

The Volvating Scarabaeid Beetles of Virginia (Coleoptera: Scarabaeidae: Ceratocanthinae)¹

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ABSTRACT

All three North American species of the scarabaeid subfamily Ceratocanthinae are reported from Virginia, two of them for the first time. *Germarostes globosus* is widespread at low elevations, *G. aphodioides* is documented only for the far southwestern end of the state, and *Ceratocanthus aeneus* (new northernmost record) only for Virginia Beach. An identification key and drawings of diagnostic characters are provided.

Key words: beetles, Ceratocanthinae, Coleoptera, distribution, Scarabaeidae, Virginia, volvation.

Almost every group of organisms contains species which have become so modified in body form that any obvious indication of their actual relationships is effectively concealed. This phenomenon is particularly engaging when the constituent group is relatively uniform in appearance and generally recognized by some vernacular name. A case of this sort in the Virginia insect fauna is demonstrated by three local members of the genera *Ceratocanthus* and *Germarostes*, which have departed from the familiar scarab image by their adaptation to a nearly spherical body form.

Volvation as a means of protection (or water conservation) has evolved in a number of animal groups (armadillos, isopods, millipeds, beetles), and this capability has been achieved by several different structural modifications. In some beetles, such as *Agathidium oniscoides* (Leiodidae), the entire forebody hinges back against the strongly convex elytra, with legs and antennae hidden inside the marginal seam formed by the juxtaposed pronotal and elytral edges. *Ceratocanthus aeneus* also achieves a globular shape by partially reflexing its forebody ventrad, but uses the broadened

tibiae of the middle and rear legs as visible external elements in the closure, in a highly singular adaptation (Fig. 1).

The great majority of known ceratocanthid species and genera are tropical in distribution; only two genera and three species, all of them native to Virginia, are represented in the United States. In addition to not looking like typical scarabs, ceratocanthids are underrepresented in collections, and appear to be found largely by serendipity. Perhaps this situation can be improved when we know more about their preferred habitats and way of life. Some species of *Ceratocanthus* are stated by Gill & Howden (2000) to feed at night on fungi growing on rotting logs; perhaps our local species might also be sought in light of such information.

Key to the North American genera and species of Ceratocanthinae

1. Body capable of enrolling into a compact sphere; elytral striae represented over most of surface only by series of minute punctures; posterior corner of pronotum broadly rounded (Fig. 3), its entire surface smooth and impunctate *Ceratocanthus aeneus*
- Body capable of forming an elongated subcylindrical form only; elytral striae represented by series of elongated short grooves; posterior corners of pronotum right-angled (Fig. 5, 6), surface punctate 2

¹Up until about 1970 this group occurred in the literature under the names Acanthocerinae or Acanthoceridae. Since the actual ranking of the group has been perceived in different ways, it has appeared in more recent literature as Ceratocanthini or Ceratocanthinae in either Scarabaeidae or Hybosoridae, or as a discrete family Ceratocanthidae. Until the currently fluctuant classification of scarabaeids has achieved some level of stability, I prefer to observe the traditional (pre-2000) nomenclature that is still followed by some conservative scarab specialists.

2. Lateral edge of elytra (epipleuron) tuberculate-serrate (best seen in dorsal aspect); front of head with fine striations arranged in transverse rows or concentric ("fingerprint") pattern; pronotum (Fig. 5) with a sharply-defined, deep groove adjacent to anterior, lateral, and posterior edges; anterolateral corner of pronotum acutely prolonged, subtending ventral margin of eye.....*Germarostes globosus*
- Lateral edge of elytra smooth; striations on front of head not concentric; pronotum (Fig. 6) with submarginal groove only behind front edge; anterolateral corner of pronotum only slightly rounded behind eye, not subtending it.....*Germarostes aphodioides*

Ceratocanthus

This exclusively New World genus (formerly known as *Acanthocerus*) is most speciose in South America, whence over 40 species have been described. Only one extends as far north as southern United States, where it is the least frequently collected of our three endemic species.

Ceratocanthus aeneus (MacLeay) (Figs. 1-4).
New state and northernmost record

As noted by Woodruff (1973), this species is one of the least collected of American scarabaeoids, estimated by him to be represented by fewer than 15 specimens in all collections at that time. The range known to Woodruff included United States south of North Carolina and Tennessee. It is now possible to extend this area slightly northward on the basis of two recently-collected specimens.

City of Virginia Beach: First Landing/Seashore State Park, 23 June - 6 July 2003, Robert Vigneault (VMNH 2). This locality is 310 km (192 miles) northeast of Southern Pines, N.C., where recorded by Brimley (1938).

However, the insect collection at NCSU has a single specimen of *C. aeneus*, collected by Tom Daggy during July 1980 in Iredell County [without further locality], North Carolina. This county is slightly north of Southern Pines; its location in the western Piedmont demonstrates that the species is not restricted to the Coastal Plain and may be found in the Piedmont region of Southside Virginia.

Of the three Virginia ceratocanthids, *C. aeneus* is most completely modified for volvation, its forebody larger and hindbody more convex than in the species of *Germarostes*. When the animal is enrolled, the flattened tibiae are incorporated as integral units of the sphere, with their truncate distal edges making a complete midventral contact and the posterior edge of pro- and mesotibiae

overlapping the anterior edge of the tibiae following (Fig. 2). The antennae are entirely concealed by the protibiae and lateral end of the pronotum. The meso- and metatarsi are hinged to lie back against the inner tibial surface (Fig. 4), and protarsi are retracted into the midventral space closed by the mesotibiae.

Woodruff (1973) reported captures by beating dead vines in Florida. A more precise biotope was described by Choate (1987): a basal cavity in a floodplain tree in Liberty County, Florida, that contained both adults and immature stages. Such tree holes are apparently primarily developmental sites, as adults were sometimes not present, and were noted to vacate the hole after merging from their pupal stage (early June in Florida). If adults resort to flowers for feeding, they have apparently not been specifically captured at such resource sites. Choate (1987) observed that adults fly readily and effectively, and surmised that canopy-flowering plants might be implicated. But perhaps like other ceratocanthids they normally feed upon fungi.

The specimens from Virginia Beach were taken by general beetle techniques (e.g., beating, de-barking, etc.) and the collector did not individualize the precise habitat of small nondescript species.

Germarostes

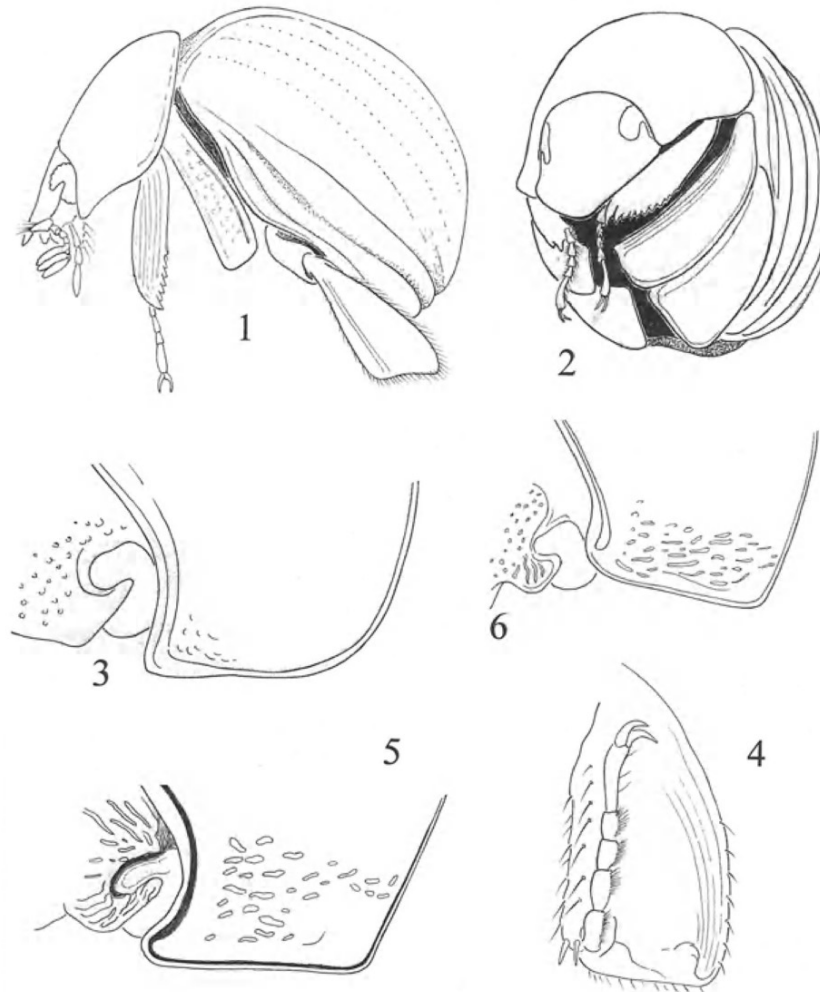
Prior to 1980, this genus appeared in American literature (e.g., Woodruff, 1973) under the name *Cloeotus*. *Germarostes*, proposed by R. Paulian (1982) to accommodate North American species, has found universal acceptance in recent literature.

In this genus the body form is relatively elongated, and as a result, even though the forebody (head and thorax) folds back upon the ventral side of the hindbody and the tibiae are flattened and enlarged to help close a ventral cavity, the effect is more compressed-oviform or lenticular than the nearly spherical form assumed by *Ceratocanthus*.

Germarostes globosus (Say) (Figs. 5, 7).

As currently defined, this species occupies an extensive range: from Pennsylvania and Illinois southward through much of South America. In Virginia, it appears to occur statewide at low elevations, although the majority of records are for the Coastal Plain and eastern Piedmont (Fig. 7).

VMNH has material from Appomattox, Bath, Brunswick, Dickenson, Dinwiddie, Essex, Fairfax, Greenville, Halifax, Isle of Wight, Lee, and Prince William counties, and the cities of Suffolk and Virginia Beach. All of the 33 specimens were collected between mid-May and early July, most of them having been



Figs. 1-6: Fig. 1. *Ceratocanthus aeneus*, lateral aspect of "unrolled" specimen with the hindleg pulled out of the reflexed position assumed by the front and midlegs. Fig. 2. *C. aeneus*, oblique anteroventral view of specimen in which the truncate ends of the tibiae are not completely in contact and tarsi of front legs are visible. In complete enrollment all of the edges surrounding the space shown in black would be in tight contact. Fig. 3. *C. aeneus*, lateral aspect of pronotum and ocular region of head. Fig. 4. *C. aeneus*, inner surface of tibia of rear legs, with tarsi shown in their normal retracted position. Fig. 5. *Germarostes globosus*, lateral aspect of pronotum and ocular region of head, showing complete submarginal groove (black). Fig. 6. *G. aphodioides*, lateral aspect of pronotum and ocular region. Figs. 1 and 2 drawn to same scale, figs. 3-6 to same scale but enlarged.

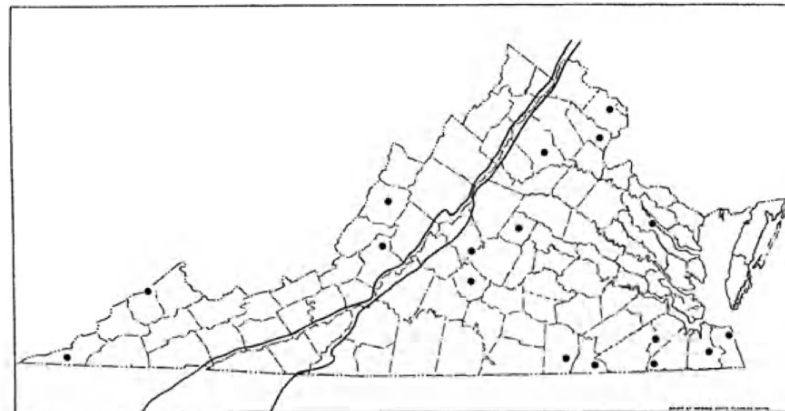


Fig. 7. Distributional records for *Germarostes globosus* in Virginia. Capture sites in the western-most counties are discussed in the text. The Blue Ridge is indicated by the outlined oblique area.

attracted to UV lights. USNM specimens add the counties of Botetourt, Culpeper, Fluvanna, and Nelson, and the City of Chesapeake, and one extends the season of adult activity into September.

The localities in Bath County (Cowpasture River at Rt. 629 bridge, 6.4 km N of Millboro Springs, 9 June 1999, S. M. Roble) and Botetourt County (8 km SSE of Clifton Forge, May 1982, W. E. Steiner) would at first appear to be disjunct from the bulk of the species' range in Virginia (Fig. 7), but many "austral" or lowland species are known to follow the floodplains of large rivers far into western Virginia, and *G. globosus* may correspond to this pattern.

Localities in Dickenson and Lee counties are consistent with an austral ("Carolinian") distribution pattern which extends northward both east and west of the southern Appalachians.

***Germarostes aphodioides* (Illiger) (Fig. 6).**

New state record

The documented range of this species is extensive: generally south of a line drawn between the District of Columbia, and Illinois (Woodruff, 1973, fig. 397) but more recently recorded also from southeastern Nebraska (Ratcliffe, 1991) and southern Ontario (Howden, 1992). It may occur statewide in Virginia, but the only specimens examined are from the extreme southwestern end of the state, adjacent to the Kentucky border.

Lee Co.: Cedars Natural Area Preserve, ca. 10 km SW of Jonesville, limestone barren, 25 May 2002, C. S. Hobson (VMNH 1). *Dickenson Co.*: Breaks Interstate Park, 10 km N of Haysi, 1-14 July 2000, Robert Vigneault (VMNH 1).

Harpootlian (2001) cited *G. aphodioides* only from Clemson and Greenville in westernmost South Carolina. Brimley (1938) did not list the species, and I am not aware of any published records for North Carolina. It is therefore desirable to confirm its presence there from two specimens in the NCSU collection. *Mecklenburg Co.*: Davidson, 26 April 1954, T. Daggy (1). *Wake Co.*: Raleigh, 7 June 1980, D. L. Stephan (1). Since Raleigh is on the Fall Line, only 50 miles south of Virginia, it seems probable that *G. aphodioides* will be found in central or eastern areas of this state, confirming the old "D.C." record (Ulke, 1902) which has heretofore seemed "out of range" (if not a little suspect).

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Conservation and Recreation, and I am indebted to Dr. Steven M. Roble for placing them in my hands for study. The remaining specimens, including the only instate material of *C. aeneus*, were collected for the museum by Robert Vigneault (Oka, Quebec). Information about these species in the North Carolina State University collection (NCSU) was obtained through the cooperation of Dr. Lewis L. Deitz, curator, and Robert L. Blinn, collections manager. Dr. Brett C. Ratcliffe kindly provided relevant pin label data from USNM specimens on long-term loan to his laboratory at the University of Nebraska.

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