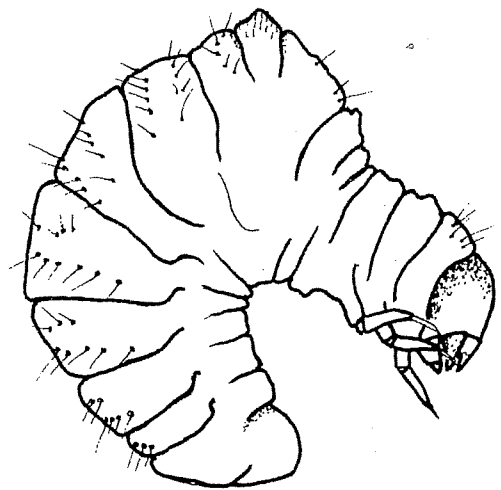
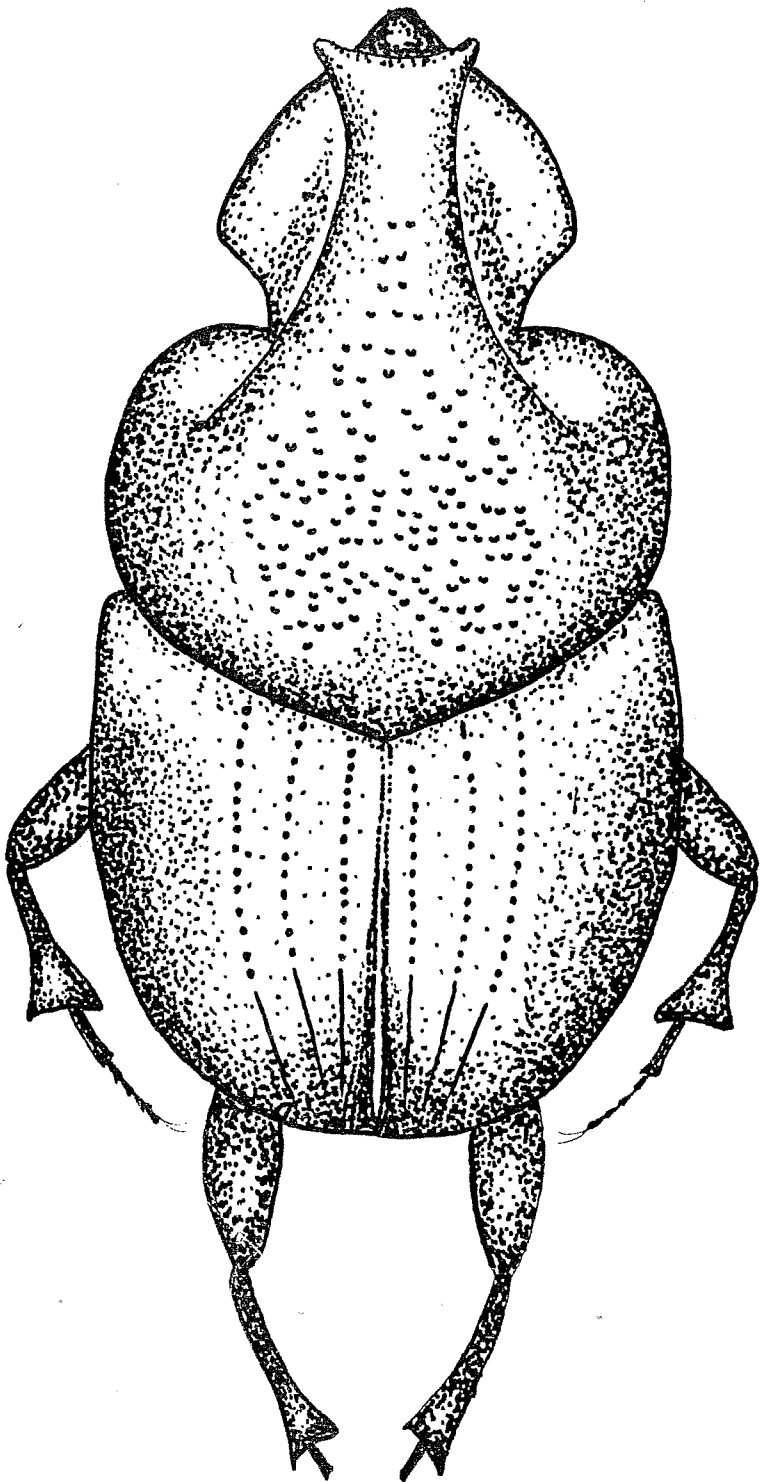


# SAPROPHAGOUS SCARABAEIDAE

## (Coleoptera) OF NORTH DAKOTA



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Cover plate: Adult male and third instar larva of *Onthophagus hecate* (Panz.).

## INTRODUCTION

The saprophagous Scarabaeidae attract attention, especially in a ranching state such as North Dakota, because of their peculiar habits, importance as decomposers of fecal and humus material and potential to transmit disease. Saprophagous Scarabaeidae are distinguished by their food preference, decomposed plant materials, as defined in the ecological section.

Adult Scarabaeidae are typified by an 8-11 segmented lamellate antenna (fig. 2) and a bi- or tridentate protibia (fig. 3).

Larvae are C-shaped grubs with a transverse anal slit, cribiform spiracles and a trilobed labrum. With the exception of the *Phyllophaga* and related economic species, few larvae of Scarabaeidae have yet been described. To better understand the phylogeny and the ecological requirements of scarab species, more intensified work is needed in larval taxonomy. The result of this work is a complete systematics, not just the taxonomy of adults.

This paper includes larval descriptions for sixteen species. Descriptions of *Aphodius ruricola* Melsh. and *Aphodius lentus* Horn are original. Specimens of nine other species were examined and re-described. The remaining descriptions were adapted as indicated in the text. Specimens of the two previously undescribed larvae are deposited in the North Dakota State University and United States National Museum insect collections.

The taxonomy and ecology of fifty species, included in five subfamilies and fourteen genera are described for the state. No comprehensive study of the North Dakota Scarabaeidae has been done prior to this paper. The published ranges of most scarab species, therefore, have not included North Dakota. The data presented extend the ranges of many species.

Since the validity of certain species and subspecies was questionable, new evidence is introduced to assess the validity of these taxa.

## METHODS AND MATERIALS

Collecting Adults Several techniques were employed in collecting adult saprophagous Scarabaeidae because their habits were so diverse. Some species were diurnal, some nocturnal-photophilic and others nocturnal-photophobic.

Many species were abundantly collected directly from a confined microhabitat, such as dung. This was probably the most common method of collecting the majority of diurnal species. Although sometimes tedious, this method yielded more information on the ecology of the species than did light or pit traps.

Nocturnal-photophilic species were most effectively collected with light traps. Photophilic species were attracted to an 18", 15 watt

fluorescent U.V. bulb which was mounted on the shield of the light trap. Cyanide was placed in the receptacle as a killing agent.

Nocturnal-photophobic species were most effectively collected in pit traps. Two types of pit traps, permanent and temporary, were used.

For seasonal studies permanent pit traps were employed which caused minimum disturbance of the surrounding environment each time the trap was visited. A  $5\frac{1}{2}$ " deep by  $5\frac{3}{4}$ " in diameter galvanized receptacle was forced into the ground at the selected trap site. The ground inside the receptacle was carefully removed without disturbing the surrounding environment. A  $1\frac{1}{2}$  quart stainless steel bowl was placed in the receptacle so that the tip of the bowl was flush with the soil surface. To preserve the specimens, enough ethylene glycol (1.5 inches/wk) was placed in the bowl to supply the intervals of study. A cover was placed over the trap to keep out leaf litter, rain and larger animals.

A rapid system for installing a set of temporary pit traps was devised by R. J. Sauer and D. L. Haynes. A sod-sampler the size of a one pint ice cream container was used to form a hole into which the container was placed. The sod-sampler retained the core of sod so that no debris disturbed the surrounding environment. The container was partially filled with ethylene glycol and covered. Specimens from pit traps were washed in alcohol and mounted for study.

Rearing Larvae All larvae were reared with the same technique. Adults were field collected and introduced into cages containing a four inch layer of soil or sand and a source of uncontaminated (i.e., not inhabited by insects) bovine fecal material. Precautions were taken so that no beetles escaped or entered the rearing cages, thus assuring proper identification of future larvae. As a double-check (in most cases) adults were reared from caged larvae.

Two problems were encountered in rearing larvae. Initial attempts at rearing *Aphodius* larvae were fruitless because dehydration of feces at high room temperatures ( $90^{\circ}\text{F}$ ) progressed faster than the development of the larvae. To correct this situation larvae were reared in plastic pails fitted with plastic tops containing small ventilation holes. The soil in the cages was dampened. This kept the humidity in the cage at a high level and prevented dehydration of the feces. The cages were then placed in a room where the day temperature remained at approximately  $90^{\circ}\text{F}$  and the night temperature at about  $70^{\circ}\text{F}$ . Larval development progressed rapidly and successfully in these conditions of high temperature and high humidity. Several species completed a generation in less than one month.

Obtaining oviposition was the second problem in attempting to rear some species. Mohr (1943) noted that *Aphodius distinctus* (Mull.) and *A. walshi* Horn frequent fecal deposits in large numbers, but never oviposit at these sites. The author found this true when trying to rear these two species. Apparently the adults are attracted to the feces, but oviposit in another site. Most likely feces are common attractants for large numbers of individuals stimulating them to congregate and copulate.

## MORPHOLOGY

Although many modern techniques (e.g., serology, chromatography and cytogenetics) are presently employed for species identification, morphological distinction still is the most practical approach because identification is rapid and simplified.

The general external morphology of the saprophagous Scarabaeidae is outlined in figures 1 and 2 and only the more important and unique morphological variations among these scarabs are discussed in relation to their function. Terminology for other structures and vestitures of the exoskeleton follow the definitions in standard entomological glossaries.

### ADULT MORPHOLOGY

The Head The labrum is vestigial in adult Scarabaeidae. Sutures in the dorsoventrally flattened head are lacking, making delineation of the clypeus, frons and genae difficult (fig. 1). Modifications of the clypeus are especially important in some species and range from a nearly entire margin (*Aphodius consentaneus* LeC.) to an emarginate, dentate clypeus (fig. 18). The specific variability in clypeal patterns (figs. 18-23) is probably related to the burrowing habits of these species. When burrowing in dung or soil the scarab uses the flattened head as a shovel, pushing the media forward with the anterior legs and upwards with the head.

The Legs The legs, as well as the head, are important in burrowing. Most variation occurs in the tibiae where the modifications of the teeth (for digging) and carinae, spurs and spinules (for bracing) are important in the different burrowing requirements of different species (fig. 3).

Vestitures Figure 4 is a composite elytron depicting some of the different vestitures (one on each interval) of the scarab exoskeleton. It is difficult to explain the specific variations of vestitures by function, but such variation is prominent throughout the Scarabaeidae.

### LARVAL MORPHOLOGY

The epipharynx, maxillae and raster are all important variable characters in the larval Scarabaeidae.

The Epipharynx and Maxilla The epipharynx (fig. 5) is composed of a basal sclerite, the torma (which is divided into a dextortorma (right), epitorma (center) and laeotorma (left)) and a fleshy phobal region. The dexio- and laeotorma normally extend cephalad and caudad. But in some species the laeotorma may not extend caudad. Microsensilla in the region of the protophoba vary in number intra- and interspecifically. Excepting the Geotrupinae, stridulatory teeth are present on the maxilla of the saprophagous Scarabaeidae. Variation in the numbers and location of these teeth are specific in many instances (especially in the Aphodiinae). Specific differences in the number of setae on the galea and lacinia are also apparent.

The Raster Setal patterns on the raster (fig. 6) or the venter of

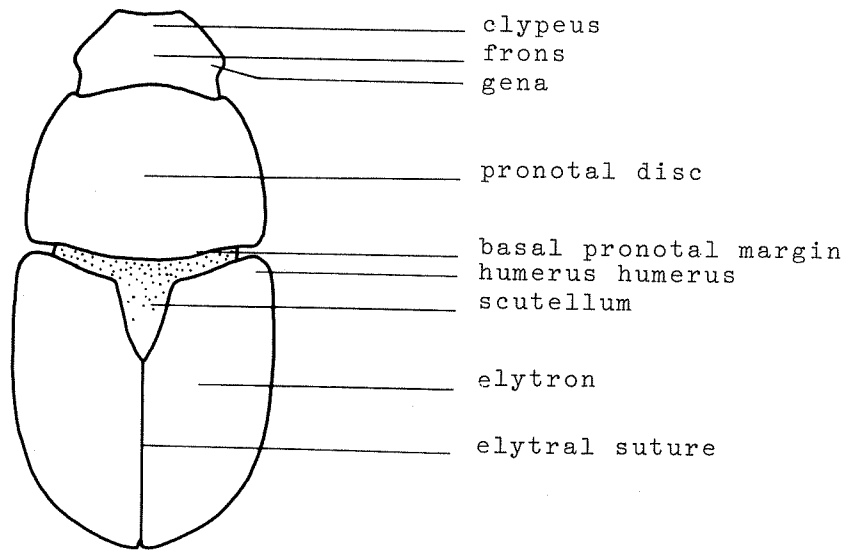


Figure 1. Dorsal aspect of *Aphodius fossor* (L.)

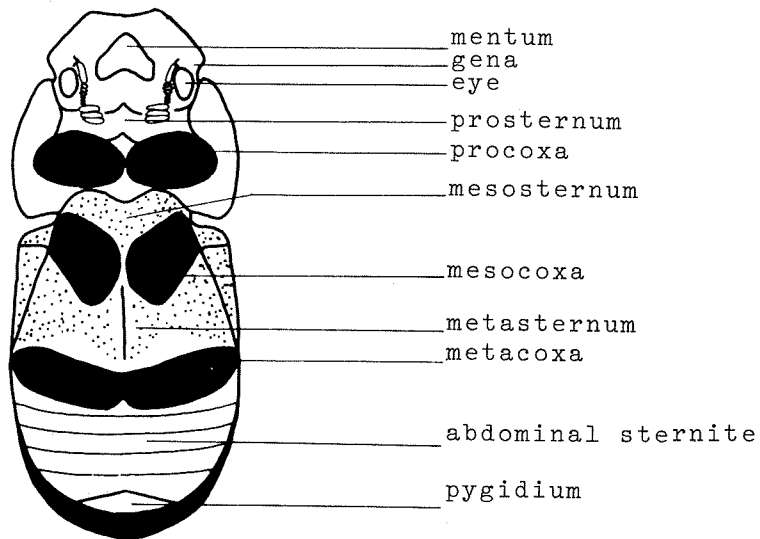


Figure 2. Ventral aspect of *Aphodius fossor* (L.) with legs removed.

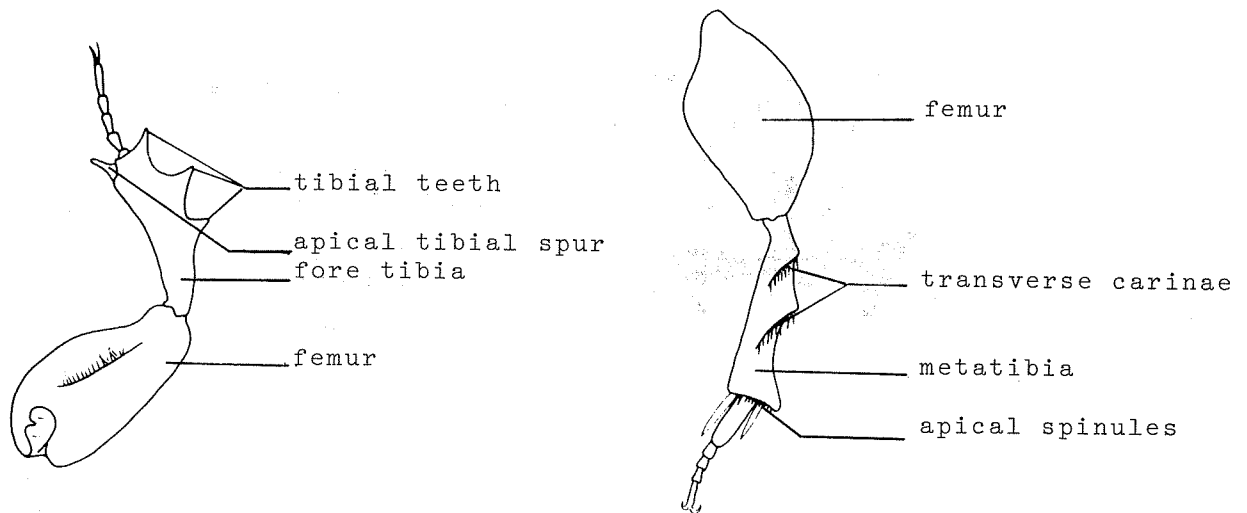


Figure 3. Proleg (left) and metaleg (right) of *Aphodius fossor* (L.) with coxae removed.

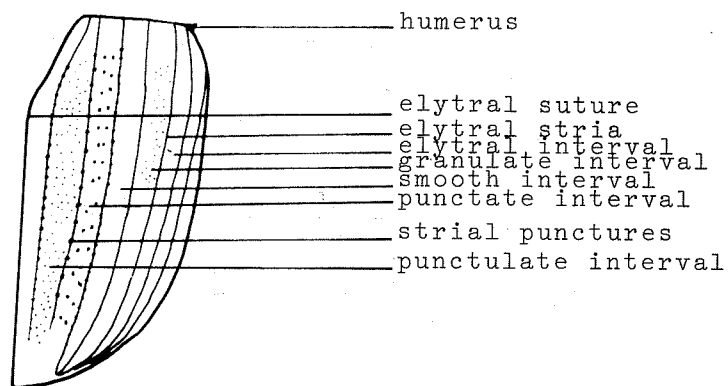


Figure 4. Composite elytron showing different vestitures of scarab exoskeleton.

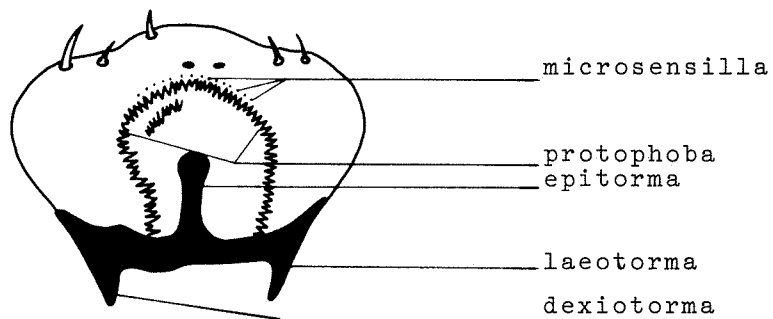


Figure 5. Epipharynx of an *Aphodius* sp. larva showing characters used to distinguish different species.

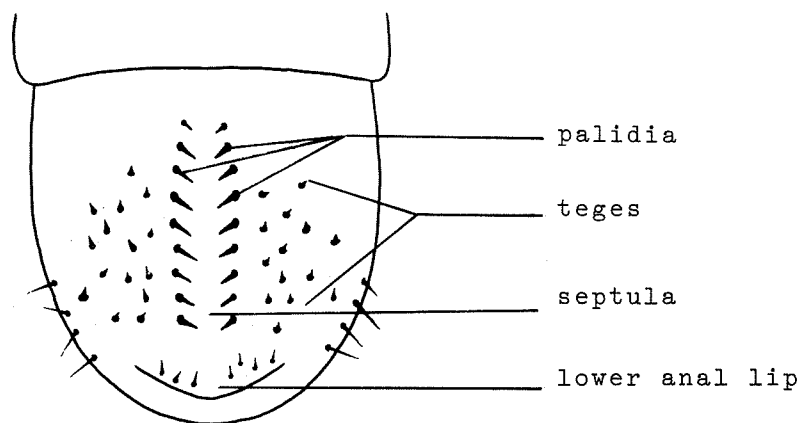


Figure 6. Venter of ninth and tenth abdominal segments showing setal pattern on raster (generalized).



the tenth abdominal segment vary from an unmodified teges (area of short setae) to a pair of tegillia divided by palidia (two rows of medially oriented, flattened setae divided by a septula).

### ECOLOGY OF SAPROPHAGOUS SCARABAEIDAE

The species of Scarabaeidae discussed here are similar in general food preference. The diet for all species is some form of decomposed plant matter, such as humus or feces of herbivorous animals. Saprophagous species which feed on decomposed animal matter are found only in the Troginae and are not discussed.

Species of saprophagous Scarabaeidae are divided into two major groups based on food preference; 1) dung feeders, and 2) humus feeders. The division holds for most species, but is not absolute. Some species, such as *Geotrupes semiopacus* Jekel and *Onthophagus hecate* (Panzer) feed on humus when dung is not readily available. Others, such as *Aphodius distinctus* (Mull.) and *A. walshi* Horn, apparently feed on dung as adults and humus as larvae.

Both feces and humus represent energy which is not directly usable by higher plants and animals in a community. Saprophagous organisms are decomposers which utilize this potential energy source, help to recycle nutrients and contribute to a more efficient and integrated community.

#### DUNG AS A MICROHABITAT

The most abundant fecal material in North Dakota is that from cattle. Of the fifty species of saprophagous Scarabaeidae in North Dakota, twenty-three are associated with cattle dung. This large supply of fecal material provided by cattle, however, is not new to North Dakota. The large herds of buffalo that once roamed the grasslands of this state apparently offered the same habitat as the cattle do today. Some species which appear to be specific to cattle dung throughout the state are also collected in bison dung in Theodore Roosevelt Memorial Park (Table I).

Species Occurrence and Physical Change in Dung Although cattle dung forms the major type of fecal material in the state, many other types (e.g., sheep, deer and other herbivorous animals) are available and used by saprophagous Scarabaeidae. Table I summarizes fecal preference of dung-feeding species in North Dakota based primarily on my observations. Where fecal preference of a species was not determined by my observations published data were used, but the preferences of some remain unknown.

The dung of as many herbivorous mammals as possible were investigated, but the dung of some species was too scarce or too concealed to discover associations. Some mammals like the rabbit and the Pronghorn scatter their dung so no one large source is found. Others, such as pocket gophers, bury their dung so unless dug for, only accidental observations are made.

A fecal deposit is a microhabitat with discernable boundaries and

TABLE I  
 OCCURRENCE OF SPECIES IN VARIOUS FECAL SOURCES

Species	Fecal Source					
	cow	buffalo	sheep	deer	prairie dog	other burrowing mammals
<i>Canthon praticola</i>	*	*			*	
<i>C. pilularius</i>	*	*				
<i>Onthophagus hecate</i>	*	*	*	*		
<i>O. pennsylvanicus</i>	*		*			
<i>Aphodius fossor</i>	*	*				
<i>A. hamatus</i>	*					
<i>A. erraticus</i>	*					
<i>A. haemorrhoidalis</i>	*	*				
<i>A. pseudabusus</i>	*	*				
<i>A. fimetarius</i>	*	*	*	*		
<i>A. tenellus</i>	*		*			
<i>A. ruricola</i>	*	*	*	*		
<i>A. granarius</i>	*					
<i>A. vittatus</i>	*	*				
<i>A. lentus</i>	*		*			
<i>A. explanatus</i>					*	*
<i>A. iowensis</i>						*
<i>A. criddlei</i>						*
<i>A. haldemani</i>						*
<i>A. concavus</i>						*
<i>A. dentigerulus</i>					*	
<i>A. coloradensis</i>	*					
<i>A. distinctus</i>	*		*	*		
<i>A. leopardus</i>	*		*	*		
<i>A. walshi</i>	*		*			
<i>Ataenius spretulus</i>	*					
<i>Dialytes criddlei</i>				*		
<i>Rhyssemus sonatus</i>		*			*	
<i>Geotrupes semiopacus</i>	*		*	*		
<i>Bothynus relictus</i>	*	*				
<i>B. gibbosus</i>	*					

rapidly changing physical and biological properties. Mohr (1943) made a basic study of "cattle droppings as ecological units" in which he made the inaccurate conclusion that predictable physical and biological changes within this microhabitat are successional, with definitive microseres. The physical changes, however, are not the result of amelioration by dominant species. They occur with or without the presence of organisms. The successional concept, therefore, does not explain the rapid replacement of specific populations.

The major physical change in dung which affects the survival and replacement of a specific population is the rapid loss of water. Since most larvae which develop in dung, such as Diptera and Coleoptera, are not highly motile outside this microhabitat, the adult female must oviposit in the dung at a time which permits full development of the larvae before the drying process becomes a limiting factor to the growth of the larvae. Figure seven shows the water loss in dung and the oviposition (A & B) and pupation (C & D) times for many Diptera (A to C) and most *Aphodius* (B to D). Samples were taken in the field from June to August. Cores were removed from the center of one dropping to include the crust-ed surface and inner portion.

This dehydration is dependent upon environmental factors such as wind, humidity and temperature. In the sandhills of Richland County, some fecal deposits were observed to dry so fast during August that larval development of *Aphodius* spp. was halted at the third instar.

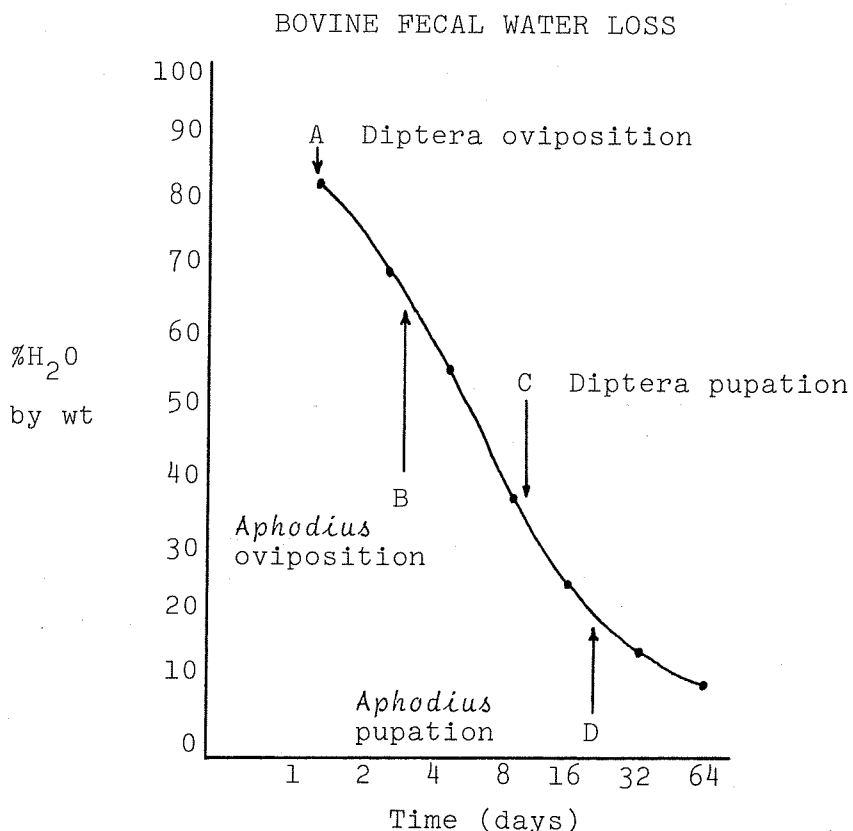


Figure 7. Water loss and insect development in a cattle dropping over a two month period from June 15 to August 15, 1966.

A rapid population change accompanies this progressive loss in water according to the tolerance of the species. As shown in figure seven the tolerance range of many Diptera is from 76% to 30% water, whereas the tolerance range of *Aphodius spp.* is from 60% to 10%. Table II reflects the taxon change with data taken from ten cattle droppings in Richland County and the North Dakota State University pastures at Fargo, from June through August 1965.

TABLE II.

TAXON CHANGE IN COW DUNG

taxa	days					
	1 day	4 days	8 days	12 days	16 days	30 days
Diptera	*****					
<i>Aphodius</i>	*****					
<i>Bothynus</i>					*****	
<i>Canthon</i>	*****					
<i>Geotrupes</i>	*****					
<i>Onthophagus</i>	*****					

The species composition in the insect community of a fecal deposit is not only dependent on the stage of drying, but also the time of year. For example, populations of *Aphodius leopardus* Say are collected only in dung from late July to early September. Table III shows the periods of occurrence of adult *Aphodius spp.* in cow dung from March to November. It is based on observations of nearly two hundred cattle droppings, primarily from Cass and Richland Counties and light trap catches from Williston, Bowman, Trotters, Cavalier, Bismarck and Walcott, North Dakota.

TABLE III.

PERIODS OF PROMINENT OCCURRENCE OF ADULT APHODIUS SPP.  
WHICH MAY OCCUR IN COW DUNG

species	date										
	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov		
<i>A. fossor</i>			*****								
<i>A. fimetarius</i>	*****				*****						
<i>A. haemorrhoidalis</i>			*****				*****				
<i>A. walshi</i>		*****									
<i>A. distinctus</i>	*****						*****				
<i>A. vittatus</i>			*****								
<i>A. leopardus</i>					*****						
<i>A. ruricola</i>			*****								

Table III can be used to predict the species composition of adult *Aphodius* in cow dung from early spring to mid-fall in North Dakota. For example, during late May a cattle dropping may have as many as six species of *Aphodius*.

Species Which Complete Larval Development in the Cattle Dropping  
Of the Scarabaeidae which occur in cow dung only species of *Aphodius* and *Bothynus* remain in the fecal deposit from egg through complete larval development. The average developmental period of four *Aphodius* spp. reared in the laboratory was 17 days from egg to pupa. Most adults emerged after four to five days as pupae. During this period the larvae are faced with competition from many larvae and predation by others. Table IV demonstrates the typical composition of a fecal deposit at four days (the time at which many *Aphodius* oviposit).

TABLE IV.

DENSITY OF INSECT POPULATIONS IN A TYPICAL  
BOVINE FECAL DEPOSIT

species	numbers
Diptera larvae	78
Staphylinidae*	82
<i>Sphaeridium scarabaeoides</i> *	8
<i>Cercyon</i> spp.*	21
<i>Aphodius fimetarius</i> <sup>1</sup>	16
<i>Aphodius distinctus</i> <sup>1</sup>	52

\* = adults and larvae, <sup>1</sup> = adults only

My observations support Mohr's (1943) conclusion that much of the predation by adults and larvae of Staphylinidae, Hydrophilidae and Histeridae is on Diptera larvae in the fecal deposit. In several instances, however, histerid larvae were found feeding on *Aphodius* larvae as well as the more abundant Diptera larvae. Table V summarizes the predacious insects collected in North Dakota which are associated with dung.

The large numbers of fly larvae (Table IV) already present when eggs of *Aphodius* are deposited contribute to spatial competition which is somewhat alleviated by these predators.

Species Which Frequent the Cattle Dropping Only As Adults *Canthon*, *Onthophagus*, and *Geotrupes* are found only as adults in fecal deposits. But they remove amounts of dung from the deposit to a burrow where they oviposit in the stored fecal supply. Larval development in these genera (*Canthon*, *Onthophagus* and *Geotrupes*) is completely within a burrow, well away from the cattle dropping.

At times, as many as 30 *Onthophagus hecate* (Panz.) may be found beneath a fecal deposit digging burrows from two to eight inches deep into which they carry pieces of dung. Each burrow branches into pockets where the adult packs a pellet of dung (figure eight) into which one egg is

TABLE V.

PREDACIOUS COLEOPTERA ASSOCIATED WITH COW DUNG

<p>Histeridae*</p> <p><i>Atholus</i> <i>americanus</i> Payk. <i>falli</i> Rickhardt</p> <p><i>Euspilotus</i> <i>assimilus</i> Payk.</p> <p><i>Hister</i> <i>abbreviatus</i> Fab. <i>depurator</i> Say</p> <p><i>Hypocaccus</i> <i>fitchi</i> Mars. <i>patruelis</i> LeC.</p> <p><i>Margarinotus</i> <i>harrisi</i> LeC. <i>immunis</i> Er.</p> <p><i>Saprinus</i> <i>distinctus</i> Mars. <i>pennsylvanicus</i> Payk.</p>	<p>Hydrophilidae</p> <p><i>Sphaeridium</i> <i>scarabaeoides</i> L. <i>bipustulatum</i> Fab.</p> <p><i>Cercyon</i> <i>haemorrhoidalis</i> Fab. <i>quisquillius</i> L. <i>sp.</i> 3 <i>sp.</i> 4 <i>sp.</i> 5</p> <p>Staphylinidae</p> <p><i>Philonthus</i> <i>varians</i> Payk.</p> <p>and many other undeter- mined genera and species.</p>
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\*determined by Dr. Rupert Wenzel, Field Museum of Natural History.

placed. A burrow may have from one to eight branches. *Geotrupes semiopacus* Jekel digs a burrow beneath dung in wooded pastures and lines the burrow with this dung (fig. 9). As many as ten of these large beetles have been counted beneath cow dung in Richland County. After they complete the burrows little is left of the fecal deposit for other inhabitants. *Canthon pilularius* L. and *praticola* Say roll a fecal ball from the deposit to a burrow where they bury the ball after ovipositing in it. I have collected as many as 25 *Canthon praticola* Say from one deposit of buffalo dung.

Only the adults are inhabitants of the cattle dropping where they can destroy or extensively reduce the fecal deposit as a microhabitat.

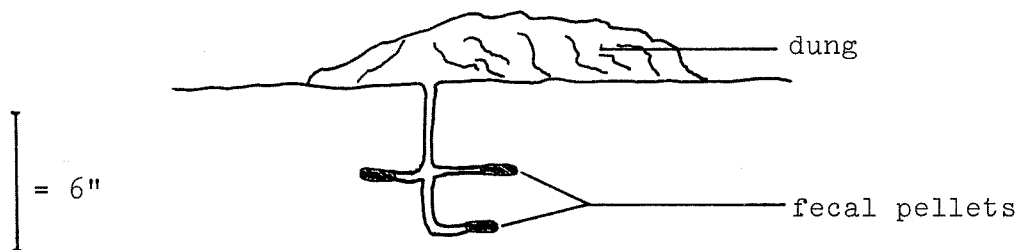


Figure 8. A burrow of *Onthophagus hecate* (Panzer) from the sandhills of Richland County.

## HUMUS AS A HABITAT

Unlike the microhabitat of a cattle dropping, humus occurrence is widespread as the substrate in a floodplain, shelter belt or grassland community. It is more difficult, therefore, to quantify observations of individuals and ecological aspects of humus-feeding Scarabaeidae.

The most common method for collecting these Scarabaeidae is by light trap, but this only captures nocturnal-photophilic species and, except for locality, yields little ecological information. *Bolboceras filicornis* (Say), a humus-feeding scarab collected at light traps, was the only species of *Bolboceras* collected in North Dakota prior to 1965. The use of pit traps in areas of high humus yielded another species, *B. falli* (Wallis). This species is nocturnal but not photophilic. Other quantitative sampling techniques must be devised to successfully analyze the species composition of extensive habitats such as humus; Berlese funnels are adequate for only small sample areas and species of limited mobility.

Every major vegetative community contains a humus source available to some species of Scarabaeidae. No attempt was made to evaluate physical changes or biological components of humus. Species occurrence or association with certain humus sources are listed in Table VI, with the habits of some species briefly discussed in the following pages. The table is based on light trap and pit trap collections from sites in Richland, Grand Forks, Pembina and Billings Counties from May through August 1966.

TABLE VI.

HUMUS PREFERENCE OF SOME SAPROPHAGOUS SPECIES

species	Humus source			
	floodplain forest	grassland	humus near standing water	shelter belts
<i>Aphodius pinguis</i>	*			*
<i>A. pinguellis</i>			*	
<i>A. omissus</i>			*	
<i>Bolboceras falli</i>	*			*
<i>B. filicornis</i>	*	*		*
<i>Bolbocerosoma bruneri</i>		*		
<i>Eucanthus lazarus</i>	*	*		
<i>E. greeni</i>	*	*		
<i>Geotrupes semiopacus</i>	*			*
<i>Ochodaeus musculus</i>	*	*		*

The ecology of *Aphodius* spp. which occur in the humus near standing water is little known. Data indicate a positive association with the high moisture and organic content of these areas, but the adults have not been observed feeding nor their larvae collected. The larvae are presumably free-living in the humus layer.

*Geotrupes semiopacus* Jekel is a diurnal, burrowing species of the Geotrupinae. When dung is not readily available, it will use humus as a food supply for future larvae. It constructs a burrow beneath a humus source and packs the end of this burrow with humus in which it oviposits (fig. 9).

Species of *Eucanthus*, *Bolboceras* and *Bolbocerosoma* are nocturnal, burrowing Geotrupinae. As Table VII suggests, adults of these species are collected at light traps most abundantly in July. The table is based on results of light traps run from May through August at six different sites across North Dakota in 1960, 1962, 1965 and 1966.

TABLE VII.

NUMBERS OF NOCTURNAL GEOTRUPINAE COLLECTED IN LIGHT TRAPS AT SIX SITES ACROSS NORTH DAKOTA

species	month			
	May	June	July	Aug
<i>Bolboceras falli</i>	0	2	15	4
<i>B. filicornis</i>	6	6	24	0
<i>Bolbocerosoma bruneri</i>	0	3	7	0
<i>Eucanthus greeni</i>	3	4	10	2
<i>E. lazarus</i>	2	13	23	2

These species construct burrows, as in figure 10, much the same as *Geotrupes* in which they store finely chewed humus for larval food. Howden (1955) suggests that differences in burrow types is species-specific in many cases.

Although it is apparent what the larvae of these species eat, it is much less apparent what the adults eat. Howden (1955) reports that some *Bolboceras* spp. feed on underground fungi, but *B. filicornis*, *B. falli*, *Bolbocerosoma bruneri*, *Eucanthus lazarus* and *greeni* have not been seen feeding as adults.



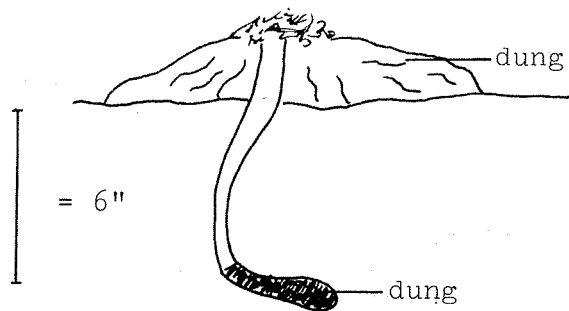


Figure 9.

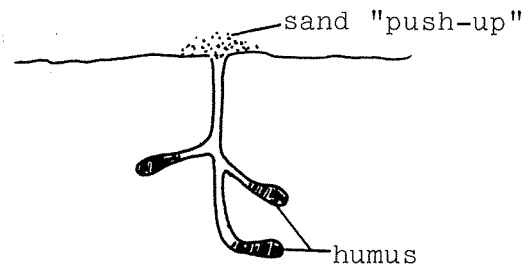


Figure 10.

- Figures 9. A burrow of *Geotrupes semiopacus* Jek. in floodplain forest of Richland County.
10. A burrow of *Bolboceras filicornis* from sandhills of Richland County.

#### TAXONOMY OF SAPROPHAGOUS SCARABAEIDAE OF NORTH DAKOTA

Taxonomically, the saprophagous Scarabaeidae present several difficult problems.

Similar morphological adaptations present problems to the inexperienced worker and even genera are sometimes confused. For example, the distinction of *Psammadius* and *Rhyssemus*, in keys, is based only on the length of the apical metatibial spur and the shape of the first metatarsal segment. Detailed studies of the morphology, however, demonstrate that many of these similarities are superficial.

Geographical variation is pronounced in wide ranging species which complicates definition of many species. *Eucanthus lazarus* Fabricius, for example, has three distinct geographic populations in the United States; one in the gulf states, one in an area from the southwestern to north-central states and one in the southeastern states.

Many species are small and secretive in habit, so they are both difficult to collect and difficult to identify. Other species, such as those in the Geotrupinae, spend the majority of their life in burrows beneath the ground. Improved trapping techniques, especially the use of pit traps, alleviated some of the collecting difficulties.

Despite these difficulties, fifty species have been distinguished within the boundaries of North Dakota. More species undoubtedly will be added to this total as the biologies of some genera, such as *Rhyssemus*, *Psammadius* and *Aegialia* are studied in more detail.

## SPECIES LIST OF NORTH DAKOTA SAPROPHAGOUS SCARABAEIDAE

Keys and descriptions of the North Dakota species of saprophagous Scarabaeidae are treated in the order of this species list. The total number of specimens collected and examined appears beside each species.\*

### SCARABAEINAE

<i>Canthon</i> Hoffmannsegg	
<i>praticola</i> LeC.	33
<i>pilularius</i> (L.)	48
<i>Onthophagus</i> Latreille	
<i>hecate</i> (Panz.)	280
<i>pennsylvanicus</i> Harold	90
<i>orpheus pseudorpheus</i>	7
How. & Cartw.	

### APHODIINAE

<i>Aphodius</i> Illiger	
<i>fossor</i> (L.)	102
<i>erraticus</i> (L.)	1
<i>haemorrhoidalis</i> (L.)	94
<i>hamatus</i> Say	15
<i>omissus omissus</i> LeC.	91
<i>omissus torpidus</i> Horn	103
<i>pinguis</i> Hald.	42
<i>pinguellis</i> Brown	179
<i>fimetarius</i> (L.)	160
<i>tenellus</i> Say	33
<i>ruricola</i> Melsh.	171
<i>granarius</i> (L.)	30
<i>vittatus</i> Say	58
<i>alternatus</i> Horn	45
<i>pseudabusus</i> Cartw.	5
<i>lentus</i> Horn	36
<i>explanatus</i> LeC.	19
<i>iowensis</i> Wickh.	4
<i>criddlei</i> Brown	40
<i>haldemani</i> Horn	1
<i>concavus</i> Say	8
<i>fucosus</i> Schmidt	16
<i>consentaneus</i> LeC.	2
<i>dentigerulus</i> Brown	75
<i>coloradensis</i> Horn	55
<i>distinctus</i> (Mull.)	181
<i>leopardus</i> Horn	53
<i>walshi</i> Horn	86

<i>Ataenius</i> Harold	
<i>spretulus</i> (Hald.)	79
<i>texanus</i> Harold	2
<i>Dialytes</i> Harold	
<i>criddlei</i> Brown	115
<i>Rhyssenus</i> Mulsant	
<i>sonatus</i> LeC.	33
<i>Psammодиус</i> Fallen	
<i>mimeticus</i> (Fall)	1
<i>Aegialia</i> Latreille	
<i>lacustris</i> LeC.	1
<i>conferta</i> Horn	0
<i>rufescens</i> Horn	1

### GEOTRUPINAE

<i>Bolbocerosoma</i> Shaeffer	
<i>bruneri</i> D. & McC.	21
<i>Bolboceras</i> Kirby	
<i>falli</i> (Wallis)	32
<i>filicornis</i> (Say)	72
<i>Eucanthus</i> Westwood	
<i>lazarus</i> (Fab.)	93
<i>greeni</i> Robinson	25
<i>Geotrupes</i> Latreille	
<i>semiopacus</i> Jekel	81

### OCHODAEINAE

<i>Ochodaeus</i> Serville	
<i>musculus</i> (Say)	180

### DYNASTINAE

<i>Bothynus</i> Hope	
<i>relictus</i> (Say)	125
<i>gibbosus</i> (DeGeer)	96

\*Specimens are included from the collections of North Dakota State University, R. G. Helgesen and R. D. Gordon.

KEY TO SUBFAMILIES OF SAPROPHAGOUS SCARABAEIDAE

Adults

- 1. One apical metatibial spur; pygidium exposed.....*Scarabaeinae* (p. 18)
- 1'. Two apical metatibial spurs; pygidium rarely exposed.....2
- 2. Eleven segmented antennae.....*Geotrupidinae* (p. 48)
- 2'. Eight to ten segmented antennae.....3
- 3. Mandibles bent, expanded and leaflike (fig. 11, pg. 24).....  
.....*Dynastinae* (p. 55)
- 3'. Mandibles normally developed.....4
- 4. Nine segmented antennae.....*Aphodiinae* (p. 23)
- 4'. Ten segmented antennae.....*Ochodaeinae* (p. 55)

Larvae

- 1. No sensorial appendage on penultimate antennal segment; anal lobes not swollen.....*Dynastinae* (p. 55)
- 1'. Sensorial appendage on inner side of penultimate antennal segment; anal lobes swollen.....2
- 2. Antennae three-segmented; mandibles and maxillae without stridulatory teeth.....*Geotrupidinae* (p. 48)
- 2'. Antennae four-segmented (secondary fold in first segment makes some appear five-segmented); mandibles and maxillae with stridulatory teeth.....3
- 3. Claws setiform or absent; dorsum of anterior abdominal segments distinctly enlarged; enclosed in fecal pellet beneath the soil.....*Scarabaeinae* (p. 18)
- 3'. Claws fully developed; dorsum of anterior abdominal segments not enlarged; not enclosed in fecal pellet.....*Aphodiinae* (p. 23)

**SUBFAMILY SCARABAEINAE**

Formerly recognized as the subfamily Coprinae, this subfamily includes the well known Sacred Scarab (*Scarabaeus sacer* L.) of Egypt. Species of this subfamily provide their larvae with a stored food supply consisting of a fecal or humus pellet in which the larvae spend their total immature life. A hidden scutellum, single apical metatibial spur and an exposed pygidium distinguished the Scarabaeinae from other saprophagous Scarabaeidae. Larvae have characteristic setiform or vestigial tarsal claws and four-segmented antennae. Two genera and five species occur in North Dakota.

KEY TO GENERA OF SCARABAEINAE

Adults

- 1. Meso- and metatibiae apically dilated.....*Onthophagus*
- 1'. Meso- and metatibiae slender and curved.....*Canthon*

Larvae

- 1. Dorsum of third abdominal segment with a distinct conical, setigerous wart; prothoracic shield with no lateral processes extending cephalad.....*Onthophagus*
- 1'. Dorsum of third abdominal segment with no distinct conical wart; prothoracic shield with lateral processes extending cephalad.....*Canthon*

Genus *CANTHON* Hoffmanssegg, 1817

In North Dakota, only species of *Canthon* roll fecal pellets above the soil surface. The ball is rolled from a fecal source to an adequate burial site where oviposition takes place; thus the common name "tumble-bug". Adult color varies from dull black to dull metallic blue or green; clypeus bi- or quadridentate; meso- and metatibiae curved and slender. Larvae typically have a single terminal tarsal seta, with no claws; a single, broad caudal lobe; raster with pair of inconspicuous tegites. Robinson (1948) recently revised the genus *Canthon* for the United States.

KEY TO SPECIES OF *CANTHON*

- 1. Clypeus bidentate; metafemora margined anteriorly; pygidium densely granulate.....*pilularius*
- 1'. Clypeus quadridentate; metafemora entire anteriorly; pygidium sparsely granulate.....*praticola*

*Canthon pilularius* (Linnaeus)

*Scarabaeus pilularius* Linnaeus, C. 1758. Systema Naturae. ed. 10. p. 349.

Adult description: Length 10.3 mm. to 18.5 mm.; width 7.5 mm. to 11.0 mm. Dorsoventrally dull black, sometimes slightly metallic blue. Head granulate with clypeus broadly emarginate, bidentate; genae extended caudad to cover over half the eye dorsally. Pronotum distinctly convex with mixed coarse and fine granules; widest just anterior of middle; anterior angles acute. Elytra with mixed coarse and fine granules; ten pairs of striae, subhumeral striae carinate the length of elytra. Pygidium with dense coarse granules. Metafemora anteriorly margined. Meso- and metatibiae slender and curved.

Larval description: The following larval description is largely from Ritcher (1945). Width of head capsule 3.55 mm. ( $\pm 0.7$  mm.). Setigerous frons. Pedium bare (one or two setae may exist). Chaetoparia each with seven to nine setae. Tormae symmetrical. Mesophoba monostichous. Four setae on haptolachus. Twelve to seventeen maxillary stridulatory teeth. Prothoracic shield with lateral projections extending cephalad. Dorsum of third abdominal segment smooth. Raster with pair of inconspicuous tegites. Tarsal claws absent; tarsi terminate in one long seta with eight to nine surrounding setae.

County records: BILLINGS CO. 28-V-66 (RGH), 15-VIII-66 (RGH); CASS CO. 18-VI-40 (SC); GOLDEN VALLEY CO. 4-VII-62 (SW & WB); MCKENZIE CO. 1-VII-62 (SW & WB); RICHLAND CO. 2-VII-65 (RGH); STARK CO. 21-VIII-57 (DN); WILLIAMS CO. 5-VII-66 (DGA).

Remarks: During late June and July, the height of *Canthon* activity in North Dakota, *C. pilularius* (L.) bury fecal balls in separate chambers between three to six inches beneath the soil, several yards away from the fecal source. One egg is deposited in each ball. Lindquist (1935) states that the developing larva deposits excrement on the outside surface of the ball.

#### *Canthon praticola* LeConte

*Canthon praticola* LeConte, J. L. 1859. Smithsonian Contributions to Knowledge. 11:1-58.

Adult description: Length 8.6 mm. ( $\pm 1.1$  mm.); width 5.1 mm. ( $\pm 0.6$  mm.). Dull black dorsoventrally. Head granulate to alutaceous with clypeus broadly emarginate, quadridentate; clypeofrontal suture distinct; genae extended caudad to cover over half the eye dorsally. Pronotum distinctly convex with mixed coarse and fine granules (sometimes alutaceous). Elytra similar to pronotum with seven obscured striae; subhumeral striae carinate. Pygidium with sparse, coarse granules. Metafemora not anteriorly margined. Meso- and metatibiae slender and curved.

Larvae unknown.

County records: BILLINGS CO. 28-V-66 (RGH), 15-VIII-66 (RGH); BOTTINEAU CO. 20-VIII-66 (JK); EDDY CO. 26-IX-65 (WB); GRAND FORKS CO. 10-VII-66 (RGH); TOWNER CO. 10-VI-64 (DGA).

Remarks: The author has seen *praticola* bury fecal balls under and very near the fecal source, yet at other times roll a ball several yards away. Whereas the pellet formed by *C. pilularius* (L.) averages near 1.5 cm. in diameter, *C. praticola* (LeC.) builds one only one third this size. The biology of this species, however, is very similar to that of *C. pilularius* (L.).

#### Genus *ONTHOPHAGUS* Latreille, 1802

In their comprehensive study of the North American *Onthophagus*, Howden and Cartwright (1963) suggest that the genus *Onthophagus* "is perhaps the largest genus of beetles" with nearly 1500 species. There are only three recorded species in North Dakota. Unlike the *Canthon*, these species dig a burrow beneath a fecal supply. At the end of this burrow they construct, piece by piece, a fecal pellet into which one egg is placed. The larvae develop fully inside this pellet, seldom using more than half the supply of dung.

Males of this genus have two forms, a major male which is large and has prominent cephalic and/or pronotal protuberance and a minor male which is small and looks much like a female (this is particularly evi-

dent in *hecate* and *orpheus pseudorpheus*). Females have a cephalic carina and sometimes a slight pronotal elevation. Beetles of this genus are oval; colored dull black, dull to shining bronze, or metallic green; meso- and metatibiae apically dilated and truncate. Larvae possess a distinctive dorsal setigerous wart on the third abdominal segment.

#### KEY TO SPECIES OF *ONTHOPHAGUS*

##### Adults

- 1. Pronotal disc granulate; dorsal color dull black.....*hecate*
- 1'. Pronotal disc punctate; dorsal color piceous, bronze or metallic green.....2
- 2. Dorsal color metallic green; male with distinct anterior elevation; size 5.8 mm. to 9.0 mm.....*orpheus pseudorpheus*
- 2'. Dorsal color dull-shining piceous to bronze; neither sex with anterior pronotal protuberance; size 4.3 mm. to 5.0 mm.....*pennsylvanicus*

##### Larvae

- 1. Raster with pair of polystichous tegites, each of 25 to 40 setae.....*hecate*
- 1'. Raster with quadrate teges of 25 to 40 setae...*pennsylvanicus*

#### *Onthophagus hecate* (Panzer)

*Scarabaeus hecate* Panzer, G. 1794. Faunae insectorum americae borealis prodromus. p. 5.

Adult description: Length 7.3 mm. ( $\pm 2.1$  mm.); width 4.0 mm. ( $\pm 1.0$  mm.). Black, often with dorsal aeneous haze. Clypeus dorsoapically reflexed forming a distinct clypeal tooth; finely punctured; carina obsolete. Frontal carina slight. Pronotum convex; with bifurcate horn (in major males) not half as wide as head and extending to posterior of clypeus; coarsely tuberculate. Elytral striae margined and shining; intervals tuberculate with small, basal, setigerous punctures. Dorsal half of pygidium alutaceous, ventral half coarsely punctate. Meso- and metatibiae dilated apically.

Larval description: Larvae have head capsule width of 2.0 mm. ( $\pm 0.8$  mm.). Frons setigerous. Pedium bare. Tormae symmetrical. Mesophoba monostichous. Six to eleven maxillary stridulatory teeth. Prothoracic shield laterally and anteriorly smooth. Dorsum of third abdominal segment with distinct setigerous wart. Pair of similar tegites on raster, each with twenty-five to forty setae. Tarsal claws absent; tarsi terminating in long seta surrounded by eight to nine small setae.

County records: BENSON CO. 10-VI-65 (RGH); BOTTINEAU CO. 30-V-66 (JK); CASS CO. 10-VI-59 (DN); DIVIDE CO. 12-VII-66 (RJS); DUNN CO. 20-VI-64 (DGA); EDDY CO. 10-VI-65 (RGH); LAMOURE CO. 12-VII-66 (RJS); McKENZIE CO. 24-VII-64 (RJS); RANSOM CO. 2-VI-62 (JO); RICHLAND CO. 17-VI-65 (RGH); SLOPE CO. 1-VII-65 (WK); STARK CO. 21-VII-57 (DN), 1-VIII-62 (DGA).

Remarks: This species is one of the most abundant and widespread of the saprophagous Scarabaeidae in North Dakota. It is often seen from May to September in and under fecal deposits. It oviposits only in a pellet formed in a chamber from two to eight inches beneath the soil surface. *O. hecate* (Panzer) is not specific to fecal types or habitat, sometimes using humus for larval pellets when a fecal supply is not available. See cover plate for adult male and third instar larva.

*Onthophagus pennsylvanicus* Harold

*Onthophagus pennsylvanicus* Harold, E. 1871. Coleopterologische Hefte. 8:115.

Adult description: Length 4.75 mm. ( $\pm 0.25$  mm.); width 2.95 mm. ( $\pm 0.25$  mm.). Dorsally dull black to piceous, often with aneous sheen; ventrally black, legs piceous. Clypeus dorsoapically reflexed and extended, smooth. Frons alutaceous to finely punctate. Both a clypeal and frontal carina present only in females and minor males. Pronotum convex with large, shallow, setigerous punctures; lacking any protuberance. Elytra with striae impressed and coarsely punctate. Pygidium coarsely, setigerously punctate. Meso- and metatibiae dilated apically. Venter alutaceous with setigerous punctures.

Larval description: This description is based largely on Ritcher's (1945) work. Head capsule width 1.31 mm. ( $\pm 0.08$  mm.). Frons setigerous. Pedium bare. Tormae symmetrical. Mesophoba monstichous. Five to seven maxillary stridulatory teeth. Prothoracic shield smooth laterally and anteriorly. Dorsum of third abdominal segment with distinct setigerous wart. Raster with quadrate teges of twenty-five to forty-five setae. Tarsi similar to *O. hecate* (Panzer).

County records: RANSOM CO. 13-VII-62 (JO); RICHLAND CO. 26-VII-65 (RGH), 5-VIII-66 (RGH).

Remarks: *Onthophagus pennsylvanicus* Harold has been found only in southeastern North Dakota and is much less abundant than *O. hecate* (Panzer). They are more common in sandy soil of sheep pastures than in cow pastures.

*Onthophagus orpheus pseudorpheus* Howden and Cartwright

*Onthophagus orpheus pseudorpheus* Howden, H. F. and Cartwright, O. L. 1963. Proc. U.S.N.M. 114:53.

Adult description: Length 7.0 mm. ( $\pm 1.0$  mm.); width 4.0 mm. ( $\pm 0.4$  mm.). Dorsoventrally metallic green with red-copper haze on anterior dorsum. Clypeus apically reflexed; coarsely and finely punctate; medially emarginate; distinct clypeal suture. Frontal carina laterally terminating in an acute horn caudad of eye. Convex pronotum of major males with broad anterior bifurcate horn extending to posterior of clypeus (females and minor males without such horn); coarsely setigerously punctate. Elytra distinctly striate, intervals punctate-tuberculate, with setae.

Larvae unknown.

County records: LAMOURE CO. 12-VII-66 (RGH); RICHLAND CO. 9-VII-66 (RGH), 25-V-66 (DGA & RDG).

Remarks: Howden and Cartwright (1963) suggest that *O. orpheus pseudorpheus* How. & Cartw. "appears to be a prairie form, unlike the other subspecies which are woodland forms." This species has been collected by pit traps in open range, floodplain forests and shelter belts in North Dakota.

### SUBFAMILY APHODIINAE

Comprehensive works on this subfamily are Horn (1887) and Schmidt (1922). Much revisionary work is needed to bring the taxonomy of the Aphodiinae up-to-date. Jerath's (1960) work in larval Aphodiinae is outstanding.

Over half the North Dakota species of saprophagous Scarabaeidae are in the Aphodiinae. The species, included in six genera, are relatively small beetles. The biology of the less common species is poorly understood. The more common species, however, show a full spectrum from specific (*Dialytes*) to more general habitat and food preference (some *Aphodius*).

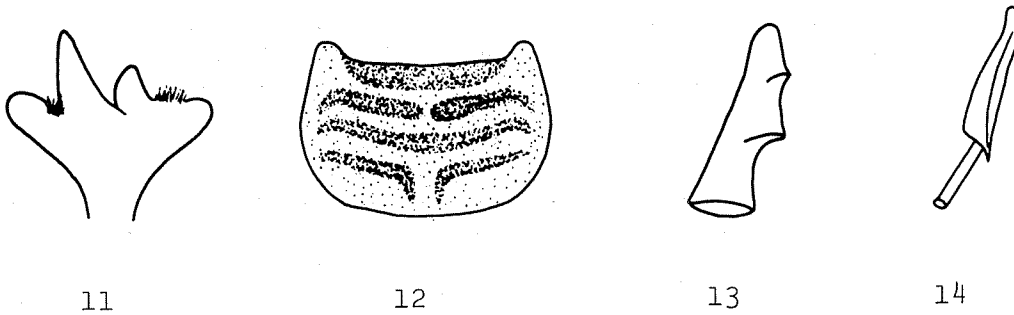
The distinctive elongate-oval shape and the nine segmented antennae are unique characters of the Aphodiinae. Larvae have four segmented antennae with a sensorial appendage on the penultimate segment and striulatory teeth on the maxillae.

### KEY TO THE GENERA OF NORTH DAKOTA APHODIINAE

#### Adults

1. Mandibles extended beyond clypeus.....*Aegialia* (p. 46)
- 1'. Mandibles concealed below clypeus.....2
2. Pronotum with alternate transverse furrows and swellings and with medial longitudinal furrow, these sometimes reduced to impressions (fig. 12, pg. 24).....3
- 2'. Pronotum without transverse furrows or swellings.....4
3. Longest apical metatibial spur as long or longer than first two tarsal segments; tarsi shorter than tibia, sometimes barely half as long and triangularly flattened.....*Psammodius* (p. 46)
- 3'. Longest apical metatibial spur shorter than first two tarsal segments; tarsus as long as tibia and never triangularly flattened.....*Rhyssemus* (p. 45)
4. Meso- and metatibia with transverse carinae (fig. 13, pg. 24); head usually with tubercles or traces of tubercles...*Aphodius* (p. 24)
- 4'. Meso- and metatibia without transverse carinae, mesotibia sometimes with traces (fig. 14, pg. 24); head never tuberculate.....5
5. Elytral intervals broadly carinate; outer apical angle of metatibia obtuse.....*Dialytes* (p. 45)
- 5'. Elytral intervals flat; outer apical angle of metatibia extended, spiniform.....*Ataenius* (p. 44)





Figures 11. Dorsal aspect of apical right mandible of *Bothynus relictus* (Say).  
 12. Pronotum of *Rhyssemus sonatus* LeC. showing transverse furrows.  
 13. Mesotibia of generalized *Aphodius* showing transverse carinae.  
 14. Metatibia with absence of transverse carinae and first metatarsal segment of *Ataenius*.

Known Larvae

- 1. Lower anal lobe divided into two distinct lobes.....2
- 1'. Lower anal lobe emarginate or entire.....3
- 2. Maxilla with stridulatory teeth on stipes.....*Ataenius*
- 2'. Maxilla without stridulatory teeth on stipes.....*Psammodytes*
- 3. Lower anal lip entire.....*Aegialia*
- 3'. Lower anal lip emarginate (fig. 15, pg. 25).....*Aphodius*

Genus *APHODIUS* Illiger, 1798

Brown (1928, 1929) and Cartwright (1939, 1957) are among the most comprehensive and recent works of this genus.

By number of individuals and species, the most common Aphodiinae belong to the *Aphodius*. The habitats of these species vary from humus and a rather wide range of fecal deposits to specific animal burrows.

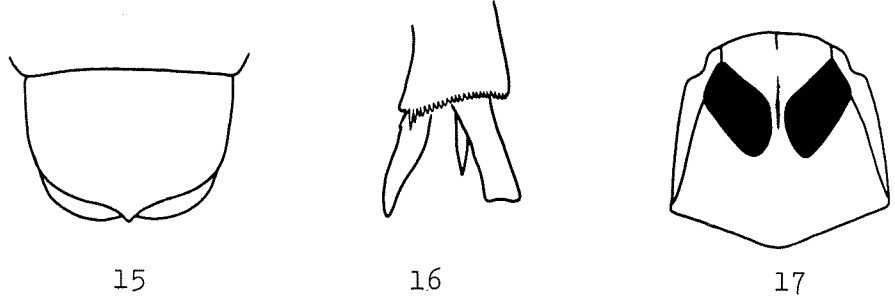
Within the Aphodiinae, the *Aphodius* are characterized by an expanded clypeus which conceals the mandibles and two or more transverse carinae on the meso- and metatibiae. Larvae have swollen anal lobes, the lower lobe being emarginate. The tarsungulus is fully developed.

KEY TO SPECIES OF *APHODIUS*

Adults

- 1. Scutellum one-fifth the length of elytra or more.....2
- 1'. Scutellum one-eighth the length of elytra or less.....9
- 2. Apical metatibial spinules equal in length; margin of fore tibiae entire above teeth (pg. 49) .....*Fasser*
- 2'. Apical metatibial spinules varying in length; margin of fore tibiae serrulate above teeth .....3

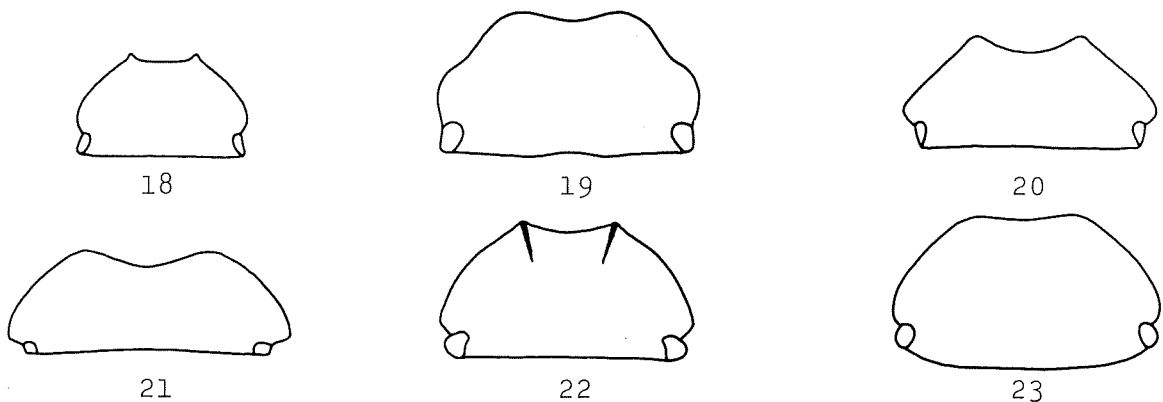
- 3. Scutellum flat and smooth throughout; margin of fore tibiae above teeth feebly serrulate ..... 4
- 3'. Scutellum longitudinally impressed, distinct anteriorly; protibial serrulation distinct ..... 5
- 4. Elytral intervals alutaceous; elytra lack pigmentation (yellow-brown color) ..... *erraticus* (p. 51)
- 4'. Elytral intervals smooth, shining; elytra black, red at apical one-third ..... *haemorrhoidalis* (p. 52)
- 5. Elytral surface alutaceous, never shining.....*hamatus* (p. 30)
- 5'. Elytral surface smooth, shining.....6
- 6. Basal pronotal margin strong, entire.....*pinguis* (p. 32)
- 6'. Basal pronotal margin obsolete or very short and indistinct, never entire.....7
- 7. Apex of clypeus uniform in thickness, or nearly so.....*pinguellis* (p. 33)
- 7'. Apex of clypeus distinctly thickened, nearly twice as thick as rest of clypeal margin.....8
- 8. Elytra uniformly pigmented, black.....*omissus omissus* (p. 31)
- 8'. Elytra lacks pigment along suture (two longitudinal stripes apparent).....*omissus torpidus* (p. 32)
- 9. Apical metatibial spinules equal in length.....10
- 9'. Apical metatibial spinules varying in length, not equal....16
- 10. Mesosternum distinctly carinate between coxae (fig. 17, pg. 25).....11
- 10'. Mesosternum smooth and flat between coxae.....12



Figures 15. Emarginate lower anal lip of *Aphodius* spp. (ventral aspect).  
 16. Metatibia and first metatarsal segment of *Aphodius fossor* (L.) showing apical metatibial spinules equal in length.  
 17. Carinate mesosternum of *Aphodius vittatus* Say (ventral aspect).

- 11. First segment of metatarsus as long as next three segments .....*vittatus* (p. 36)
- 11'. First segment of metatarsus as long as next two, no longer .....*granarius* (p. 35)
- 12. Clypeus with two distinct clypeal teeth (fig. 18, pg. 26).....*pseudabusus* (p. 37)
- 12'. Clypeus emarginate, broad and rounded (fig. 19, pg. 26)....13
- 13. Frons with at least traces of three tubercles, usually well developed in males and weak in females.....14
- 13'. Frons smooth, convex, with no traces of tubercles..*alternatus* (p. 37)

14. First metatarsal segment no longer than next two segments..  
 .....*ruricola* (p. 34)
- 14'. First metatarsal segment as long as next three segments....15
15. Coarse pronotal punctures sparse, elytra, red-orange.....  
 .....*fimetarius* (p. 33)
- 15'. Coarse pronotal punctures dense, elytra dark red-brown.....  
 .....*tenellus* (p. 34)
16. Pronotal sides explanate.....17
- 16'. Pronotal sides convex and entire, never explanate.....20
17. Clypeus angulate at sides of emargination (fig. 20).....  
 .....*explanatus* (p. 38)
- 17'. Clypeus round at sides of emargination (fig. 21).....18
18. Anterior of clypeus granulate or rugose.....19
- 18'. Clypeus entirely smooth, without granules or punctures; ely-  
 tral intervals polished, shining.....*haldemani* (p. 40)
19. Elytral intervals finely alutaceous, dull; pronotum and head  
 light red.....*criddlei* (p. 39)
- 19'. Elytral intervals smooth, shining; pronotum and head black  
 .....*iowensis* (p. 34)
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 tibiae punctate.....*lentus* (p. 38)
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- Figures 18. Head of *Aphodius pseudabusus* Cartw. showing emarginate clypeus with two teeth (dorsal view).
19. Head of *Aphodius fimetarius* (L.) showing broad and rounded emarginate clypeus (dorsal view).
20. Head of *Aphodius explanatus* LeC. showing clypeus angulate at sides of emargination (dorsal view).
21. Head of *Aphodius criddlei* Brown showing clypeus rounded at sides of emargination (dorsal view).
22. Head of *Aphodius coloradensis* Horn showing dentiform clypeus.
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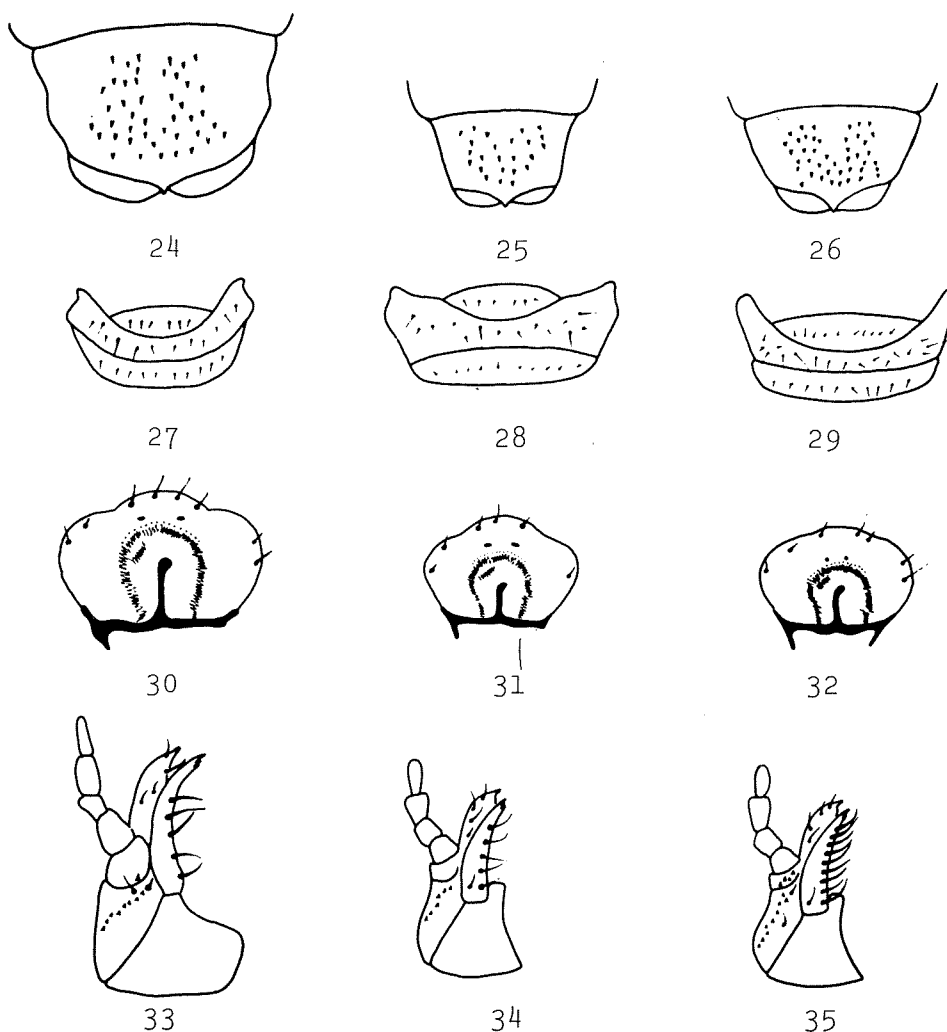
*Aphodius fossor* (Linneaus)

*Scarabaeus fossor* Linneaus, C. 1758. *Systema Naturae*, ed. 10. p. 348.

Adult description: Length 10.5 mm. ( $\pm 2.0$  mm.); width 5.1 mm. ( $\pm 0.6$  mm.). Dorsoventrally black. Head convex, punctate. Clypeus very broadly emarginate, apices of emargination reflexed. Three tubercles transverse the clypeofrontal area, well developed in males, weakly so in females. Pronotum shining, with sparse punctures, an anterior fovea present in males. Scutellum slightly longer than one fourth elytral length; slightly convex and anteriorly punctate, never with longitudinal depression. Elytral striae with very indistinct punctures; intervals with very fine punctures, otherwise very smooth, shining. Metasternal groove cariniform anteriorly. Apical metatibial spinules equal in length.

Larval description: Head capsule width 3.5 mm. ( $\pm 0.2$  mm.); alutaceous, red-brown. Two posterior setae, one exterior seta, one anterior seta and one seta in anterior angle, on each side of frons. Four to five pairs of dorsoepicranial setae.

Epipharynx with 15-23 proptophobal microsensillae; bistichous on left, monostichous on right. Dextiotorma sinuate, produced caudad and cephalad; laeotorma straight, produced cephalad. Epitorma asymmetrical, apex pro-



- Figures 24. Raster of *Aphodius ruricola* Melsh. showing bilobed teges.  
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 35. Maxilla of *Aphodius fossor* (L.) showing palpifer with four stridulatory teeth and lacinia with mesal row of nine setae.

duced toward laeotorma.

Maxilla with a row of 16-20 stridulatory teeth on the stipes and 4-6 such teeth on palpifer. Galea dorsally with eight setae; ventrally with a mesal row of 18-20 short setae. Lacinia dorsally with nine setae on mesal edge.

Two plicae on abdominal segments 1-5. Prescutum with 12 setae, scutum with 2-5 long and 5-8 short setae and scutellum with 16 setae (see fig. 29). Raster with subquadrate teges of 130-170 small, stout setae.

County records: BOTTINEAU CO. 27-V-65 (JK); DUNN CO. 22-VI-65 (RJS); MCKENZIE CO. 2-VIII-61 (CDM), 16-VII-65 (RGH); PEMBINA CO. 28-VII-65 (RGH); RANSOM CO. 14-V-59 (SC); RICHLAND CO. 17-VI-65 (RGH); SLOPE CO. 1-VIII-61 (CDM); TRAILL CO. 17-VIII-61 (RLP).

Remarks: *Aphodius fossor* is widely distributed throughout North Dakota and found consistently in cow dung from late June to early September.

#### *Aphodius erraticus* (Linneäus)

*Scarabaeus erraticus* Linneäus, C. 1758. Systema Naturae. ed. 10. p. 348.

Adult description: Length 7.0 mm. ( $\pm 0.3$  mm.); width 3.4 mm. ( $\pm 0.1$  mm.). Head, pronotum, scutellum, legs, venter piceous to black; elytra yellow-brown entirely dull. Head punctate throughout. Clypeus nearly entire, middle deflexed. One distinct clypeofrontal tubercle. Pronotum densely punctate. Scutellum one-fifth length of elytra, coarsely punctate. Elytral surface alutaceous; intervals moderately punctate; striae shallow, punctures coarse, elytral suture raised posteriorly. Apical metatibial spinules unequal in length.

Larval description: Head capsule width 2.33 mm. ( $\pm 0.6$  mm.); smooth, yellowish-brown. Clypeus with transverse protuberance, anterior angles of which raise into a tubercle.

Epipharynx with 19-21 protophobal microsensillae; protophoba trichostichous on left; monostichous on right. Both dextro- and laeotorma produced cephalad and caudad; somewhat symmetrical. Epitorma asymmetrical.

Maxilla with row of 9-13 stridulatory teeth on stipes; no such teeth on palpifer. Galea dorsally with 6-7 setae, ventrally with mesal row of 8-9 short setae. Lacinia dorsally with mesal row of 7-8 setae, 2-3 short posterior setae.

Two plicae on each abdominal segment 1-5. Prescutum with ten setae; scutum with 4-6 long setae and 11-15 short setae on each side; scutellum with 16 setae. Raster with teges of 52-75 setae.

County records: GRAND FORKS CO. 7-VII-66 (RDG).

Remarks: Only one specimen of *Aphodius erraticus* (L.) has been

collected. This specimen was found in cow dung at Northwood, North Dakota in late June. The species is common in eastern United States where it was introduced from Europe. It perhaps has not reached its full population potential this far west.

*Aphodius haemorrhoidalis* (Linneaus)

*Scarabaeus haemorrhoidalis* Linneaus, C. 1758. Systema Naturae. ed. 10. p. 348.

Adult description: Length 4.3 mm. ( $\pm 0.3$  mm.); width 2.3 mm. ( $\pm 0.1$  mm.). Dorsoventrally piceous to black, except posterior one-third of elytra which appears dark red. Head punctate throughout. Clypeus nearly entire, middle deflexed; traces of clypeofrontal tubercles present as three transverse, shortened carina. Pronotum punctate with fine and coarse punctures intermingled. Scutellum one-fifth to one-fourth the length of elytra, coarsely punctate. Elytral striae deep and punctate; intervals punctate and shining. Apical metatibial spinules unequal in length.

Larval description: Head capsule width 1.3 mm. ( $\pm 0.15$  mm.); smooth, light yellow-brown. One posterior seta, one exterior seta, no anterior seta and one seta in anterior angle, on each side of frons. 2-3 pairs of dorsoepicranial setae.

Epipharynx with 14-17 protophobal microsensillae; protophoba bistichous on left, monostichous on right. Dexio- and laeotorma extend cephalad and caudad, somewhat symmetrical. Epipharynx asymmetrical, spatulate.

Maxilla with row of 6-10 stridulatory teeth on stipes; no such teeth on palpifer. Galea dorsally with 5-6 long setae, ventrally with 8-10 short setae along mesal edge. Lacinia dorsally with mesal row of five setae, one short posterior seta.

Two plicae on each abdominal segment 1-5. Prescutum with six setae; scutum with 12-14 setae; scutellum with 8-10 setae. Raster with subquadrate teges of 51-81 setae.

County records: BOTTINEAU CO. 27-V-66 (JK); CASS CO. 26-V-65 (RGH); GRAND FORKS CO. 21-VI-66 (RGH); PEMBINA CO. 28-VII-65 (RGH); RAMSEY CO. 15-VIII-62 (DGA); RANSOM CO. 24-VI-65 (RGH); RICHLAND CO. 17-VI-65 (RGH).

Remarks: This small, "red-tipped" species is common throughout North Dakota from late May to early October. It has been collected only in cow dung.

*Aphodius hamatus* Say

*Aphodius hamatus* Say, T. 1823. J. Acad. Nat. Sci. Philadelphia. 3:139-216.

Adult description: Length 7.8 mm. ( $\pm 0.2$  mm.); width 3.8 mm. ( $\pm 0.2$  mm.). Head, pronotum, scutellum and venter piceous to black; elytra yellow-brown

with median longitudinally stripes of dark brown in intervals 2-9. Head convex, shining, with fine punctures. Clypeal margin broadly emarginate, reflexed. Pronotum with sparse, coarse punctures; basal marginal line interrupted at middle. Scutellum longitudinally impressed, impunctate; one-fourth the length of elytra. Elytral striae shallow, punctate; intervals alutaceous, punctulate. Fore tibiae serrulate above major teeth. Apical metatibial spinules equal in length. First metatarsal segment as long as next two, no longer.

Larval description: Head capsule width 2.93 mm. ( $\pm 0.6$  mm.); smooth, yellow. 3-4 pairs of dorsoepicranial setae.

Epipharynx with 18-21 protophobal microsensillae; protophoba bistichous on left and monostichous on right. Both dexio- and laeotorma produced cephalad and caudad and somewhat symmetrical. Epitorma asymmetrical.

Maxilla with row of 9-12 stridulatory teeth on stipes; one or two such teeth on palpifer. Galea dorsally with row of five or six setae, ventrally with mesal row of 11-14 short setae. Lacinia dorsally with mesal row of eight setae.

County records: BOTTINEAU CO. 30-V-66 (JK); RENVILLE CO. 3-VII-66 (DGA).

Remarks: *A. hamatus* Say has been collected only in cow dung in North Dakota. Its range appears limited to the northern areas of the state, apparently associated with the boreal life zone.

#### *Aphodius omissus omissus* LeConte

*Aphodius omissus omissus* LeConte, J. 1850. Agassiz Lake Superior p. 225.

Adult description: Length 7.1 mm. ( $\pm 0.7$  mm.); width 3.7 mm. ( $\pm 0.5$  mm.). Dorsoventrally piceous to black. Head convex; sparsely and finely punctate. Clypeal margin sharply, but narrowly reflexed; feebly emarginate; apex strongly thickened, nearly twice the thickness of the rest of margin. Pronotum with interspaced fine and coarse punctures, most sparse on disc; basal margin obsolete. Scutellum one-fourth length of elytra; longitudinally impressed and punctate. Elytral striae punctate; intervals shining with very fine punctures. Apical metatibial spinules equal in length. First segment of metatarsus shorter than next three.

Larval description: Larvae are unknown. Attempts to rear this species on cow dung were unsuccessful.

County records: BENSON CO. 13-VI-64 (DGA); BOTTINEAU CO. 14-VII-66 (RJS & RGH); BOWMAN CO. 7-VI-65 (DGA); BURKE CO. 14-VII-66 (RJS & RGH); CASS CO. 14-VII-66 (RJS & RGH); DIVIDE CO. 14-VII-66 (RJS & RGH); MONTRAILL CO. 6-VII-66 (DGA); PEMBINA CO. 14-VII-66 (RJS & RGH); RICHLAND CO. 14-VII-66 (RJS & RGH); WILLIAMS CO. 14-VII-66 (RJS & RGH).

Remarks: *Aphodius omissus omissus* LeC. is widely distributed in North Dakota. Its habitat is restricted to areas of high moisture (e.g., pond or swamp edge) and soil of high organic content. The larvae and adults appear dependent on the organic materials of the soil for nutrients.



*Aphodius omissus torpidus* Horn

*Aphodius omissus torpidus* Horn, G. 1870. Trans. Amer. Ent. Soc. 3:114.

Adult description: The description is the same as that for *A. omissus omissus* except a yellow (unpigmented) strip in the second interval extends the full length of each elytron and broadens to the fifth or sixth interval at the apex.

Larval description: Larvae unknown. Attempts to rear this species on cow dung were unsuccessful.

County records: BENSON CO. 10-VI-64 (DGA); BOTTINEAU CO. 14-VII-66 (RJS & RGH); BURKE CO. 14-VII-66 (RJS & RGH); DIVIDE CO. 14-VII-66 (RJS & RGH); NELSON CO. 14-VII-66 (RJS & RGH); PEMBINA CO. 14-VII-66 (RJS & RGH); RICHLAND CO. 14-VII-66 (RJS & RGH); ROLETTE CO. 14-VII-66 (RJS & RGH); WILLIAMS CO. 14-VII-66 (RJS & RGH).

Remarks: It is very doubtful that *A. omissus torpidus* is a subspecies of *A. omissus*. Populations of *A. omissus omissus* and *A. omissus torpidus* sampled in North Dakota are sympatric throughout the state. The two populations occurred in equal numbers in pit traps placed across the state, with equal ratios of males and females in each population. There are no intermediates between these populations (the elytral stripes being consistent). And, there is no difference in the male genitalia of the two, suggesting no reproductive isolation.

*Aphodius pinguis* Haldeman

*Aphodius pinguis* Haldeman, S. 1848. J. Acad. Nat. Sci. Philadelphia 1:103.

Adult description: Length 7.3 mm. ( $\pm 0.6$  mm.); width 3.6 mm. ( $\pm 0.2$  mm.). Dorsoventrally shining black, venter and legs sometimes piceous. Head only slightly convex distinctly but finely punctate. Clypeal margin entire, flattened and thickened apically and slightly reflexed. Pronotum widest portion of body, and nearly two-thirds length of elytra, sparsely, finely punctate; basal marginal line distinct, sometimes entire, sometimes narrowly interrupted at middle. Scutellum longitudinally impressed basally and finely punctate. Elytral striae distinct and punctate; intervals shining, indistinctly punctulate. Apical metatibial spinules equal in length. First metatarsal segment as long as next three.

Larval description: Larvae are unknown. Attempts to rear this species on cow dung were unsuccessful.

County records: BILLINGS CO. 30-V-66 (RM); MCKENZIE CO. 14-VII-66 (RJS); PEMBINA CO. 19-VI-66 (LK); RICHLAND CO. 15-VI-66 (RGH & RJS).

Remarks: *Aphodius pinguis* Hald. is common in shelter belts and floodplain forests, apparently feeding in the humus layer.

*Aphodius pinguellis* Brown

*Aphodius pinguellis* Brown, W. 1929. Can. Ent. 61:228.

Adult description: Length 5.4 mm. ( $\pm 0.9$  mm.); width 2.7 mm. ( $\pm 0.5$  mm.). Dorsoventrally piceous, shining. Head convex, finely sparsely punctate. Clypeal margin emarginate, of uniform thickness. Pronotum with fine and coarse punctures intermixed, shining; basal marginal line obsolete. Elytral intervals shining, finely punctulate; interval with fine but distinct margin on each side at edge of striae; striae with coarse punctures. Apical metatibial spinules equal in length. First metatarsal segment shorter than the next three.

Larval description: Larvae unknown. Attempts to rear this species on cow dung were unsuccessful.

County records: BOTTINEAU CO. 14-VII-66 (RGH & RJS); BURKE CO. 14-VII-66 (RGH & RJS); CASS CO. 14-VII-66 (RGH & RJS); CAVALIER CO. 14-VII-66 (RGH & RJS); DIVIDE CO. 14-VII-66 (RGH & RJS); EMMONS CO. 14-VII-66 (RGH & RJS); LOGAN CO. 14-VII-66 (RGH & RJS); RICHLAND CO. 19-VI-66 (RGH); ROLETTE CO. 14-VII-66 (RGH & RJS); WILLIAMS CO. 14-VII-66 (RGH & RJS).

Remarks: The biology of this species is probably very similar to that of *A. omissus* LeC. since it is collected in the same habitats and same times as *A. omissus* LeC.

*Aphodius fimetarius* (Linnaeus)

*Scarabaeus fimetarius* Linnaeus, C. 1758. Systema Naturae. ed. 10. p. 348.

Adult description: Length 6.7 mm. ( $\pm 0.5$  mm.); width 3.5 mm. ( $\pm 0.2$  mm.). Head, pronotum (except anterior angles), scutellum and venter black; anterior pronotal angles and elytra red-orange.

Head rugose anteriorly and punctate throughout. Clypeal margin nearly entire (very slightly emarginate), reflexed; crescent-shaped transverse suture usually present. Three frontal tubercles distinct in males, weak in females. Pronotum with fine punctures and coarse punctures limited to sides and base; anterior medial foveae in males; basal marginal line distinct and entire. Scutellum one-eighth elytral length and coarsely punctate. Elytral striae punctate; intervals shining, punctulate. Apical metatibial spinules equal in length. First metatarsal segment as long as next three.

Larval description: Head capsule width 2.1 mm. ( $\pm 0.2$  mm.); smooth, yellow to red-brown. One posterior seta, one exterior seta, one anterior seta and one seta in anterior angle, one each side of frons. 3-4 pairs of dorsoepicranial setae.

Epipharynx with 17-22 protophobal microsensillae; protophoba bistichous on left and monostichous on right. Dextiotorma slightly sinuate, produced cephalad and caudad; laeotorma straight, produced cephalad. Epitorma asymmetrical, curved right.

Maxilla with row of 14-18 stridulatory teeth on stipes; 2-4 such teeth on palpifer. Galea dorsally with seven setae, ventrally with mesal row of 17 small setae. Lacinia dorsally with mesal row of six setae.

Two plicae on each abdominal segment 1-5. Prescutum with eight setae; scutum with 4-6 short and 3-5 long setae on each side; scutellum with 10-12 setae. Raster with 55-90 curved setae.

County records: BILLINGS CO. 14-VII-65 (RGH); CASS CO. 26-X-65 (RGH); CAVALIER CO. 26-VII-62 (DGA); DUNN CO. 22-IV-65 (RJS); MCKENZIE CO. 16-VII-65 (WK); PEMBINA CO. 28-VII-65 (RGH); RICHLAND CO. 17-VI-65 (RGH), 20-III-66 (RGH); SLOPE CO. 31-VIII-61 (RLP).

Remarks: *A. fimetarius* is one of the most common species of *Aphodius*. It is found in fecal material of all types of herbivorous animals from March to October, most commonly in early June and late July.

#### *Aphodius tenellus* Say

*Aphodius tenellus* Say, T. 1823. J. Acad. Nat. Sci. Philadelphia. 3:213.

Adult description: Length 4.5 mm. ( $\pm 0.2$  mm.); width 2.1 mm. ( $\pm 0.1$  mm.). Head, pronotum, (except anterior angles) scutellum and venter piceous to black; anterior pronotal angles and elytra dark red-brown. Head rugose anteriorly and finely punctate throughout. Clypeal margin slightly emarginate; sides reflexed. Frontal tubercles indistinct, but present. Pronotum densely punctate with fine and coarse punctures intermixed throughout; basal marginal line entire. Scutellum one-tenth the length of elytra, punctures scarce. Elytra striae punctate; intervals shining, punctulate. Apical metatibial spinules equal in length. First metatarsal segment as long as next three.

Larvae unknown.

County records: BOTTINEAU CO. 13-V-65 (RDG); RANSOM CO. 2-IV-66 (RGH); RICHLAND CO. 21-IX-66 (RGH).

Remarks: *A. tenellus* Say is not a common species in the state, but the adult is found in association with cow and sheep dung.

#### *Aphodius ruricola* Melsheimer

*Aphodius ruricola* Melsheimer, F. 1846. Proc. Acad. Nat. Sci. Philadelphia 2:136.

Adult description: Length 4.7 mm. ( $\pm 0.5$  mm.); width 2.4 mm. ( $\pm 0.2$  mm.). Dorsoventrally dark red-brown to piceous. Head rugose anteriorly with sparse punctures. Clypeal margin slightly emarginate, sides of these broad emarginations reflexed. Three frontal tubercles present in varying degrees. Pronotum with fine and coarse punctures intermixed; basal marginal line entire. Scutellum one-tenth the length of elytra. Elytral striae shallow with wide punctures; intervals shining, sparsely punctulate. Apical metatibial spinules equal in length. First metatarsal segment as long as next two, no longer.

Larval description: The following is an original description based on 25 specimens reared in July, 1966. Specimens are deposited in the North Dakota State University insect collection and the United States National Museum insect collection. Head capsule width 1.3 mm. ( $\pm 0.05$  mm.); smooth, red-brown. Two posterior setae, one exterior seta, one anterior seta and one seta in anterior angle, on each side of frons. Four pairs of dorsoepicranial setae.

Epipharynx (fig. 30) with 14-18 protophobal microsensillae; protophoba bistichous on left, monostichous on right. Dexiotorma produced cephalad and caudad; laeotorma produced cephalad. Epitorma asymmetrical, curved to right.

Maxilla (fig. 33) with row of 4-10 stridulatory teeth on stipes; one such tooth on palpifer. Galea dorsally with 5-6 setae, ventrally with mesal row of 10-11 setae. Lacinia dorsally with mesal row of five setae.

Two plicae on each abdominal segment 1-5. Prescutum with six setae; scutum with four small and three long setae on each side of scutellum with 8-10 setae. Raster with bilobed teges of 34-41 setae. See fig. 24 and 27.

County records: BILLINGS CO. 14-VII-65 (RGH); BOTTINEAU CO. 17-VI-65 (RGH); CASS CO. 6-VI-62 (DGA); EMMONS CO. 22-VII-64 (RJS); MCKENZIE CO. 16-VII-65 (RGH); RANSOM CO. 1-VII-64 (RLP); RICHLAND CO. 10-VII-65 (RGH); WELLS CO. 25-VI-60 (DK).

Remarks: *A. ruricola* Melsh. is found in fecal material of most large herbivorous mammals in North Dakota. It is one of the most common species in the state and the predominant species collected at light traps.

#### *Aphodius granarius* (Linnaeus)

*Scarabaeus granarius* Linnaeus, C. 1758. Systema Naturae ed. 10. p. 348.

Adult description: Length 4.7 mm. ( $\pm 0.6$  mm.); width 2.2 mm. ( $\pm 0.2$  mm.). Dorsoventrally piceous to black. Head rugose anteriorly, punctate posteriorly. Clypeal margin broadly emarginate, middle deflexed. Three frontal tubercles present, sometimes indistinct. Pronotum finely and coarsely punctate, punctures indistinct on disc; basal marginal line entire. Scutellum one-tenth the length of elytra; sparsely punctate. Elytral striae shallow, punctate; intervals shining, punctulate; humeri distinct, almost square. Mesosternum carinate between coxae. Apical metatibial spinules equal in length. First metatarsal segment not longer than next two.

Larval description: Head capsule width 1.55 mm. ( $\pm 0.13$  mm.); smooth yellow-brown. 3-4 pairs of dorsoepicranial setae.

Epipharynx with 18-21 protophobal microsensillae; protophoba bistichous on left, monostichous on right. Dexio- and laeotorma symmetrical, produced cephalad and caudad. Epitorma asymmetrical, curved toward laeotorma.

Maxilla with row of 7-10 stridulatory teeth on stipes; 1-2 such teeth on palpifer. Galea dorsally with five setae, ventrally with mesal row of 6-7 short setae. Lacinia dorsally with mesal row of six setae.

Two plicae on each abdominal segment 1-5. Prescutum with eight setae; scutum with 3-5 short and 2-4 long setae on each side; scutellum with 11-12 setae. Raster with three palidia surrounded on each side by 24-35 tegular setae.

County records: BILLINGS CO. 25-VI-65 (RJS); CASS CO. 4-VI-41 (HST); EDDY CO. 13-VI-65 (RGH); GOLDEN VALLEY CO. 23-V-22 (RLW); MCKENZIE CO. 16-VII-65 (RGH); MORTON CO. 19-V-22 (RLW).

Remarks: This species is very similar to *A. ruricola* differing mainly in the carinate mesosternum. Unlike *A. ruricola*, however, it is not a common species in North Dakota.

#### *Aphodius vittatus* Say

*Aphodius vittatus* Say, T. 1825. Proc. Acad. Nat. Sci. Philadelphia 5:191.

Adult description: Length 4.2 mm. ( $\pm 0.4$  mm.); width 1.7 mm. ( $\pm 0.3$  mm.). Head, pronotum, elytral suture, scutellum, middle-lower portions of elytra and venter black; elytra red-brown. Head slightly rugose anteriorly, punctate posteriorly. Clypeus broadly, feebly emarginate. Frontal tubercles indistinct, but present. Pronotum punctate throughout; basal marginal line entire. Scutellum one-tenth elytra length. Elytral striae very shallow, punctate; intervals shining, punctulate; humeri distinct, nearly square. Mesosternum carinate between coxae. Apical metatibial spinules equal in length. First metatarsal segment as long as next three.

Larval description: Head capsule width 1.18 mm. ( $\pm 0.06$  mm.); smooth, light yellow-brown. One posterior seta, one exterior seta, no anterior seta and one seta in anterior angle, on each side of frons. 3-4 pairs of dorsoepicranial setae.

Epipharynx with 12-14 protophobal microsensillae; protophoba bistichous on left and monostichous on right. Dextro- and laetorma symmetrical, produced cephalad and caudad. Epitorma asymmetrical, straight on left curved on right.

Maxilla with 5-10 stridulatory teeth on stipes; 1-2 such teeth on palpifer. Galea dorsally with five setae; ventrally with mesal row of eight short setae. Lacinia dorsally with mesal row of five setae.

Two plicae on each abdominal segment 1-5. Prescutum with six setae; scutum with 2-3 long and 4-5 short setae on each side; scutellum with 8-10 setae. Raster with bilobed teges of 51-81 setae.

County records: BILLINGS CO. 25-VI-65 (RJS); CASS CO. 7-VII-66 (RGH); EDDY CO. 13-VI-65 (RGH); GRAND FORKS CO. 21-VI-66 (RGH); MCKENZIE CO. 16-VII-65 (RGH); PEMBINA CO. 7-VII-66 (LK); RICHLAND CO. 19-VI-66 (RGH).

Remarks: *A. vittatus* Say apparently is restricted to cow and buffalo dung. It is collected in light traps, but not in great numbers. It is a common species during late June and early July.

*Aphodius alternatus* Horn

*Aphodius alternatus* Horn, G. 1870. Trans. Amer. Ent. Soc. 3:129.

Adult description: Length 4.5 mm. ( $\pm 0.3$  mm.); width 2.1 mm. ( $\pm 0.2$  mm.). Head, pronotum, scutellum, elytral suture and sides of elytra black. Elytra with second, fourth and sixth intervals yellow-brown; first, third and fifth black (sometimes any combination of these may be yellow-brown). Head nearly flat; shining; punctate posteriorly, punctate-rugose anteriorly. Clypeal margin feebly emarginate, sides slightly reflexed. Scutellum one-tenth the length of elytra, moderately punctate. Elytral striae deep and closely punctate; intervals shining, with moderate punctures in two irregular rows. Apical metatibial spinules equal in length. First metatarsal segment not longer than next two segments.

Larvae unknown.

County records: BILLINGS CO. 9-VI-65 (WK), 10-VI-65 (DGA); CASS CO. 29-IV-23 (WB), 20-V-39 (OO); DIVIDE CO. 15-VII-66 (RJS); GRAND FORKS CO. 17-VI-65 (RGH); NELSON CO. 4-VI-66 (RGH); WILLIAMS CO. 15-VII-66 (RJS).

Remarks: This species is widely distributed throughout the state, but limited in habitat. The biology of the species is not well understood, but is it commonly collected near the edges of standing water.

*Aphodius pseudabusus* Cartwright

*Aphodius pseudabusus* Cartwright, O. 1957. Coleopterists' Bull. 11:60.

Adult description: Length 3.9 mm. ( $\pm 0.2$  mm.); width 1.9 mm. ( $\pm 0.1$  mm.). Dorsoventrally piceous to black, shining. Head slightly convex; rugose anteriorly, punctate posteriorly. Clypeal margin emarginate, bidentate. Three frontal tubercles present, but indistinct. Pronotum moderately punctate throughout, shining; basal marginal line entire. Scutellum one-tenth elytral length; punctate. Elytral striae punctate; intervals with sparse, fine punctures appearing in two irregular rows; alutaceous at apex. Apical metatibial spinules equal in length. First metatarsal segment no longer than next two.

Larvae unknown.

County records: BILLINGS CO. 10-VII-66 (RGH); RANSOM CO. 2-VI-62 (JO); RICHLAND CO. 21-III-66 (RGH).

Remarks: This small black species is superficially similar to *A. ruricola* Melsh., but has two distinct clypeal teeth. It is found in both cow dung and prairie dog burrows.

*Aphodius lentus* Horn

*Aphodius lentus* Horn, G. 1870. Trans. Amer. Ent. Soc. 3:125.

Adult description: Length 3.1 mm. ( $\pm 0.4$  mm.); width 1.4 mm. ( $\pm 0.2$  mm.). Dorsoventrally ferruginous, dull. Head flat, punctate alutaceous throughout. Clypeal margin feebly emarginate. Pronotum alutaceous; coarsely, densely punctate; basal marginal line entire. Scutellum one-tenth elytral length; punctate. Elytral striae shallow, moderately punctate; intervals appear verrucose, with two irregular rows of setae. Mesosternum finely carinate between coxae. Apical metatibial spinules unequal in length. First metatarsal segment as long as next three segments.

Larval description: The following is an original description based on two larvae reared in July, 1966. Head capsule width .95 mm. to 1.0 mm.; smooth, yellow-brown. One posterior seta, one exterior seta, one anterior seta and one seta in anterior angle on each side of frons. Two pairs of dorsoepicranial setae.

Epipharynx (fig. 31) with 14-17 protophobal microsensillae; protophoba bistichous on left and monostichous on right. Dextiotorma produced cephalad and strongly caudad; laeotorma produced cephalad. Epitorma asymmetrical, sinuate.

Maxilla (fig. 34) with 7-11 stridulatory teeth on stipes; no such teeth on palpifer. Galea dorsally with 5-6 setae, ventrally with mesal row of 8-9 short setae. Lacinia dorsally with mesal row of five setae.

Two plicae on each abdominal segment 1-5. Prescutum with six setae; scutum with three long and four short setae on each side; scutellum with ten setae. Raster with subquadrate tegees of 25 to 30 stout setae. See fig. 25 and 28.

County records: RANSOM CO. 9-VI-62 (RDF); RICHLAND CO. 7-VI-66 (RGH).

Remarks: *A. lentus* Horn is collected in both cow and sheep dung in North Dakota. It is numerous when encountered, but these encounters are infrequent, the adult life span apparently being rather short. Specimens reared in the laboratory lived from six to eight days.

*Aphodius explanatus* LeConte

*Aphodius explanatus* LeConte, J. 1878. Proc. Amer. Phil. Soc. 17:353-472.

Adult description: Length 7.1 mm. ( $\pm 0.6$  mm.); width 3.2 mm. ( $\pm 0.4$  mm.). Head (except margins), pronotal disc and venter dark brown to piceous; elytra, pronotal sides, margins of head yellow-brown. Head densely punctate; slightly convex. Clypeal margin angulate and reflexed at sides of emargination, sides straight. Pronotum shining, punctures increasing in size from anterior to posterior, sides explanate, (especially at anterior angles; basal marginal line strongly sinuate, entire. Scutellum one-tenth the length of elytra, coarsely punctate. Elytral striae moderately punctate; intervals feebly alutaceous with two irregular rows of fine punctures. Mesosternum carinate between coxae. Apical metatibial spinules

unequal in length. First metatarsal segment not any longer than next two.

Larvae unknown.

County records: BILLINGS CO. 28-V-66 (RGH).

Remarks: *A. explanatus* LeConte inhabits the burrows of herbivorous burrowing mammals. The series represented in the North Dakota State University collection was collected as the individuals emerged from the burrows of Black-tailed Prairie Dogs, *Cynomys ludovicianus* (Ord.), in late May.

*Aphodius iowensis* Wickham

*Aphodius iowensis* Wickham, H. 1913. Psyche. 20:28.

Adult description: Length 7.25 mm.; width 3.5 mm. Most of head, pronotum, scutellum and venter rufopiceous; sides of head and pronotum and elytra red-brown. Head slightly convex, finely granulate anteriorly, finely punctate posteriorly. Clypeal margin broadly emarginate, angles broadly rounded, margin narrowly reflexed. Frontal tubercles broad and low, but distinct. Pronotum impunctate on disc; sparse, coarse punctures confined to sides; sides broadly explanate with posterior impression; basal marginal line faint on each side of middle. Scutellum one-tenth the length of elytra, sparsely punctate. Elytral striae moderate and closely punctate; intervals flat, smooth. Apical metatibial spinules vary in length. First metatarsal segment no longer than next two segments.

Larvae unknown.

County records: RICHLAND CO. 11-VI-61, 20-V-61 (RDG).

Remarks: Only two specimens were collected in the state, both at light traps.

*Aphodius criddlei* Brown

*Aphodius criddlei* Brown, W. 1928. Can. Ent. 60:19.

Adult description: Length 6.9 mm. ( $\pm 0.3$  mm.); width 3.4 mm. ( $\pm 0.2$  mm.). Dorsoventrally ferruginous. Head rugose anteriorly; punctate posteriorly; shining. Clypeal margin broadly emarginate, sides of emargination reflexed. Pronotum coarsely punctate laterally and posteriorly; sides explanate, with posterior depression on each side. Scutellum one-tenth the length of elytra; very sparsely, coarsely punctate. Elytral striae shallow, closely punctate; intervals finely alutaceous, punctulate, shining. Mesosternum flat between coxae. Apical metatibial spinules varying in length. First metatarsal segment no longer than next two segments.

Larvae unknown.

County records: BENSON CO. 4-VIII-66 (RGH); BURLEIGH CO. 13-VII-65 (RGH); PEMBINA CO. 11-VIII-65 (RGH), 3-VIII-66 (LK); RANSOM CO. 7-V-62



(SC); RICHLAND CO. 8-VI-66 (RGH); ROLETTE CO. 28-VII-62 (DGA).

Remarks: This species is collected readily at light traps throughout the state, but its biology is not understood. It is supposed that *A. criddlei* inhabits the burrows of small mammals.

*Aphodius haldemani* Horn

*Aphodius haldemani* Horn, G. 1870. Trans. Amer. Ent. Soc. 3:128.

Adult description: Length 9.2 mm.; width 4.3 mm. Entire dorsum very highly polished with a high sheen; most of head, pronotum, and venter black; pronotal sides and elytra dark red. Head finely alutaceous, slightly convex. Clypeal margin broadly emarginate, sides reflexed. Pronotum impunctate on disc; coarse punctures near posterior angles; sides explanate with posterior depression. Scutellum one-tenth elytra length, smooth. Elytral striae very shallow, punctate; intervals with micropunctules, highly polished. Apical metatibial spinules vary in length. First metatarsal segment no longer than next two segments.

Larvae unknown.

County records: RICHLAND CO. 23-IX-66 (DGA).

Remarks: This is an unusually large, shiny species. One specimen was collected in a pit trap in early fall. *A. haldemani* is believed to inhabit the burrows of burrowing mammals.

*Aphodius concavus* Say

*Aphodius concavus* Say, T. 1823. J. Acad. Nat. Sci. Philadelphia 5:214.

Adult description: Length 7.7 mm. ( $\pm 1.1$  mm.); width 3.5 mm. ( $\pm 1.1$  mm.). Entirely rufopiceous to red. Head slightly convex with mixed fine and coarse punctures at sides. Genae prominent. Clypeus broadly emarginate, rounded and fimbriate. Pronotum shining with punctules and coarse punctures at sides. Scutellum one-tenth elytra length. Elytral striae wide and deep with coarse punctures; intervals punctulate. Apical metatibial spinules varying in length. First metatarsal segment no longer than next two segments.

Larvae unknown.

County records: RICHLAND CO. 13-VII-62 (DGA), 17-VI-66 (RGH).

Remarks: *A. concavus* Say is collected at light traps and pit traps in the sandhills of Richland County. It is difficult to distinguish from *A. fucosus* Schmidt but is generally slightly larger.

*Aphodius fucosus* Schmidt

*Aphodius fucosus* Schmidt, A. 1922. Aphodiinae, Das Tierreich. Lief. 45.

Adult description: Length 6.7 mm. ( $\pm 0.5$  mm.); width 3.3 mm. ( $\pm 0.2$  mm.). Entirely rufopiceous to red. Head slightly convex with mixed fine and coarse punctures at sides. Genae prominent. Clypeus broadly emarginate, rounded and fimbriate. Pronotum shining with punctules and coarse punctures at sides. Scutellum one-tenth elytral length. Elytral striae wide and deep with coarse punctures; intervals punctulate. Apical metatibial spinules varying in length. First metatarsal segment no longer than next two segments.

Larvae unknown.

County records: BURLEIGH CO. 13-VII-65 (RGH); CASS CO. 10-VI-62 (DGA); RANSOM CO. 11-VII-62 (JO); RICHLAND CO. 15-VII-66 (RGH).

Remarks: *A. fucosus* Schmidt is very similar to *A. concavus* Say except it is generally smaller. It is somewhat more common in the state. They are collected in light traps and pit traps.

*Aphodius consentaneus* LeC.

*Aphodius consentaneus* LeConte, J. 1850. Agassiz Lake Superior p. 255.

Adult description: Length 4.5 mm. ( $\pm 0.15$  mm.); width 2.0 mm. ( $\pm 0.1$  mm.). Head, pronotal disc and legs piceous; pronotal sides and elytra fuscous. Head smooth, punctulate and shining. Clypeus nearly entire, broadly rounded at sides. Pronotum evenly punctate with basal margin entire. Scutellum one-tenth elytral length. Elytral striae deep and punctate. Intervals convex, alutaceous and punctulate. Apical metatibial spinules varying in length. First metatarsal segment no longer than next two segments.

Larvae unknown.

County records: PEMBINA CO. 7-VII-66 (LK).

Remarks: Only three specimens of *A. consentaneus* LeC. were collected at a light trap in a woodland pasture in Pembina County.

*Aphodius dentigerulus* Brown

*Aphodius dentigerulus* Brown, W. 1929. Can. Ent. 61:208.

Adult description: Length 5.0 mm. ( $\pm 0.6$  mm.); width 2.5 mm. ( $\pm 0.3$  mm.). Entirely black and shining. Head regularly punctate, rugose anteriorly. Clypeus with a subacute tooth inside each side of angulate emargination; fimbriate. Genae prominent and fimbriate. Pronotum with close, coarse punctures, basal marginal line entire. Scutellum one-tenth elytral length. Elytral striae shallow and moderately punctate; intervals flat and finely punctate. Apical metatibial spinules varying in length. First metatarsal segment no longer than next two.

Larvae unknown.

County records: BILLINGS CO. 29-V-66 (RGH).

Remarks: At the time the above specimens were caught hundreds were emerging from the entrance of Black-tailed Prairie Dog, *Cynomys ludovicianus* (Ord.), burrows.

*Aphodius coloradensis* Horn

*Aphodius coloradensis* Horn, G. 1870. Trans. Amer. Ent. Soc. 3:130.

Adult description: Length 6.2 mm. ( $\pm 0.7$  mm.); width 3.2 mm. ( $\pm 0.2$  mm.). Dorsoventrally piceous to black, shining. Head moderately punctate; slightly convex. Clypeal margin broadly emarginate, sides angulate, reflexed; tips of emargination thickened and dentiform. Pronotum with sparse, moderate punctures on disc, sides more dense with coarse punctures; basal marginal line entire. Scutellum one-tenth elytra length, very sparsely punctate. Elytral striae shallow, moderately punctate; intervals flat, finely punctate, shining. Apical metatibial spinules varying in length. First metatarsal segment no longer than next two.

Larvae unknown.

County records: BOTTINEAU CO. 17-VI-65 (RGH); CASS CO. 13-VI-59 (DN), 16-VI-62 (DGA); MCKENZIE CO. 16-VII-65 (RGH); PEMBINA CO. 7-VII-66 (LK); RANSOM CO. 25-VI-62 (DGA); RICHLAND CO. 18-VI-66 (RGH).

Remarks: *A. coloradensis* Horn is common in cow dung and often collected at light traps throughout the state.

*Aphodius distinctus* (Muller)

*Aphodius distinctus* Muller, O. 1776. Zoologiae Danicae Prodrromus.... Hafniae. p. 53.

Adult description: Length 5.0 mm. ( $\pm 1.0$  mm.); width 2.4 mm. ( $\pm 0.4$  mm.). Head, pronotum and scutellum black, legs rufopiceous; elytra yellow-brown with five extremely variable black spots, one on the side of the elytra, two at the base and two at apex. Head verrucose anteriorly, punctate posteriorly. Clypeal margin narrowly reflexed; broadly emarginate. Three frontal tubercles distinct. Pronotum sparsely and indistinctly punctate, very smooth, basal marginal line entire. Scutellum one-tenth elytral length, punctate. Elytral striae with close, coarse punctures; intervals flat, shining, with two irregular rows of indistinct punctules. Mesosternum anterior of coxae with four longitudinal carinae grouped medially. Apical metatibial spinules vary in length. First metatarsal segment no longer than next two segments.

Larvae unknown.

County records: BURLEIGH CO. 14-X-58 (RLP); CASS CO. 26-X-65 (RGH); RICHLAND CO. 31-X-65 (RGH); 13-V-66 (RJS).

Remarks: This species is collected quite commonly in early spring and late fall when it is attracted to fresh fecal deposits in large numbers. They were collected in cow, sheep, deer and buffalo dung.

*Aphodius leopardus* Horn

*Aphodius leopardus* Horn, G. 1870. Trans. Amer. Ent. Soc. 3:124.

Adult description: Length 5.7 mm. ( $\pm 0.5$  mm.); width 2.8 mm. ( $\pm 0.3$  mm.). Head, pronotal disc and venter piceous to black, sides of pronotum, scutellum and elytra red-yellow. Head slightly rugose anteriorly, punctate throughout. Clypeus very broadly emarginate, reflexed at emarginal sides. Three frontal tubercles indistinct. Pronotum shining, coarse and fine punctures mixed densely throughout; basal marginal line entire. Scutellum one-tenth elytra length, one to three punctures. Elytral striae closely punctate; intervals finely alutaceous, sparsely punctate. Apical metatibial spinules vary in length. First metatarsal segment no longer than next two segments.

Larvae unknown.

County records: BILLINGS CO. 15-VIII-66 (RGH); GRAND FORKS CO. 27-VIII-62 (RP), 5-VIII-65 (RGH); RAMSEY CO. 15-VIII-62 (DGA); RICHLAND CO. 20-VIII-65 (DGA).

Remarks: *A. leopardus* is a short-lived species frequenting cow and sheep dung the first few weeks of fall and is collected occasionally at light traps.

*Aphodius walshi* Horn

*Aphodius walshi* Horn, G. 1870. Trans. Amer. Ent. Soc. 3:132.

Adult description: Length 4.8 mm. ( $\pm 0.6$  mm.); width 2.3 mm. ( $\pm 0.3$  mm.). Head, pronotal disc, scutellum, and venter black; pronotal sides and elytra fuscous. Head sparsely, finely punctate, shining. Clypeus slightly emarginate; margin narrowly reflexed. Frontal tubercles indistinct. Pronotum shining, finely punctate with few coarse punctures; basal marginal line entire; sides fimbriate, with long setae. Scutellum one-tenth elytra length, punctate. Elytral sides pubescent; striae deep, moderately punctate; intervals convex, alutaceous, punctulate. Fore tibiae with uppermost tooth obsolete or nearly so. Apical metatibial spinules vary in length. First metatarsal segment as long as next three.

Larvae unknown.

County records: EDDY CO. 10-VI-65 (RGH); RANSOM CO. 2-VI-62 (JO); RICHLAND CO. 6-V-62 (RDF), 17-VI-65 (RGH).

Remarks: This species is common in cow dung in late spring and early summer. It does not, however, oviposit in the dung. Results from pit traps in areas of rather thick humus indicate *A. walshi* may oviposit in humus.

Genus *ATAENIUS* Harold, 1867

Species of this genus closely resemble some *Aphodius*, but entirely lack the transverse carinae of the meso- and metatibia. The accessory spinule of the metatibia (a spiniform prolongation of the outer apical metatibial angle) is unique to the *Ataenius*. The biology of *Ataenius* is only vaguely understood. Apparently the larvae develop in soils of rich organic content (Jerath, 1960). The adults are active in early spring and are commonly attracted to light traps.

KEY TO SPECIES OF *ATAENIUS*

1. Clypeus broadly rounded at emargination and sides...*spretulus*  
1'. Clypeus dentiform at emargination; angulate at sides...*texasus*

*Ataenius spretulus* (Haldeman)

*Aphodius spretulus* Haldeman, S. 1848. J. Acad. Nat. Sci. Philadelphia. 2:95-110.

Adult description: Length 4.75 mm. ( $\pm 0.15$  mm.); width 2.0 mm.; shining piceous. Head rugulose anteriorly, finely punctate posteriorly. Clypeus very broadly emarginate; wide, round edges of emargination reflexed. Pronotum with sparse, coarse punctures intermingled with fine punctures; sides fimbriate. Elytral striae deep with indistinct, wide punctures; intervals flattened, punctulate; humeri dentate. Meso- and metatibia without traces of transverse carinae. Outer apical angle of metatibia spiniform. First segment of metatarsus longer than next three.

Larvae unknown.

County records: CASS CO. 6-VI-62 (DGA); PEMBINA CO. 17-VI-66 (LK); RICHLAND CO. 7-VII-66 (RGH).

Remarks: *Ataenius spretulus* Harold is most commonly collected at light traps in eastern North Dakota. It has been collected in aged cow dung.

*Ataenius texasus* Harold

*Ataenius texasus* Harold, E. 1874. Coleopterologische Hefte. 11:23.

Adult description: Length 3.6 mm.; width 1.4 mm. Entirely piceous. Head rugulose anteriorly, coarsely punctate posteriorly. Clypeus with dentiform emargination, angulate at sides. Pronotum with dense, coarse punctures; sides not fimbriate. Elytral striae deep with wide punctures; intervals convex, shining, with one row of moderate punctures; humeri dentate. Meso- and metatibia without traces of transverse carinae. Outer angle of metatibia spiniform. First metatarsal segment longer than next three.

Larvae unknown.

County records: PEMBINA CO. 7-VII-66 (LK).

Remarks: Only two specimens of this species were collected in the upper northeast corner of North Dakota. They were collected at a U.V. light trap along with specimens of *Ataenius spretulus* (Hald.).

Genus *DIALYTES* Harold, 1869

*Dialytes criddlei* Brown

*Dialytes criddlei* Brown, W. 1929. Can. Ent. 61:210.

Adult description: Length 3.6 mm. ( $\pm 0.2$  mm.); width 1.6 mm. ( $\pm 0.1$  mm.); opaque, piceous to black. Head punctate; clypeus obtusely emarginate, with a small reflexed tip (tooth) at sides of emarginations; genae rounded. Pronotum coarsely punctate; a median, longitudinal groove apparent the length of pronotum; sides parallel; base sinuate at sides. Elytral intervals broadly carinate; striae limited on each side by a fine small carinule which is interrupted by strial punctures; humeri dentate. Sternum coarsely punctate, alutaceous. Anterior femur coarsely punctate posteriorly, enlarged. Meso- and metatibiae with only traces of transverse carinae (not more than one-third circumference of tibia). First segment of metatarsus longer than next three.

Larvae unknown.

County records: DUNN CO. 12-VII-64 (RDG); RICHLAND CO. 10-VI-66 (RGH).

Remarks: Cartwright (personal communication) states that the specimens collected in North Dakota are the first records of *Dialytes criddlei* Brown in the United States. They are exclusively limited to deer feces.

Genus *RHYSSEMUS* Mulsant, 1842

*Rhyssemus sonatus* LeConte

*Rhyssemus sonatus* LeConte, J. 1881. Trans. Kansas Acad. Sci. 7:77.

Adult description: Length 3.7 mm. ( $\pm 0.1$  mm.); width 1.7 mm. ( $\pm 0.1$  mm.); rufopiceous to piceous (usually covered, in various degrees, with clay incrustation). Head convex, surface moderately verrucose. Clypeus acute each side of emargination; sides rounded, reflexed. Genae fimbriate with 1-4 setae each. Pronotum tuberculate, with four furrows and three distinct ridges (third medially sinuate); fourth ridge very narrow, interrupted, often indistinct; sides and base crenate and fimbriate with clavate-spatulate setae. Elytral striae moderately deep; intervals with two rows of irregular tubercles. Pygidium fimbriate. Metasternum shining with median groove. Abdominal sternites alutaceous. Metatibial spur as long as first tarsal segment, not as long as first two.

Larvae unknown.

County records: BARNES CO. 2-V-64 (RDG); BILLINGS CO. 10-VI-64 (RGH), 17-VIII-66 (RGH); BOTTINEAU CO. 17-IX-66 (JK).

Remarks: *Rhyssemus sonatus* LeC. was collected in pit traps placed in open fields. The most abundant numbers have come around animal burrows, especially the Black-tailed Prairie Dog, *Cynomys ludovicianus* (Ord.).

Genus PSAMMODIUS Fallen, 1807

*Psammobius mimeticus* (Fall)

*Psammobius mimeticus* Fall, H. 1932. J. New York Ent. Soc. 40:199.

Adult description: Length 3.8 mm.; width 1.6 mm.; dull to shining red-brown to rufopiceous. Head convex, surface verrucose. Clypeus emarginate; sides rounded, reflexed and slightly arcuate. Genae fimbriate and indistinct. Pronotal surface verrucose with four transverse furrows; ridges distinct, the last being variously interrupted; sides and base crenate and fimbriate. Elytra as wide at base as pronotum; striae deep and wide; intervals convex, alutaceous shining. One small tooth on each humerus. Mesosternum shining, with a deep median groove; abdominal sternites alutaceous, crenate in front, slightly margined posteriorly. Pygidium fimbriate apically. Metatibial spur at least as long as first two tarsal segments. First tarsal segment triangular and expanded.

Larvae unknown.

County records: GRANT CO. 18-V-64 (RDG).

Remarks: Cartwright (1959) recently revised this genus for North America. Of the several species included in that paper, only *P. mimeticus* has been collected in North Dakota. However, intensified investigation of the ecology of *Psammobius* should yield several more species. They are reported to be associated with sand areas of beaches and rivers (Cartwright 1959).

Genus AEGIALIA Latreille, 1807

The biology of the *Aegialia* is poorly understood. The few specimens caught in North Dakota were taken in wind and light traps. It is apparent from these traps and from fecal investigation that these species are not associated with the more common fecal deposits (cow, sheep and deer), but are perhaps more closely associated with humus in the floodplains of North Dakota rivers. The three species collected are represented by one specimen each.

In the latest revision of this genus Brown (1931) distinguished *Aegialia* from other Aphodiinae by the dorsally exposed mandibles (the clypeus is not expanded).

KEY TO NORTH DAKOTA SPECIES OF AEGIALIA

1. Frons punctate, punctures dense and coarse; pronotum coarsely and closely punctate.....*lacustris*
- 1'. Frons impunctate, usually granulate; pronotum finely, sparsely punctate.....2
2. Pronotum with fine punctures; elytra wider than pronotum....  
.....*conferta*
- 2'. Pronotum with very coarse and fine punctures; elytra as wide as pronotum.....*rufescens*

*Aegialia lacustris* LeConte

*Aegialia lacustris* LeConte, J. 1850. Agassiz Lake Superior. p. 225.

Adult description: Length 4.2 mm.; width 2.1 mm. Dorsally dark red-brown, lighter ventrally. Head with dense, fine granules; clypeus not covering mandibles. Frons coarsely punctate. Pronotum coarsely punctate; small fovea in each lateral declivity; slightly narrower than elytra. Elytra with striae of dense, coarse punctures; intervals smooth, slightly convex. Metatibiae with strong transverse ridges on distal edge. Metatibial spurs slender, sharply pointed.

Larval description: The following larval description is taken from Jerath (1960). The larvae he described were collected in soil under willows.

Larval head capsule width 1.36 mm. ( $\pm 3.5$  mm.). Cranium yellow-white, smooth. Frons with two small depressions on each side. 3-4 microsensillae and 5-6 setae on each side of dorsoepicranium. Prophoba with 15-17 basal microsensillae. Maxilla with 15-20 stridulatory teeth. Galea with five stout, dorsal setae. Lacinia with six such setae. Abdominal segments 1-5 dorsally with 2 plicae each. Raster with teges of approximately 55 setae. Anal lobe entire.

County records: WILLIAMS CO. 23-V-64 (RDG).

Remarks: The state record for this species is in the collection of R. D. Gordon.

*Aegialia conferta* Horn

*Aegialia conferta* Horn, G. 1871. Trans. Amer. Ent. Soc. 3:293.

Adult description: Length 4.2 mm.; width 2.0 mm. Color shining red-brown. Entire head with dense, fine granules. Pronotum finely and sparsely punctate; distinct fovea in the middle of each lateral declivity. Elytra wider than pronotum; finely striate with moderate to coarse, dense punctures; intervals flat, smooth. Metatibiae stout, with feeble transverse ridge apically. Metatibial spurs foliaceous, less than twice as long as wide.

Larvae unknown.



County records: MORTON CO., Mandan, North Dakota.

Remarks: Brown (1931) cited a reference to a specimen of *A. conferta* collected in Mandan, North Dakota. No other data was given.

*Aegialia rufescens* Horn

*Aegialia rufescens* Horn, G. 1887. Trans. Amer. Ent. Soc. 14:99.

Adult description: Length 4.0 mm.; width 1.8 mm. Entirely ferruginous, shining. Head granulate, granules close. Frons impunctate. Pronotum sparsely, but very coarsely and deeply punctate; disc with indistinct fovea each side of lateral declivity; posterior angles deflexed. Elytra as wide as pronotum; humeri distinct, not dentate; striae deep with coarse punctures; intervals slightly convex, punctulate. Metatibial spurs stout, wider at middle than base.

Larvae unknown.

County records: GRAND FORKS CO. 6-VI-66 (RGH).

Remarks: One specimen of *A. rufescens* was collected in a wind trap 11 feet high at Northwood, North Dakota.

**SUBFAMILY GEOTRUPINAE**

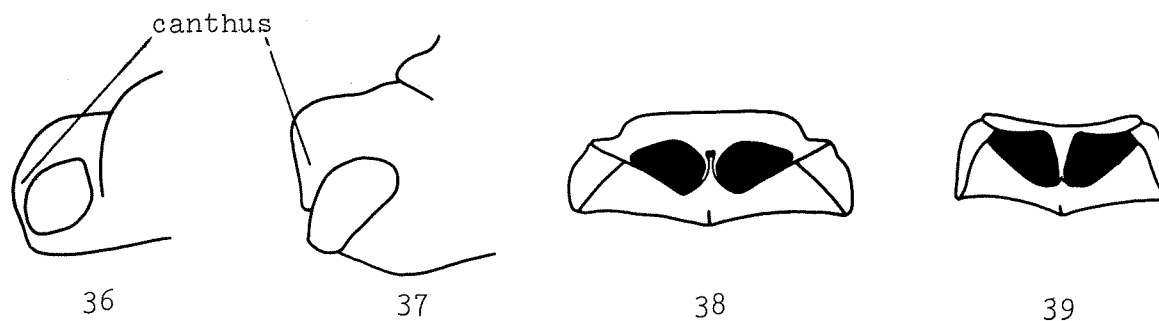
Howden (1955) offers the most complete and recent study of the North American Geotrupinae. His study gives needed information on the biology and taxonomy of these secretive beetles and indicates the need for more study in the biology of saprophagous Scarabaeidae.

North Dakota species are most commonly collected at light traps or pit traps. Adults construct a deep burrow in which they spend a majority of their life. They line this burrow with fecal material or humus for larval food. The Geotrupinae do not roll a fecal ball.

The most distinctive feature of the Geotrupinae is the 11-segmented antennae. These are the only saprophagous Scarabaeidae larvae with a three-segmented antenna.

KEY TO THE GENERA OF GEOTRUPINAE

- 1. Antennal club approximately as long as the first eight antennal segments, rounded.....2
- 1'. Antennal club only half the length of the first eight antennal segments, flattened.....*Geotrupes*
- 2. Eyes completely separated by canthus (fig. 36, pg.49).....3
- 2'. Eyes partly separated by canthus (fig. 37, pg. 49).. *Eucanthus*
- 3. Mesocoxae slightly separated by thin mesosternal projection; basic color orange-brown with areas of black to dark brown (fig. 38, pg. 49).....*Bolbocerosoma*
- 3'. Mesocoxae contiguous; color uniform brown to black (fig. 39, pg. 49).....*Bolboceras*



- Figures 36. Left eye of *Bolboceras filicornis* (Say) showing canthus completely dividing the eye (dorsal aspect).  
 37. Left eye of *Eucanthus greeni* Rob. showing canthus only partially dividing the eye (dorsal aspect).  
 38. Mesosternum of *Bolbocerosoma bruneri* D. & McC. showing mesocoxae separated by this mesosternal projection.  
 39. Mesosternum of *Bolboceras falli* (Wallis).

KEY TO THE GENERA OF GEOTRUPINAE LARVAE  
 (from Howden 1955)

1. Metathoracic legs much reduced; tenth abdominal segment obliquely flattened.....*Geotrupes*  
 1'. Metathoracic legs fully developed; tenth abdominal segment rounded.....2  
 2. Legs without claws; single conical sense organ on second antennal segment; single ventral anal lobe.....*Bolboceras*  
 2'. Legs with claws; two or more conical sense organs on second antennal segment; pair of ventral anal lobes.....3  
 3. Second antennal segment with two conical sense organs; legs 4-segmented.....*Bolbocerosoma*  
 3'. Second antennal segment with three or more conical sense organs; legs 3-segmented.....*Eucanthus*

Genus *BOLBOCEROSOMA* Shaeffer, 1906

*Bolbocerosoma bruneri* Dawson and McColloch

*Bolbocerosoma bruneri* Dawson, R. W. and McColloch, W. J. 1924. Can. Ent. 56:9-15.

Adult description: Length 11.5 mm. ( $\pm 3.0$  mm.); width 8.0 mm. ( $\pm 1.5$  mm.). Dorsally orange with black markings on entire head, posterior pronotal margin, scutellum, elytral suture and posterior third of elytra. Clypeus punctate; males with protuberance as high as length of clypeus, females with a transverse carina. Canthus completely dividing eye. Pronotum deeply and coarsely punctate; males with lateral carinae anteriorly, deep groove mesad of the lateral carinae, and a medial transverse carina widely separated and bifurcate; females with small lateral carinae, slight grooves and small transverse carina. Elytra with seven coarsely punctate striae between humeral unbone and elytral suture. Mesosternum with well developed prominence in front and between mesocoxae, which is anteriorly grooved, raised well above mesosternal surface.

Larvae unknown.

County records: BILLINGS CO. 10-VII-66 (RGH); CASS CO. 30-VI-65 (RGH); DUNN CO. 10-VI-65 (WK); EDDY CO. 26-VII-65 (RGH); RANSOM CO. 5-VII-62 (DGA); WALSH CO. 15-VII-66 (RGH).

Remarks: The biology of this species is practically unknown. The adults are collected with light traps or pit traps in areas of thick leaf litter or humus layers in grassland regions. They burrow as do all the Geotrupinae.

Genus *BOLBOCERAS* Kirby, 1818

Wallis (1928) revised this genus, then recognized as *Odontaeus* Dej., to include ten United States species, two of which occur in North Dakota.

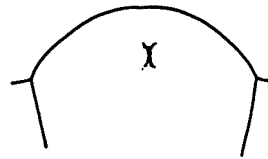
In North Dakota, shelter belts and floodplain forests offer adequate habitats where adult *Bolboceras* construct burrows in soil with a thick humus layer. Most male *Bolboceras* have a long, thin frontal horn which extends to the mid-pronotum. This feature is unique among the North Dakota saprophagous Scarabaeidae. Unlike *Eucanthus*, the eye is completely divided by a canthus in *Bolboceras* as well as *Bolbocerosoma*. The larvae have a two-segmented leg with no claws. None of the North Dakota species have yet been described as larvae.

KEY TO SPECIES OF *BOLBOCERAS*

- 1. Medial clypeal carina meets emarginate (flattened) apex of clypeus; color red-brown to light brown, never black; size small, about 7 mm. but variable; males with movable clypeal horn (fig. 40).....*filicornis*
- 1'. Medial clypeal carina absent, medial tubercle sometimes present, but never fused to entirely rounded clypeal margin; color black (red-brown in teneral specimens); size large, about 10 mm. but variable; male with fixed clypeal horn (fig. 41).....*falli*



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- Figures 40. Clypeus of *Bolboceras filicornis* (Say) showing flattened apex and medial carina (dorsal aspect).  
 41. Clypeus of *Bolboceras falli* (Wallis) showing entire clypeal margin (dorsal aspect).

*Bolboceras falli* (Wallis)

*Odontaeus falli* Wallis, J. 1928. Can. Ent. 60:151-152.

Adult description: Length 9.0 mm. ( $\pm 2.0$  mm.); width 6.5 mm. ( $\pm 1.5$  mm.). Dorsally shining black, piceous brown below (entirely red-brown in teneral specimens). Clypeus entirely rounded; acutely margined; with small medial longitudinal tubercle never meeting anterior clypeal margin; surface irregularly intersected by deep rugosities. Frontal horn of males fixed and over half the length of pronotum; females with transverse frontal carina. In male, pronotum sparsely, coarsely punctate; deep foveae mesad of well developed lateral carinae, with two small medial tubercles; in females, the characters much less distinct, medial tubercles form slight transverse carina. Elytral striae normally impressed and coarsely punctured.

Larvae unknown.

County records: BILLINGS CO. 14-VII-65 (RGH); CASS CO. 10-VII-66 (RJS); GRAND FORKS CO. 4-VIII-66 (RGH); PEMBINA CO. 7-VII-66 (RLP); ROLETTE CO. 14-VII-66 (RGH); SLOPE CO. 13-VII-65 (RGH).

Remarks: This species does not come to light traps, but numerous specimens were caught with pit traps in wooded areas of North Dakota.

*Bolboceras filicornis* (Say)

*Geotrupes filicornis* Say, T. 1823. J. Acad. Nat. Sci. Philadelphia 3:136-216.

Adult description: Length 8.0 mm. ( $\pm 1.5$  mm.); width 4.5 mm. ( $\pm .5$  mm.). Dorsally red-brown, slightly lighter beneath. Clypeus slightly rounded at the sides, but distinctly flattened anteriorly; acutely margined; medial carina appears to join apical clypeal margin; surface irregularly intersected by deep rugosities. Frontal horn of male "movable," extending half the length of pronotum; female with transverse frontal carina, no horn. In males, pronotum sparsely, coarsely punctate; deep foveae mesad of well developed lateral carinae; with two small medial tubercles; in females, these characters much less distinct, medial tubercles form transverse carina. Elytral striae weakly impressed and coarsely punctated.

Larvae unknown.

County records: MCKENZIE CO. 16-VII-65 (RGH); PEMBINA CO. 28-VII-65 (RGH); RANSOM CO. 10-VII-62 (DGA); RICHLAND CO. 15-VII-66 (RGH); WELLS CO. 8-VII-60 (DK).

Remarks: *Bolboceras filicornis* (Say) is readily collected at light traps placed near wooded areas or in grassland regions.

Genus *EUCANTHUS* Westwood, 1848

The two North Dakota species of *Eucanthus* are readily collected at light traps from May to late July. They tend to prefer the more sandy, humus covered soils of the state, which agrees with Ritcher's (1947) find-

ings. The two species, *Eucanthus lazarus* (Fabricius) and *E. greeni* Robinson are morphologically quite similar. The geographical variation of *Eucanthus lazarus* (Fabricius) is quite pronounced from east to midwestern United States.

*Eucanthus* have the eye partially divided by a canthus; a transverse bifurcate clypeal tubercle is as high as wide; similar tubercle on vertex. Larvae have three pairs of fully developed legs and three or more sense organs on the second antennal segment.

#### KEY TO SPECIES OF EUCANTHUS

1. Outer third of anterior pronotal margin arcuate or sinuate; anterior pronotal angle acute; anterior angle of canthus rounded (fig. 42).....*lazarus*
- 1'. Outer third of anterior pronotal margin nearly straight; anterior pronotal angle obtuse; anterior angle of canthus angulate (fig. 43).....*greeni*



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- Figures 42. Head of *Eucanthus lazarus* (Fab.) showing rounded anterior angle of canthus (dorsal aspect).  
 43. Head of *Eucanthus greeni* Rob. showing angulate anterior angle of canthus (dorsal aspect).

#### *Eucanthus lazarus* (Fabricius)

*Scarabaeus lazarus* Fabricius, 1775. *Systema entomologiae*. p. 11.

Adult description: Length 10.0 mm. ( $\pm 1.5$  mm.); width 5.2 mm. ( $\pm 0.7$  mm.). Dorsally red-brown; ventrally lighter. Head with clypeus coarsely punctate and quadrate; males with a short wide horn, females with transverse carina. Canthus enlarged anteriorly; angulate to round; partially covering eye anteriorly. Clypeofrontal suture distinct. Frons coarsely punctate with a strong transverse carina. Anterior pronotal angles acute; anterior pronotal margin sinuate; lateral tubercles and median transverse carina indistinct, but present. Elytral striae strong, coarsely punctate. Ventral side covered by dense, long setae.

Larval description: The larva of this species was described by Ritcher (1947).

County records: BOTTINEAU CO. 8-VII-62 (DGA); BOWMAN CO. 3-VIII-65

(RGH); BURLEIGH CO. 21-VI-65 (RGH); CASS CO. 1-VII-62 (DGA); RANSOM CO. 10-VII-62 (DGA); SLOPE CO. 18-VI-65 (JOB); WARD CO. 15-V-59 (RN); WELLS CO. 7-VII-60 (DK).

Remarks: *E. lazarus* (Fab.) is commonly collected at light traps especially in sandy grasslands in late June and July. Its range, in North Dakota, is sympatric with the very similar *E. greeni* Robinson.

*Eucanthus greeni* Robinson

*Eucanthus greeni* Robinson, M. Trans. Amer. Ent. Soc. 74:29-36.

Adult description: Length 10.0 mm. ( $\pm 1.0$  mm.); width 5.8 mm. ( $\pm 0.7$  mm.). Dorsally red-brown, ventrally lighter. Clypeus coarsely punctate and quadrate; males with a short, wide horn; females with transverse carina. Canthus enlarged anteriorly; fore angle  $90^{\circ}$  or less, partially covering eye anteriorly. Clypeofrontal suture distinct. Frons coarsely punctate with a strong transverse carina. Anterior pronotal angles obtuse. Anterior pronotal margin only slightly sinuate. Lateral pronotal margins explanate and coarsely punctured. Lateral tubercles and median transverse carina indistinct, but present. Elytral striae strong, coarsely punctate. Ventral side covered by dense, long setae.

Larvae unknown.

County records: BOWMAN CO. 3-VIII-65 (RGH); PEMBINA CO. 7-VII-66 (LK); RAMSON CO. 10-VII-62 (DGA); SLOPE CO. 21-VII-66 (JOB).

Remarks: Howden (1955) questioned the validity of *E. greeni*, feeling that the species should perhaps be relegated to a subspecies. Later, Howden (1964), recognized *E. greeni* as a distinct species.

In North Dakota, *E. lazarus* and *E. greeni* are sympatric. Gradient characters between the two at first seemed apparent, e.g., total body length, and size and shape of anterior or pronotal angle. However, the body lengths of twenty specimens were carefully measured and the anterior pronotal angles carefully compared. The mean body length of *lazarus* is 9.4 mm. with a standard deviation of  $\pm 0.742$  mm. and a range of 10.5 mm. to 8.2 mm. (See Table VIII). The anterior pronotal angle is acute (although varying somewhat) and its anterior margin is sinuate in varying degrees. The mean body length of *greeni* is 10.9 mm. with a standard deviation of  $\pm 0.678$  mm. and a range of 9.5 mm. to 12.0 mm. (See Table VIII). The anterior pronotal angle is obtuse and its margin straight. The aedeagus in both species were compared (the genital capsule is not sclerotized enough to show consistent characters in *Eucanthus*) to determine if a mechanical isolation exists between the species. Six lateral aedeagal hooks on each lobe were consistent in *lazarus*, with the longest teeth on the ventral lobe being .4 mm. long. In *greeni* there are nine lateral aedeagal hooks on each lobe and the longest teeth on the ventral lobe are .25 mm. long. The apex of the aedeagus in *greeni* is ventrally cleft and has many small spines; the apex of the aedeagus in *lazarus* is entire and has very few spines.

TABLE VIII.

COMPARISON OF TOTAL BODY LENGTHS OF *EUCANTHUS LAZARUS* AND *EUCANTHUS GREENI*

	<i>Eucanthus lazarus</i>		<i>Eucanthus greeni</i>	
1	10.5 mm	9.5 mm	10.0 mm	10.2 mm
2	8.4	10.2	11.4	9.5
3	9.8	9.4	11.3	11.4
4	9.5	10.5	10.4	12.0
5	9.1	10.0	10.8	10.8
6	8.2	9.1	12.0	10.2
7	10.0	9.2	11.0	10.3
8	8.5	8.7	11.5	11.2
9	10.3	8.2	11.6	10.4
10	8.7	10.0	10.5	11.5
range	10.5 mm to 8.2 mm		9.5 mm to 12.0 mm	
mean	9.4 mm		10.9 mm	
stand. dev.	±.742 mm		±.678 mm	

Although these two populations are sympatric, they are morphologically different and reproductively isolated (mechanically) and therefore two distinct species.

Genus *GEOTRUPES* Latreille, 1796*Geotrupes semiopacus* Jekel

*Geotrupes semiopacus* Jekel, H. 1865. Annales Societe Entomologique de France. 5:513-618.

Adult description: Length 16.0 mm. ( $\pm 3.5$  mm.); width 9.5 mm. ( $\pm 1.5$  mm.). Dorsally dull iridescent green to purple with base color black; ventrally black with some iridescence; antennae red-brown. Head variously punctate. Clypeus entirely margined; clypeal suture entire, arcuate anteriorly. Canthus well developed and margined. Pronotum convex; coarsely punctated along margins. Elytral striae well developed, anteriorly devoid of punctures. Meso- and metatibiae each with three transverse carinae, the inner carina sometimes indistinct. Mesotarsal claw and last tarsal segment of males distinctly enlarged.

Larval description: Description of the third instar is based, mainly, on Howden's (1964) recent description. Head capsule 5.2 mm. wide. Six setae on disc of labrum. One posterior seta on each side of frons, three setae in each anterior angle. Third antennal segment half as long as second, reduced. Torma united mesally. 10-11 short setae anterior to

pedium. 6-8 maxillary stridulatory teeth on stipes, two or three on palpifer. Legs three-segmented, metathoracic legs reduced, with stridulatory teeth.

County records: GRAND FORKS CO. 5-VII-66 (RGH); RICHLAND CO. 20-VII-64 (DKM), 16-VI-66 (RGH); TRAILL CO. 15-III-61 (RLP).

Remarks: *Geotrupes semiopacus* Jekel is rather widespread in the extreme eastern third of North Dakota. At one location in Richland County several pit traps were placed across a shelter belt. Thirty individuals were captured in one trap and none in the other traps. An attractant is possibly involved in the male-female relationship.

### SUBFAMILY OCHODAEINAE

#### *Ochodaeus musculus* Say

*Balvoceras musculus* Say, T. 1837. Boston Journ. N. H. 1:178.

Adult description: Length 5.8 mm. ( $\pm 0.8$  mm.); width 3.4 mm. ( $\pm 0.2$  mm.). Entirely ferruginous to rufopiceous. Head granulate with a transverse carina. Clypeus small, distinct, no tubercles. Genae expanded laterally. Pronotum convex, granulate setigerous; sides fimbriate. Elytra with feebly impressed striae and striae punctured; intervals with two irregular rows of setigerous granules. Antennae ten-segmented. Mentum flat; as long as wide; longitudinally impressed. Meos- and metatibia without transverse carinae. Metafemora of male with apical uniform tooth (this wears with use and may be indistinct).

Larvae unknown.

County records: BOTTINEAU CO. 21-VI-62 (DGA); BOWMAN CO. 3-VIII-65 (RGH); BURLEIGH CO. 13-VII-65 (RGH); CASS CO. 10-VII-62 (DGA); MORTON CO. 1-VII-65 (RGH); PEMBINA CO. 28-VII-65 (RGH); RANSOM CO. 4-VII-65 (RGH); RENVILLE CO. 7-VII-63 (DGA); RICHLAND CO. 18-VI-66 (RGH); ROLETTE CO. 28-VII-62 (DGA); SLOPE CO. 18-VI-65 (Job); WELLS CO. 9-VI-60 (DK); WILLIAMS CO. 14-VII-61 (KB).

Remarks: *Ochodaeus musculus* (Say) is commonly collected at light traps throughout the state, most abundantly during the same months as the photophilic Geotrupinae (pg. 15). It is the only species of *Ochodaeus* in northern United States, although there are many southern species.

### SUBFAMILY DYNASTINAE

In some parts of the United States these species are economically important because larvae may feed on roots of plants. North Dakota species often feed on deteriorated fecal material, especially cow manure, although they may feed on any rich organic medium. Most of the manure piles inspected on farms throughout North Dakota were inhabited by one of the two species of *Bothynus*, the only genus of Dynastinae in North Dakota.



The expanded, leaf-like mandibles, variously denticulate, are characteristic only of the Dynastinae. Larvae are large, with no sensorial appendage on the penultimate segment of the four-segmented antennae.

Genus *Bothynus* Hope, 1837

Much confusion in the nomenclature of this genus existed until Cartwright (1959) published a detailed study of the nine United States species of *Bothynus*. Casey (1915) described 32 species and five genera, based on "minor variation" in *Bothynus*. *Bothynus* have the head with distinct transverse carina; clypeus triangular, dentate; pronotum often with short apical tubercle and anterior depression; scutellum exposed; elytra with four pairs of oblique germinate striae. Only two species of *Bothynus* are reported in North Dakota.

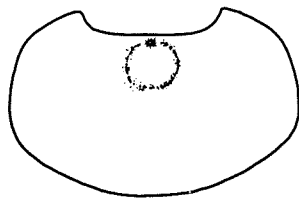
KEY TO SPECIES OF *BOTHYNUS*

Adults

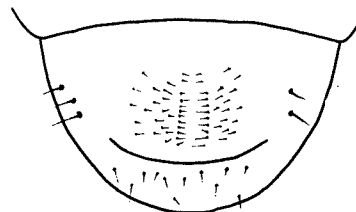
- 1. Pronotum anteriorly with a small, but distinct, median tubercle anterior at the base of a wide depression (fig. 44)...*gibbosus*
- 1'. Pronotum anteriorly smooth, lacking tubercle or depression  
.....*relictus*

Larvæ

- 1. Raster with teges (no palidia) of approximately 50 setae; cranial surface smooth to reticulate.....*gibbosus*
- 1'. Raster with palidia and tegillia of 5 to 7 irregular rows of setae; cranial surface coarsely punctate (fig. 45)...*relictus*



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Figures 44. Pronotum of *Bothynus gibbosus* (DeGeer).  
45. Raster of *Bothynus relictus* (Say).

*Bothynus relictus* (Say)

*Scarabaeus relictus* Say, T. 1825. J. Acad. Nat. Sci. Philadelphia 5:194.

Adult description: Length 20.5 mm. ( $\pm 3.5$  mm.); width 11.5 mm. ( $\pm 1.5$  mm.). Dorsoventrally piceous. Clypeus bidentate, surface rugose. Frontal carina interrupted, not extended to side margins. Pronotum convex, anterior portion smooth, lacking tubercle and depression; surface moderately

punctate. Elytra finely punctate between annular punctures of striae. Underside moderately pilose anteriorly, prosternal process smooth or only sparsely pilose.

Larval description: Larval head capsule 6.5 mm. ( $\pm 0.5$  mm.). Cranium red-brown, coarsely punctate. Single exterior frontal seta caudad of each precoilus. No anterior and posterior frontal setae. Anterior frontal angle each with 2-3 setae. Each half of dorsocranium with 3 to 5 setae. Left labral margin angulate. Left mandible without a tooth. Few chaetoparal sensilla. Raster with palidia and tegillia of 5 to 7 irregular rows of setae.

County records: BURLEIGH CO. 24-V-59 (RLP); CASS CO. 13-VI-56 (RLP); GRAND FORKS CO. 19-IX-60 (SC); RANSOM CO. 20-V-62 (JO); RICHLAND CO. 3-VI-62 (JO); SLOPE CO. 18-VI-65 (JOB); WELLS CO. 12-VI-60 (DK); WILLIAMS CO. 29-VIII-61 (RLP).

Remarks: *Bothynus relictus* (Say) is the more common species of *Bothynus* in North Dakota. It is collected at light traps from late May through August. Larvae are often abundant in old bovine fecal deposits. Larvae burrow down to 18 inches below the soil surface to pupate, or may simply pupate in the fecal source.

#### *Bothynus gibbosus* (DeGeer)

*Scarabaeus gibbosus* DeGeer, C. 1774. Memoires pour servir a l'histoire des insectes. 4:322.

Adult description: Length 13.5 mm. ( $\pm 3.5$  mm.); width 8.5 mm. ( $\pm 2.5$  mm.). Dark red-brown dorsoventrally. Clypeus bidentate, surface rugose. Frontal carina thin, sinuate; surface of frons rugose. Pronotum convex, moderate anterior median tubercle at base of distinct, wide depression; surface punctate. Elytra with fine punctures between the annular punctures of striae. Undersurface pilose, distinct prosternal process entirely pilose.

Larval description: Larval head capsule width 4.5 mm. ( $\pm 0.25$  mm.). Cranium yellow-brown, reticulate to smooth. Single exterior frontal seta caudad of each precoilus. Pair of posterior frontal setae. Anterior frontal angles each with 3 to 5 setae. Each half of dorsoepicranium with 2 setae. Labral margin entire, rounded. No chaetoparal sensilla. Left mandible with one small tooth. Raster with triangular teges of approximately 50 stout setae.

County records: BURLEIGH CO. 14-VII-64 (RJS); CASS CO. 26-VI-62 (DGA); RANSOM CO. 26-VI-62 (DGA).

Remarks: *Bothynus gibbosus* (DeGeer) is the smaller and less common species of this genus in North Dakota. It is collected at light traps in the same areas and during the same period as *B. relictus*.

### ABBREVIATIONS OF COLLECTORS' NAMES

DGA	David G. Aarhus	RN	R. Nelson
WB	William Brandvik	DN	David Noetzel
KB	Karen Brevick	JOB	James Oberfoell
SC	Student Collection	JO	Jerome Onsager
RDF	Richard D. Frye	OO	O. Osteros
RDG	Robert D. Gordon	RP	Robert Poole
RGH	Robert G. Helgesen	RLP	Richard L. Post
LK	Larry Kotchman	RJS	Richard J. Sauer
JK	James Knudson	HST	H. S. Telford
DK	Donald Kuske	RLW	R. L. Webster
CDM	C. D. Mampe	SW	Shannon Wilson
DKM	Dean K. McBride		

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#### SUMMARY

1. Saprophagous Scarabaeidae were collected throughout much of North Dakota during the summer of 1965 and 1966.
2. Specimens were obtained by direct capture, in light traps and in pit traps. The effectiveness of these methods varied with species' habits.
3. Scarabaeinae, Aphodiinae and Geotrupinae had both dung-feeding and humus-feeding species. Thirty species were dung-feeders and twelve species were humus-feeders.
4. Dung-feeding species were commonly limited to a microhabitat (a fecal deposit) where they encountered spatial competition from Diptera larvae and predation by Histeridae, Hydrophilidae and Staphylinidae.
5. Humus-feeders in the Geotrupinae constructed burrows in which they stored a food supply for larvae. Other humus-feeders appeared to be free-living.
6. Major morphological differences in adults were the clypeal margin, tibial structure and vestitures.

7. Major morphological differences in larvae were the raster setation, epipharyngeal and maxillary structure, as well as antennal and leg structure.
8. Of the fifty species distinguished in this study, fifteen species were widespread and abundant. Eleven species were uncommon, perhaps because of limited distribution or rare occurrence, or sampling deficiencies.
9. *Aphodius omissus torpidus* Horn was considered a variant of the species *Aphodius omissus* LeC. because *A. omissus omissus* LeC. and *A. omissus torpidus* Horn are sympatric throughout North Dakota and no reproductive isolation could be found between these two populations.
10. *Eucanthus greeni* was considered a distinct population from *E. lazarus* based on morphological and reproductive differences.
11. *Dialytes criddlei* Brown was reported in the United States for the first time.
12. The larvae of *Aphodius lentus* Horn and *A. ruricola* Melsh. were described for the first time.