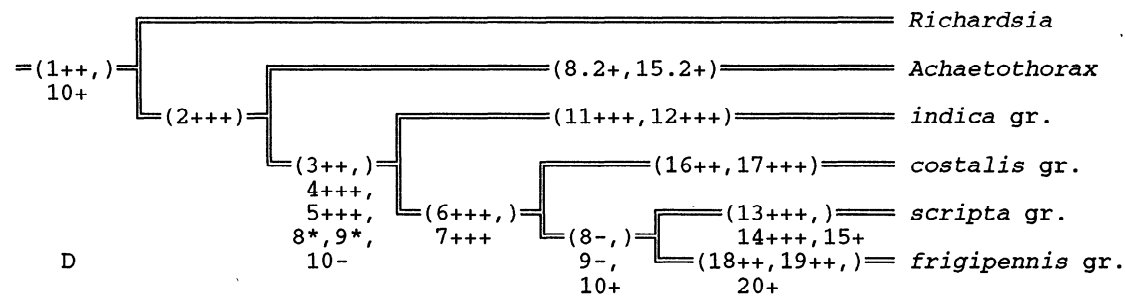
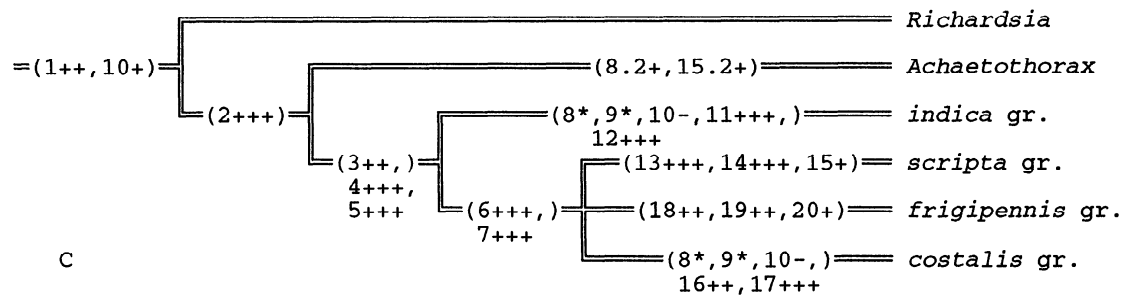
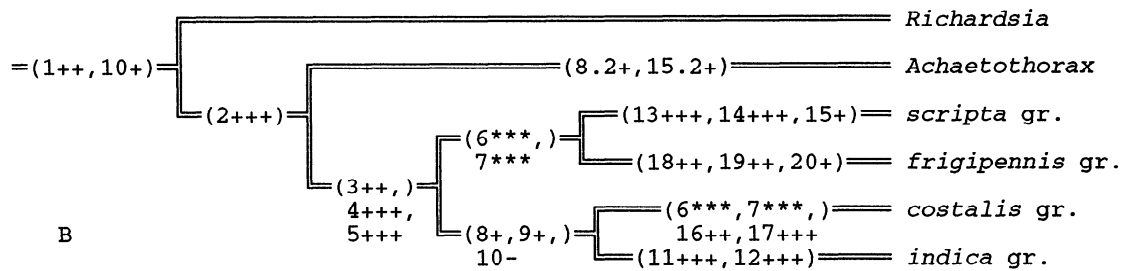
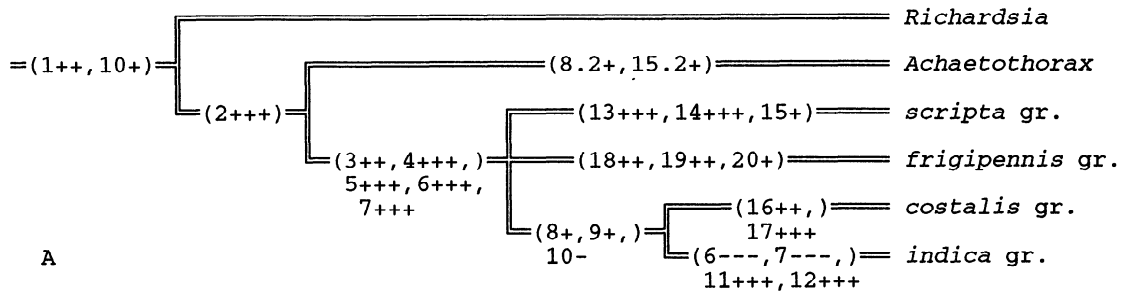
		Character numbers									
		21	22	23	24	25	26	27	28	29	30
Taxa		21	22	23	24	25	26	27	28	29	30
<i>singusta</i>		0	0	1	0	0	0	0	0	0	0
<i>mexicana</i>		1	0	0	0	0	?	0	0	0	0
<i>scripta</i>		1	0	0	0	0	1	0	0	0	1
<i>fumipennis</i>		3	0	0	0	0	0	0	0	0	0
<i>yukonensis</i>		3	0	0	0	0	?	0	0	0	0
<i>triglabra</i>		?	?	?	?	?	?	0	0	?	0
<i>lacteipennis</i>		0	1	1	1	1	1	1	1	0	1
<i>frigipennis</i>		0	1	1	1	1	1	1	1	1	1
<i>fulvipennis</i>		2	1	1	1	1	1	1	1	1	0

Papp (1988) proposed the genus *Norrbonmia* for *N. indica* Papp and the Palearctic species that were previously placed in *Borborillus* Duda. He noted that *Borborillus*, as previously composed, was polyphyletic. The type species, *B. uncinatus* (Duda), and *B. vitripennis* (Meigen) are part of a monophyletic group also including *Dudaia*, *Afroborborus*, *Gymnometopina*, and *Metaborborus* (Norrbon and Marshall 1988). Papp (1988) suggested that most other species formerly placed in *Borborillus* probably also belong in *Norrbonmia*. Our study confirms this for all of the New World species. True *Borborillus* species are not known from the Americas.

The relationships of *Norrbonmia* species to other Copromyzini have not been discussed previously, other than the statement by Papp (1988) that they lack apomorphies of the male genitalia found in the *Borborillus* - *Metaborborus* clade. In fact, *Norrbonmia* also lacks apomorphies of the larger group composed of this clade plus *Lotophila* Liöy and *Copromyza* Fallén (Norrbon and Kim 1985).

Norrbonmia appears to form a monophyletic group with *Achaetothorax* Hedicke (Fig. 3A-D). This hypothesis of relationship is supported primarily by their modified male cercus (character 2), which is usually elongate, with lobes or depressions such that its shape is normally species specific. This differs from the plesiomorphic state found in most Copromyzini, in which the cercus is small and simple. Some species

Figure 3. Relationships of *Norrbonmia*. A-D, among species groups of *Norrbonmia* and related genera; A-B, based on unweighted characters; C-D, based on weighted characters. E, relationships among species of *frigipennis* group. F, relationships among species of *scripta* group. Numbers refer to characters listed in Table 1. "+" symbols represent character weights, "*" symbols represent homoplasies, "-" symbols represent reversals.



F

of *Metaborborus* and *Gymnometopina* also have modified male cerci, but their shapes are different and we do not consider this a synapomorphy for those species and *Norrbonnia* and *Achaetothorax*. The relatively short basiphallus (character 1) is another probable synapomorphy for *Norrbonnia* and *Achaetothorax* and possibly also *Richardsia* Papp, a monotypic genus whose relationships are poorly understood. The ratio of basiphallus length to narrowest width in lateral view is usually less than 2.0 in *Richardsia*, *Achaetothorax*, and within *Norrbonnia*, in the *indica* group, the *scripta* and *frigipennis* groups, and some species of the *costalis* group (e.g. *gravis* (Adams)). In other species of the *costalis* group, such as *N. costalis* (Zetterstedt), *N. fumipennis* (Stenhammar), and *N. yukonensis*, n.sp., it is 2.5-3.0, and as much as 3.5 in *N. nitidifrons* (Duda). In most other Copromyzinae, the ratio is greater than 3.5, and usually greater than 4.0. The basiphallus is short (ratio less than 3.5) in some species of *Gymnometopina*, *Dudaia*, and *Metaborborus*, but its shape is different and other character state distributions indicate that this is homoplasy. The reduced number of setae on the epiproct (Character 10) might be another synapomorphy for *Norrbonnia* + *Achaetothorax* + *Richardsia*. However, there is considerable homoplasy in this character (the plesiomorphic state is present in the *indica* and *costalis* groups of *Norrbonnia*), and because it is a loss character we have assigned it low weight in the analysis.

The monophyly of *Achaetothorax* is well established by a suite of synapomorphies (Papp and Norrbom 1992). The monophyly of *Norrbonnia* is indicated by three synapomorphies (characters 3-5). The spermatheca has a very slender, sclerotized neck at least as long as the main part of the spermatheca (character 3). The neck is very short in *N. hispanica* of the *indica* group, which we suggest is due to reversal. It is also sometimes shorter than the main part of the spermatheca in *N. fulvipennis*. Some species of *Achaetothorax*, *Gymnometopina*, and *Metaborborus* have an elongate neck, but it usually is not longer than the main part of the spermatheca, and it is not as slender as in *Norrbonnia*, which suggests this is due to convergence. The other two synapomorphies are: the surstylus has a blade-like mesal lobe (character 4), a structure unique to *Norrbonnia*; and, the distiphallus has a large, dorsally projected, uniquely shaped, basal sclerite (character 5). The latter may be homologous with similar structures in other copromyzine genera, but its shape is unique to *Norrbonnia*. Only a simple structure is present basally in *Achaetothorax*, al-

though a dorsally projected sclerite is present just apical to this.

The *Norrbonnia* species we examined appear to form four clades, here termed the *indica*, *costalis*, *scripta*, and *frigipennis* groups. The relationships among these species groups are not well resolved. Characters 8, 9 and 10 suggest that the *indica* and *costalis* groups are sister taxa (Fig. 3A-B), whereas characters 6 and 7 indicate that the *indica* group is the sister taxon of a clade including the other three groups (Fig. 3C-D). The latter hypothesis is preferred when character weights are considered. Characters 6 and 7, which are complex and unique to the *costalis*, *scripta* and *frigipennis* groups, are less likely to be the result of homoplasy than characters 8-10. Character 8, the microtrichial pattern of the frons, is highly variable within the Copromyzinae. For example, the size and presence of the bare areas vary within the genera *Crumomyia* Macquart, *Archiborborus* Duda, *Lotophila*, and *Metaborborus*. We tentatively consider state 0 (frons with 2-3 small bare spots bordering the ocelli) to be plesiomorphic because this state occurs in *Richardsia* and is the more common state within the Copromyzini. Both characters 9 and 10 involve the loss of bristles. Character loss is generally considered more likely to occur through homoplasy than the independent development of similar characters, so these characters are assigned low weight.

Although the weighted character trees suggest that the *indica* group is the sister group of the rest of *Norrbonnia*, relationships among the *scripta*, *costalis*, and *frigipennis* groups are unresolved. There is weak evidence that the *scripta* and *frigipennis* groups are the more closely related of the three groups (Fig. 3D). If characters 8 and 9 and character 10, state 0 are assumed to be synapomorphies for *Norrbonnia*, reversal of these characters are synapomorphies for the *scripta* + *frigipennis* groups. Because these are low weight characters and a trichotomy of the three groups is equally parsimonious (Fig. 3C), we do not consider this evidence very significant.

The *indica* group is primarily Palearctic; *N. sordida* is the only species of this group present in the Americas, probably through spread by man. Hypothesized synapomorphies for this group include: the basal sclerite of the distiphallus with sheath-like lateral parts, the medial part bilobed or truncate (character 11); and the spermatheca teardrop shaped (character 12). Many of the species of the *indica* group are densely microtrichose and have a genal pattern similar to *N. sordida*, but at least one species, *N. hispanica*, is not so. Female sternite 4 is undivided in

this group (i.e. the plesiomorphic state of character 21 is retained).

The *costalis* group is a large Holarctic clade with only two species in the Nearctic Region, the Arctic *N. yukonensis* and the Holarctic *N. fumipennis*. These species share two apomorphies with a number of other Palearctic species we have examined, including *N. costalis*. The male cercus is raised posteriorly, forming a knob or ridge (character 16), and the hypoproct has a characteristic shape and a separate bifid sclerite associated with it anteriorly (character 17). The triangular, anteriorly acute, bare area on the gena may be a synapomorphy for a group within the *costalis* group that includes *N. fumipennis* and *N. yukonensis*. The broader, anteriorly more truncate shape in the *scripta* and *frigipennis* groups and in *Richardsia* is probably plesiomorphic. Female sternite 4 is quadripartite (character 21.3) in *N. fumipennis*, *N. yukonensis*, and a number of other species of the *costalis* group, which may be a synapomorphy for these species within the group.

The *frigipennis* group is primarily eastern Nearctic. It includes *N. frigipennis*, *N. fulvipennis*, *N. lacteipennis*, and *N. triglabra*, which share the derived states of characters 18-20. The apomorphic state of character 18 is less obvious in *N. lacteipennis* than in the other species, and that of character 19 is less obvious in *N. triglabra*, but is especially pronounced in *N. frigipennis* and *N. fulvipennis*. Because the female of *N. triglabra* is unknown, the status of characters 22-25 is uncertain. Each may be a synapomorphy for the *frigipennis* group, or only for *N. frigipennis*, *N. fulvipennis*, and *N. lacteipennis* as is shown in Fig. 3D. Similarly, the significance of the kleptoparasitic habit (character 26) in the latter three species is also uncertain, because the biology of *N. triglabra* is unknown. Kleptoparasitism also occurs in *N. scripta* in the *scripta* group.

The monophyly of the clade including *N. frigipennis*, *N. fulvipennis*, and *N. lacteipennis* (Fig. 3E) is supported by two male characters, the extreme length of the bristles on the posteroventral part of the surstylus (character 27) and the bilobed or notched shape of the cercus (character 28). Of these three species, *N. frigipennis* and *N. fulvipennis* are probably more closely related. They are the only species of *Norrbomia* with the pleura of female abdominal segments 6 and 7 striate (character 29). They also have a more similarly shaped male cercus and have the setae on the base of the cercus and bordering area of the epandrium slightly more densely clustered than in *N. lacteipennis* (see character 19). This hypothesis is contradicted by the color of the wing (character 30),

which suggests that *N. frigipennis* is more closely related to *N. lacteipennis* than to *N. fulvipennis*. The wing is also white in *N. scripta*, indicating that this character is subject to homoplasy within the genus.

The *scripta* group includes *N. mexicana*, n. sp., *N. scripta* (Malloch), and *N. singusta*, n. sp. This group is restricted to the New World, and is primarily western Nearctic, with one species known from the Neotropical part of Mexico. Synapomorphies for the *scripta* group include two characters that appear to be unique to it: the shape of female sternites 6 and 7, which are bare and shiny anteriorly, with a deep transverse groove (character 13); and the presence of a comblike row of 5-8 stout, straight bristles on the posteroventral part of the surstylus (character 14). Another probable synapomorphy is the large size of the bare area on the anepisternum (character 15), although like the frons microtrichial pattern, this character is also highly subject to homoplasy in the Copromyzinae. Within the group, *N. mexicana* and *N. scripta* are probably the more closely related species (Fig. 3F). This hypothesis is supported by character 21, state 1, the split of female sternite 4 into two sclerites. The breakup of sternites is common in females, but usually occurs in different ways in different species. We hypothesize that the tripartite condition (state 2) in *N. fulvipennis* and the quadripartite condition (state 3) in many species of the *costalis* group are independently derived. In some specimens of *N. yukonensis*, n. sp., the lateral pair of sternites is reduced, resulting in a secondarily bipartite condition.

Norrbomia scripta, like at least some species of the *frigipennis* group, is kleptoparasitic (character 26). Like *N. lacteipennis* and *N. frigipennis*, it also has white wings (character 30) that often are associated with this habit. *Ceroptera* Macquart (Limosininae), the only other genus of Sphaeroceridae that is kleptoparasitic on scarabs, also has white wings. This raises the interesting question of whether kleptoparasitism originated independently in different lineages of *Norrbomia*, or if it originated once and was lost in *N. singusta*. Although it seems unlikely that this complex behavior should originate twice in the same genus, further information on the behavior of the poorly known species, plus better resolution of the relationships between the *frigipennis*, *scripta*, and *costalis* groups are required to pursue this question.

Key to the Nearctic species of *Norrbornia*

1. Tarsi, other than tarsomeres 1 and 2 of hindleg, white; remainder of legs brown. Wing membrane and all veins white. Female sternite 4 single, about half as wide as sternite 3.
 frigipennis (Spuler), Florida to Massachusetts. 6
- Tarsi brown or pale brown. Wing variable. Female sternite 4 divided into pieces or as wide as sclerite 3. 2
2. Anepisternum with nonpruinose shiny area small (Fig. 21), its dorsal margin closer to level of anteroventral corner of anepisternum than to level of ventral margin of spiracle. Frons entirely pruinose, or (*N. fulvipennis*) with small bare area lateral to posterior ocellus not much larger than ocellus. Wing membrane transparent or with brownish tint 7
- Anepisternum with nonpruinose shiny area large (Fig. 24), its dorsal margin dorsal to level of ventral margin of spiracle or at least closer to it than to level of anteroventral corner of anepisternum. Frons with bare area lateral to ocelli at least as large as area between ocelli (often difficult to see in *N. lacteipennis* (Fig. 7)). Wing membrane often opaque whitish. 3
3. Anepisternum with dorsal margin of bare area ventral to level of dorsal margin of spiracle (Fig. 23). 4
- Anepisternum with dorsal margin of bare area at or dorsal to level of dorsal margin of spiracle (Fig. 24). 5
4. Wing membrane transparent. Eye large, its height approximately 2.0 times gena height. Parafacial narrower than height of pruinose area on gena, approximately 1/10 of height of antennal flagellomere. *triglabra*, n. sp., Kentucky.
- Wing membrane opaque whitish. Eye small, its height approximately 1.5 times gena height. Parafacial broader than height of pruinose area on gena, at least 1/3 of height of antennal flagellomere (Fig. 10) *lacteipennis* (Malloch) South central United States to northeastern Mexico.
5. Frons pruinose anterior to anterior ocellus or with bare area not much larger than ocellus (Fig. 8). Male hind tibia with row of long thin posterodorsal setae. Female sternite 4 divided (Fig. 85). Wing membrane usually whitish. *scripta* (Malloch) Western North America, Mexico.
- Frons with elongate bare area anterior to anterior ocellus. Male hind tibia with or without row of long thin posterodorsal setae. Female sternite 4 undivided or divided. Wing membrane brownish 6
6. Hind femur not strongly swollen. Male hind tibia with only short posterodorsal setae. Female sternite 4 divided into 2 widely separated parts (Fig. 80). *mexicana*, n. sp., Chiapas, Mexico.
- Hind femur strongly swollen. Male hind tibia with row of long thin posterodorsal setae. Female sternite 4 undivided (Fig. 90).
 *singusta*, n. sp., Western North America.
7. Genal pruinosity dense, whitish, strongly contrasted with bare area, which is narrow (its height at narrowest point approximately half that of pruinose area) but slightly expanded at anterior margin (Fig. 19). Only 1 (prescutellar) pair of large, well differentiated dorsocentral bristles
 *sordida* (Zetterstedt) Widespread Holarctic, south to Guatemala.
- Genal pruinosity less dense, not strongly contrasted with bare area, which is broad and truncate or acutely tapered anteriorly. 3 (1+2) pairs of large, well differentiated dorsocentral bristles. 8
8. Genal bare area tapered, acute anteriorly (Fig. 16). Frons entirely pruinose. 3-5 interfrontal setae. Female sternite 4 divided into 2 or 4 parts. Hypoproct deeply concave anteriorly, with separate, bifurcate process (Fig. 71-72). 9
- Genal bare area broad, truncate anteriorly (Fig. 15). Frons with small bare area lateral to posterior ocellus. 6 or more interfrontal setae. Female sternite 4 divided into 3 parts (Fig. 62). Hypoproct slightly concave anteriorly, without separate, bifurcate process (Fig. 65). *fulvipennis*, n. sp. Eastern and central United States to eastern Mexico.
9. Posteromedial part of male sternite 5 pale, densely microsetulose. Posterior margin of paramere evenly convex (Fig. 54). Male cercus in lateral view (Fig. 53) with dorsal part slightly produced. Arm of bifurcate process of hypoproct subequal in length to middle part of hypoproct (Fig. 72)
 *yukonensis*, n. sp., Yukon.
- Posteromedial part of male sternite 5 not differentiated from rest of sternite. Posterior margin of paramere deeply notched, thus appearing sinuate (Fig. 33). Male cercus in lateral view (Fig. 35) with dorsal part strongly produced. Arm of bifurcate process of hypoproct much shorter than middle part of hypoproct (Fig. 71).
 *fumipennis* (Stenhammar) Northern Holarctic, Rocky Mountains.

Norrbomia frigipennis (Spuler)
new combination
(Figs. 4, 14, 20, 26-28, 56-60)

Borborus sp. Knab 1915:40.

Borborus (*Borborillus*) *frigipennis* Spuler 1925:9.
Holotype female, FLORIDA. Lake Worth, Slosson
(USNM).

Copromyza (*Borborillus*) *frigipennis*: Richards
1965:720; Steyskal 1971:477.

Borborillus *frigipennis*: Sivinski 1983:419, 1984:232.

Description. Body length 1.6-4.5 mm. Body color dark brown to black; antenna and middle of face reddish; coxae, femora, tibiae, and first 2 tarsomeres of hindleg brown; other tarsomeres and halter white or pale yellow. **Head:** Arista length slightly greater than intervibrissal distance; arista hairs \approx 2X basal width of arista. Frons (Fig. 4) pruinose, with medium sized bare area lateral to ocelli, only part on nonrugose cuticle extended posterolaterally from posterior ocellus obviously shiny. Interfrontal bristles in 6-8 small pairs; 7-9 inclinate inner orbital setulae. Each side of face luteous on medial half, black on outer half. Eye height \approx 1.5X genal height. Gena (Fig. 14) black, narrowly microtrichose ventrally (extreme margin bare), nonmicrotrichose area very broad, truncate anteriorly. **Thorax:** Anepisternal bare area (Fig. 20) with dorsal margin even with to slightly ventral to level of ventral margin of spiracle, nonmicrotrichose area ventral to spiracle not separated from main bare area. Katepisternum bare below level of dorsal setae, pleuron otherwise lightly pruinose except for narrow bare area on meron; scutum and scutellum uniformly, heavily pruinose. Wing membrane opaque, whitish; all veins white; second costal sector 1.8-2.0X third. Midleg brown except white or yellowish tarsi; first tarsomere with stout ventral bristles. Hindleg long-setose, brown except tarsomeres 3-5 and ventral part of tarsomere 2; femur with two erect dorsal bristles on distal half; tibia with small anteroapical stout bristle and large apicoventral spur; anteroventral bristle long and slender. Posterodorsal setae on distal half of male hind tibia slightly longer than tibial width. Pulvilli large, pads distally expanded and contiguous, together wider than tarsomere 5, covering claw in ventral view. **Male abdomen:** Syntergite 1+2 uniformly pruinose brown. Membrane of segments 3-5 with setae on sclerotized bases. Sternite 5 simple, darkly pigmented along posterior margin. Epandrium with dense, short setae dorsally, laterally with 4-5 long bristles, dorsolateral bristle longest. Surstylus

(Figs. 26, 28) densely setulose posterolaterally, posterior setae longer than surstylus; anterior part of surstylus short, with carinate, anteriorly pointed ventral lobe. Cercus with dense patch of setae posterodorsally; posteroventrally short setose, bilobed, outer lobe narrow; inner lobes of cerci separated by shallow apical notch, cerci otherwise posteromedially contiguous. Paramere (Fig. 27) broad near middle, tapered to bilobed apical process. Basiphallus with long, narrow epiphallus. Basal sclerite of distiphallus undivided, apically with single, medial, dorsally projected lobe; distal part of distiphallus larger, with rounded distal ventral lobe and paired, dorsoventrally flattened, distal dorsal lobes. **Female abdomen:** Preabdominal sternites (Fig. 57) entire, sternite 4 small. Pleuron of segment 6 rugose anteriorly and longitudinally striate posteriorly, pleuron 7 longitudinally striate (Fig. 58). Tergites 6 and 7 (Fig. 56) complete anteriorly and trilobed posteriorly, middle part very pale. Tergite 8 bipartite; epiproct (Fig. 60) elongate, emarginate anteriorly, produced posteriorly, bare except for 2 bristles. Sternites 6 and 7 elongate, bipartite except along anterior margin, with single transverse row of bristles. Sternite 8 bipartite, with dark posteromedial lobes, and third, small, ill-defined sclerite present anteriorly between main pieces of sternite 8. Hypoproct emarginate and bare anteriorly, setulose posteriorly. Spermatheca (Fig. 59) subspherical, flattened at top and bottom, with large basal apodeme; neck twice as long as main part.

Material examined. Holotype (see synonymy). Over 1,000 specimens from the following areas: UNITED STATES. FLORIDA. Alachua Co., Duval Co., Hernando Co., Highlands Co., Marion Co., Levy Co., Nassau Co., Orange Co., Polk Co., Putnam Co., Volusia Co., Sarasota Co. GEORGIA. Brooks Co., Clinch Co. MASSACHUSETTS. Dukes Co. NEW JERSEY. NORTH CAROLINA. Buncombe Co. SOUTH CAROLINA. Aiken Co.

Almost all of the examined specimens with any biological data were taken on dung. Collection dates included March, April, May, June, August, October, November, and December. Sivinski (1983) recorded adults in northern Florida for all months except December, January and February.

Distribution. East coast of the United States from Massachusetts to Florida.

Comments. *Norrbomia frigipennis* is one of the most common coprophagous insects in Florida, and almost every kind of dropping the authors have examined in

at least the northern half of that state has been attended by these conspicuously white-winged flies. This species is kleptoparasitic on the dung caches of dung-burying scarabs, and has also been collected clinging to the adult beetles (Knab 1915, as *Borborus* species "with milk-white wings"). Sivinski (1983, 1984) described its biology. He found that adult flies intercept adult scarabs and usually cling to the dorsal surface of the beetle on the posterior part of the thorax or the anterior part of the elytra. Both sexes accompany the beetles underground, and oviposition takes place in the dung cache. Specimens have been observed in association with *Phaneus vindex* (MacLeay), *P. igneus* (MacLeay), *Boreocanthon depressipennis* (LeConte), *Onthophagus* spp., *Canthon pilularius* (L.), and *C. imitator floridanus* Brown [previously misidentified as *C. viridis* in Knab (1915) according to Steyskal (1971)].

Sivinski (1983) found that the sex ratio of both lab reared and field collected specimens was significantly female biased. The extreme size variation in *N. frigipennis* does not reflect sexual dimorphism (Sivinski 1983). Sivinski (1984) discusses the relationship between male size and reproductive success in this species.

Norrbomia frigipennis, *N. lacteipennis*, and *N. fulvipennis* form a monophyletic group characterized by similar male genitalia, pale tarsi, and several attributes of the female abdomen, including the fourth sternite broken into a median remnant and several lateral pieces.

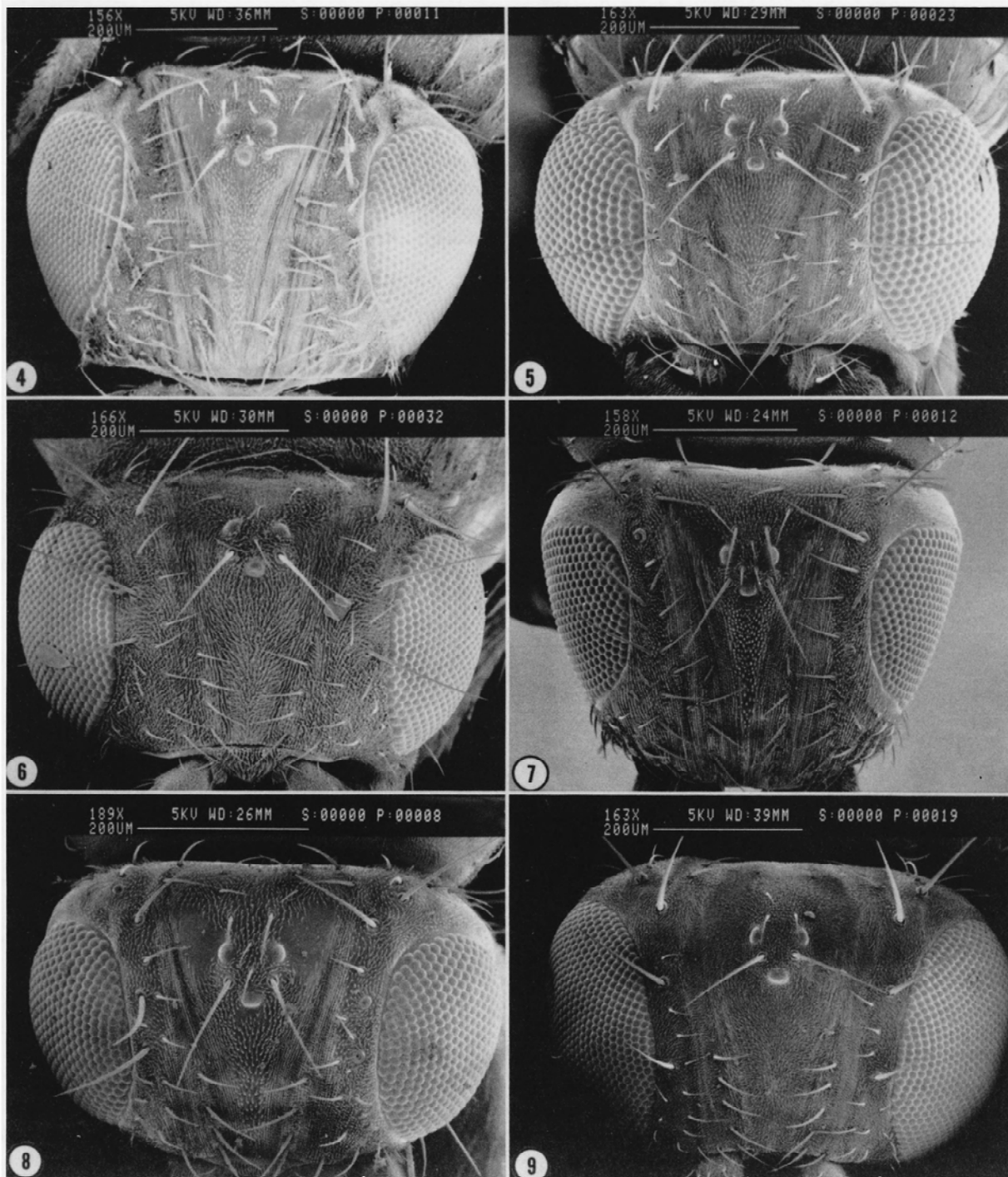
Norrbomia fulvipennis, new species (Figs. 5, 11, 15, 21, 29-31, 61-65)

? *Borborus* sp.: Knab 1915:40.

Borborus singularis: Sivinski 1983:419 (mis-identification)

Description. Body length 1.6-3.5 mm. Body color dark brown to black; antenna and middle of face reddish; coxae, femora, tibiae, and first tarsomere of hindleg brown; other tarsomeres and halter pale brown or yellowish. **Head:** Arista length slightly greater than intervibrissal distance; arista hairs ca. 3X basal width of arista. Frons (Fig. 5) pruinose, with small, indistinct, nonmicrotrichose shiny spot beside posterior ocellus. Interfrontal bristles in 5 small pairs; 7-9 inclinate inner orbital setulae. Each side of face luteous on medial half, black on outer half. Eye height ca. 2.5X genal height. Gena (Figs. 11, 15) dark reddish brown, microtrichose anteriorly and fairly broadly

ventrally (extreme ventral margin narrowly bare), nonmicrotrichose area broad, truncate anteriorly or its anterior margin concave. **Thorax:** Katepisternum bare below level of dorsal setae; anepisternum (Fig. 21) with tiny isolated nonmicrotrichose area immediately anteroventral to spiracle, main nonmicrotrichose area relatively small, its dorsal margin well ventral to level of ventral margin of spiracle; pleuron otherwise lightly pruinose; scutum and scutellum uniformly, heavily pruinose. Wing membrane transparent, with light brown tint; all veins pale brown; second costal sector 2.0-2.2X as long as third. Foreleg setose, brown; tarsi pale. Midleg brown, tarsi pale; first tarsomere with slightly enlarged ventral bristles. Hindleg long-setose, brown; tibia with small anteroapical spur and large apicoventral spur; femur with 3 erect dorsal bristles on distal half. Posterodorsal setae of distal half of male hind tibia longer than tibial width. Pulvilli narrow, pads widely separated. **Male abdomen:** Syntergite 1+2 uniformly pruinose brown. Membrane of segments 3-5 with setae on sclerotized bases. Sternite 5 simple, darkly pigmented along posterior margin. Epandrium with dense, short setae dorsally; laterally with 4-5 long bristles, dorsolateral bristle longest. Surstylus (Figs. 29, 31) setulose posterolaterally, posterior setae longer than surstylus; anterior part of surstylus elongate, with small, carinate anteriorly rounded ventral lobe. Cercus with dense patch of setae posterodorsally; posteroventrally short setose, bilobed; outer lobe broad and short; inner lobes of cerci separated by deep apical notch, cerci posteromedially contiguous over dorsal half. Paramere (Fig. 30) broad near middle, tapered to an acute apical process. Basiphallus with long, narrow epiphallus. Basal sclerite of distiphallus undivided, apically with single, medial, dorsally projected lobe; distal part of distiphallus larger, with rounded distal ventral lobe and paired, dorsoventrally flattened, distal dorsal lobes. **Female abdomen:** Sternite 4 (Fig. 62) divided into 3 separate sclerites, sclerites weak or broken up on some specimens; sternite 5 entire but pale medially. Pleuron of segment 6 rugose anteriorly and longitudinally striate posteriorly, pleuron 7 longitudinally striate (Fig. 63). Tergites 6 and 7 (Fig. 61) complete anteriorly and tripartite posteriorly, middle part very pale. Tergite 8 bipartite, epiproct (Fig. 65) elongate, emarginate anteriorly, produced posteriorly, bare except for 2 bristles. Sternites 6 and 7 elongate, bipartite except along anterior margin, with single row of bristles near middle. Sternite 8 tripartite, with dark posteromedial lobes; median part narrow and weakly sclerotized. Hypoproct emarginate and bare anteriorly, setulose posteriorly. Sper-



Figures 4-9. Dorsal view of head of *Norrbomia* spp. 4, *N. frigipennis*; 5, *N. fulvipennis*; 6, *N. fumipennis*; 7, *N. lacteipennis*; 8, *N. scripta*; 9, *N. sordida*.

matheca (Fig. 64) subspherical, flattened at top and bottom, with large basal apodeme; neck 0.75-1.20 times as long as main part.

Holotype. male, UNITED STATES. FLORIDA. Collier Co., Seminole State Park, 28.xii.1979, S.A. Marshall (CNC).

Paratypes. UNITED STATES. ALABAMA. Kushla, "Oc.'24", Sturtevant Collection, (1m USNM). FLORIDA. Alachua Co., Gainesville, 20.iv.1967, light trap, W.W. Wirth (1m USNM); near Gainesville, on back of *Canthon pilularis*, 8.v.1981, J. Sivinski; Highlands Co., Highlands Hammock State Park, orange grove, pig dung, 14-18.vi.1982, Woodruff & Rench (5m1f FSCA); Lake Placid, 2-3.xi.1983, pig dung, R.E. Woodruff (5m5f FSCA); Archbold Biological Station, vacuumed from dung, 17.iv.1989, S.A. Marshall (1m); Marion Co., Ocala National Forest, 12-18.vi.1983, 7.vi.1984, and 15-16.iii.1984, R.E. Woodruff (1m3f); Orange Co., E Orlando, 2-3.vii.1982, sand pine scrub, R.E. Woodruff (1m); Okaloosa Co., Blackwater River State Forest, Florida A&M research station, pig dung, 15-17.vi.1978, L. Stange (1m); Polk Co., 7 mi N 14, 2-3.xi.1983, pig dung, R.E. Woodruff (1m); Sarasota Co., Myakka River State Park, 21.v.1982, pig dung, R.E. Woodruff (1m1f). GEORGIA. Towns-Union Co., Mt. Enotah, 4,782 ft., 23.ix, 24.x.1952, trap 6, H.R. Dodge (10m4f WSU, USNM); Rabun Co., Rabun Bald, 24.ix, 25.x.1952, trap 6, H.R. Dodge (8m8f WSU, USNM); Chatham Co., Savannah, 14.v.1954, privy trap 84, J.W. Kilpatrick, (2m4f WSU, USNM); Folkston, 14 mi N, dung trap, 10-18.iv.1989, J. Swann (5m2f). MARYLAND. Montgomery Co., v.1959, light trap, A.A. Hubert (1m USNM). MASSACHUSETTS. Dukes Co., Naushon I., 2.ix.1923, A.H. Sturtevant (1m USNM); Nonamesset I., 24.vi.1923, sheep dung, 7.vii.1923, A.H. Sturtevant Collection (4m USNM). MICHIGAN. Livingston Co., George Reserve, 17.ix.1949, K.K. Bohnsack, (1m USNM). MISSISSIPPI. Horn I., 10.v.1944, light trap, E.A. Richmond (1f USNM). NEBRASKA. Thomas Co., Nebraska National Forest, 2.5 mi W Halsey, 16.vii.1967, H.B. Leech (1f CAS). NEW YORK. Riverhead, L.I. Veg. Res. Fm., 24-31.vii. and 7-20.viii.1978 (2m). NORTH CAROLINA. Macon Co., Wayah Bald, 5300', 14.vii.1967, J.G. Chillcott (1m CNC). OKLAHOMA. Wichita Mts., 5-7.vi.1979, dung traps, S. Peck (1m). SOUTH CAROLINA. Bluffton, 7.vi.1955, E.C. Turner (1 USNM). TEXAS. Bastrop Co., Bastrop Co. State Park, 24-27.v.1983, S&J Peck, carrion traps, Oak woods (1m); Randall Co., Palo Duro Canyon State Park, 3420', 7-9.vi.1979, S&J Peck, mesquite-prairie (1f). MEXICO.

VERACRUZ. Allende, vii.1944, M. Guerra (1m AMNH).

Distribution. Nebraska, Michigan and Massachusetts to Florida and Veracruz, Mexico.

Comments. *Norrbomia fulvipennis* is widely distributed in eastern North America, but unlike the closely related *N. frigipennis*, does not seem to be abundant anywhere. Most specimens have been taken on dung or in dung-baited traps. Sivinski (1983) recorded this species (as *Borborillus singularis* Spuler) as phoretic on adults of the dung-rolling scarab *Canthon pilularis* (L.). Sivinski also reared individuals from a dung cache of the nocturnal, burrowing scarab *Copris minutis* (Drury). The larger "*Borborus*" species "with smoky wings" reported by Knab (1915) as riding on *Canthon imitator floridanus* (as *C. viridis*, see comments under *N. frigipennis*) might be *N. fulvipennis*. The flies from Missouri reported by Moulton (1880) are probably *N. scripta*, not this species as suggested by Sivinski (1983, as *B. singularis*).

This species is closely related to *N. frigipennis* and *N. lacteipennis*, from which it can be separated by its brownish wings.

**Norrbomia fumipennis (Stenhammar),
new combination
(Figs. 6, 16, 22, 32-34, 66-71)**

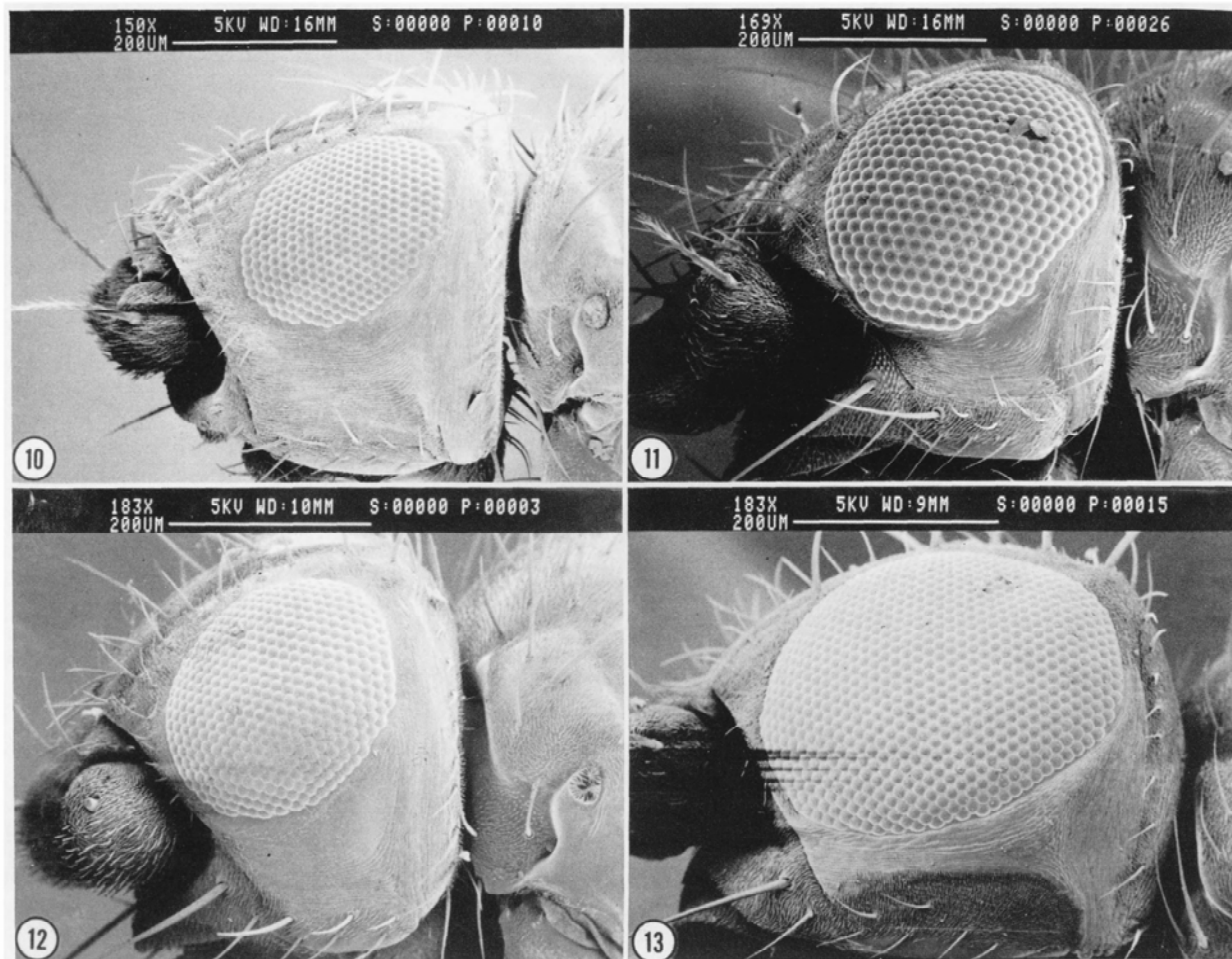
Copromyza fumipennis Stenhammar 1855:352. Lectotype male [here designated] (NRS). SWEDEN. Laponia Lulensi (=Lule, Lappmark), C.H. Boheman [with following labels: "Lp. in."; "Bhm."; and "nov. spec. Sthr"].

Borborus articus Malloch 1913:367. Lectotype male [here designated] (USNM). CANADA. QUEBEC. Fort Chimo [with following labels: "Ft. Chimo, Labr, 7.22"; "L.M. Turner Collector"; red "Type No. 14950 U.S.N.M."; and "*Borborus articus* Malloch"]. **new synonym.**

Borborus (Borborillus) articus: Spuler 1925:12. [unjustified emendation].

Copromyza (Borborillus) arctica: Richards 1965:720.

Description. Body length 2.2-3.5 mm. Body color, including antennae, face and legs, black; halter pale brown or yellowish. *Head*: Aristal length slightly greater than intervibrissal distance; aristal hairs ca. 3X basal width of arista. Frons (Fig. 6) entirely pruinose. Interfrontal bristles in 5 pairs; 5-8 inclinate



Figures 10-13. Left lateral view of head of *Norrbomia* spp. 10, *N. lacteipennis*; 11, *N. fulvipennis*; 12, *N. scripta*; 13, *N. sordida*.

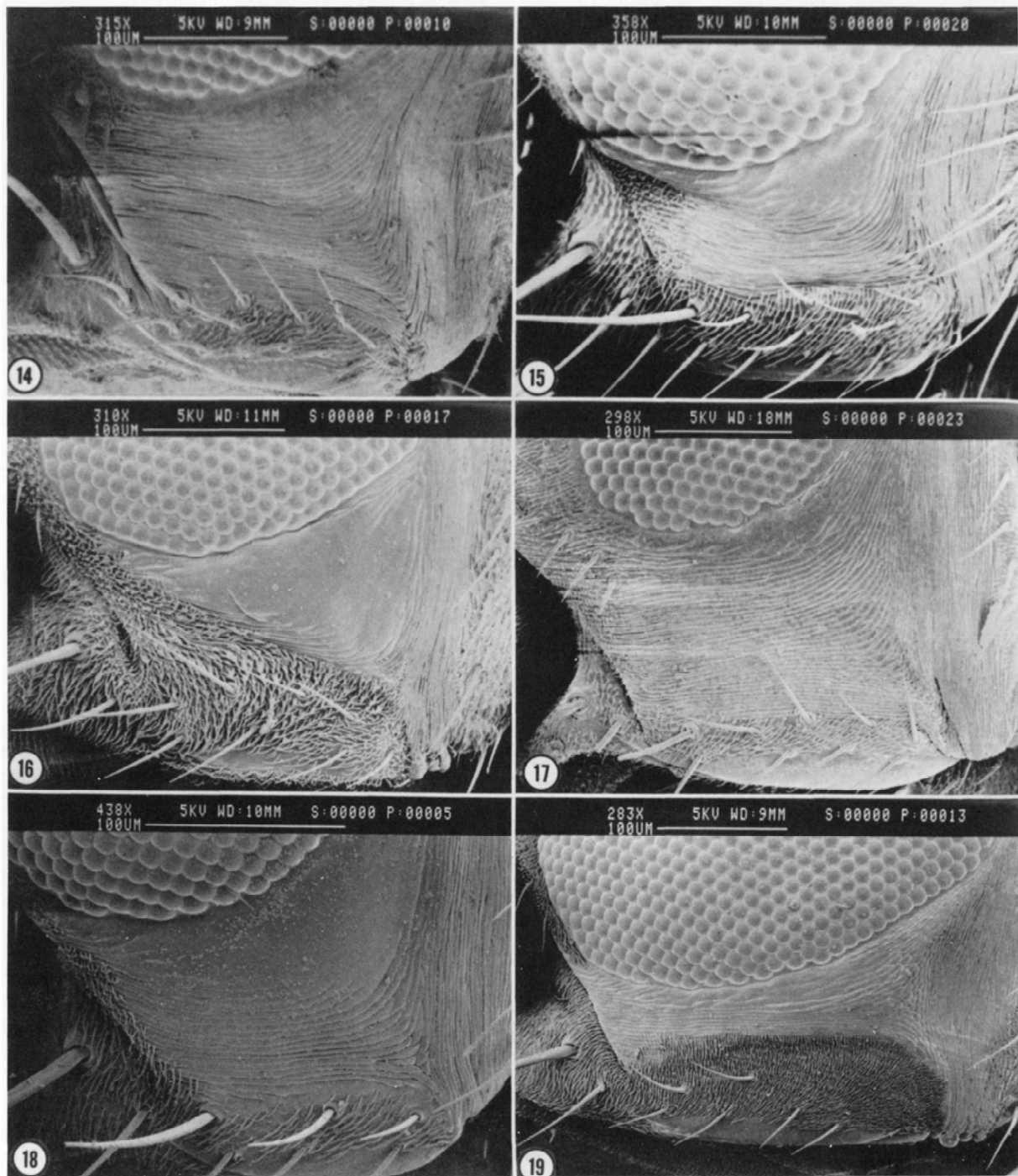
innerorbital setulae. Eye height ca. 2.1X genal height. Gena (Fig. 16) dark, broadly pruinose anteroventrally, nonpruinose area tapered, acute anteriorly. *Thorax*: Katepisternum bare below level of dorsal setae; anepisternum (Fig. 22) with tiny, isolated nonmicrotrichose area immediately anteroventral of spiracle, main nonmicrotrichose area small, its dorsal margin well ventral to level of ventral margin of spiracle; pleuron, including meron, otherwise entirely lightly pruinose; scutum and scutellum uniformly, heavily pruinose. Wing membrane transparent, with light brown tint; all veins brown; second costal sector 2.8-3.0X as long as third. Foreleg black, knees sometimes reddish. Mid tibia dark, first tarsomere with slightly enlarged ventral bristles. Hindleg short-setose, dark; tibia with single, very long apicoventral spur; femur with 2 erect dorsal

bristles on distal half. Posterodorsal bristles of male hind tibia slightly shorter than tibial width. Pulvilli narrow, pads widely separated. *Male abdomen*: Syntergite 1+2 uniformly pruinose black. Membrane of segments 3-5 bare or with 1-2 minute setulae. Sternite 5 large, dark; posterior margin prominent and weakly concave posteromedially; ventral part of sternite 6 thickened, dark, with conspicuous concavity behind posteromedial part of sternite 5. Epandrium with sparse, short setae dorsally; laterally and posteriorly with a few longer bristles. Surstylus (Fig. 32, 34) setulose posterolaterally and ventrally, longest bristles much shorter than surstylus length; with compact group of bristles posteromedially, anterior part of surstylus broad, elongate, mostly bare, with small, carinate, anteriorly rounded inner ventral lobe and second small inner lobe next to apex of large inner

lobe. Cercus with rounded, bare posterior depression, apical part of cercus thus scoop-like. Cerci divided by broad, deep, triangular cleft. Paramere (Fig. 33) broad near middle, posterior surface strongly sinuate beyond middle, tapered to digitate apical process; 5 setulae along posterior surface and 2 preapical setae anteriorly. Basiphallus with long, narrow epiphallus. Basal sclerite of distiphallus undivided, apically with single, medial, dorsally projected lobe; distal part of distiphallus larger, with rounded distal ventral lobe and paired, dorsoventrally flattened, distal dorsal lobes. *Female abdomen*: Sternite 4 (Fig. 67) divided into 4 separate sclerites; sternite 5 entire but with small anteromedial notch. Pleura of segments 4 and 5 (Fig. 68) with a few large setulae, some on sclerotized bases. Tergites 6 and 7 (Fig. 65) complete, dark, tripartite posteriorly. Tergite 8 complete posteriorly, dark, shiny. Epiproct (Fig. 70) long-setulose, with 4 larger bristles. Sternites 6 and 7 bipartite except along anterior margin, with single row of bristles near middle. Sternite 8 bipartite, dark, posteromedial corners shiny and projected ventrally; some indistinct sclerotization in groove between halves of sternite 8. Hypoproct emarginate anteriorly, with bifurcate sclerite in emargination, surface of hypoproct setulose, bifurcate sclerite not setulose. Two small vaginal sclerites visible on cleared specimens. Spermatheca (Fig. 69) subspherical, with large basal apodeme extending almost length of main part; neck 3-4X longer than main part.

Material examined: Lectotypes of *C. fumipennis* and *B. articus* (see synonymy). SWEDEN. "Lp. in.", "Bhm" (1m2f paralectotypes of *C. fumipennis* NRS); Norrbotten, 16 km W Messaure, 16.vi.1967, L.V. Knutson (1f USNM); Tjuonaj, 28.vii.1926, 30.vii.1918 (3m ZIL, USNM); Jebrenj, 24.vii.1918 (1m1f ZIL); Uåker, 28.vi.1922 (1m ZIL); Nuolja, 25.vii.1926 (1m ZIL); Vällista, 1.vii.1939 (1m ZIL); Abisko, 19.vii.1918 (1f ZIL). CANADA. BRITISH COLUMBIA. Tunjony L., 58°26'N, 132°45'W, 20.vii.1960, flowers, grasses and sedge, 3200', R. Pilfrey (1m CNC); Lisadele L., 58°41'N, 133°04'W, 11.vii.1960, 4000', R. Pilfrey (1f CNC). MANITOBA. Churchill, 15.vi.1930, O. Bryant, 17.vii.1930 (2m CAS), 30.vi.1952, 26.vi.1948, 3.viii.1952, 25.viii.1950, 26.vi.1948, 18.vii.1952, viii.1952, J.G. Chillcott, G.E. Shewell (3m6f CNC). LABRADOR. Ungava Bay, 24.vii, L.M. Turner (1f paralectotype of *B. articus* USNM); Hebron, 10.vii.1954, J.F. McAlpine (7m5f CNC); Nutak, 23.vii.1954, J.F. McAlpine (2m3f CNC); Cartwright, 19.vii.1955, E.E. Sterns (1m CNC); 10 mi up Sagleg Fjord, 3.viii.1954, J.F. McAlpine (6m CNC). NEW-

FOUNDLAND. Bay St. George, 10.vii.1915 (1m AMNH). NORTHWEST TERRITORIES. Salmita Mines, 64°05'N, 11°15'W, vi-viii.1953, J.G. Chillcott (10m2f CNC); Tuktoyaktuk, 8-12.vii.1971, D.M. Wood (3f CNC); Chesterfield, 9-24.viii.1950, bred from pupae in *Lemmus* burrow, J.R. Vockeroth (10m7f CNC); Aklavik, 2.vii, 5.viii.1931, Bryant (1m1f CAS); Masik R., Banks I., 17.vii.1968, G. Shewell (1m CNC); Eskimo Point, 16.vii.1950, G.G. Dilabio (1m); Clyde, Baffin Is., 2.viii.1958, G.E. Shewell (2f CNC); Spence Bay, 13.vii.1951, J.G. Chillcott (1m1f CNC); Muskox L., 64°45'N, 108°10'W, 11-25.vii.1953, J.G. Chillcott (7m5f CNC); Ford Lake, 63°11'N, 108°10'W, 27.vi.1966 (1f CNC). QUEBEC. Ft. Chimo, 29.vii, L.M. Turner (1f paralectotype of *B. articus* USNM); Indian House Lake, 8.vi-5.viii.1954, W.R. Richards (8m7f CNC); Payne Bay, 18-30.vii.1954, R. McCondochie, W.R.M. Mason, E.E. McDougall (3m4f CNC); Sugluk, 2.viii.1954, H. Hockett (7m2f CNC); Pt. Harrison, 9,10,25.vi.1949, D.P. Williams, P.J. Lachaine (1m1f CNC); Gt. Whale River, 7,8,15.viii.1949, bred from pupae in nest of *Microtus*, J.R. Vockeroth (2m2f CNC). YUKON. Richardson Mtns., flood plain of small creek, 5.vii.1987, S.A. Marshall (1m); 67°58'N 136°29'W, 1-5.vii.1987, dung traps in wet tundra, S. Marshall (1f); Otter Lake, 130°25'N 62°30'W, 4000', 16-22.vii.1960, J.E.H. Martin, E.W. Rockburne (11m7f CNC); Herschel Is., 10-20.vii.1953, C.D. Bird, J.S. Waterhouse (3m2f CNC); Tombstone Mtn. campground on Dempster Hwy, mushroom traps, 5-11.vii.1985, S.A. Marshall (1m); North Fork Crossing, mi 43 Peel Pt. Rd., 3500', 3.vii.1962, R.E. Leech (1m1f CNC); Firth River, 24.vi, 17.viii.1956, E.F. Cashman (2 CNC); Haines Jct., 2.viii.1958, Mason & Hughes (1f CNC). UNITED STATES. ALASKA. Umiat, 3-24.vii.1959, R. Madge (9m8f CNC); Ulnalakeet, 4-22.vii.1961, R. Madge, B.S. Hemming (2m1f CNC); Cape Thompson, 25-29.vii.1961, B.S. Hemming (3m3f CNC); Naknek, 6,18.vii.1952, W.R. Mason (2m CNC); St. Paul Is., 14-22.vii.1980, Adler (1m USNM); same, 10.viii.1920, G.D. Hanna (2mf CAS, USNM); St. Paul Is., from Thick-billed Murre, 22.vii.1980 (1m); Sealer's Is., 10.vii.1965 (1m3f); Isabel Pass, mi 206 Richardson Hwy., 4500', 18.vii.1962, R.E. Leech (1m CNC); Richardson Hwy., mi 206, mammal runs near beaver pond, 19.vi.1987, S.A. Marshall (1m1f); Miller House, Steese Hwy, 10.vii.1937, C.B. Philip (1f USNM); Eagle Summit, 54 mi SW Circle, 1105 m, carrion trap, 6-13.viii.1984, S.&J. Peck (1f). COLORADO. Loveland Pass, 12,000', 7.viii.1961, J.G. Chillcott (1m4f CNC); Boulder Co., Corona Pass, 10,600', 11.viii.1961, 11.viii.1955, J.G. Chillcott (1m2f CNC); Clear Creek Co., Mt. Evans, 12,800', 24.vii.1961, B.H. Poole (1f



Figures 14-19. Left gena of *Norrbomia* spp. 14, *N. frigipennis*; 15, *N. fulvipennis*; 16, *N. fumipennis*; 17, *N. lacteipennis*; 18, *N. scripta*; 19, *N. sordida*.

CNC); Gunnison Co., Cottonwood Pass, 11,000', 29.vii.1961, J.G. Chillcott (1f CNC); Lake Co., Independence Pass, 12,100', tundra, 31.vii, 7.viii.1961, J.G. Chillcott (2m4f CNC); Larimer Co., Cameron Pass, 11.viii.1964, G.F. Knowlton (1f CNC). NEW MEXICO. Taos Co., 1.7 mi SE Tres Ritos, 8500', dung, 3-5.vii.1972, A. Newton (1f). UTAH. Duchesne Co., Mirror Lk., 10300', 30.vii-12.viii.1979, S.&J. Peck, spruce-fir meadow, carrion-malaise (2m1f4). WYOMING. Mirror Lake, Snowy Range Mtns., 13.viii.1957, G.F. Knowlton (1m1f WSU); Carbon Co., Lake Marie, 20 km W Centennial, 3230 m, sweep, 1.viii.1973, P. Arnaud (3m7f CAS, USNM); Sublette Co., Wind River Mts., 20 mi NE Pinedale, nr. Nelson Lake, 10400-11000', carrion, tundra, 15-23.viii.1979, S. Peck (2m10f).

Distribution. Throughout the northern Holarctic Region, occurring south to New Mexico in the mountains of the western United States.

Comments. *Norrbomia fumipennis*, *N. yukonensis*, and *N. sordida* exhibit a number of similarities, such as the setulose epiproct and entirely pruinose frons, shared with other species of *Norrbomia* not found in the New World. *Norrbomia fumipennis* and *N. yukonensis* are very closely related to *N. costalis* (Zetterstedt), with which they share a quadripartite female sternite 4, posteriorly concave male cercus, a characteristic surstylus shape, and the possession of a separate sclerite in an anterior emargination of the hypoproct. These species differ most obviously in cercus shape, the latter species having an elevated posteromedial corner. The Palearctic species of the *costalis* group are in need of revision.

Kim (1972) did not report type specimens of *C. fumipennis* in the NRS, and P.I. Persson (pers. comm.) found no specimens under this name. However, among the series of *Sphaerocera* species, he located four specimens fitting Stenhammar's description and with appropriate labels to be syntypes. The label "Lp.in." is an abbreviation for "Lapponia interior", or Inner Lappland, where Lule, Lappmark is located, and "Bhm" means Boheman (P.I. Persson, pers. comm.).

Ft. Chimo, the type locality of *B. articus*, is in northern Quebec, rather than Labrador as the label of the lectotype and the original description indicate.

Norrbomia fumipennis has been reared from and collected as adults in burrows of rodents (*Lemmus* and *Microtus* spp.).

Norrbomia lacteipennis (Malloch)
new combination
(Figs. 1-2, 7, 10, 17, 23, 35-37, 73-78)

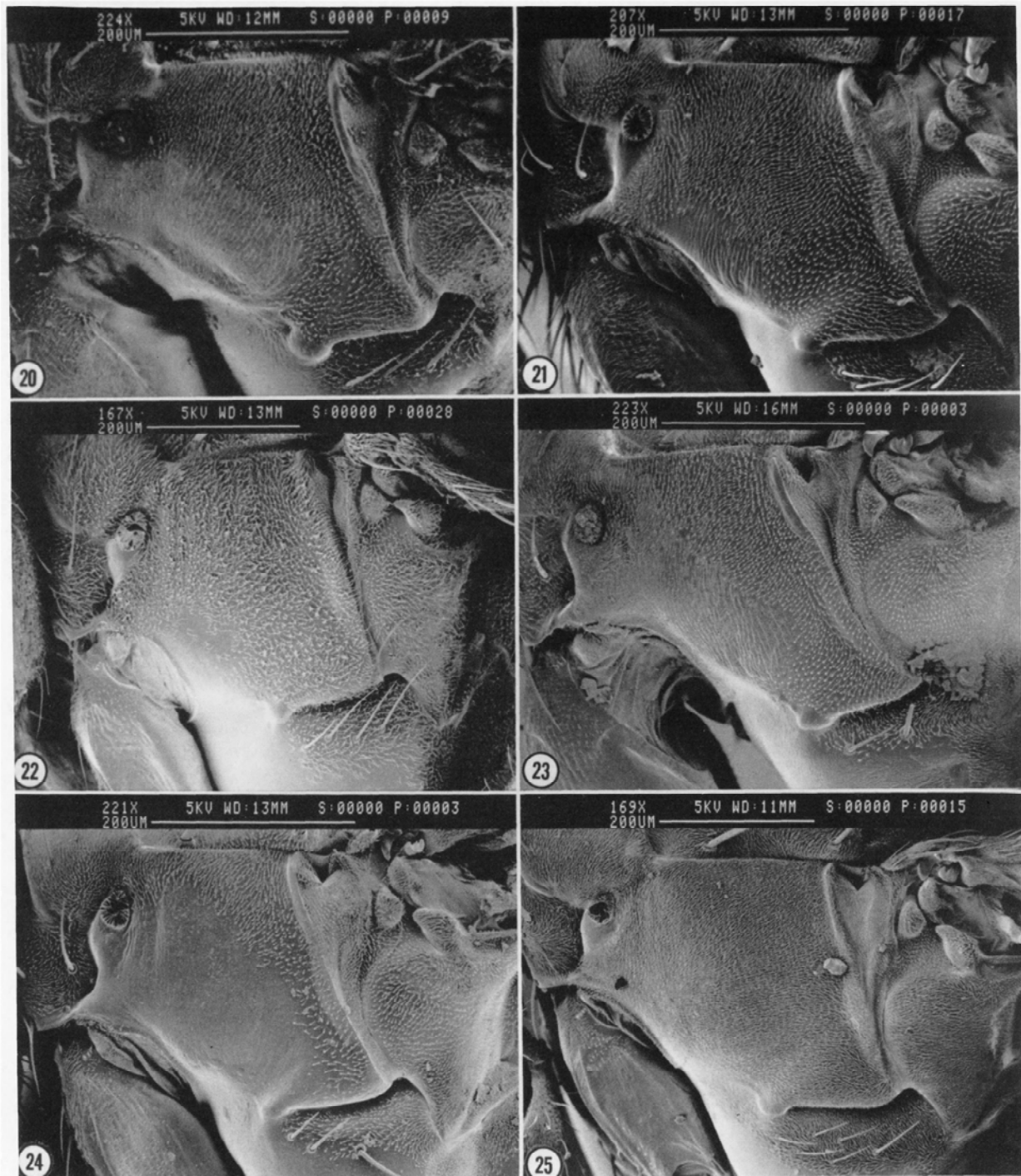
Borborus lacteipennis Malloch 1913:366. Lectotype male [here designated] (USNM). MEXICO. TAMAULIPAS. Tampico, "29-12/ E.A. Schwarz" (with following labels, "Tampico Mex 29.12", "E.A. Schwarz Collector", red "Type No. 14949 U.S.N.M.", "Borborus lacteipennis Malloch", red-bordered "Holotype Borborus lacteipennis Mall. Steyskal 1970").

Borborus (Borborillus) lacteipennis: Spuler 1925:9.
Borborus (Borborillus) peltastes Spuler 1925:10. Holotype male (USNM). UNITED STATES. TEXAS. Mobeste (sic), A.W. Barber (with following labels, "Mobeetie, Oct 9, Tex", orange "PARATYPE Copromyza peltastes Spuler", "A.L. Melander Collection 1961", "Copromyza peltastes Spuler" [Melander's writing], and "Type male, this is the real holotype, det. Sabrosky"); Steyskal 1971:478 (synonymy).

Copromyza (Borborillus) lacteipennis: Richards 1967:2; Steyskal 1971:478.

Copromyza (Borborillus) peltastes: Richards 1965:720.

Description. Body length 1.6-3.5 mm. Body color brown to black, heavily pruinose and darker dorsally; lower frons and gena reddish; antenna, legs and face luteous; halter knob and stem white. **Head:** Arista length slightly greater than intervibrissal distance; arista hairs ca. 1.5X basal width of arista. Frons (Fig. 7) microtrichose, with medium sized nonmicrotrichose area lateral to ocelli, only part on nonrugose cuticle extending posterolaterally from posterior ocellus obviously shiny. Interfrontal bristles in 5-6 small pairs; 7-9 inclinate inner orbital setulae. Face deeply concave, uniformly luteous. Eye height ca. 1.5X genal height (Fig. 10). Gena (Fig. 17) pale reddish brown, narrowly pruinose anteriorly and ventrally (extreme ventral margin bare), nonpruinose area very broad, truncate anteriorly. **Thorax:** Katepisternum non-pruinose ventral and anterior to dorsal setae; anepisternum (Fig. 23) with nonpruinose area moderately large, its dorsal margin slightly ventral to slightly dorsal to level of ventral margin of spiracle; pruinosity extended towards or to anteroventral corner, partially or entirely isolating tiny nonpruinose area anteroventral to spiracle; pleuron otherwise pruinose except for narrow bare area on meron; scutum and scutellum uniformly, heavily pruinose. Wing membrane opaque, whitish; all veins usually whitish,



Figures 20-25. Left anepisternum of *Norrbomia* spp. 20, *N. frigipennis*; 21, *N. fulvipennis*; 22, *N. fumipennis*; 23, *N. lacteipennis*; 24, *N. scripta*; 25, *N. sordida*.

costa sometimes and other veins rarely pale brown; second costal sector 2.1-2.3X as long as third. Foreleg light brown, tarsi pale. Midleg brown, tarsi pale; first tarsomere with slightly enlarged ventral bristles. Hind femur with 3 slightly enlarged erect dorsal setae. Distal 4/5 of hind tibia of male with 8-10 long, thin posterodorsal hairs *ca.* 3X as long as tibial width; both sexes with small anteroapical spur and large apicoventral spur. Pulvilli narrow, pads widely separated. *Male abdomen:* Syntergite 1+2 pruinose, dark brown with black strip before posterior margin, posterior margin pale; syntergite 1.7X as long as tergite 3. Membrane of segments 3-5 with a few short setae with dark, sclerotized bases. Sternites 3 and 4 reduced to a few small patches; sternite 5 divided longitudinally. Epiandrium with dense, short setae dorsally and a few longer bristles laterally, dorsolateral bristle longest. Surstylus (Figs. 35, 37) with dense, long setae ventrally, some setae longer than surstylus. Anterior part of surstylus elongate, with small, carinate inner ventral lobe. Cercus bilobed, inner lobe elongate, narrow. Cerci separated by deep notch. Paramere (Fig. 36) broad near middle, tapered to apex; posterior surface with scalloped, setose edge near middle. Basiphallus with long, narrow epiphallus. Basal part of distiphallus well sclerotized; distal part smaller, with rounded distal ventral lobes. *Female abdomen:* Sternite 4 (Fig. 74) completely absent; sternite 5 very pale, membranous medially. Pleura of segments 3-5 with numerous setae (Fig. 75), each arising from separate large, dark, sclerotized base. Tergites 1-5 (Fig. 73) complete; tergites 6 and 7 with posteriorly concave anterior part and weakly pigmented tripartite posterior part; tergite 8 divided medially; epiproct (Fig. 78) with bilobed anterior process and simple posterior process; bare except for 4 bristles. Sternites 6 and 7 each divided into anterior, bare, shiny, posteriorly concave part and posterior, paler, posteriorly tripartite part. Sternite 8 divided into 2 large, dark, lateral sclerites and paler ridge-like sclerites in the ventral groove between the main sclerites of sternite 8. Hypoproct (Fig. 77) pale, concave anteriorly, entirely setulose. Spermatheca (Fig. 76) subspherical, flattened at top and bottom, with large basal apodeme; neck 4-5X as long as main part.

Material examined: Lectotype of *B. lacteipennis*, holotype of *B. peltastes* (see synonymy). MEXICO. TAMAULIPAS. Tampico, "29.12", E.A. Schwarz (1f

paralectotype of *B. lacteipennis* USNM). UNITED STATES. LOUISIANA. Cameron, 7.vii.1905, J.S. Hine (1m4f OhSU, USNM); Logansport, 24.iii.1908, E.S. Tucker (2f USNM). OKLAHOMA. Lattimer Co., 5 mi W Red Oak, 8-14.v.1977, dung, K.W. Stephan (2m1f FSCA); Comanche Co., Wichita Mts. Refuge, 5-7.vi.1979, shortgrass prairie, S.&J. Peck (1m1f). TEXAS. Mobeetie, 9.x, A.W. Barber (3f paratypes of *B. peltastes* USNM); Brazos Co., College Station, 20.iv.1935, H.J. Reinhard; Burleson Co., reared in lab, 1978 "from STK" (5m6f USNM); Galveston Co., Galveston, "May", F.H. Snow (3m2f UKaL, USNM); Kleberg Co., 24.ix.1970, from *Phanaeus difformis* Lec., R.R. Blume (4m14f USNM).

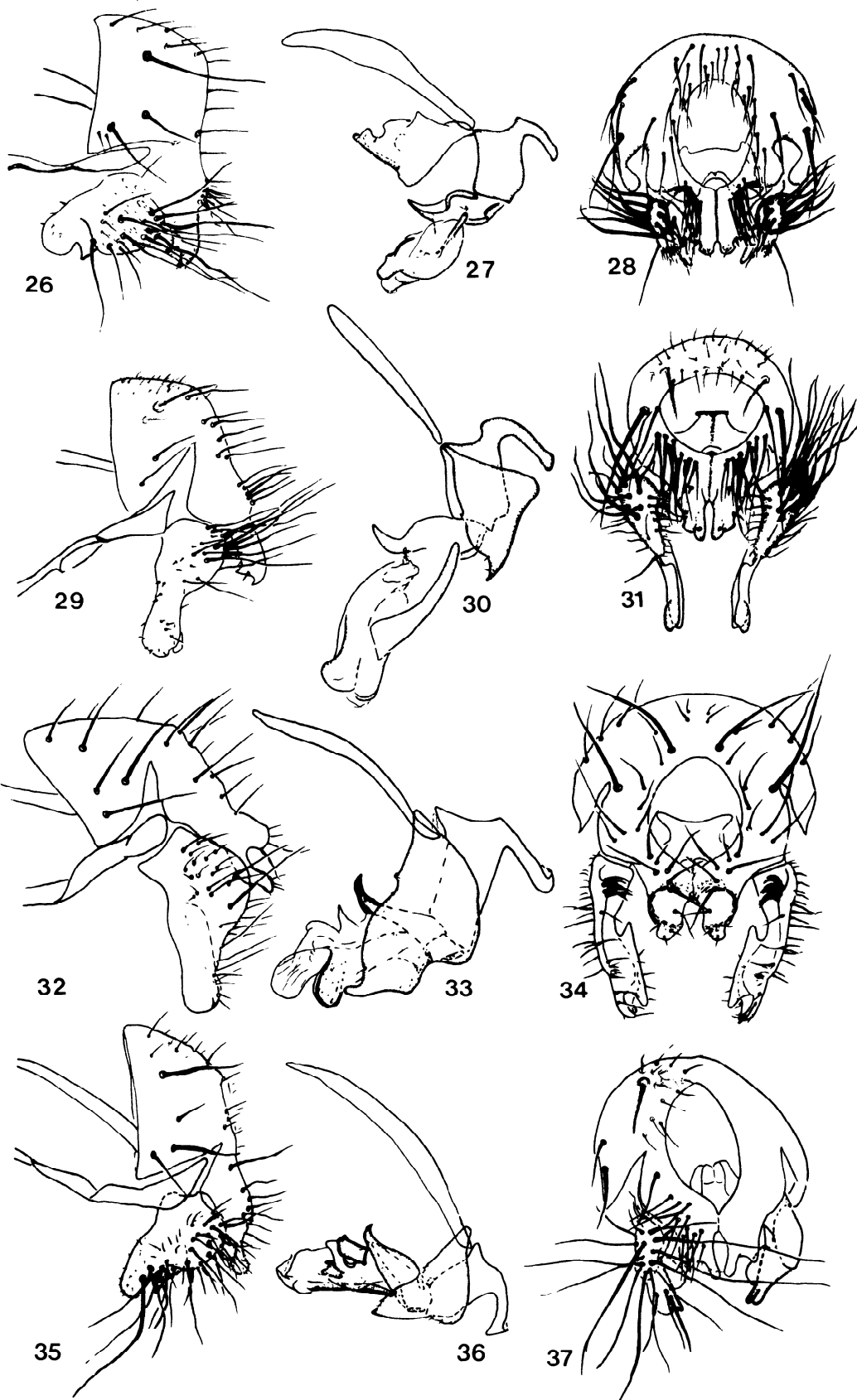
Distribution. From eastern Oklahoma, Texas and Louisiana to northeastern Mexico.

Comments. *Norrbomia lacteipennis* is recognized by its small eyes, sclerite-based pleural setae, and deep cleft separating the male cerci. The pruinosity patterns are difficult to see. Like *N. fulvipennis*, *N. frigipennis*, and *N. scripta*, *N. lacteipennis* is phoretic on coprophagous scarab beetles. Adults have been collected from *Phanaeus difformis* LeConte. One of the three female paratypes of *B. peltastes* in the USNM was mislabelled as the "TYPE", probably by Spuler or Melander. Spuler clearly stated in the description that the holotype was a male. Steyskal (1971) said that he "labeled" Malloch's male syntype of *B. lacteipennis* "as holotype", but this designation can be made only in the original description. Steyskal's statement is not a lectotype designation by inference of holotype (see International Code of Zoological Nomenclature, Art. 74b), because Malloch clearly stated that he had more than one specimen. We hereby designate the male as lectotype to eliminate any ambiguity.

Norrbomia mexicana, new species (Figs. 38-40, 79-83)

Description. Body length *ca.* 2.0 mm. Body color reddish brown to black; antennae and legs reddish brown; halter stem brown, knob whitish. *Head:* Arista length equal to intervibrissal distance; arista hairs *ca.* 3X basal width of arista. Frons pruinose, with large, triangular nonmicrotrichose shiny area sur-

Figures 26-37. Male *Norrbomia*. Left lateral view of terminalia; aedeagus and associated structures; posterior view of terminalia. 26-28, *N. frigipennis*; 29-31, *N. fulvipennis*; 32-34, *N. fumipennis*; 35-37, *N. lacteipennis*.



rounding ocelli and extended almost to anterior margin of interfrontal plate (on some specimens shiny area divided into 3 parts by narrow oblique pruinose strips). Interfrontal bristles in 4-6 pairs; 6-8 inclinate inner orbital setulae. Each side of face dark except along carinate middle part of face. Eye height ca. 2.0X genal height. Gena dark reddish brown, pruinose anteriorly and ventrally (extreme ventral margin bare), nonpruinose area broad, truncate to slightly tapered anteriorly. *Thorax*: Katepisternum nonpruinose except posterodorsal corner above dorsal setae; anepisternum pruinose only narrowly on dorsal and posterior margins, nonpruinose area very large, its dorsal margin dorsal to dorsal margin of spiracle; pleuron otherwise lightly pruinose except for narrow bare area on meron; scutum and scutellum uniformly, lightly pruinose. Wing membrane transparent, with light brown tint; all veins pale brown; second costal sector ca. 2.0X as long as third. Coxae, trochanters, and tibiae reddish brown; tarsi paler. Hindleg long-setose, brown; femur with 2-3 thin, erect, dorsal bristles; tibia with small anteroapical bristle and large, curved apicoventral spur. Hind tibia of male with posterodorsal setae subequal in length to tibial width. Pulvilli small, widely separated, together much smaller than tarsomere 5, covering only basal half of claw. *Male abdomen*: Syntergite 1+2 with small pale patch between tergites 1 and 2. Membrane of segments 3-5 with 4-6 small setae per segment, without sclerotized bases. Sternite 5 simple, darkly pigmented along posterior margin. Epandrium with sparse, short setae dorsally, laterally with about 6 longer bristles, all epandrial bristles relatively short. Surstylus (Figs 38, 40) with small, short setose posterolateral area, ventrolateral margin with some longer bristles; posteroventral margin with 5-6 stout bristles; anterior part of surstylus quadrate, with blade-like inner ventral lobe. Cercus with group of 7-8 setae posterodorsally; posteroventrally short setose, divergent, apex quadrate, with sharp corners; cerci separated by broad, deep apical notch, cerci posteromedially contiguous dorsally. Paramere (Fig. 39) broad near middle, tapered to acute apical process; anterior surface with lobes above and below middle. Basiphallus with long, narrow epiphallus. Distiphallus relatively simple, with thin dorsal sclerite and prominent basal ventral sclerite. *Female abdomen*: Sternite 4 (Fig. 80) divided longitudinally into 2 small, widely separated sclerites. Sternite 5 emarginate anteromedially,

anterolateral corners with long, thin lateral lobes. Pleuron of segment 3 (Fig. 81) with numerous small setae arising from membrane near sternites; pleuron of segment 5 with a few larger bristles arising from sclerotized bases. Tergites 6 and 7 (Fig. 79) weakly pigmented posteriorly, tergite 8 with trilobed posterior part and weakly concave anterior part. Epiproct (Fig. 83) simple, bare except for 2 bristles. Sternites 6 and 7 divided into separate sclerites; anterior sclerite dark, bare, with deep transverse groove; posterior part of sternite 7 weakly pigmented, with transverse row of bristles. Sternite 8 divided into 2 large, dark, lateral sclerites and paler ridge-like sclerites in ventral groove between lateral sclerites. Hypoproct with distinct anteromedial lobe; bare medially, setulose laterally. Cerci short, barely twice as long as wide. Spermatheca (Fig. 82) subspherical, flattened at top and bottom, with large basal apodeme; neck twice as long as main part.

Holotype. Male (CNC), MEXICO. CHIAPAS. 2 mi S Trinitaria, 21-24.viii.1971, 5100', oak-tropical deciduous forest, human dung, A. Newton.

Paratypes. Same data as holotype (13♀m GUE, USNM, CNC, FMNH), MEXICO. CHIAPAS. 11 mi E Trinitaria, 5200', viii.1971, tropical deciduous forest, human dung, A. Newton (2m4f).

Distribution. Known only from Chiapas, Mexico.

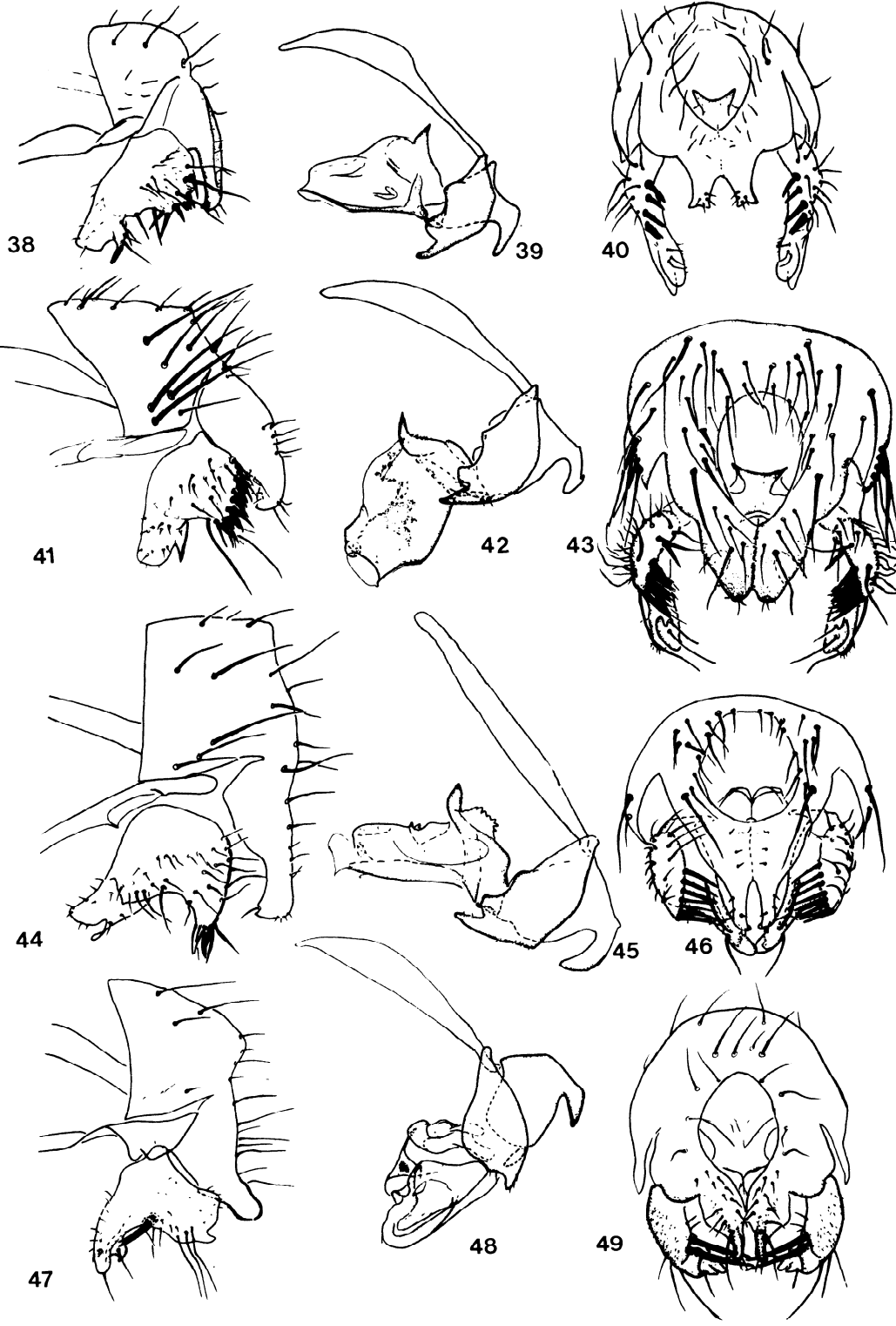
Comments. *Norrbomia mexicana* is recognized by its large nonmicrotrichose area on the frons and its distinctive quadrate male cerci. It is closely related to *N. scripta*. A female from Sonora, 10 mi E of Navajoa (in the USNM) may be this species, but differs from the female paratypes in having sternite 5 without anterolateral lobes.

Norrbomia scripta (Malloch)
new combination
(Figs. 9, 12, 18, 24, 41-43, 84-88)

Borborus scriptus Malloch 1915:64. Holotype male (INHS). UNITED STATES. ILLINOIS. St. Joseph, 17.v.1914, J.R. Malloch [genitalia dried out and stuck to bottom of microvial].

Borborus (Borborillus) scriptus: Spuler 1925:11.

Figures 38 - 49. Male *Norrbomia*. Left lateral view of terminalia; aedeagus and associated structures; posterior view of terminalia. 38-40, *N. mexicana*; 41-43, *N. scripta*; 44-46, *N. singusta*; 47-49, *N. sordida*.



Copromyza (Borborillus) scripta: Richards 1965:720; Steyskal 1971:477.

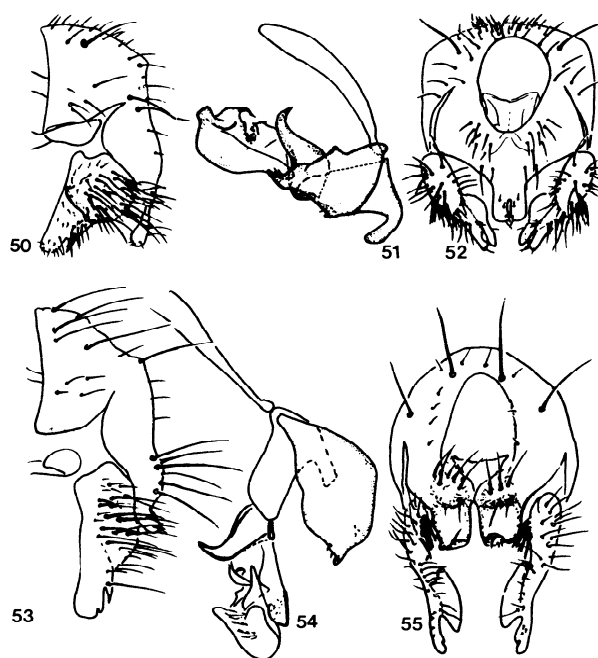
Borborus (Borborillus) singularis Spuler 1925:12. Holotype male (USNM). UNITED STATES. WASHINGTON. Kettle Falls, A.L. Melander [with following labels: "Kettle Falls, 3 May '12, Wash.", "A.L. Melander Collection 1961" [added when incorporated in USNM collection], and "Copromyza vitripennis Meig". in Melander's writing. **new synonym.**

Copromyza (Borborillus) singularis: Richards 1965:720.

Description. Size variable, body length *ca.* 2 mm. Body color reddish brown to black; antenna, legs, face and gena luteous; halter white with pale brown stem. **Head:** Arista length equal to intervibrissal distance; arista hairs *ca.* 2X basal width of arista. Frons pruinose, with medium sized nonmicrotrichose areas lateral to ocelli (Fig. 9), only part on nonrugose cuticle posterolateral to posterior ocellus obviously shiny. Interfrontal bristles in 5-6 small pairs; 7-9 inclinate inner orbital setulae. Each side of face luteous on medial half, black on outer half. Eye height *ca.* 2.0X genal height. Gena (Fig. 18) dark reddish brown, narrowly microtrichose anteriorly and ventrally (extreme ventral margin bare), nonmicrotrichose area very broad, truncate or slightly tapered anteriorly. **Thorax:** Katapisternum bare ventral and anterior to dorsal setae; anepisternum with nonmicrotrichose area large, its dorsal margin approximately level with or slightly dorsal to dorsal margin of spiracle; pleuron otherwise lightly pruinose except for narrow bare area on meron; scutum and scutellum uniformly, heavily pruinose. Wing membrane opaque, whitish or occasionally transparent; all veins usually whitish, costa sometimes and other veins rarely pale brown; second costal sector 1.8-2.0X as long as third. Foreleg brown, tarsi pale. Midleg brown, tarsi pale; first tarsomere with slightly enlarged ventral bristles. Hindleg brown; femur with 2 slightly enlarged dorsal setae; hind tibia of male with 2-6 long, thin posterodorsal hairs on distal half; hind tibia in both sexes with small anteroapical spur and large apicoventral spur. Pulvilli narrow, widely separated. **Male abdomen:** Syntergite 1+2 uniformly pruinose brown, 1.7X as long as tergite 3. Membrane of segments 3-5 with a few weak setae. Sternite 5 simple, darkly pigmented along posterior margin. Epandrium with short, sparse setae dorsally, laterally with 6-7 long bristles. Surstylus (Figs. 41, 43) short setose posterolaterally, posteroventral setae dense, thick, and relatively short; some long thin bristles also

present. Anterior part of surstylus elongate, with small, carinate inner ventral lobe. Cercus with a few setae posterodorsally; posteroventrally short setose, inflexed to anteriorly directed, tapered angle. Cerci separated by shallow, broad apical notch only. Paramere (Fig. 42) broad near middle, tapered to acute apical process; anterior surface with small triangular lobe near middle and large, quadrate preapical lobe. Basiphallus with long, narrow epiphallus. Basal part of distiphallus well sclerotized; distal part larger, with rounded distal ventral lobes. **Female abdomen:** Sternite 4 (Fig. 85) divided into 2 separate sclerites, also often with remnants of middle sclerite; sternite 5 entire and dark. Pleura of segments 4 and 5 (Fig. 86) with 1-3 distinct sclerites, each bearing 1-4 short setulae. Tergites 1-6 (Fig. 84) complete, tergite 7 weakly pigmented posteriorly; tergite 8 weakly pigmented medially; epiproct (Fig. 88) simple, produced posteriorly, bare except for 2 bristles. Sternites 6 and 7 each divided into anterior, bare, shiny, transversely concave part and paler, setose posterior part. Sternite 8 divided into 2 large, dark, lateral sclerites and paler ridge-like sclerites in ventral groove between main sclerites of sternite 8. Hypoproct pale and bare anteriorly, setulose along posterior margin. Cerci very short, less than twice as long as wide. Spermatheca (Fig. 87) subspherical, flattened at top and bottom; neck longer than main part.

Material examined: Holotypes of *B. scripta* and *B. singularis* (see synonymy). CANADA. SASKATCHEWAN. Cypress Hills, 26.v.1955, J.R. Vockeroth (2m CNC). MEXICO. HIDALGO. El Chico Nat. Park, 1 mi S El Chico, 8400', 16.vii.1971, D.H. Newton (1m USNM). JALISCO. 7 mi N Tequila, 17.viii.1960, P.H. Arnaud, Jr. (1m CAS). NUEVO LEON. E slope Cerro Potosí, 9200', Pine, human dung, v.1971, A. Newton (2f). UNITED STATES. ARIZONA. Cochise Co., Chiricahua Mts., 6 mi SE Portal, 4150', ix.1970, desert grassland, human dung, A. Newton (40m 12f GUE, MCZ, CNC); Chiricahua Mts., 7000', 15-21.vii.1978, dung, O. Kukal (6m); Coronado National Monument, 11-15.viii.1984, dung, B.V. Brown (3m 3f). Santa Cruz Co., Patagonia Lake State Park, 9-11.viii.1984, dung, B.V. Brown (15m 16f); Santa Rita Mtns., Madera Canyon, 5500', ix.1970, human dung, A. Newton (2m); Madera Canyon, 14.v.1977, dung, J. Helava (1m); Bear Canyon Bridge, Lociel-Bisbee Road, 5300', 29.vii.1965, H.B. Leech (1f CAS); Yank's Spring, Sycamore Canyon, Tumacacori Mts, 4000', H.B. Leech (1m CAS); 7 mi WNW Nogales, Calabasas Canyon, 3850', desert grassland, ix.1972, A. Newton (1m 1f); 8 mi NNW Nogales, Walker Canyon, 3900', oak wood-



Figures 50-55. Male *Norrbomia*. Left lateral terminalia; aedeagus and associated structures; posterior terminalia. 50-52, *N. triglabra*; 53-55, *N. yukonensis*.

land, dung, ix.1970, A. Newton (1m1f). Pima Co., Santa Catalina Mtns., Mt. Lemmon, Fir forest, viii.1972, dung, A. Newton (1m). INDIANA. LaFayette, iv.1926, J.M. Aldrich (1f USNM); Lafayette, v.14, on human excrement, J.M. Aldrich (1f USNM). ILLINOIS. Champaign Co., 1.vi, 17.v.1925, M.W. Shackelford (1m1f CNC). KANSAS. Manhattan, 18.v.1938, 25.v.1935, 13.ix.1930, 3.x.1930, D.A. Wilbur (3m3f USNM). NEW MEXICO. Eddy Co., 30 mi WSW Carlsbad, Sitting Bull Falls, 4600', 23-27.vii.1975, dung, S. Peck (10m8f). Guadalupe Co., Santa Rosa Lake State Park, 3-4.viii.1984, dung, B.V. Brown (1m). Lincoln Co., 10 mi N Sierra Blanca, 10-26.vi.1979, alpine meadow, 11000', carrion S.&J. Peck (2m1f). OKLAHOMA. Comanche Co., Wichita Mts. Refuge, 5-7.vi.1979, shortgrass prairie, dung traps, S.&J. Peck, (4m11f); Murray Co., Sulphur, Chickasaw Recreation Area, creek, bottom woods, S.&J. Peck (1m); Texas Co., Guymon, 21.vi.1941, L.H. Banker (1m UKaL). TEXAS. Brewster Co., 3.5 mi E Marathon, 26-27.ix.1979, dung trap, R. Woodruff & G. Fincher (5m5f FSCA); Randall Co., 3420', Palo Duro Canyon State Park, 7-9.vi.1979, mesquite prairie, S.&J. Peck, (7m9f); San Patricio Co., Welder Wildlife Refuge near Verna Mills, 1.xi.1988, on dung scarab (*Canthon* sp.), J. Heraty (1m1f); Terrence Co., Dryden, iv-v.1954, O.

Schomberg (1m USNM); Rio Frio, "v.12.10" F.C. Pratt (3m3f USNM); Val Verde Co., 17 mi W Langtry, 27.ix.1979, pig dung, R. Woodruff & G. Fincher (1f FSCA).

Distribution. Eastern Washington, Saskatchewan, and Indiana south to Arizona, Texas and central Mexico.

Comments. Steyskal (1971) keyed this species partly on the basis of a syntergite 1+2 "as long as terga 3, 4 and 5 together". In none of the specimens we examined, including the type, was the syntergite any longer than tergites 3 and 4, nor was there any significant difference between syntergite lengths of this and related species. *Norrbomia scripta* can be separated from all congeners by its distinctive genitalia, especially the stout surstylar setae, broadly notched male cerci, and the female sternites 5-7. Externally, this is the only species with white wings, brown tarsi, large shiny areas near the ocelli, and eye height much greater than genal height.

Spuler stated that the holotype of *B. singularis* was a male from Kettle Falls, Washington, collected by Melander, whose collection was later sold to the USNM. We found no specimen labelled as holotype in the USNM type collection, but in the general collection there was a male of *N. scripta*, originally from the Melander collection, with appropriate locality data. Considering the discrepancies with other USNM Spuler types (e.g. what are labelled as the holotypes of *Borborus calcitrans* and *B. immensa* are probably only paratypes, and what is probably the holotype of the former is labelled as a paratype of an unpublished name; see also comments about the *B. peltastes* types under *N. lacteipennis*), it would not be surprising if this male was the holotype. We have made this assumption as the specimen more or less fits Spuler's description, although the latter is not detailed enough to confirm with certainty that *B. singularis* is *N. scripta*. We originally assumed that the name *B. singularis* corresponded to the species we are now calling *N. singusta*, because of Spuler's statement that the hind femur is strongly swollen. The size of the gena is larger in that species, however; the genal height is more than 0.5 times the long diameter of the eye, whereas in the Kettle Falls male it is 0.4 times, much closer to Spuler's statement that this ratio is 1/3. The hind femur is only slightly swollen in the Kettle Falls male, but in his key, Spuler was comparing it with that of *N. fumipennis* (as *B. arcticus*) which he had not seen, and which Malloch described as having the hind femur "normal in size". Most specimens of *N.*

scripta we have seen have the wing membrane whitish, whereas Spuler said it was hyaline, with the veins brown, but the Kettle Falls male is one of the specimens fitting the latter description. Other than Spuler's statement that there were four rows of acrostichal setae, which does not fit any species of *Norrbonnia*, the other characters he listed, such as the hind tibia with a row of long thin hairs on the extensor (dorsal) side, the location of r-m and the ratio of the sections of the medial vein, the short arista length, and various color and chaetotaxy characters, all fit the Kettle Falls male as well as several other Nearctic *Norrbonnia* species. They do not contradict the idea that the Kettle Falls male is the *B. singularis* holotype, but neither do they confirm this with certainty. The surstylus of this male differs slightly from Figure 41 in that the posterior part projects a bit more as a ventral lobe and the setae on the posterior margin are slightly smaller. We do not consider this variation significant and therefore regard *B. singularis* as a junior synonym of *N. scripta*.

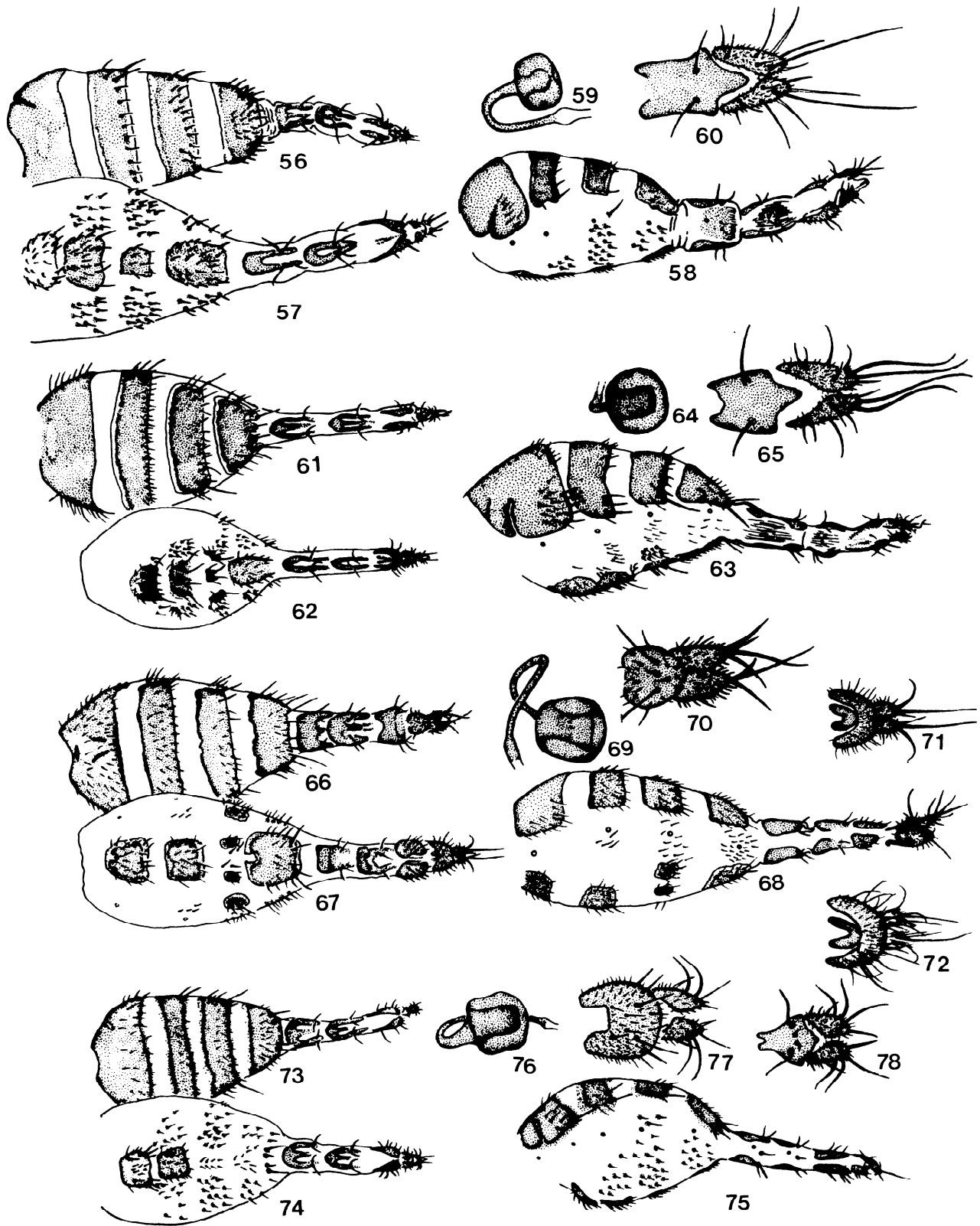
Several examined specimens were collected on a scarab (*Canthon* sp.), and the white-winged flies briefly described by Moulton (1880) as riding on a dung beetle in Missouri are probably this species. H. Howden and J. Martin (pers. comm.) filmed white-winged flies riding on *Canthon humectus* (Say) in Durango, Mexico in 1964. Considering the location, these flies probably also were *N. scripta*.

Norrbonnia singusta, new species (Figs. 44-46, 89-93)

Description. Body length 2.0-2.5 mm. Body color reddish brown to black; antenna and legs brown; halter white or yellowish. *Head:* Arista length less than intervibrissal distance; arista hairs shorter than arista width. Frons with medium sized nonmicrotrichose shiny areas lateral to ocelli and long, narrow shiny area in front of anterior ocellus. Interfrontal bristles in 5 small pairs; 8-10 inclinate inner orbital setulae. Face black except for pale median strip. Eye height ca. 1.5X genal height. Gena dark, nonpruinose except very narrowly anteriorly.

Thorax: Katepisternum bare below level of dorsal setae; anepisternum with nonpruinose area large, its dorsal margin approximately level with to slightly dorsal to dorsal margin of spiracle; pleuron otherwise lightly pruinose except narrow bare area on meron; scutum and scutellum uniformly lightly pruinose, subshiny. Wing membrane transparent, with light brown tint; all veins pale brown; second costal sector 2.0-2.2X as long as third. Midleg dark brown, tarsi brown; first tarsomere with slightly enlarged ventral bristles. Hindleg long-setose, brown; tibia with small anteroapical spur and large apicoventral spur. Hind tibia of male with many long posterodorsal hairs over twice as long as tibial width. Hind femur, at least in male, strongly swollen, with 2 thin dorsal bristles. Pulvilli small, narrow, less than half as long as claw; pads widely separated. *Male abdomen:* Syntergite 1+2 uniformly pruinose brown, about as long as tergites 3 and 4 together. Membrane of segments 3-5 with small setae. Sternite 5 simple, darkly pigmented along posterior margin. Epandrium with sparse, short setae dorsally, laterally with 4-5 long bristles. Surstylus (Figs. 44, 46) setulose posterolaterally, posteroventral setae forming straight row of 8 stout, straight setae; anterior part of surstylus elongate, with small, carinate anteriorly rounded inner ventral lobe. Cercus with a few small setulae posteromedially and posteroventrally; apically with elongate, truncate lobes separated by deep cleft; cerci fused dorsally. Paramere (Fig. 45) broad near middle, tapered to acute apical process; anterior surface with broadly triangular process near middle and quadrate lobe preapically. Basiphallus with long, narrow epiphallus. Basal sclerite of distiphallus undivided, apically with single, medial, dorsally projected lobe; distal part of distiphallus larger, lightly sclerotized; anteroventral surface with strongly serrate lobes flanking base of stout median process. *Female abdomen:* All preabdominal sclerites undivided (Figs. 89, 90). Pleura (Fig. 91) smooth, with few, weak bristles. Tergites 6 and 7 undivided; tergite 8 bipartite; epiproct (Fig. 93) simple, bare except for 2 bristles. Sternites 6 and 7 entire, sternite 8 tripartite, with dark, very large posterolateral lobes; median part narrow and weakly

Figures 56-78. Female *Norrbonnia*. Figs. 56-60, *N. frigipennis*. 56, abdomen dorsal; 57, abdomen ventral; 58, abdomen lateral; 59, spermathecae; 60, epiproct and cerci. Figs. 61-65, *N. fulvipennis*. 61, abdomen dorsal; 62, abdomen ventral; 63, abdomen lateral; 64, spermathecae; 65, epiproct and cerci. Figs. 66-71, *N. fumipennis*. 66, abdomen dorsal; 67, abdomen ventral; 68, abdomen lateral; 69, spermathecae; 70, epiproct and cerci; 71, hypoproct, cerci and sclerite anterior to hypoproct. Fig. 72, *N. yukonensis*, hypoproct, cerci and sclerite anterior to hypoproct. Figs. 73-78, *N. lacteipennis*. 73, abdomen dorsal; 74, abdomen ventral; 75, abdomen lateral; 76, spermathecae; 77, hypoproct and cerci; 78, epiproct and cerci.



sclerotized; sternite 8 large, its posterolateral lobes extending lateral to abdomen in dry specimens. Hypoproct emarginate and bare anteriorly, setulose posteriorly. Spermatheca (Fig. 92) subspherical, flattened at top and bottom, with large basal apodeme; neck longer than main part.

Holotype. Male (CNC), CANADA. SASKATCHEWAN. Val Marie, 11.vi.1955, in entrance of *Cynomys burrow*, J.R. Vockeroth.

Paratypes. Same data as holotype (10m9f CNC, USNM). UNITED STATES. ARIZONA. Navajo Co., 15 mi SE Holbrook, 14-16.vii.1979, 5300', grassland carrion traps, S.&J. Peck (1m).

Distribution. Known only from Saskatchewan and Arizona.

Comments. *Norrbomia singusta* is a distinctive member of the *scripta* group, which also includes *N. scripta* and *N. mexicana*, all of which share distinctive genitalic characters of the male (row of stout surstylar bristles) and female (transverse anterior groove on sternites 6 and 7). Within this group, *N. singusta* is distinctive for its undivided female sternite 4 and its characteristic long male cerci. It has been collected in mammal burrows, but otherwise nothing is known of its biology. The specific epithet is a coined word and is considered a noun in apposition.

***Norrbomia sordida* (Zetterstedt)**
(Figs. 9, 13, 19, 25, 47-49, 94-98)

Copromyza sordida Zetterstedt 1847:2484. Lectotype male [here designated] (ZIL - Göteborg Collection). Southern SWEDEN [with label with "C. sordida Svec. unik." in Zetterstedt's writing].

Copromyza sordida var. *nigritella* Zetterstedt 1847:2484 [Holotype male (ZIL - Diptera Scandinaviae Collection). SWEDEN. Scania, Esperöd [with only tiny blue rectangle, which indicates Esperöd as the locality (H. Andersson, pers. comm.), and a label with "C. nigritella [male symbol] an var. sordid.?" in Zetterstedt's writing].

Borborus bilineatus Grimshaw 1901:75. Syntypes male female (BMNH). UNITED STATES. HAWAII. Kona.

Borborus minutus Johnson 1913:449. Holotype male (MCZ). BERMUDA. Spanish Point, 5.vii, Spaeth.

Borborus brevisetus Malloch 1913:365. Lectotype male [here designated] (USNM), UNITED STATES. WASHINGTON, D.C. [with following labels: "Nat. Mus., 28.4.12, J.R. Malloch"; red "Type No. 14948 U.S.N.M.", and "Borborus breviseta Malloch [male symbol] Type"].

Borborus (Borborillus) marmoratus: Spuler 1925:11, and authors, not Becker.

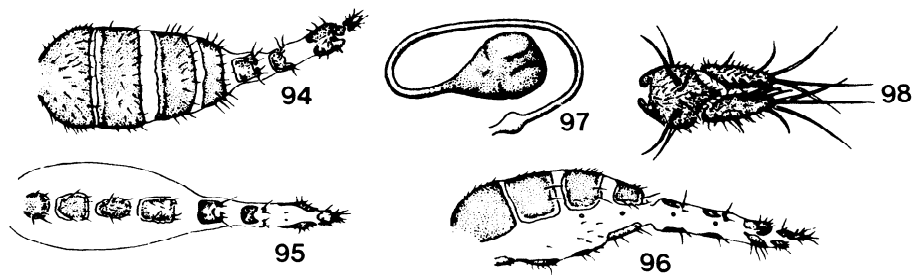
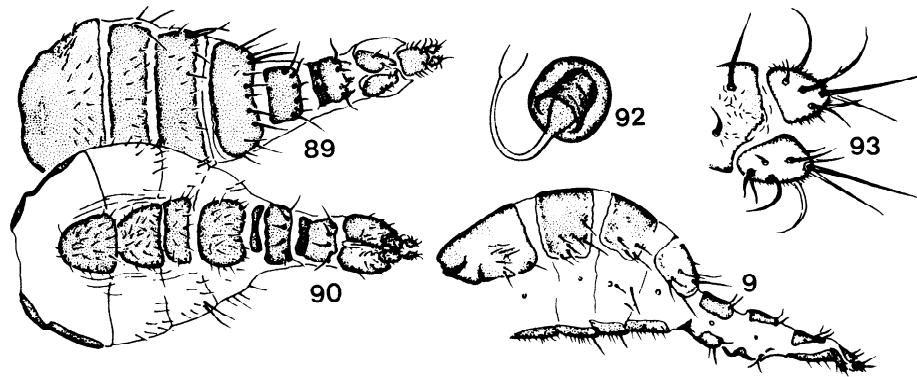
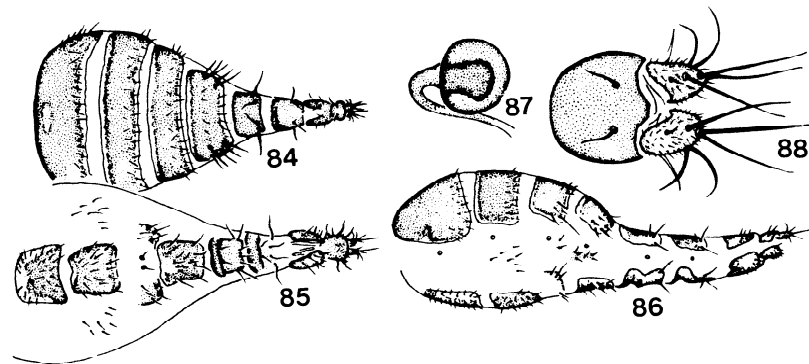
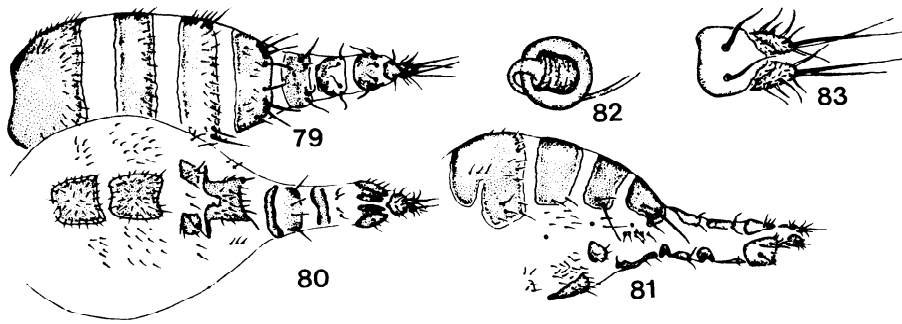
Borborus (Borborillus) sordidus: Duda 1923:84.

Copromyza (Borborillus) sordida: Richards 1930:313, 1965:720; Hackman 1977:399.

Norrbomia sordida: Papp 1988:394.

Description. Body length 2.5-3.0 mm. Body, legs and antennae dark brown to black, heavily pruinose except shiny areas on pleuron, gena, terminalia, and anterior margins of tergites; halter pale brown. **Head:** Arista length less than intervibrissal distance; arista hairs shorter than arista width. Frons entirely pruinose, interfrontal and orbital plates golden pruinose, intervening areas and back of head darker. Interfrontal bristles in 5 small pairs; 6-7 inclinate inner orbital setulae. Face uniformly brown, pruinose. Eye height ca. 2.5X genal height. Gena (Fig. 19) shiny black, with broad, whitish, densely pruinose ventral area (extreme ventral margin very narrowly nonpruinose); nonmicrotrichose area approximately half as wide as pruinose area at narrowest point, broadening slightly at anterior margin. **Thorax:** Katepisternum nonpruinose below level of dorsal setae; anepisternum pruinose except for tiny isolated bare area immediately anteroventral to spiracle, and often very small bare area in anteroventral corner; pleuron, including meron, otherwise entirely pruinose. Scutum and scutellum heavily pruinose; pruinosity brown between acrostichal bristles, silvery between acrostichals and dorsocentrals, brown along dorsocentral rows, then again silvery outside dorsocentral areas; only prescutellar pair of dorsocentrals large and well differentiated (3 pairs are well developed in other species). Wing membrane transparent, with light brown

Figures 79-98. Female *Norrbomia*. Figs. 79-83, *N. mexicana*. 79, abdomen dorsal; 80, abdomen ventral; 81, abdomen lateral; 82, spermathecae; 83, epiproct and cerci. Figs. 84-88, *N. scripta*. 84, abdomen dorsal; 85, abdomen ventral; 86, abdomen lateral; 87, spermathecae; 88, epiproct and cerci. Figs. 89-93, *N. singusta*. 89, abdomen dorsal; 90, abdomen ventral; 91, abdomen lateral; 92, spermathecae; 93, epiproct and cerci. Figs. 94-98, *N. sordida*. 94, abdomen dorsal; 95, abdomen ventral; 96, abdomen lateral; 97, spermathecae; 98, epiproct and cerci.



tint; all veins pale brown; second costal sector 2.5-2.9X as long as third. Midleg brown; first tarsomere with uniform ventral bristles. Hindleg very short-setose, brown; tibia with single, large apicoventral spur; tibial setae less than half as long as tibial width, setae along posterodorsal edge of male tibia not enlarged as in most other species. Hind femur with 1 thin dorsal bristle. Pulvilli small, narrow, less than half as long as claw; pads widely separated. *Male abdomen*: Syntergite 1+2 pruinose brown except for mushroom-shaped pale median area on tergite 1; syntergite slightly shorter than tergites 3 and 4 together. Membrane of segments 3-5 bare or with a few minute setulae. Sternite 5 simple, darkly pigmented and broadly bilobed posteromedially, setae restricted to posterior half and middle region. Epandrium with sparse, medium-length setae only. Surstylus (Figs. 47, 49) setulose posterolaterally; anterior part of surstylus elongate, with large, carinate, inner ventral lobe; inner ventral surface of surstylus with 2 very large bristles extending beyond ventral lobe. Cercus with a few small setae posteromedially and posteroventrally; apically with elongate, broadly carinate lobes separated by deep cleft; cerci fused dorsally. Paramere (Fig. 48) broad near middle, tapered to narrow, truncate process; anterior surface with broadly triangular process anterior lobe preapically. Basiphallus with long, narrow epiphallus. Basal sclerite of distiphallus with sheath-like lateral lobes, medial part slightly bilobed apically; distal part of distiphallus with loop-like distal lobes; ventral process with narrow process projected proximally between ventral basal lobes. *Female abdomen*: Preabdominal sclerites undivided, darkly pigmented; pleura (Fig. 96) weakly striate, with few, small setulae. Tergites 6 and 7 (Fig. 94) emarginate posteriorly; tergite 8 emarginate anteriorly and posteriorly, posterolateral corners detached; epiproct (Fig. 98) short, setulose, with 2 large bristles and 4-5 small bristles. Sternites 6 and 7 (Fig. 95) posteriorly emarginate, posterolateral corners of sternite 7 detached. Sternite 8 bipartite, each half strongly tapered anteriorly, less strongly tapered and very dark posteriorly. Hypoproct setulose except for narrow anterolateral lobes. Spermatheca (Fig. 97) teardrop-shaped, with slight constriction where it begins to taper to neck, which is ca. 2.5X as long as main part; large apical apodeme present, but no basal apodeme.

Material examined: Lectotypes of *C. sordida* and *B. brevisetus*, holotype of *C. nigritella* (see synonymy), and over 400 specimens from the following areas: CANADA. Alberta, British Columbia, Manitoba, Ontario, Quebec,

New Brunswick, Newfoundland, Nova Scotia, Saskatchewan. UNITED STATES. Alabama, Alaska, Arizona, California, Colorado, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Texas, Utah, Virginia, Washington, Washington, D.C., Wisconsin, Wyoming. BERMUDA. MEXICO. Baja California Norte, Guerrero, Veracruz. GUATEMALA. Alta Vera Paz. ENGLAND. GERMANY. GREECE. SPAIN. Specimens collected v-viii, most by sweeping but some taken from horse dung.

Distribution. A common Holarctic species, occurring south to Guatemala in the Neotropical Region. Papp (1988) suggests that Afrotropical records are misidentifications, and records from India (Hackman 1977) are unconfirmed. Although *N. sordida* is reliably recorded from Hawaii (Tenorio 1968), all other Pacific *indica* group specimens we examined belong to other species. We have seen no specimens of *N. sordida* or any other *Norrbomia* from the Neotropical Region south of Guatemala.

Comments. *Norrbomia sordida* is a distinctive species, differing greatly from its New World congeners, from which it is most easily separated by its dense pruinosity, the very narrow, anteriorly broadened, nonmicrotrichose area on the gena, the striped notum, and many abdominal characters. This species is synanthropic and coprophagous, and has probably attained its wide distribution by moving with man from the Old World. The closest relatives to *N. sordida* are Old World species.

Norrbomia triglabra, new species (Figs. 50-52)

Description. Body length 3.8-3.9 mm. Body color dark reddish brown to black; antenna, bases of tibiae and tarsi luteous; halter stem brown, knob whitish. *Head*: Arista longer than intervibrissal distance; arisal hairs subequal to basal width of arista. Frons pruinose, with large nonmicrotrichose shiny area lateral to ocelli and small nonmicrotrichose shiny area in front of anterior ocellus. Interfrontal bristles in 5-6 pairs; 9-10 inclinate inner orbital setulae. Each side of face dark except along carinate middle part of face. Eye height ca. 2.0X genal height. Gena dark reddish brown, microtrichose narrowly anteriorly and fairly broadly ventrally (extreme ventral margin narrowly bare), nonmicrotrichose area broad, trun-

cate anteriorly. *Thorax*: Katepisternum bare below level of dorsal setae; anepisternum with dorsal margin of nonmicrotrichose area approximately level with ventral margin of spiracle, nonmicrotrichose area immediately ventral to spiracle not isolated; pleuron otherwise lightly pruinose; scutum and scutellum uniformly, heavily pruinose. Wing membrane transparent, with light brown tint; all veins pale brown; second costal sector 3.0X as long as third. Foreleg setose, brown, tarsi and base of tibia luteous. Midleg brown, tarsi and base of tibia luteous. Hindleg short setose, brown; femur with 1 thin, erect, dorsal bristle; tibia with small anteroapical bristle and large, curved apicoventral spur; posterodorsal tibial setae similar to other setae, shorter than tibial width. Pulvilli small, widely separated, together much smaller than tarsomere 5, covering only basal half of claw. *Male abdomen*: Syntergite 1+2 uniformly pruinose brown. Membrane of segments 3-5 with 3-4 small setae per segment, without sclerotized bases. Sternite 5 simple, darkly pigmented along posterior margin. Epandrium with dense, short setae dorsally, laterally with 4-5 long bristles, dorsolateral bristle longest. Surstylus (Figs. 50, 52) setulose posterolaterally, setae relatively short, less than half as long as surstylus; anterior part of surstylus quadrate, with blade-like inner ventral lobe. Cercus with a group of 7-8 setae posterodorsally; posteroventrally short setose, elongate, apex expanded, clublike; cerci separated by deep apical notch, cerci posteromedially contiguous dorsally. Paramere (Fig. 51) broad near middle, tapered to acute apical process; anterior surface with triangular lobe near middle. Basiphallus with long, narrow epiphallus. Basal sclerite of distiphallus undivided, apically with single, medial, dorsally projected lobe; distal part of distiphallus larger, with quadrate distal ventral lobe. *Female* unknown.

Holotype. Male (CNC), UNITED STATES. KENTUCKY. Whitley Co., Cumberland Falls State Park, 29-30.vi.1984, dung trap, S.A. Marshall.

Paratype. Same data as holotype (1m GUE).

Distribution. Known only from Kentucky.

Comments. This species belongs to the *frigipennis* group, and can be most easily distinguished from other species in the group by its distinctive male cerci. *Norrbornia triglabra* is named for the three glabrous areas that surround the ocellar triangle.

A female in the MCZ may also be this species. It bears the following data: GEORGIA. Clayton, 2000-3700 ft, vi.1909, W.T. Davis, "on *Canthon chaleites* ball".

***Norrbornia yukonensis*, new species**
(Figs. 53-55, 72)

Description. Body length 2.1-3.2 mm. Body color, including antennae, face and legs, black; halter pale brown or yellowish. *Head*: Arisal length subequal to intervibrissal distance; arisal hairs \approx 3X basal width of arista. Frons almost entirely pruinose; shiny areas beside ocelli, if present, smaller than ocellus. Interfrontal bristles in 5 pairs; 5-8 inclinate inner orbital setulae. Eye height \approx 2.1X genal height. Gena dark, broadly pruinose anteroventrally, nonpruinose area tapered, acute anteriorly. *Thorax*: Katepisternum usually bare below level of dorsal setae, anteroventral margin sometimes microtrichose; anepisternum with tiny, isolated nonmicrotrichose area immediately anteroventral to spiracle, main nonmicrotrichose area small, its dorsal margin well ventral to level of ventral margin of spiracle; pleuron, including meron, otherwise entirely lightly pruinose; scutum and scutellum uniformly, heavily pruinose. Wing membrane transparent, with light brown tint; all veins brown; second costal sector 2.8-3.0X as long as third. Foreleg black, knees sometimes reddish. Mid tibia dark, first tarsomere with slightly enlarged ventral bristles. Hindleg short-setose, dark; tibia with single, very long apicoventral spur; femur with 2-3 erect dorsal bristles on distal half. Posterodorsal bristles of male hind tibia slightly shorter than tibial width. Pulvilli narrow, pads widely separated. *Male abdomen*: Syntergite 1+2 uniformly pruinose black. Membrane of segments 3-5 bare or with 1-2 minute setulae. Sternite 5 large, dark; posteromedial area pale and densely microsetulose; ventral part of sternite 6 thickened, dark, with conspicuous concavity behind posteromedial part of sternite 5. Epandrium with sparse, short setae dorsally; laterally and posteriorly with a few longer bristles. Surstylus (Figs. 53, 55) with large inner ventral lobe, narrow distally, rounded along outer surface, broader than that of *N. fumipennis* and narrower than that of *N. costalis*; base of surstylus with compact group of about 6 bristles posteromedially, only 2-3 visible in posterior view. Cercus with bare posterior area below setulose, rounded, slightly raised part and above strongly elevated posteroventral part. Cerci divided by nar-

row, deep, almost parallel-sided cleft. Paramere (Fig. 54) very broad on distal half, abruptly tapered to short apical process; 5 setulae along posterior surface and 2 preapical setae anteriorly. Basiphallus with long, narrow epiphallus. Basal sclerite of distiphallus undivided, apically with single, medial, dorsally projected lobe; distal part of distiphallus larger, with flattened distal ventral lobe and paired, dorsoventrally flattened, distal dorsal lobes. *Female abdomen*: Generally similar to *N. fumipennis*, but with considerable variation in development of sclerites of sternite 4, ranging from 4 heavily sclerotized sections characteristic of *N. fumipennis* and *N. costalis* to 2 small medial sclerites, with outer pair reduced. Sternite 8 bipartite, inner posterior corners of each half raised into strong carinae. Hypoproct deeply emarginate anteriorly, with bifid sclerite in emargination, this sclerite separate from hypoproct and deeply cleft such that each arm is as long as median length of hypoproct.

Holotype. Male (CNC), CANADA. YUKON. Northern Richardson Mountains, Erebia Creek base camp, 67°58'N 136°29'W, dung cups in wet tundra, 1-8.vii.1987, S.A. Marshall.

Paratypes. Same data as holotype (3m1f GUE, USNM). CANADA. YUKON. locality as above but: mammal runs near creek (2f); carrion trap in wet tundra (2f); flood plain of creek (2f GUE, USNM).

Distribution. Known only from the Yukon.

Comments. *Norrbomia yukonensis* resembles *N. fumipennis*, which also occurs in northwestern North America, so closely that examination of the male genitalia is necessary to reliably tell them apart. There are several Palearctic species of the *N. costalis* complex that are very closely related to *N. yukonensis* and *N. fumipennis* and quite difficult to separate. The species described here differs from *N. costalis* and the very similar *N. cryptica* (Papp) primarily in details of the surstylus. Both of the latter species have broader inner lobes and more elongate clusters of long basal bristles. The shape of the sclerite anterior to the hypoproct also differs among these species. The variability in sternite 4 of the female is here considered intraspecific, but it should be noted that the main character used by Papp to distinguish the Mongolian species *N. cryptica* from *N. costalis* is the reduction of the female fourth sternite to two sclerites in the latter species. As is the case in many groups, taxonomic study of adequate collections from the eastern Palearctic

region as well as the northwestern Nearctic are required to properly clarify the *N. costalis* complex.

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