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Back cover: Indian Cucumber-root (Medeola virginiana), original drawing by John Banister.
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An Annotated List of the Caddisflies (Trichoptera) of Virginia: Part III. Emendations and Biogeography

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ABSTRACT

Ten species of caddisflies collected in Virginia since 2007 are added to the list of known native species occurring in the Commonwealth, bringing the total to 361. Most species are more or less statewide in distribution, but for others a clear distinction between boreal and austral patterns is evident, apparently reflecting environmental constraints of the immature stages. A considerable number of species reach their range limits within the state, mostly as the southern extremity of northern forms, but northern and eastern terminations are also evident. Several cases of lowland disjunctions of montane species are noted. A possible total of 400 resident species does not seem unlikely.

Key words: Caddisflies, distribution, Trichoptera, Virginia.

INTRODUCTION

The two preceding parts of our summary of the caddisfly fauna of Virginia (Flint et al., 2004, 2008) documented a total of 351 species confirmed as native to the Commonwealth, 73 of them hitherto unpublished records. Ten additional species discovered by recent collecting increase the total to 361 species, surpassing the numbers published for Alabama (Harris et al., 1991) and Tennessee (Etnier et al., 1998) for the greatest known diversity of any eastern state.

Nonetheless, since a number of other species are known to occur in adjacent states north, west, and south of Virginia, it is inevitable that continued inventory work will discover instate populations of many of these potential additions and this seems especially true for species of Hydroptilidae. Although collections have been made in virtually all of Virginia’s political divisions, the fact that so many of our resident species are known from less than five counties indicates that 361 is by no means an accurate approximation of the actual number of these insects that occur in this state. As many as 400 species does not seem unlikely, an estimate that seems justified by the following ten additions, all of which were made during the past several years, and seven of them from Caroline County, from which 56 species were previously known.
I. ADDITIONS TO THE TRICHOPTERA FAUNA OF VIRGINIA

*Hydropsyche (H.) decalda* Ross: This seldom reported species is known all along the Gulf Coast states from Texas to Florida and up the Atlantic Coastal Plain as far as southern Delaware with a questionable record from Connecticut. This is the first report from the Coastal Plain in Virginia. Caroline Co., Lonesome Gulch Pond, Fort A.P. Hill Mil. Res., 38.102°N, 77.343°W, 10 June 2008, 2♂, 1♀ (NMNH); same, but Lonesome Gulch beaver pond, 26 May 2009, 3♂ (NMNH).

*Orthotrichia dentata* Kingsolver & Ross: Originally described from Florida, the species subsequently has been recorded from Mississippi and South Carolina. This is the first record from Virginia where it was taken in the Coastal Plain. Caroline Co., Jordan Crossing Pond, Fort A.P. Hill Mil. Res., 38.148°N, 77.375°W, 10 June 2008, 1♂ (NMNH); same, but 26 May 2009, 6♂, 3♀ (NMNH); same, but Lonesome Gulch, beaver pond, 38°06.1'N, 77°20.6'W, 20 July 2009, 26♂, 8♀ (NMNH); same, but Turkey Track Cr., pond above Jeff Davis Dr., 38°07.2°N, 77°22.1'W, 21 July 2009, 4♂, 10♀ (NMNH).

*Oxyethira anabola* Blickle: This species has a wide distribution in eastern North America. It is reported from Newfoundland west to Michigan and south to Alabama, with most records from New England. This first record from Virginia is from the Coastal Plain. Caroline Co., Jordan Crossing Pond, Fort A.P. Hill Mil Res., 38.062°N, 77.370°W, 10 June 2008, 1♂ (NMNH).

*Oxyethira glasa* (Ross): This is a species primarily of the southeastern United States, being reported from Oklahoma and Louisiana east to Florida and north to South Carolina. Although only females have been taken in Virginia, the identification seems certain. Cleared females were compared with cleared females from a series containing both sexes collected in Florida, and they were found to be identical. It is another species taken up to now only in the Coastal Plain at Fort A.P. Hill in Caroline County. Caroline Co., Fort A.P. Hill, Turkey Track Cr., pond above Jeff Davis Dr., 38°07.2°N, 77°22.1'W, 21 July 2009, 6♀ (NMNH); same, but Lonesome Gulch, beaver pond, 38°06.1°N, 77°20.6'W, 20 July 2009, 1♀ (NMNH).

*Triaenodes nox* Ross: The species has a widespread, but scattered, distribution in North America, being recorded from Quebec south to Florida and west to Wisconsin and Mississippi with an outlying record from British Columbia. This first record from Virginia is from the upper Coastal Plain. Caroline Co., Turkey Track Cr., Jeff Davis Dr., Fort A.P. Hill, 38°07.2°N, 77°21.1'W, 26 May 2009, 1♂ (NMNH).

*Chimarra floridia* Ross: This species is another one limited to the Coastal Plain, being recorded from New Jersey to Florida and west to Mississippi. Lago & Harris (1987) recorded variants in the genitalia of this species - this one from Virginia is very similar to the variant from New Jersey. These are the first examples known from Virginia. Caroline Co., Jordan Crossing Pond, Fort A.P. Hill Mil. Res., 38.148°N, 77.375°W, 10 June 2008, 1♂ (NMNH); same, but 26 May 2009, 4♂ (NMNH); same, but outlet creek, Jordan Crossing Pond, 57♀ (NMNH); same, but Lonesome Gulch, beaver pond, 38°06.1°N, 77°20.6'W, 4♀ (NMNH); same, but Turkey Track Cr., pond above Jeff Davis Dr., 38°07.2°N, 77°22.1'W, 21 July 2009, 1♀ (NMNH).

*Paranyctiophylax banksi* (Morse): This is another wide-ranging, but seldom reported, species of eastern North America. It is recorded from Quebec west to Minnesota and south to Alabama and Mississippi (these latter two records may be misidentifications of the closely related *P. barrorum*, J. C. Morse in litt.). This new record from Virginia is from the Cumberland Plateau in the far western part of the state. Dickenson Co., Breaks Interstate Park, porch at motel, 4 June 2008, 1♂ (NMNH).

*Polycentropus carlsoni* Morse: This is a rarely reported species known previously only from Alabama, South Carolina, and North Carolina. In addition to the below recorded collections, there is a single male from Montgomery County, Maryland in the NMNH. The Virginia collections were made primarily from a small trickle, which may dry up in summer, that is a tributary to the Potomac River. Fairfax Co., Turkey Run Park, Gulch stream, 38°57.9°N, 77°09.7°W, 9 collections, 2 May-21 Oct 2008, 12♂, 12♀ (NMNH); same, but W riverside, 38°58'N, 77°09.6°W, 23 Aug-18 Sep 2006, 1♂ (NMNH); same, but 3 collections, 18 May-27 Sep 2007, 6♂, 1♀ (NMNH); same, but 5-19 June 2008, 1♂ (NMNH); same, but riverside, 38°57.9°N, 77°09.4°W, 31 May-13 Jun 2007, 1♂ (NMNH); same, but by headquarters, 38°57.4°N, 77°08.5°W, 19 September-11 October 2006, 1♂ (NMNH). VA: Fairfax Co., Great Falls, swamp trail, 38°59.4°N, 77°15.2°W, 12-26 Jul 2007, 1♂ (NMNH).
Rhyacophila simmonsi: This species was recently described based on a series of males and larvae collected in southwest Virginia (Armitage, 2008). It is a member of the lieftincki group, 12 species of which are found in eastern and southeastern Asia, one in western North America, and now R. simmonsi in Virginia.

Smyth Co., N Fork Holston River, RM 85.6, Bradford Ford near McCready, 36.903°N, 81.734°W, 16 March 1990, 6♀ (NMNH, ROM, BJAC); same, but RM 91.6, 6 Nov 1988, 2 larvae.

Agarodes crassicornis (Walker): This species is an inhabitant of the Atlantic Coastal Plain, recorded from Maryland to Florida and Mississippi. There is a pair of examples from the Pine Barrens in eastern New Jersey in the collection of the NMNH. The Virginia collection is from the Coastal Plain.

II. BIOGEOGRAPHIC PATTERNS

Although our knowledge of caddisfly distribution in Virginia is still woefully incomplete, existing information is sufficient to permit some general inferences about the different patterns of dispersal, here summarized as a set of models to be tested by subsequent collecting activities. These images are presented in two major categories, one treating species’ ranges in the broad sense, the other categorizing patterns as expressed within the state by groups of species collectively.

A. Instate Distributional Limits

The known ranges of a number of caddisflies terminate somewhere in Virginia, reflecting the basic distribution of the species. Some categories are very provisionally recognized, with several representative species cited for each.

1. Southern Appalachian taxa known in Virginia only from the Mount Rogers-White Top massif include Arctopsyche irrorata, Parapsyche cardis, Wormaldia mohri, Rhyacophila mycta, and Lepidostoma mitchelli.

Several species, however, extend somewhat farther northward, typically along the Blue Ridge, with their terminal county indicated: Phylotanypus auriceps (Franklin), Cheumatopsyche etrona, Psychopsyche flavata, and Goerita semata (Patrick), Brachycentrus spinae (Amherst), Lepidostoma tibiale (Giles), Hydropsyche coveetensis, Dolophilodes major, and Rhyacophila teddyi (Page-Madison).

2. Species restricted to southern United States whose ranges terminate in the Virginia Coastal Plain include Orthotrichia dentata, Oxyethira glasa, and Ceraclea protoenepha.


4. Many caddisfly taxa whose basic distributions lie to the north of Virginia extend southward through the Appalachians at increasingly higher elevations, ending in the Great Smokies or northern Georgia. However, a number of such species occur no farther south than somewhere in western Virginia. Some representatives with their county of record are: Glossosoma lividum (Bath), Cheumatopsyche gracilis (Washington), Homoplecta monticola (Wythe & Tazewell), Hydropsyche walkeri (Washington), Agraylea costello (Giles), Hydropsyche dentata (Rockbridge), H. metoeca (Smyth), Ochrotichia demingi (Botetourt), Polycentropus pisi (Bath), Rhyacophila manistee (Smyth), and Nemotaulius hostilis (Highland).

Several northern species occur in Virginia as populations seemingly very disjunct from the main body of their known ranges: Hydropsyche acedia (Dismal Swamp region, from Nova Scotia), H. ajax (Washington Co., from West Virginia and Kentucky), H. eramosa (Tazewell Co., from Ontario), and Ceraclea rufae (Highland Co., from northern Pennsylvania).

5. A smaller contingent of species with “interior/Midwestern” distributions occurs in western Virginia in the tier of counties adjacent to West Virginia and Kentucky. Some represent apparent disjunctions from the main body of the species’ range: Hydropsyche artesa (Bath Co., from the Ozark region), H. lonchera (Louisa Co., from a Cumberland Plateau – New Hampshire range), and Polycentropus interruptus (southeastern counties, from Tennessee).

B. Instate Distributional Patterns

The extent to which the caddisfly fauna of the cities and counties of Virginia has been sampled is indicated by Fig. 1. On that as well as all other maps, the Fall
Fig. 1. The counties of Virginia with number of documented caddisfly species indicated for each, including several former counties that became co-extensive when incorporated as cities. Lack of space did not permit entries for small independent cities (e.g., Galax, Radford).

Fig. 2. County distribution for *Oecetis inconspicua*, the most frequently-collected species in our fauna. The lack of records for Bath County, otherwise with 119 species, is remarkable.
Line is shown by an undulate broken line, and the Blue Ridge set off by two solid lines running northeast-southwest. The very uneven distribution of numbers of species reflects both accessibility of collecting sites, collector bias, and specific site emphasis, as well as the actual diversity of the region. It is likely, for instance, that the fauna of the two Eastern Shore counties will not be much greater than the current figures suggest. Few counties in the Coastal Plain per se are likely to harbor more than about 50 species. Twelve counties and (county-sized) cities in Virginia currently have only one to three confirmed species, with four additional counties completely lacking caddisfly records.

The high figures for Caroline, Hanover, and Greensville counties reflect their location on the Fall Line, with both warm and cool water habitats as well as preferential collecting. Low numbers in the central and southern Piedmont are due primarily to neglect.

Counties in and west of the Blue Ridge vary widely in terms of their known faunas, largely a function of collector bias, but it is reasonable to assume that most of them are inhabited by as many as 150 species.

If geomorphic units are distinguished instead of political boundaries, it is entirely likely that the Mount Rogers/Iron Mountain region contains at least 200 caddisfly species, for instance.

A large number of our species are essentially statewide in range, as exemplified by what is doubtless our most frequently collected species, *Oecetis inconspicua* (Fig. 2). It is a singular fact that this euryzonal species has not yet been found in Bath County, which boasts the greatest number of resident species.

Aside from the euryzonal species that occur nearly statewide, the most pervasive distributional pattern reflects the classic dichotomy of warm- vs. cold-adapted species. For caddisfly larvae, this translates into the combination of temperature, oxygenation, and chemical composition of the water in which they live. By looking at spot maps for those species that are preferential collecting. Low numbers in the central and southern Piedmont are due primarily to neglect.

A considerable number of species are widespread on and west of the Blue Ridge (Fig. 8): *Prototila maculata*, *Cheumatopsyche gracilis*, *C. minuscula*, *C. sordida*, *C. wrighti*, *Hydropsyche chelonis*, and *H. potomacensis*.

7. Mountains and Piedmont only, e.g., *Cheumatopsyche campyla*, *C. ela*, *C. geora*, *Hydropsyche bronta*, *H. scalaris*, *H. sparna*, *Macronemum zebratum*, *Chimarra aterrima*, *C. obscura*, *Mystacides sepulchralis*, and *Psychomyia flavida*.

A considerable number of species are widespread on and west of the Blue Ridge, but also occur across the *northern* third of the Piedmont, west of a line between Charlottesville to Arlington. This is curious because the climate of the northern Virginia Piedmont is as warm as that anywhere in the state.

**Unusual patterns**

8. A surprisingly large number of species are documented in Virginia so far only from the Blue Ridge itself (Fig. 10): *Agapetus pinatus*, *Cheumatopsyche halima*, *Dolophilodes major*, *Rhyacophilla appalachia*, *R. teddyi*, *Adicrophleps hitchcocki*, *Brachycentrus spiniae*, *Merasema burksi*, and *Goerita stylata*. Such a geographic constraint is curious, perhaps representing surviving populations of species that formerly existed also westward in the Alleghenies.
Fig. 3. County distribution of *Ocectis osteni*, a species basically restricted to the Coastal Plain in Virginia. The single disjunct spot in Lunenburg County possibly represents the capture of an adventive individual; confirmation of this record is desirable.

Fig. 4. County distribution of *Hydropsyche rossi* (▲) and *Macrostemum carolinum* (●), two Coastal Plain species which extend sporadically westward onto the Piedmont.
Fig. 5. County distribution of *Oecetis nocturna*, an example of an "austral" species that also occurs west of the Blue Ridge at lower elevations (recent peripheral migrants?).

Fig. 6. County distribution of two caddisflies whose ranges in Virginia are restricted to the Piedmont: *Hydropsyche catawba* (▲) and *H. mississippiensis* (●).
Fig. 7. County distribution of *Banksiola dossnaria*, a species of northern affinities that occurs in Virginia at elevations above 1,000 meters in the Alleghanies and Cumberland Plateau regions.

Fig. 8. County distribution of *Hydropsyche potomacensis* (•) and *Cheumatopsyche wrighti* (▲), occurring in both the Blue Ridge and Alleghanies.
Fig. 9. County distribution of *Mystacides sepulchralis*, widespread in the Piedmont and mountains but absent from the Coastal Plain, a common pattern among Virginia caddisflies.

Fig. 10. County distribution of *Dolophilodes major*, one of several species known only from the Blue Ridge.
9. An interesting pattern reflects the classical “Lower Austral” distribution: widespread east of the Blue Ridge but also present in the far southwestern counties, where the valleys of the upper Tennessee River system, as well as the adjacent low mountains of the Appalachian Plateau, are occupied (Fig. 11). This pattern is seen in a considerable number of strictly terrestrial organisms, vertebrates as well as arthropods. Caddisfly examples include *Phylocentropus placidus*, *Nectopsyche pavida*, and *Ironoquia kaskaskia*.

10. A substantial number of species occur in Virginia only in and west of the New River Valley, but exclusive of the Iron Mountain region (Fig. 12). Some of these are quite local, some are dispersed westward in the Cumberland Plateau, a few others (e.g., *Rhyacophila atrata*) extend far northward. Without sorting into such categories, this caddisfly fauna contains: *Agapetus tonus*, *Hydropsyche bassi*, *H. depravata*, *H. etnieri*, *H. rotosa*, *Hydroptila eramosa*, *H. fiskei*, *H. grandiosa*, *Rhyacophila otica*, *Neophylax acutus*, *N. etnieri*, and *N. toshioi*.

11. The distribution of one common species commands attention. *Phryganea sayi* (Fig. 13) appears at first glance to be statewide, but available records indicate three prominent lacunae. There are no collections from Virginia Beach, Chesapeake, and the two Eastern Shore counties, all of which have been extensively surveyed in recent years, although the species extends as low as sea level in Mathews, York, and Lancaster counties. There are no records for the central and northern Alleghanies, north of Clifton Forge, even for thoroughly sampled Bath County and the northern Blue Ridge. Thirdly, there are no records for the Mount Rogers region: Smyth, Grayson, and Washington counties. This large and usually abundant caddisfly could scarcely be overlooked in even the most superficial collecting. Elevation is not a factor: *P. sayi* has been found above 3,000 feet (900 m) in both Tazewell and Floyd counties.

12. Last, but surely not least, is a small contingent of species whose ranges are basically montane, but which also occur at favorable sites on or below the Fall Line in eastern Virginia (Fig. 14): *Lepidostoma tibiale*, *Ceraclea diluta*, *Limmephilus moestus*, and *Trianeodes perna*. Existing records imply that these species apparently are absent from the Piedmont. Perhaps such insects are Post-Pleistocene climatic relics that survived the warmer Hypsithermal Interval in localized cool habitats.

EPILOGUE

In retrospect, it is obvious that current knowledge of the caddisfly fauna of Virginia is scarcely more than a window into a future of unlimited discoveries: still more additions to the state fauna, new localities for both counties and species which are now so poorly represented, even still undescribed species. It is hoped by the compilers of the present list that a future generation of investigators will be challenged to confront the problems we have uncovered and exploit the world of discoveries afforded by the caddisflies themselves. Preparation of a comprehensive *Trichoptera of Virginia* should now be regarded as an attainable goal.

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LITERATURE CITED


Fig. 11. County distribution of *Nectopsyche pavida*, an austral species that extends northward in the Cumberland Plateau region and occurs in extreme southwest Virginia while absent from the Blue Ridge and folded Appalachians.

Fig. 12. County distribution for two species of western affinities confined to the Alleghany and Cumberland Plateau regions, west of the New River Valley: *Hydropsyche depravata* (●) and *Neophylax toshioi* (▲).
Fig. 13. County distribution of *Phryganea sayi*, a common species for which there are no extant records for several well-sampled regions of Virginia.

Fig. 14. County distribution of *Lepidostoma tibiale* (●), a southern Appalachians endemic represented by disjunct populations on or near the Fall Line, and *Limnephilus moestus* (▲), a boreal species extending as far south as North Carolina, with two relict populations known from the Coastal Plain. *Triaenodes perna* (★) represents a similar distribution.


*Banksiola crotchi* Banks (from Ross, 1944).
Bees (Hymenoptera: Anthophila) of a Riverside Outcrop Prairie in Fairfax County, Virginia

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ABSTRACT

The bees (Hymenoptera: Anthophila) of a riverside outcrop prairie in Fairfax County, Virginia were surveyed twice monthly from June-October 2007 and March-May 2008. Capture methods included bee bowl transects and netting. A total of 91 taxa in 28 genera and five families was documented. These include the first Virginia records for *Andrena nida* Mitchell (Andrenidae) and *Coelioxys immaculata* Cockerell (Megachilidae) and the second Virginia record of *Melecta pacifica atlantica* Linsley (Apidae). The relative abundance of each species captured is recorded. Plant associations are given for each species netted.

Key words: Apoidea, bees, Fairfax County, national park, pollination, prairie, Virginia.

INTRODUCTION

The ecological importance of bees as pollinators and their economic importance in the production of fruits and vegetables has been recognized since the late seventeenth century (Proctor et al., 1996), yet the bee fauna of Virginia remains poorly known. Virginia bee records can be gleaned from general texts on bees of North America (Mitchell, 1960, 1962; Hurd, 1979), generic revisions (LaBerge & Ribble, 1972; Baker, 1975), pollination studies conducted in the Commonwealth (Ivey et al., 2003; Shuler et al., 2005) or unpublished distributional data (Ascher & Droege, 2009).

During the June 2006 Potomac Gorge Bioblitz, *Anthidiellum notatum* (Latreille), a bee previously unknown from Virginia (Evans, 2008), was collected by Craig Tufts and Hormuzd Katki from the riverside outcrop prairie vegetation zone (sensu Fleming, 2007) in Great Falls Park, Virginia. Suspecting that other rare bees might inhabit this globally rare plant community type, a systematic inventory of the associated bee fauna was begun in June 2007. The results of that study are presented herein.
STUDY SITE

The study site is the largest contiguous area (0.5 ha) of riverside outcrop prairie located in the 323 ha Great Falls Park in Fairfax County, Virginia (38°59'40.90" N, 77°15'04.71" W). It lies in the Piedmont physiographic province, approximately 13 km northwest of the center of Washington, DC. The area is administered by the National Park Service as a unit of the George Washington Memorial Parkway.

The riverside outcrop prairie occurs naturally in patches that cover a total area of only one hectare. Despite its small size, the prairie contains 283 vascular plant taxa, accounting for the richest plant community in Great Falls Park, which contains more than 1,015 total vascular plant taxa (Steury et al., 2008). One additional species, Geranium maculatum (author citations are given in Table 2), was added during this study to the riverside outcrop prairie flora. The prairie occupies bedrock terraces on the western rim of the Potomac River Gorge and is subject to considerable scour during major floods that stunt the growth of woody species and maintain a predominately herbaceous plant community. Although the site contains persistent pools, it is often seasonally xeric. It is located 14 to 17 m above mean water level and has a flood return interval estimated at 7 years (Lea, 2000). The vegetation is patchy because of frequent areas of exposed bedrock, but is locally dense where soil is present. Woody vegetation consists of low shrubs and stunted trees less than 10 m tall. In fall, the prairie is dominated by the warm-season grasses Andropogon gerardii Vitman, Sorghastrum nutans (L.) Nash, and Schizachyrium scoparium (Michx.) Nash, and stunted Fraxinus americana L. The surrounding vegetation includes deciduous woodlands and herbaceous shoreline plant communities.

Riverside outcrop prairies are a globally-rare vegetation type known only from scattered sites along both sides of the Potomac River Gorge in Maryland and Virginia and from stretches of the Shenandoah River in Virginia (Fleming, 2007). The plant community is classified within the United States National Vegetation Classification as Piedmont/Central Appalachian Riversive Outcrop Prairie: Fraxinus americana/ Andropogon gerardii – Sorghastrum nutans – Schizachyrium scoparium – Pycnanthemum tenuifolium Herbaceous Vegetation (Grossman et al., 1998).

MATERIALS AND METHODS

Twice monthly, from 13 June to 1 November 2007 and 5 March to 23 May 2008, a transect consisting of 50 3.25 oz. Solo brand souffle cups spaced approximately five meters apart was run. The white cups were painted fluorescent yellow, fluorescent blue, or left non-fluorescent white. The cups were filled with a dilute detergent mixture of one gallon of water and a squirt of liquid, unscented, Dawn Blue® or Planet® brand dishwashing detergent. Cups of the three colors were alternated in a transect that was oriented across the broadest width of the prairie. Transect routes varied slightly with each set. The average set time was 24 hours. Sets were planned to coincide with weather forecasts of sunny days and no rain. Opportunistic netting of bees was conducted for approximately one hour on the date of each set and recovery in order to optimize the number of captures (Roulston et al., 2007). Netted specimens were placed in killing jars containing ethyl acetate or tetrachlorethane. The species of plant on which each bee was netted was recorded. Bees collected in cups were filtered through a fine mesh 12.5 x 15 cm minnow net, stored in Whirl-packs with 70% ethyl alcohol, washed in warm water and dried with blotter paper. All specimens were pinned and deposited in the collection at the George Washington Memorial Parkway, Turkey Run Headquarters. Bees were identified using the Discover Life guide online at http://www.discoverlife.org/mp/20q?search=Apidea.

RESULTS AND DISCUSSION

A total of 91 bee taxa in 28 genera and five families was documented (Table 1). Seven taxa were not determined to species due to difficulties in separating taxonomically similar species. These are identified to genus and the most closely related species or group is given in parentheses. Male specimens of Andrena alleghehniensis (author citations are given in Table 1) were indistinguishable from those of A. atlantica to the authors, so these are combined in the list of species. No additional specimens of Anthidium notatum were found during this study. The most species-rich family of bees found in the riverside prairie was Halictidae (25 taxa in seven genera), followed by Apidae (23/11), Andrenidae (21/2), Megachilidae (19/6), and Colletidae (3/2). The most species-rich genera were Andrena (20), Lasio glossum (18), Osmia (9), Nomada (7), and Bombus (5). The most commonly collected bees in the riverside outcrop prairie were Lasio glossum quebecense (162), Andrena erigeniae (95), Ceras tina calcarata (63), C. strenua (56), L. tegulare (45), Hoplitis producta (33), and Augochlorella aurata (32). A total of 145 L. quebecense was captured in bee bowls during 9-10 April 2008. Based on total captures during each month, bees are most active in the riverside prairie in April (437 captures), May (154), July (117), and August (87). Bee bowls set on 17-18 March 2008 failed to capture...
any bees and none were netted on those days; however, single specimens of _A. erigeniae_ and _L. quebecense_ were captured during 5-6 March 2008. Of the 91 total taxa, 28 are represented by one specimen. Twenty taxa were collected only by netting, including nine species of _Andrena_, two _Nomada_, and one species each of _Bombus_, _Ceratina_, _Coelioxys_, _Colletes_, _Halictus_, _Lasiosglossum_, _Melissodes_, _Osmia_, and _Xylocopa_.

Inventories in a superficially similar habitat type using seven Malaise traps near Flintstone, Maryland, 160 km (100 miles) northwest of Great Falls, produced 60 species and 27 morphospecies in 16 genera over three years (Kalhorn et al., 2003). Only 20.2% of the species overlapped in the two studies.

Bees were netted on 41 plant taxa in 20 families within the riverside prairie, including 30 herbs and 11 shrubs or small trees (Table 2). The largest number of associations was documented for the Asteraceae (11 species), followed by five species of Rosaceae, and three species each of Ericaceae, Fabaceae, and Scrophulariaceae. More bee taxa were captured on _Cerastium arvensum_ ssp. _velutinum_ var. _velutinum_ (17 bee taxa) than on any other plant. Bees were captured on three non-native plant species: _Pyrrus calleryana_, _Ramunculus bulbosus_, and _Rosa multiflora_. Thirteen bee taxa were captured during 9-10 April 2008 on one _P. calleryana_ tree. The attractiveness of this non-native tree to native bees is an indication of how non-native plants may draw native pollinators, thus benefiting native plants in the community (Stubs et al., 2007). However, Totland et al. (2006) documented strong negative impacts on the pollinator visitation rates to native plants when an exotic plant was introduced to a native plant community. Other plants in the riverside prairie that were visited by multiple bee taxa were _Symphyotrichum petiolatum_ (10 taxa), _Cephalanthus occidentalis_ and _Solidago simplex_ ssp. _randii_ var. _racemosa_ (7 taxa each), and _Pycnanthemum tenuifolium_ (5 taxa).

Fairfax is the only known Virginia county with populations of the state-rare goldenrod _Solidago simplex_ ssp. _randii_ var. _racemosa_ (Wieboldt et al., 2007). Bees documented on this plant were _Apis mellifera_, _Angochlora pira_, _Angochlora aurata_, _Bombus impatiens_, _Ceratina calcarata_, _C. strenua_, and _Lasiosglossum quebecense_.

Based on lack of documentation in Robertson (1929), Mitchell (1960, 1962), Hurd (1979), Moure & Hurd (1987), and Ascher & Droege (2009), rare associations between seven bee taxa and various plant genera were observed, including _Angochlora aurata_ (Allium and Euphorbia), _Bombus perplexus_ (Polygonum), _Ceratina calcarata_ (Agalinis), _Lasiosglossum tegulare_ (Spiraea), _Megachile mendica_ (Agalinis, Allium, and Veronicastrum), _Osmia collinsiae_ (Lythrum), and _Osmia subfasciata_ (Vicia).

According to eastern North American bee distribution data maintained by Ascher & Droege (2009), and reviews of Mitchell (1960, 1962), LaBerge & Ribble (1972), Baker (1975), and Hurd (1979), this survey documented the first Virginia records for _Andrena nida_ Mitchell (Andrenidae) and _Coelioxys immaculatus_ Cockerell (Megachilidae) and the second record of _Melecta pacifica atlantica_ Linsley (Apidae) from the Commonwealth.

_Andrena nida_ was previously documented from Vermont to northern Florida, and west to Mississippi and Missouri (Pascarella, 2008; Ascher & Droege, 2009). It has been recorded as active between 10 March and 15 May (Mitchell, 1960; LaBerge, 1972). Often considered an oligolectic of _Salix_ (Pascarella, 2008), one male was collected on 9 April in the Great Falls riverside prairie on the non-native tree _Pyrrus calleryana_. Mitchell (1960) records this bee from a nest site in sand near a creek and cites collections of males on _Prunus_ and _Anemonechilus_ in North Carolina. Pascarella (2008) recorded the first Florida record on _Prunus angustifolia_ Marshall, further evidence that males often forage on members of the Rosaceae.

_Coelioxys immaculatus_ is a cleptoparasite of _Megachile addenda_ (Michener et al., 1994; Cane et al., 1996) and is documented in the Midwestern states from Kansas to Texas and along the East Coast from Massachusetts to central Florida (Pascarella, 2008; Ascher & Droege, 2009). It has been recorded as early as 30 March in Florida and as late as 14 July in Massachusetts (Baker, 1975). It forages on _Asclepias_, _Baptisia_, _Tephrosia_, _Rubus_, and _Vaccinium_ (Mitchell, 1962; Cane et al., 1996). In the riverside prairie, single males were captured on 5 and 23 May on _Vaccinium stamineum_ and _Rubus flagellaris_, respectively.

_Meletia pacifica atlantica_ is a cleptoparasite of _Anthophora_ (Michener et al., 1994), known from New Jersey to Kansas, south to Alabama and Georgia (Ascher & Droege, 2009). It flies from March to May and is documented on _Fragaria_, _Lithospermum_, and _Pentstemon_ (Mitchell, 1962). The only species of _Anthophora_ found in the riverside prairie was _A. ursina_. During this study, one female _M. pacifica atlantica_ was captured in a bee bowl set on 23-24 April 2008. The only other specimen record for Virginia was collected on 22 April 2003 near Charlottesville by Ruth Douglas.

_Anthophora ursina_ is also rarely collected in Virginia (Droege, pers. obs.). Although apparently absent from the central United States, this species is found in most western states north to Washington and Wyoming and south to Arizona and New Mexico. In the East, it is known west to Illinois and along the East
Table 1. Bee taxa documented during this study. Nomenclature follows Ascher & Droege (2009). The earliest and latest dates of collection are reported, followed by plant associations using the letter-digit codes given in Table 2. Plant codes are followed by the number of individuals netted on the plant if >1. FL denotes specimens netted in flight. The total number of specimens is also reported for each taxon.

### Short-tongued Bees

**Family Andrenidae**

- *Andrena alleghaniensis* Viereck/A. *atlantica* Mitchell
- *Andrena banksi* Malloch
- *Andrena barbara* Boucoman & LaBerge
- *Andrena barbilabris* (Kirby)
- *Andrena bradleyi* Viereck
- *Andrena carlini* Cockerell
- *Andrena cressonii* Viereck
- *Andrena erigeniae* Robertson
- *Andrena forbesii* Robertson
- *Andrena imitatrix* Cresson
- *Andrena miserabilis* Cresson
- *Andrena nasonii* Robertson
- *Andrena nida* Mitchell
- *Andrena nigra* Robertson
- *Andrena perplexa* Smith
- *Andrena personata* Robertson
- *Andrena tridens* Robertson
- *Andrena vicina* Smith
- *Andrena violae* Robertson
- *Andrena* sp. (Trachandrena or Scrapteropsis group)

**Family Colletidae**

- *Coffetes inaequalis* Say
- *Colletes thoracicus* Smith

**Family Halictidae**

- *Agapostemon virescens* (Fabricius)
- *Augochlora pura* (Say)
- *Augochlora aurata* (Smith)
- *Augochloropsis metallica* (Fabricius)
- *Halictus ligatus* Say
- *Halictus rubicundus* (Christ)
- *Lasioglossum admirandum* (Sandhouse)
- *Lasioglossum atlanticum* (Mitchell)
- *Lasioglossum bruneri* (Crawford)
- *Lasioglossum coerulescens* (Robertson)
- *Lasioglossum cressoni* (Robertson)
- *Lasioglossum fascipenne* (Smith)
- *Lasioglossum imitatum* (Smith)
- *Lasioglossum laevissimum* (Smith)
- *Lasioglossum oblongum* (Lovell)
- *Lasioglossum pilosum* (Smith)
- *Lasioglossum planatum* (Lovell)
- *Lasioglossum platyporini* (Robertson)
- *Lasioglossum quebecense* (Crawford)
- *Lasioglossum rohweri* (Ellis)
Table 1 (continued).

<table>
<thead>
<tr>
<th>Genus</th>
<th>Species and References</th>
<th>Collection Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lasioglossum</td>
<td>tegulare (Robertson, sensu Gibbs, 2009)</td>
<td>9 Apr-1 Nov; R6; 45♀</td>
</tr>
<tr>
<td>Lasioglossum</td>
<td>versatum (Robertson)</td>
<td>23 Apr; C3; 1♀</td>
</tr>
<tr>
<td>Lasioglossum</td>
<td>sp. (viridatum group)</td>
<td>8-9 Aug; 1♀</td>
</tr>
<tr>
<td>Sphecodes</td>
<td>atlantis Mitchell</td>
<td>11-12 Sep; 1♀</td>
</tr>
</tbody>
</table>

**Long-tongued Bees**

### Family Apidae

<table>
<thead>
<tr>
<th>Genus</th>
<th>Species and References</th>
<th>Collection Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthophora</td>
<td>ursina Cresson</td>
<td>9 Apr-5 May; F3(2); 4♂, 1♀</td>
</tr>
<tr>
<td>Apis</td>
<td>mellifera Linnaeus</td>
<td>22 Jun-3 Oct; A1, A5(4), A9, A10(4), A11(3), C2, L1; 17♀</td>
</tr>
<tr>
<td>Bombus</td>
<td>bimaculatus Cresson</td>
<td>28 Jun-12 Jul; L2, R7; 2♂, 1♀</td>
</tr>
<tr>
<td>Bombus</td>
<td>fervidus (Fabricius)</td>
<td>11-12 Jul; 1♀</td>
</tr>
<tr>
<td>Bombus</td>
<td>griseocollis (DeGeer)</td>
<td>28 Jun-12 Jul; L2, R7(2); 3♂</td>
</tr>
<tr>
<td>Bombus</td>
<td>impatiens Cresson</td>
<td>28 Jun-4 Oct; A10, A11(2), R7(2), S2; 12♀</td>
</tr>
<tr>
<td>Bombus</td>
<td>perplexus Cresson</td>
<td>28 Jun-12 Jul; L2, P2, R7(5); 6♂, 2♀</td>
</tr>
<tr>
<td>Ceratina</td>
<td>calcarata Robertson</td>
<td>9 Apr-1 Nov; A3, A4(4), A6, A7, A9(2), A10, A11(4), E4, R1(2), R3, S2(2); 31♂, 32♀</td>
</tr>
<tr>
<td>Ceratina</td>
<td>dupla Say</td>
<td>24-25 Sep; A6; 1♀</td>
</tr>
<tr>
<td>Ceratina</td>
<td>strenua Smith</td>
<td>9 Apr-25 Sep; A2, A3, A10(7), A11, C3; 14♂, 1♀, 42♀</td>
</tr>
<tr>
<td>Melissodes</td>
<td>subbiliata LaBerge</td>
<td>23-24 Apr; 1♀</td>
</tr>
<tr>
<td>Melitoma</td>
<td>tauraev (Say)</td>
<td>25 Sep-11 Jun; A5; 5♂, 3♀</td>
</tr>
<tr>
<td>Nomada</td>
<td>denticulata Robertson</td>
<td>9-24 Apr; C3 1, R3(4); 5♂, 1♀</td>
</tr>
<tr>
<td>Nomada</td>
<td>imbricata Smith</td>
<td>23 Apr-23 May; FL(2); 6♀</td>
</tr>
<tr>
<td>Nomada</td>
<td>luteoloides Robertson</td>
<td>9 Apr; R3; 1♀</td>
</tr>
<tr>
<td>Nomada</td>
<td>maculata Cresson</td>
<td>5 May; O1; 1♂</td>
</tr>
<tr>
<td>Nomada sp. 1 (near cressonii Robertson)</td>
<td></td>
<td>23 Apr-6 May; C3, R3; 2♂, 2♀</td>
</tr>
<tr>
<td>Nomada sp. 2 (near pygnaea Cresson)</td>
<td></td>
<td>23 Apr-23 May; E3(2); FL(1); 7♂, 3♀</td>
</tr>
<tr>
<td>Nomada sp. 3 (bidentate group)</td>
<td></td>
<td>9 Apr-23 May; C3(4); 10♂</td>
</tr>
<tr>
<td>Pepsophis</td>
<td>primum (Say)</td>
<td>23 Jul-12 Sep; 1♂, 2♂</td>
</tr>
<tr>
<td>Ptilothrix</td>
<td>bombiformis (Cresson)</td>
<td>11-24 Jul; 3♂</td>
</tr>
<tr>
<td>Xylocopa</td>
<td>virginica (Linnaeus)</td>
<td>23 Apr-4 Oct; A7, A11, A12, R4; FL(2); 2♂, 4♀</td>
</tr>
</tbody>
</table>

### Family Megachilidae

<table>
<thead>
<tr>
<th>Genus</th>
<th>Species and References</th>
<th>Collection Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthidium</td>
<td>oblongatum (Illiger)</td>
<td>28 Jun-12 Sep; L2, L3(2); 3♂, 7♀</td>
</tr>
<tr>
<td>Coelioxys</td>
<td>immaculata Cockerell</td>
<td>5-23 May; E3, R5; 2♂</td>
</tr>
<tr>
<td>Coelioxys</td>
<td>sayi Robertson</td>
<td>28 Jun-24 Sep; A11; 4♂</td>
</tr>
<tr>
<td>Hoplitis</td>
<td>pilosifrons (Cresson)</td>
<td>5-23 May; S3; 5♂, 1♀</td>
</tr>
<tr>
<td>Hoplitis</td>
<td>proctica (Cresson)</td>
<td>23 Apr-23 May; 30♂, 3♀</td>
</tr>
<tr>
<td>Hoplitis</td>
<td>spoliata (Provancher)</td>
<td>22-23 May; 3♂</td>
</tr>
<tr>
<td>Megachile</td>
<td>addenda Cresson</td>
<td>22-23 May; O2; 4♂, 2♀</td>
</tr>
<tr>
<td>Megachile</td>
<td>brevis Say</td>
<td>22-23 May; 1♀</td>
</tr>
<tr>
<td>Megachile</td>
<td>mendica Cresson</td>
<td>28 Jun-12 Sep; A5, A7, F2, L2(2), L3(2), R7(5), S2, S4, 21♂, 6♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>atriventris Cresson</td>
<td>9 Apr-22 May; C3, R5; 3♂, 6♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>bucephala Cresson</td>
<td>23 Apr-6 May; FL(1); 2♂, 3♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>collinaeae Robertson</td>
<td>9 Apr-23 May; F1, F3(2), G1; 3♂, 9♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>conjuncta Cresson</td>
<td>22-23 Apr; 1♂, 1♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>cornifrons (Radoszkowski)</td>
<td>9-10 Apr; R3; 2♂, 2♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>lignaria Say</td>
<td>22-23 May; 1♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>pumila Cresson</td>
<td>9 Apr-22 May; C3(2), G1(2), S3, 1♂, 6♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>taurus Smith</td>
<td>9-24 Apr; P1, R2, S1; 13♂, 2♀</td>
</tr>
<tr>
<td>Osmia</td>
<td>subfasciata Cresson</td>
<td>5 May; F3; 1♀</td>
</tr>
<tr>
<td>Stelis</td>
<td>lateralis Cresson</td>
<td>22-23 May; 2♂, 3♀</td>
</tr>
</tbody>
</table>
Table 2. Plants documented as nectar and pollen sources for bees netted in the riverside outcrop prairie. The letter-digit codes preceding the plant names correspond to those used in Table 1. Nomenclature follows Kartesz (1999). Non-native plants are denoted by an asterisk.

<table>
<thead>
<tr>
<th>Family</th>
<th>Plant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCLEPIADACEAE</td>
<td>A1. <em>Ascopetalum verticillata</em> L.</td>
</tr>
<tr>
<td>ASTERACEAE</td>
<td>A2. <em>Bidens aristosa</em> (Michx.) Britton</td>
</tr>
<tr>
<td></td>
<td>A4. <em>Eupatorium hyssopifolium</em> L.</td>
</tr>
<tr>
<td></td>
<td>A6. <em>Ionactis linariifolia</em> (L.) Greene</td>
</tr>
<tr>
<td></td>
<td>A8. <em>Solidago bicolor</em> L.</td>
</tr>
<tr>
<td></td>
<td>A9. <em>Solidago nemoralis</em> Aiton</td>
</tr>
<tr>
<td></td>
<td>A11. <em>Symphyotrichum patens</em> (Ait.) Nesom</td>
</tr>
<tr>
<td>CAPRIFOLIACEAE</td>
<td>C1. <em>Viburnum prunifolium</em> L.</td>
</tr>
<tr>
<td>ERICACEAE</td>
<td>E1. <em>Rhododendron periclymenoides</em> (Michx,) Shinners</td>
</tr>
<tr>
<td></td>
<td>E2. <em>Vaccinium corymbosum</em> L.</td>
</tr>
<tr>
<td></td>
<td>E3. <em>Vaccinium stamineum</em> L.</td>
</tr>
<tr>
<td>EUPHORBIACEAE</td>
<td>E4. <em>Euphorbia corollata</em> L.</td>
</tr>
<tr>
<td></td>
<td>F3. <em>Vicia caroliniana</em> Walter</td>
</tr>
<tr>
<td>GERANIACEAE</td>
<td>G1. <em>Geranium maculatum</em> L.</td>
</tr>
<tr>
<td>LAMIACEAE</td>
<td>L1. <em>Lycopus virginicus</em> L.</td>
</tr>
<tr>
<td>LILIACEAE</td>
<td>L3. <em>Allium cernum</em> Roth</td>
</tr>
<tr>
<td>OLEACEAE</td>
<td>O1. <em>Chionanthus virginicus</em> L.</td>
</tr>
<tr>
<td>ONAGRACEAE</td>
<td>O2. <em>Oenothera fruticosa</em> L.</td>
</tr>
<tr>
<td>POLEMONIACEAE</td>
<td>P1. <em>Phlox subulata</em> L.</td>
</tr>
<tr>
<td>RANUNCULACEAE</td>
<td>R1. <em>Ranunculus bulbosus</em> L.*</td>
</tr>
<tr>
<td>ROSACEAE</td>
<td>R2. <em>Amelanchier arborea</em> (F. Michx.) Fernald</td>
</tr>
<tr>
<td></td>
<td>R3. <em>Pyrus calleryana</em> Decne. *</td>
</tr>
<tr>
<td></td>
<td>R4. <em>Rosa multiflora</em> Thunb. *</td>
</tr>
<tr>
<td>RUBIACEAE</td>
<td>R7. <em>Cephalanthus occidentalis</em> L.</td>
</tr>
<tr>
<td>SAXIFRAGACEAE</td>
<td>S1. <em>Saxifraga virginiensis</em> Michx.</td>
</tr>
<tr>
<td>SCROPHULARIACEAE</td>
<td>S2. <em>Agalinis purpurea</em> (L.) Pennell</td>
</tr>
<tr>
<td></td>
<td>S3. <em>Penstemon laevigatus</em> Aiton</td>
</tr>
<tr>
<td></td>
<td>S4. <em>Veronicastrum virginicum</em> (L.) Farw.</td>
</tr>
</tbody>
</table>
Coast between Rhode Island and Georgia (Ascher & Droge, 2009). It flies between March and June and has been recorded on Azalea, Pedicularia, Pentstemnon, Vaccinium, and Vicia (Mitchell, 1962). Robertson (1929) recorded A. ursina on Aesculus, Asclepias, Astragalus, Cercis, Collinsia, Delphinium, Dicentra, Dodecatheon, Geranium, Lithospermum, Lonicera, Mertensia, Monarda, Phlox, Physalis, Polygonatum, Polymonium, Ribes, Scutellaria, Trifolium, and Viola. During this study, one male was taken in a bee bowl on 9-10 April 2008, and a male and a female were collected in bee bowls set on 23-24 April 2008. Two additional male specimens were taken on Vicia caroliniana on 23 April and 5 May 2008.

Additionally, records from Virginia of Megachile addenda are uncommon. Found across the southern United States from California to southern Florida, and north to Quebec and Ontario, Canada (Pascarella, 2008; Ascher & Droge, 2009), it has been recorded between April and July on Amorpha, Baptisia, Hieracium, Hypericum, Oenothera, Opuntia, Pentstemon, Polycodium, Psoralea, Rubus, Tephrosia, and Vaccinium (Mitchell, 1962). Robertson (1929) adds records from Asclepias, Coreopsis, Dianthera, Gilienia, and Rosa. In the Mid-Atlantic area this species is almost entirely associated with open, xeric, sandy sites of the Coastal Plain with niches similar to those found on beaches and riverside prairies in the Potomac River Gorge. Similarly, the moth Euxoa violaris (Grote & Robinson), which is known only to inhabit areas of loose, shifting sand such as beach and dune areas along the Atlantic Coastal Plain, was found in the Piedmont physiographic province in Great Falls Park in 2006 (Steury et al., 2007). In the riverside prairie, six M. addenda were captured on 22-23 May 2008. One male was netted on Oenothera fruticosa and five additional specimens were captured in bee bowls.

The discovery of three bee species (Andrena nida, Coelioxys immaculata, and Anthidium notatum) new to the fauna of Virginia within an area of 0.5 ha over three years with a total search effort of less than three weeks seems to be an indication that the bee fauna of the Commonwealth remains poorly known. A Chao-2 estimate (Colwell & Coddington, 1994) calculated a total of 140 bee species within the riverside prairie compared to the sampling total of 91 taxa, suggesting that about a third of the actual fauna remains to be documented. As bee identification tools such as the Discover Life guides available online become more widely used and user friendly, it is expected that the knowledge of Virginia’s bee fauna will continue to expand. Search efforts in rare habitat types may prove to be particularly productive.

LITERATURE CITED


North of Mexico. Smithsonian Institution Press, Washington, DC.


An Annotated List of the False Click Beetles of Virginia (Coleoptera: Eucnemidae)

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ABSTRACT

Thirty-two species of Eucnemidae are documented for the Virginia fauna, seven of them (Golbachia impressicollis, Isarthrus calceatus, Rhagomicrus humeralis, Euryptychus heterocerus, E. ulkei, Onichodon archisides, and O. downiei) for the first time. Fourteen additional species that may occur in the state are also discussed.

Key words: Coleoptera, Eucnemidae, false click beetles, Virginia.

INTRODUCTION

The Eucnemidae is a moderate-sized family of beetles, related to the Elateridae in general body form (including the ability to “click”) and structure of the male genitalia. A distinct and easily-seen difference is the subterminal, eccentric attachment of the 2nd antennomere to the first: strictly terminal in elaterids. Species of the family have acquired a variety of special modifications absent from elaterids, such as crests of setae on the meso- and metatibiae, and prominent circular pits on or near the dorsal procoxal condyles.

The classification of North American eucnemids was not well-established prior to publication by Jyrki Muona (2000) of a revision of the Nearctic fauna, which provided diagnoses and keys for all taxon levels, descriptions of all species and drawings for many of them, and full collection data for all specimens examined. With this valuable base-line resource at hand, it is now possible to identify material with confidence and predict which species may be expected to occur in any given region on the basis of known distributions. In the following pages all citations to “Muona” refer to this revision unless specifically indicated otherwise. As the first step toward a detailed treatment of the Virginia eucnemid fauna, we offer here an annotated list of the 32 species actually documented for the state as well as justification for inclusion [bracketed] of 14 other species that will almost certainly be added with additional collecting, giving a projected total of about 46 likely native resident species of this family (but the case of Dendrocharis inexspectata reminds that almost any eucnemid known from eastern North America may turn up in Virginia). Collection data are provided for the seven species here added to the known fauna as well as others represented in recent collections at the Virginia Museum of Natural History (VMNH), the National Museum of Natural History (USNM), and the personal collections of the second author (RLO) and Dr. Arthur V. Evans (AVEC).

In contrast with various other beetle families (e.g.,
Scarabaeidae, Elateridae, Chrysomelidae), the species of Eucnemidae can generally be considered as under-represented in most collections, and many are known from only a handful of specimens despite continent-wide ranges. The majority of species appear to be largely dendrophilous, requiring assiduous “beating” of trees and rearing from dead branches, and most are not attracted to ultraviolet light traps. Several species have been taken in some numbers in Malaise traps. Accumulation of material in local collections (and in major museums as well) has been slow and some time may pass before we can aspire just to having material of all the species likely to occur in Virginia, to say nothing of being able to define their in-state distribution in any detail. Perhaps greater attention to the collection and rearing of larvae would be a fruitful course to pursue.

One point about the biology of eucnemids mentioned repeatedly throughout Muona’s paper is that a number of species are extremely rare over extensive ranges, and some have not been collected in recent decades (one for over a century). Perhaps the extensive deforestation of North America since 1800 is a contributing factor by reducing the number of obligatory host trees.

Muona’s description of rare new species from a few localities in Maryland, Indiana, and Florida reflects the retarded condition of our knowledge of these beetles. Even new taxa may be found in Virginia, an incentive for increased attention to our local fauna.

The arrangement of taxa at all levels in the following list follows that of Muona’s monograph.

EUCNEMIDAE

Perothopinae

Perothops mucida (Gyllenhal)

Widespread in eastern United States from Maine to Florida. Mount Vernon, Fairfax Co. (USNM) is the only known Virginia locality, however.

Phyllocerinae

[Anelastes drurii Kirby]

Continent-wide in range; in the southeast recorded from Florida to North Carolina (Raleigh) and thus likely to be discovered in the Southside or Tidewater regions of Virginia.

Pseudomeninae

Schizophilus subrufus (Randall)

Widespread but not common in eastern United States, recorded by Muona from East Falls Church, Fairfax Co.

Melasinae

Melasis pectinicornis Melsheimer

Generally distributed over eastern United States; recorded by Muona from Fairfax and King & Queen counties and the City of Chesapeake. VMNH has specimens from Essex Co.: 1.5 km SE of Dunnsville, 11 April 1991, Malaise trap, D. R. Smith (1) and King & Queen County, without specific locality, 24 February 1940, L. A. Hetrick (2). Collectively these records imply a distribution in the Coastal Plain.

[Isorhipis nubila (Bonvouloir)]

A rarely collected species apparently restricted to southeastern United States, this beetle was documented by Muona for Alabama, Florida, Georgia, and South Carolina. It is therefore not unlikely that it occurs also in the Tidewater region of our state.

Isorhipis ruficornis (Say)

Listed from Fairfax and Montgomery counties by Muona, and also recorded from the former by Evans (2008). The record for Virginia Beach by Van Horn (1909) was apparently based on a misidentified specimen of the following species.

Isorhipis obliqua (Say)

The most commonly collected eucnemid in eastern United States according to Muona, who listed specimens from Bath and Mecklenburg counties and the City of Norfolk. We have seen material from Chesterfield, Clarke, Essex, Dickenson, Henrico, Louisa, Northampton, Powhatan, Rockingham, and Sussex counties, reflecting a pervasive statewide range in Virginia. Virtually all of the 35 VMNH specimens were taken in Malaise traps during May and June.

According to J. Muona (in litt. to RLO) the larva illustrated by Van Horn (1909, figs. 1-3) under the name Tharops ruficornis is actually a specimen of I. obliqua.
[Hylochares nigricornis (Say)]

With the known range extending from Massachusetts to Iowa, this species is a likely candidate for discovery in our western mountains.

[Xylophilus cylindriformis (Horn)]

This uncommon beetle occurs primarily in western North America, with a few isolated records cited by Muona for Kentucky, New Hampshire, New York, and West Virginia (Hardy Co.: W. Northeimer, in Malaise trap). The last-named site raises the likelihood that X. cylindriformis occurs sporadically in western Virginia.

[Xylophilus crassicornis Muona]

A very rare species known only from the female holotype collected at Annapolis, Maryland, thus a probable resident of the Virginia Coastal Plain.

[Hylis frontosus (Say)]

Recorded from Maryland and North Carolina, this species will surely be collected in Virginia.

Hylis terminalis (LeConte)

This beetle is recorded from Quebec to Michigan, southward in the Atlantic states to North Carolina. Muona saw a single specimen labeled only “Va.” VMNH has the following specimens: Cumberland Co.: 7 km SW of Columbia, pitfalls, 2 September 1990, J. C. Mitchell (1). Dickinson Co.: Breaks Interstate Park, 10-14 June 2002, R. Vigneault (1). Essex Co.: 1.5 km SE of Dunnsville, Malaise trap, 2-11 July 1991, D. R. Smith (2). Louisa Co.: 4 miles S of Cuckoo, Malaise trap, 25 April-13 May 1988, D. R. Smith (2).

Microrhagus audax Horn


Microrhagus pectinatus LeConte

The range of this species is continent-wide (British Columbia to Nova Scotia), extending southward in the Appalachian region as far as northern Georgia. It was recorded by Muona from Virginia on the basis of a specimen with no precise locality data. VMNH specimens are from near sea level to about 3500 feet (1067 m): Bedford Co.: Sharp Top Mountain, Peaks of Otter, UV trap, 13 June 2001, J. C. Ludwig (1). Essex Co.: 1.5 km SE of Dunnsville, Malaise trap, 29 April 1981 (1), 4-14 May 1993 (1), D. R. Smith. Louisa Co.: 4 miles S of Cuckoo, Malaise trap, 25 April-13 May 1988, D. R. Smith (2).

Microrhagus subsinuatus LeConte

Widespread over much of eastern North America (but rare or absent from most of the southeastern states), this species was recorded by Muona from Alexandria, Fairfax, and Fluvanna counties, Virginia. VMNH collections add the following records: Cumberland Co.: 2 km S of Columbia, pitfalls, 16 June 1990, J. C. Mitchell (1). Dickinson Co.: Breaks Interstate Park, 1-14 July 2000, R. Vigneault (1). Floyd Co.: Laurel Fork Creek, 3.3 miles
W Blue Ridge Parkway, 17 June 2007, S. M. Roble (1).
Louisa Co.: 4 miles S of Cuckoo, Malaise trap, 14-26 May 1988, D. R. Smith (1).

**Microrhagus triangularis** (Say)

Widespread and common in eastern North America, and apparently statewide in Virginia. Muona saw USNM material from Lee and York counties, and the cities of Chesapeake and Virginia Beach. Our records are from Appomattox, Clarke, Dickenson, Essex, Fairfax, Floyd, and Patrick counties. Numerous specimens were taken in Malaise traps in Essex County, 14 June to 26 July.

**Golbachia impressicollis** (Bonvouloir)

New State Record, New Northernmost Record


Muona’s drawing of the forebody in lateral aspect does not indicate the antennal groove clearly; we herewith provide a sketch (Fig. 1) made from a slightly more ventrolateral view that shows the abrupt anterior obliteration of the very shallow groove. The subocular surface is, however, concave and may serve as a rudimentary groove.

*[Adelothyreus defeani* Bonvouloir]*

Confirmed range is from Florida to Louisiana. However, if the record for Maryland by Horn (1886) can be confirmed, the species would become a likely candidate for discovery in Virginia also.

*[Adelothyreus downiei* Muona]*

Known only from Indiana, Oklahoma, Pennsylvania, and West Virginia. The record for Morgan County in the last-named state permits the assumption that this very rare species may be found in western Virginia.

**Entomophthalmus rufiolus** (LeConte)


Nowhere in Muona’s monograph is there any reference to the condition of the eyes in this species, a curious fact since the derivation of the generic name basically means “cut-eyes”. Inspection of specimens
shows that there is in fact a relatively prominent notch of the eye outline immediately adjacent to the deep postantennal sensory pit, as shown in our drawing (Fig. 2). This condition appears to be unique, at least in the North America fauna, and constitutes a definite and easy to see generic recognition character. Bonvouloir obviously had a good reason for his choice of a name for the genus to which this beetle belongs.

**Rhabomicrus humeralis** (Say)
New State Record

Although recorded from many eastern states, this species was not represented by Virginia specimens in material examined by Muona. It is apparently not abundant, as our single specimen was captured at a site from which a number of eucnemid species have been collected. Essex Co.: 1.5 km S of Dunsville, 11 July 1991, Malaise trap, D. R. Smith (1).

**Rhabomicrus bonvouloiri** (Horn)

Although this species is generally distributed in eastern North America, the known localities are relatively few and dispersed. Muona saw Virginia material only from Shenandoah County (USNM), to which we can add another: Appomattox Co.: Holiday Lake State Park, 14-28 June 1999, R. Vigneault (RLO 1).

**Sarpedon scabrosus** Bonvouloir

Although represented on both sides of the continent, this species is not recorded south of Virginia and Tennessee. Specimens in USNM are from Fairfax and Nelson counties.

**Eucneminae**

**Dendrocharis inexpectata** Muona

This relatively large eucnemid was known from only two specimens taken in Florida and Texas until it was found in southeastern Virginia several years ago. Details of this capture, comments on some discrepancies in the original description, and drawings of structural details have been published separately (Hoffman, 2008). City of Virginia Beach: First Landing State Park, 23 June-7 July 2003, R. Vigneault (2).

**Stethon pectorosus** LeConte

Although documented for nearly all of the eastern states, this species has only recently been reported for Virginia, at the Potomac River Gorge, Fairfax County (Evans, 2008). Two additional collections are from Appomattox Co.: Holiday Lake State Park, 14-28 June 1999, R. Vigneault (RLO 5), and Chesterfield Co.: 63310 Qualla Road, Chesterfield, March-September 2003, C. R. McClung (AVEC 1).

**[Eucnemis americana** Horn]**

This rare species occurs on the Pacific Coast and eastern North America, north of the latitude of New Jersey and Indiana. A record for Westmoreland Co., Pennsylvania, suggests the possibility of its eventual capture in the mountains of western Virginia.

**Macrualacinae**

**Euryptychus heterocerus** (Say)
New State Record, New Southern Record

Considered by Muona to be “a rare eastern species”, with most of the specimens he examined being taken prior to 1930. Its range extends from New York to Wisconsin and Oklahoma, the VMNH material from Virginia being southernmost for the Atlantic Coast states. Fauquier Co.: Bull Run Mountains, UV light, 30 July 1998, A. C. Chazal, C. S. Hobson, G. Fleming (3).

**Euryptychus ulkei** (Horn)
New State Record

A more southern species than the foregoing, *E. ulkei* has nonetheless been documented for southern Ohio and western Pennsylvania, anticipating its eventual discovery in Virginia: City of Chesapeake: Northwest River Park, 5 miles SE of Hickory, 30 July 1999, R. Vigneault (RLO 1).

**Onichodon orchesides** Newman
New State Record

Widespread in the northern states and adjacent Canada (Quebec to North Dakota) but more sporadic southward (Arkansas, Mississippi, North Carolina); Virginia specimens were not recorded by Muona. Material at hand (VMNH except as noted) is from a statewide transect: City of Virginia Beach: False Cape State Park, UV light, 17 August 1998, S. M. Roble (1); First Landing State Park, 23 June-7 July 2003, R. Vigneault (1), 16-17 June 2007, M. E. Dougherty (AVEC 1). Patrick Co.: west end of Philpott Reservoir, Rt 624, UV trap, A. C. Chazal (1). Dickenson Co.: Breaks Interstate Park, 1-14 July 2000, R. Vigneault (1).
[Onichodon canadensis (Brown)]

Recorded from as near as Snyder Co., Pennsylvania, this northern species is a possible member of our fauna.

[Onichodon rugicollis (Fall)]

Having been found only 35 miles (56 km) south of the Virginia state line at Durham, North Carolina, this austral species may be considered a probable resident in our “Southside” counties.

Onichodon downiei Muona
New State Record

This recently-described species is known from “Maryland” and western Pennsylvania, anticipating its discovery in northern or western Virginia. We confirm that possibility with a record for Appomattox Co.: Holiday Lake State Park, 14-28 June 1999, R. Vigneault (RLO 2).

Fornax bicolor (Melsheimer)

Accounted to be a rare southeastern species by Muona, who adds “most records from other areas are old or very old.” Only single collections were cited by him for most states, including only Nelson County for Virginia. VMNH has three specimens: Essex Co.: 1.5 km SE of Dunnsville, Malaise trap, 26 June 1991, D. R. Smith (1). Nottoway Co.: Fort Pickett, Twin Lakes, UV in pine forest, 10 June 1999, A. C. Chazal (1). City of Virginia Beach: First Landing State Park, UV trap, without date [June or July 2006], P. Bedell and A. C. Chazal (1).

Isarthrus rufipes (Melsheimer)

Recorded by Muona from most of the eastern states, including Virginia (Fairfax County). The single specimen we have seen came from a very nearby locality: Prince William Co.: Manassas National Battlefield Park, near Stone Bridge, pitfall trap, 26 May-21 June 1999, A. C. Chazal (1).

Isarthrus calceatus (Say)
New State Record

This widespread eastern species has been documented from both north (District of Columbia) and south (Georgia) of Virginia, and was therefore certainly to be expected as a component of our fauna.

Isle of Wight Co.: Zuni Pine Barrens, Blackwater Ecological Preserve, 15 April 2006, A. V. Evans & D. Loomis (AVEC 3).

Dromaeolus badius (Melsheimer)

Known from most of the eastern states, specimens of this species were seen by Muona from Fairfax County, Virginia. VMNH specimens are from Nottoway Co.: Piedmont Research Station, Blackstone, 6 July 1977, P. Egan (1) and York Co.: ponds at Grafton, 19 October 1990, K. A. Buhlmann (1). An eastern, lowland distribution in the state is thus suggested.

Dromaeolus cylindricollis (Say)

Although widespread in eastern North America, this species apparently does not occur in the southeastern Coastal Plain. It is known from Fairfax, Lee, and Nelson counties (Muona) and the following new locality: Patrick Co.: Fairystone State Park, 27 June 1999, R. Vigneault (RLO 1).

Dromaeolus striatus LeConte


[Dromaeolus punctatus LeConte]

This species is documented from North Carolina to Tamaulipas, Mexico, dominantly at lower elevations. It probably occurs in Southside Virginia.

[Dromaeolus turnbowi Muona]

With a known distribution from West Virginia south to Georgia and Louisiana, this species is a likely resident of our far southwestern counties.

Thambus horni Muona

Another widespread but rarely collected species, with no records for the southeastern states. In the interior of the country, it extends as far south as Texas. Muona listed a single specimen from Arlington Co., Virginia.
**Deltometopus amoenicornis** (Say)

Characterized by Muona as the most common eastern eucnemid, and recorded by him from Arlington, Campbell, Fairfax, and Nelson counties, *D. amoenicornis* is represented in our material by only a few specimens: *Essex Co.:* 1.5 km SE of Dunsville, 2 July 1991, Malaise trap, D. R. Smith (1). *James City Co.:* York River State Park, 20 May 2006, A. V. Evans (AVEC 2). *Louisa Co.:* 4 mi. S of Cuckoo, Malaise trap, 6-18 June 1987, D. R. Smith (1). *York Co.:* ponds at Grafton, 19 October 1990, pitfall trap, K. A. Buhlmann (1).

**Nematodes atropos** (Say)


**Nematodes collaris** Bonvouloir

Muona thought that this species might be extinct inasmuch as he had seen only material collected a century earlier, but recent collections from Ohio and Missouri (Otto, unpubl. data) establish that it survives in the midwestern United States. Old captures for Montgomery Co., Maryland, and Sumter Co., South Carolina, and the more recent for Ohio suggest that the species might occur in Virginia. The combination of orange prothorax and projecting apical ventrite make this species easy to recognize.

**Nematodes penetrans** (Say)


**SUMMARY**

The majority of the 32 species of eucnemids now documented for Virginia are widespread in eastern North America, although many are known only from a few widely separated states. Several species can be considered as statewide in distribution, but most are known from too few localities to justify any categorization of their instate ranges. Two species represent substantial range extensions northward from Florida (*Dendrocharis inexpectata*) and southern North Carolina (*Golbachia impressicollis*), half a dozen additional “probable” species fall into this same Lower Austral pattern. *Dirrhagofarsus lewisi*, a recently introduced Asiatic species, is now essentially statewide in Virginia, and collected in remote “natural” habitats. The capture of *Fornax bicolor* at three localities confirms the survival of the species, since most of the existing museum material was collected decades ago.

**ACKNOWLEDGEMENTS**

Much of the VMNH material of this family was collected by Dr. David R. Smith during Malaise trap collecting programs, and by him very generously donated to VMNH. Many specimens were obtained through inventory activities conducted by staff members of the Virginia Division of Natural Heritage and transmitted to VMNH through the good offices of Dr. Steven M. Roble. The authors are indebted to Dr. Arthur V. Evans for contributing records of specimens in his collection. He also scanned the eucnemid material in the National Museum of Natural History for any Virginia specimens added since Muona’s examination of that source.

**LITERATURE CITED**


Horseshoe crab (*Limulus polyphemus*), dorsal aspect.

Original drawing by John Banister.
The Forest Caterpillar Hunter, *Calosoma sycophanta*,
An Old World Species Confirmed as Part of the
Virginia Beetle Fauna (Coleoptera: Carabidae)

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ABSTRACT

The presence of the predatory forest caterpillar hunter, *Calosoma sycophanta* (Linnaeus), is confirmed in Virginia. A native of Europe, this species was purposefully introduced into North America early in the 20th Century as part of a biological control project to control the gypsy moth, *Lymantria dispar* (Linnaeus) and browntail moth, *Euproctis chrysorrhoea* (Linnaeus) in New England. A brief review of the distribution and natural history of *C. sycophanta* in North America is presented, along with a key to the species of *Calosoma* in Virginia.

Key words: Bull Run Mountains, *Calosoma*, Carabidae, Coleoptera, forest caterpillar hunter, Virginia.

INTRODUCTION

In July of 2008, while conducting a beetle survey of the Bull Run Mountains Natural Area Preserve in Fauquier and Prince William counties in Virginia, I found numerous metallic green elytra scattered along a foot trail winding through an oak woodland on a west-facing slope. The area had been heavily infested with the larvae of the gypsy moth, *Lymantria dispar* (Linnaeus), as evidenced by thousands of larval exuviae and pupal cases that festooned the trunks of oaks and other hardwood trees.

At first glance, I thought the beetle remains were those of the indigenous caterpillar hunter or fiery searcher, *Calosoma scrutator* (Fabricius), a common, brightly colored, and widespread carabid beetle found in the mountains and lowlands of Virginia. Closer inspection revealed that the elytra were much brighter and more yellow than those of *C. scrutator* and lacked the characteristic coppery red border along the lateral and apical margins.

Further searching in the area produced an extremely fragile, yet nearly intact specimen ensnared in an abandoned spider web. The pronotum of this specimen was mostly black with metallic blue along the margins, rather than bluish with violet or coppery yellow-green borders typical of *C. scrutator*. Of the five other species of *Calosoma* known in Virginia (*C. calidum* [Fabricius], *C. externum* [Say], *C. frigidum* Kirby, *C. sayi* Dejean, and *C. wilcoxi* Le Conte), only *C. wilcoxi* has entirely metallic green elytra, but it is smaller and much duller than either *C. scrutator* or the silk-wrapped remains in question. All seven species of *Calosoma* in Virginia are shown in Figure 1.

With the aid of Gidaspow’s (1959) monograph on the *Calosoma* of North America, I identified the Bull Run Mountains corpse as the European forest caterpillar hunter, *C. sycophanta* (Linnaeus). The label data for this specimen and a single elytron are as follows: USA: VA, Fauquier Co., Bull Run Mountains NAP, W of Bull Run Mountain Estates, N38.87875 W77.68927, 20 August 2008, A.V. Evans. Both specimens are housed in my collection.

Gidaspow (1959) provides a brief history of the initial introduction of *C. sycophanta* into the United States. Already known as an important predator of gypsy moth larvae in France, 4,046 beetles were imported into the United States between 1905 and 1910, most of which were released in New England to...
combat outbreaks of two European species of lymantriids: the gypsy moth, *Lymantria dispar* (Linnaeus), and the browntail moth, *Euproctis chrysorrhoea* (Linnaeus). For a more complete overview of the life history, behavior, and introduction of *C. sycophanta* in New England, see Burgess (1911) and Burgess & Collins (1915).

**DISTRIBUTION IN NORTH AMERICA**

Bousquet & Larochelle (1993) record *C. sycophanta* in the United States from Connecticut, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Washington. Weseloh et al. (1995) note releases in Delaware, Michigan, and West Virginia, adding that the species was already established in the latter. Schaefer et al. (1999) added Maryland to the list, but did not find recent records of the beetle in Michigan or Washington that were not associated with releases and concluded that *C. sycophanta* is not yet established in these states. In spite of releases on Vancouver Island, British Columbia, Quebec, New Brunswick, and Nova Scotia, *C. sycophanta* is not known to be established in Canada (Bousquet, 1991; Schaefer et al., 1999).

Schaefer et al. (1999) provide an informative overview of historical range expansion of *C. sycophanta* in North America from 1905 to 1994, including a state and county map showing intentional release sites. They note a single record from Winchester, Virginia, collected on 9 July 1915 by O.I. Shapp in the collection of the National Museum of Natural History (NMNH), Smithsonian Institution, Washington, DC. However, Schaefer et al. (1999) state that the “...specimen probably resulted from an intentional release made just prior to its collection” and that “no population persisted in Virginia in subsequent years.” A second Virginia record from 1974 was reported by Thiele (1977), but this was disputed by Schaefer et al. (1999), who could not locate the specimen in the NMNH collection. They believe that Thiele’s record was erroneous and intended to refer to the 1915 specimen.

With relatively recent recoveries of beetles in West Virginia (1994) and Maryland (1998), combined with its dispersal abilities (see Doane & Schaefer, 1971), Schaefer et al. (1999) concluded that *C. sycophanta* was very likely to occur in northern Virginia. They included the region in their 1994 distribution map with a question mark, and noted that the next Virginia occurrence would establish a renewed state record. The aforementioned discovery of numerous elytra and an intact specimen in the Bull Run Mountains does indeed establish the presence of *C. sycophanta* in the Commonwealth.

I located the 1915 Virginia specimen of *C. sycophanta* in the insect collection of the NMNH, but no subsequent Virginia records were found. Nor were specimens located in the collection at Virginia Polytechnic Institute & State University. However, at the Virginia Museum of Natural History, I found one specimen of *C. sycophanta* amongst a series of *C. scrutator* with the following locality data: VA, Prince William Co., Prince William Forest Park, June 8, 1992, J.C. Killian, uv light trap. It is not known if this specimen represents an established population.

**NATURAL HISTORY**

Both the adult and larval *C. sycophanta* climb trees to attack and eat caterpillars and pupae of gypsy moths and other species (Gidaspow, 1959). Adult males are more likely to be found on tree trunks, while females tend to remain on the ground (Weseloh, 1993). Based on observations in the laboratory and in the field (Weseloh, 1993), both males and females are active day and night. Males tend to be more active and conspicuous, spending most of their time searching for mates, while the more secretive females spend much of their time buried in the soil and hidden among leaf litter to feed and lay eggs.

Adult activity coincides with the larval activity of the gypsy moth. Adults emerge from their overwintering sites in June to search for prey and mates, although some beetles may remain dormant for up to two years (Larochelle & Larivière, 2003). Although adults are strong and agile fliers and capable of leaving their overwintering sites behind to search for high populations of caterpillars, their appearance at new outbreaks of gypsy moths is by no means certain (Doane & Schaefer, 1971). Released beetles often remain near the release site (Weseloh et al., 1995).

They will attack a variety of other caterpillar species, but they are most abundant where populations of gypsy moth caterpillars are high, especially at sites two or three years after an outbreak (Weseloh, 1985; Weseloh et al., 1995). Adults are active for only about a month and re-enter the soil in July and remain there until the following spring (Weseloh et al., 1995).

Weseloh (1993) suggests that adult *C. sycophanta* predation alone is not the beetle’s primary impact on gypsy moth populations. Instead, the forest caterpillar hunter’s greatest impact is through larval production and the voracious appetites of the larvae for mature caterpillars and pupae. The ability of adult beetles to reproduce is directly dependent upon the availability of high densities of gypsy moth caterpillars, especially since females require sufficient protein to ensure...
successful oviposition (Spieles & David, 1998).

Eggs are laid in the soil beginning in early July and hatch in 4-7 days. The larvae climb trees in search of caterpillars and pupae. The remains of pupae attacked by beetle larvae have characteristically large and jagged holes (Weseloh et al., 1995). Mature beetle larvae seek pupation sites in the soil. The entire life cycle, from egg to adult, takes about seven weeks. In Connecticut, adults are known to live 3-4 years (Weseloh, 1990).

Anecdotal evidence suggests that forest caterpillar hunters are potentially important predators of gypsy moth larvae and pupae, but there is still much to learn (Weseloh, 1985). Nearly all of the information on the ecology and behavior of *C. sycophanta* was gathered during the brief period of adult activity that coincides with gypsy moth outbreaks, but little is known about the ecology of this species between outbreaks (Weseloh, 1990).

IDENTIFICATION OF *CALOSOMA* SPECIES IN VIRGINIA

The genus *Calosoma* is distinguished from other Virginia carabids by the following combination of characters: large size (19-35 mm); head wider than half the width of the pronotum; antennal segments 5-10 pubescent with large glabrous spots; large mandibles lack teeth near the apex, but have distinct or indistinct
ridges across the base; last segment of maxillary palp larger and broader than the penultimate segment; elytra with distinctly impressed grooves; flight wings well-developed; front tarsi expanded in males (Ciegler, 2000). The genus contains the largest and most brilliantly colored ground beetle in Virginia, C. scrutator.

Key to the Calosoma of Virginia
(modified from Gidaspow, 1959)

1. Pronotum without basal setae ........................................ 2
1'. Pronotum with basal setae close to hind angles............. C. sayi Dejean

2(1). Last segment of maxillary palpi distinctly wider and often shorter than preceding segment; tooth of mentum almost always long and pointed; underside with little or no metallic luster .......... 3
2'. Last segment of maxillary palpi of the same length and hardly wider than penultimate segment; tooth of mentum small and blunt; underside metallic green or with distinct bluish or greenish luster..... 4

3(2). Head sparsely covered with large punctures; antennal segments 5-11 are uniformly pubescent .................................. C. externum (Say)
3'. Head densely covered with small punctures; antennal segments 5 and 6 with long, glabrous spots ............ C. calidum (Fabricius)

4(2). Femora dark brown or black, without metallic blue, green, or violet luster ........................................ 5
4'. Femora reddish or dark brown, with metallic blue, green, or violet luster ........................................ 6

5(4). Elytra golden green, sometimes with reddish luster on sides; pronotum black with metallic blue toward sides; 22-25 mm .................................. C. sycophanta (Linnaeus)
5'. Elytra dark brown, bronze, or black, with large green, coppery, or golden pits; 19-27 mm ......................... C. frigidum Kirby

6(4'). Larger (23-35 mm); pronotum dark blue or violet with broad purple or golden green margin; middle tibiae of male strongly curved with brush of reddish setae at tip .......... C. scrutator (Fabricius)
6'. Smaller (17-22 mm); pronotum black or dark olive green, with bluish luster; pronotal margin purple or golden green; middle tibiae of male straight, or only slightly curved, without reddish setae on tip .................... C. wilcoxi LeConte

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LITERATURE CITED


An Updated List of Macrolepidopteran Moths
Collected near Vontay, Hanover County, Virginia 1996-2003

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This paper provides a complete species list of macrolepidopteran moth (= macro-moth) species recorded from a site on the Virginia Piedmont, 2 km W of Vontay in western Hanover County. Unlike many forested regions of Virginia, the site has never been aerial sprayed with pesticides to control gypsy moth (Lymantria dispar) populations. The study site, methodology, and original species list are given in Ludwig (2000) and two updates were provided (Ludwig, 2001, 2002). This paper provides a synthesized list of all subsequent collections as well as corrected identifications of specimens reported in my previous papers. All species were recorded between 30 October 1996 and 14 September 2003 during 475 collection nights. Six methods (sugar baiting, incandescent light, black or ultraviolet light, mercury vapor light, ultraviolet light trap, and observation without collection) were used to record moths at the study site. Two to four methods were used concurrently on all collection nights. Except when temperatures dropped to near or below freezing, sampling was conducted regardless of moon phase and weather conditions. Emphasis was placed on obtaining an inclusive species list and not a quantitative sample of macro-moth species. Determinations were assigned primarily by the author with assistance from several coworkers and a number of expert lepidopterists.

A total of 2,293 macrolepidopteran moth specimens was pinned and identified during this study. The number of specimens would be much higher if all 100,000+ macro-moths encountered at the lights and bait were taken rather than selecting only moths that appeared to be new to the study. Even with the bias of collecting only moths that appeared to be new, 559 species of macro-moths from 318 genera in 13 families were collected or observed during this study (Table 1).

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LITERATURE CITED


Table 1. Macro-moth species encountered during this study given in order of Hodges et al. (1983) with modifications as needed due to post-1983 systematic investigations.

**Thyatiridae (2 genera, 2 species)**
06237 Pseudephytaira cymatophoroides (Gn.)
06240 Euthyphira pudens (Gn.)

**Drepanidae (3 genera, 3 species)**
06251 Drepana arcuata Wlk.
06253 Endelina herminiata (Gn.)
06255 Oreta rosea (Wlk.)

**Geometridae (73 genera, 110 species)**
06258 Aethes pholos (Harr.)
06261 Heliomata cycladeta Grt. & Rob.
06270 Proteria virginalis (Hulst)
06273 Speranza postularia (Gn.)
  = Itame postularia (Gn.)
06322 Mellilla xanthometaria (Wlk.)
06326 Macaria aemulataria Wlk.
  = Semiothisa aemulataria (Wlk.)
06331 Macaria promiscuata (Fgn.)
  = Semiothisa promiscuata Fgn.
06339 Macaria transfusa Wlk.
  = Semiothisa transfusa (F.)
06341 Macaria bicolorata (F.)
  = Semiothisa bicolorata (F.)
06352 Macaria granitata (Gn.)
  = Semiothisa granitata (Gn.)
06353 Macaria multilineata Pack.
  = Semiothisa multilineata (Pack.)
06362 Digrammia continuata (Wlk.)
  = Semiothisa continuata (Wlk.)
06386 Digrammia ocellinata (Gn.)
  = Semiothisa ocellinata (Gn.)
06405 Digrammia gnophosaria (Gn.)
  = Semiothisa gnophosaria (Gn.)
06443 Glenodes texanaria (Hulst)
06449 Glena cribararia (Gn.)
06452 Glena plumosaria (Pack.)
06478 Eurydyce pyrolaria Gn.
06486 Tornos scolopacinus (Gn.)
06584 Iris ipharia (Gn.)
  = Anacampodes humaria (Gn.)
06586 Iris defectoria (Gn.)
  = Anacampodes defectoria (Gn.)
06588 Iris larvaria (Gn.)
06590 Anarbrotella pampanaria (Gn.)
06594 Cleora subhuminaria (Gn.)
06597 Ectropis crepuscularia (D. & S.)
06599 Euphyes hortaria (F.)
06620 Melanolophia canadaria (Gn.)
06654 Hypagyris mupunctata (Haw.)
06655 Hypagyris stelleri (Barnes)
06659 Philea delinucula Wlk.
06660 Philea striigata (Minot)
06662 Palaearcita vernata (Peck)
06663 Palaearcita merricata Dyar

06665 Eranis tiliaria (Harr.)
06667 Lonographa vestalista (Gn.)
06677 Cabera erythraaria Gn.
06711 Thysanopyga intractata (Wlk.)
06720 Lytrois unaria (H.-S.)
06721 Lytrois simulata Rindge
06724 Euchlaena serrata (Dru.)
06726 Euchlaena obrunaria (Hbn.)
06729 Euchlaena johnsonaria (Fitch)
06733 Euchlaena amoenaaria (Gn.)
06733 Euchlaena phyllochira (Wlk.)
06735 Euchlaena pectinaria (D. & S.)
06739 Euchlaena iraria (B. & McD.)
06743 Xanthotype spectata (Drury)
06754 Pero ancetaria (Hbn.)
  = Pero hubneria (Gn.)
06755 Pero morrisonaria (Hy. Edw.)
06763 Phaeonura gurnaria (J.E. Sm.)
  = Nacophora gurnaria (J.E. Sm.)
06796 Campaea perlata (Gn.)
06797 Ennomos magnaria Gn.
06815 Gueneria similaria (Wlk.)
06817 Selica alpicaaria Wlk.
06818 Selica cantaria (Gnt. & Rob.)
06822 Metarcrinus duaria (Gn.)
06826 Metarcrinus hypocrateria (H.-S.)
06828 Metarcrinus humberaria (Gnt. & Rob.)
06832 Metarcrinus obfirmaia (Hbn.)
06834 Cephis decoloraria (Hulst)
06836 Anagula occidentaria (Wlk.)
06837 Proboe alienaria H.-S.
06838 Proboe amicaria (H.-S.)
06842 Plagolis phlogosaria (Gn.)
06843 Plagolis servidoria (H.-S.)
06844 Plagolis alcalaria (Gn.)
06884 Besna endriaria (Gnt. & Rob.)
06885 Besna qurveroria (Gn.)
06892 Lambdae pellucidaria (Gnt. & Rob.)
06894 Lambdae athasaria ferrivaria (Wlk.)
06941 Ensaria coniferaia Hbn.
06963 Tetrois crocallata Gn.
06964 Tetrois caxhizata Gn.
06966 Entropelia chaladaria (J.E. Sm.)
06974a Patalena olyzonaria puber (Gnt. & Rob.)
06982 Prochoerodes lineola (Goeze)
  = Prochoerodes transversata (Dr.)
07033 Nemoria lexaria (Gn.)
07046 Nemoria bistrata bistrata Hbn.
07047 Nemoria rubrifrontaria (Pack.)
07053 Dichorda iridaria (Gn.)
07058 Synchila aeroa (F.)
07071 Chlorochlamys chloroleucaria (Gn.)
07075 Chloroperys tepperaria (Hulst)
07084 Hethemia pisucata (Gn.)
07094 Lobocleta ossularia (Gey.)
07114 Ideea demissaria (Hbn.)
07123 Ideea obsfusaria (Wilk.)
07132 Pleuroprotha insulansia (Gn.)
07136 Cyclophora packardi (Prout)
07146 Haematopota grataria (F.)
07159 Scopula limboundata (Haw.)
07169 Scopula indicata (Gn.)
07179 Lepotaphila rubromarginaria (Pack.)
07181 Lophophora luteata (Hulst)
07196 Euthysis diversilineata (Hbn.)
07237 a Hydromena transfigurata manitoba B.& McD.
07292 Rheumaptera prunivora (Fgn.)
= Hydria prunivora (Fgn.)
07388 Xanthorhoe ferrugata (Clerck)
07390 Xanthorhoe laevistriata (Gn.)
07414 Orthotoma obsfusaria (F.)
07416 Costacovexa centrostrigaria (Woll.)
= Orthotoma centrostrigaria (Woll.)
07417 Disclisipractic stellata (Gn.)
07422 Hydrelia inornata (Hulst)
07440 Erubaphe mendicu (Gn.)
07474 Eupithecia diversilineata Grt.
07509 1 Eupithecia naitheri Rindge
[Specimens originally reported as Eupithecia herefordaria C.& S. in Ludwig (2000)]
07538 Cladara angulimeta (Grt.& Rob.)
07539 Cladara atrifera (Wlk.)
07547 Heterophleps trigattaria H.-S.
07548 Dyspteris arborivaria (H.-S.)
07590 1 Eupithecia naitheri Rindge

Epiplemidac (2 genera, 2 species)
07650 Callezia amorata Pack.
07653 Calledaperyx dryopterata Grt.

Mimallonidae (1 genus, 1 species)
07659 Lacosoma chiridota Grt.

Apatelodidae (2 genera, 2 species)
07663 Apatelodes torrefacta (J.E.Sm.)
07665 Olceclostera altaecta (Grt.)

Lasiocampidae (4 genera, 5 species)
07670 Tolype vellida (Stoll)
07683 Artace eriptraria (Ljungh)
07687 Phythodesma americana (Harr.)
07698 Malacosoma disstria Hbn.
07701 Malacosoma americanum (F.)

Saturniidae (10 genera, 12 species)
07704 Eacles imperialis (Dru.)
07706 Citheronia regalis (F.)
07708 Citheronia sepuleris Grt.& Rob.
07715 Dryocampa rubicunda (F.)
07716 Anisota stigma (F.)
07723 Anisota virginiensis (Dru.)
07730 Hemileuca maia (Dru.)
07746 Antonellis io (F.)
07757 Antheraea polyphemus (Cram.)
07758 Actias luna (L.)
07761 Callosamia angulifera (Wlk.)
07767 Hyalophora cecropia (L.)

Sphingidae (14 genera, 21 species)
07771 Agris cingulatus (F.)
07775 Manduca sexta (L.)
07780 Manduca jasminearum (Guer.)
07784 Dolba hylaeus (Dru.)
07786 Ceratomia anlyntor (Geyer)
07787 Ceratomia induliosa (Wlk.)
07789 Ceratomia catalpa (Bdv.)
07793 Paratrea plebeja (F.)
07816 Lapura coniferarum (J.E.Sm.)
07820 Smerinthus jamaicensis (Dru.)
07824 Paonias excaecatus (J.E.Sm.)
07825 Paonias myops (J.E.Sm.)
07826 Paonias angulata (Dru.)
07827 Lacthojus juglandis (J.E.Sm.)
07853 Hemaris thysea (F.)
07855 Hemaris diffinis (Bdv.)
07870 Sphecodina abbottii (Swainson)
07871 Deidamia inscripta (Harr.)
07885 Darapsa myron (Cram.)
07886 Darapsa phoebe (Cram.)
07894 Hyles lineata (F.)

Notodontidae (18 genera, 35 species)
07896 Clostera inclusa (Hbn.)
07902 Datana ministrana (Druy.)
07903 Datana angustia Grt.& Rob.
07905 Datana drexelii Hy. Edw.
[This specimen was assigned to D. drexelii based on food plant preference, but it may be D. major Grt. & Rob.]
07906 Datana conica Grt.
07907 Datana integra Grt. & Rob.
07908 Datana persicina Grt. & Rob.
07915 Nadura gibbosa (J.E.Sm.)
07917 Hyperaeschra georgica (H.-S.)
07920 Peridea angulosa (J.E.Sm.)
07921 Peridea ferruginea Pack.
07929 Nerice bidentata Wlk.
07931 Glyphisias septentrionalis Wlk.
07936 Furcilia horealis (Guer.)
07937 Furcila cinerea (Wlk.)
07942 Cerura scripta Wlk.
07951 Symmerista albifrons (J.E.Sm.)
07952 Symmerista canicosta (Drury)
07957 Dasylophia anguinea (J.E.Sm.)
07958 Dasylophia thyatiroides (Wlk.)
07974 Misogada unicolor (Pack.)
07975 Macrurocampa mariesia (Cram.)
07983 Heterocampa obliqua Pack.
07990 Heterocampa umbrata Wlk.
07994 Heterocampa guttivera (Wlk.)
07995 Heterocampa bimaculata Wlk.
07998 Lochmaea nevadae Doubleday
07999 Lochmaea bilineata (Pack.)
08005 Schizura ipomoeae Doubleday
08006 Schizura badia (Pack.)
08007 Schizura unicornis (J.E.Sm.)
08011 Schizura leptinoeides (Grt.)
08012 Oligocentria semifasciata (Wlk.)
08017 Oligocentria lignicolor (Wlk.)
08022 Hyparnea aurora (J.E.Sm.)

Arctiidae (18 genera, 33 species)

08045 Cranbida lithosioides Dyar
08046 Cranbida minitana Dyar
08053.1 Cranbida sp. near cephalica (Grt.& Rob.)
08061 Cisthene kentuckiensis (Dyar)
08067 Cisthene phumea Stretch
08072 Cisthene packardi (Grt.)
08089 Hypoprepia minita (Kby.)
08090 Hypoprepia fuscata Hbn.
08098 Clemensia albata Pack.
08099 Pagara simplex Wik.
08107 Haploa eymene (Brown)
08110 Haploa contigua (Wik.)
08111 Haploa lecontei (Guer.-Meneville)
08118 Virbia opella (Grt.)

Lymantrieidae (3 genera, 6 species)

08292 Dasychira thephra Hbn.
08296 Dasychira basiflava (Pack.)
08302 Dasychira obliquata (Grt.& Rob.)
08314 Orgyia definita Pack.
08316 Orgyia leucostigma (J.E.Sm.)
08318 Lymatrina dispar (L.)

Noctuidae (168 genera, 327 species)

08322 Idia americana (Gn.)
08323 Idia oenoma Hbn.
08326 Idia rotundalis (Wlk.)
08327 Idia forbesi (French)
08328 Idia jula (B.&McD.)
08329 Idia dimittendis (B.&McD.)

08333 Idia dentencalis (Harv.)
08334 Idia lunacalis (Gey.)
08338 Phalaenophysa pyramidalis (Wlk.)
08340 Zanclognatha littoralis (Hbn.)
08345 Zanclognatha laevigata (Grt.)
08347 Zanclognatha obscuripennis (Grt.)
08348 Zanclognatha pedipilalis (Gn.)
08349 Zanclognatha rusticulalis (Wlk.)
08351 Zanclognatha rusticulalis (Gn.)
08355 Chryolita morinula (Gn.)
08356 Chryolita paralis (Grt.)
08358 Macrocchilo litophora (Grt.)
08364 Phalaenophysa laevigata (Grt.)
08366 Tetanota myxalalis (Wlk.)
08368 Tetanota floridana (Sm.)
08370 Blepina costula (Gn.)
08378 Renia sahysalis (Wlk.)
08381 Renia discoloralis (Gn.)
08381.1 Renia sp. near discoloralis (Gn.)
08384.1 Renia flavipunctalis (Gey.)
08387 Renia sobrialis (Wlk.)
08393 Lascaria ambigualis Wik.
08397 Palthis angulalis (Hbn.)
08398 Palthis asoalis (Grt.)
08401 Redectis virreia (Grt.)
08404 Rhythula provisionalis Grt.
08407 Oxycera malacca (Gn.)
08411 Calobycha interpuncta (Grt.)
08426 Dyspyralis illacata Wrr.
08427 Dyspyralis puncticauda (Sm.)
08428 Dyspyralis nigella (Stkr.)
08430 Paralypenodes quadralis B.&McD.
08440 Nigetia formosalis Wik.
08441 Hypena mowalis (Wlk.)
08442 Hypena balearalis (Wlk.)
08444 Hypena palmaria (Wlk.)
08445 Hypena aballevalis (Wlk.)
08446 Hypena decepcialis (Wlk.)
08447 Hypena neudemalis (Gn.)
08448 Hypena neudemalis (Gn.)
08465 Hypena scabra (F.)
08467 Hemeroplia scapanus (Haw.)
08479 Sparagelina sexpunctata Grt.
08490 Pangrapta decoralis Hbn.
08491 Ledea perditalis (Wlk.)
08493 Isogona tennis (Grt.)
08499 Metalectra discalis (Grt.)
08500 Metalectra quadrisignata (Wlk.)
08502 Metalectra tuntillus (Grt.)
08505 Metalectra richardsi Brower
08509 Arugisa latenella (Wlk.)
09225  Acronicta vinulata (Grt.)
09227  Acronicta laetifica Sm.
09229  Acronicta hastia Gn.
09236  Acronicta nora Sm. & Rob.
09237  Acronicta interupta Gn.
09238  Acronicta lobelianae Gn.
09242  Acronicta exilia Gn.
09243  Acronicta ovata Gn.
09244  Acronicta modico Wilk.
09250  Acronicta inclora Sm.
09251  Acronicta retarda (Wlk.)
09254  Acronicta afflcta Gn.
09257  Acronicta impeta Wilk.
09259  Acronicta noctivaga Gn.
09264  Acronicta longa Gn.
09266  Acronicta lithospila Gn.
09272  Acronicta oblinata (J. E. Sm.)
09280  Simyra insularis (H.-S.)
  = Simyra henrici (Gn.)
09281  Agriopodes fallax (H.-S.)
09284  Anteastra teratophora (H.-S.)
  = Agriopodes teratophora (H.-S.)
09285  Polygrammate hebraeicum Hbn.
09286  Harrisimemna triagnata (Wlk.)
09286.1 Comachara cadbutyi Franch.
09299  Endrias unio (Hbn.)
09301  Endrias grata (F.)
09332  Apamea vulgaria (Gn. & Rob.)
09348  Apamea amputatrix (Fitch)
09404  Oligia modica (Gn.)
09427  Meropleon diversicolor (Morr.)
09454  Loscopia velata (Wlk.)
  = Amphipoea velata (Wlk.)
09456  Amphipoea interoceanica (Sm.)
09463  Parapamea huffaloensis (Gn.)
09466  Papapiaena cataphracta (Gn.)
09484  Papapiaena rutula (Gn.)
09485  Papapiaena baptisae (Bird)
09496  Papapiaena nebris (Gn.)
09501  Papapiaena eupatorii (Lyman)
09505  Papapiaena cereumata (Gn.)
09525  c. bellora aobu (Dyar)
09545  Enplexia bennesimilis McD.
09547  Phlogophora periclosa Gn.
09556  Chyonix polliacricula (Gn.)
09560  Dypterygia roznani Berio
09582  Nedra ramusula (Gn.)
09618  Phosphila turbulentia Hbn.
09619  Phosphila miselioideae (Gn.)
09631  Callopisnia mollissima (Gn.)
09638  Amphipyra pyramidoideae Gn.
09647  Proxenna miranda (Gn.)
09650  Anorthodes tarda (Gn.)
09661  Charmodes talidiformis Gn.
09662  Balsa malana (Fitch)
09666  Spodoptera frugiperda (J. E. Sm.)
09669  Spodoptera ornithogalli (Gn.)
09678  Elaphria versicolor (Gn.)
09679  Elaphria chalcedonia (Hbn.)
09681.1  Elaphria cornutinis Salu & Pogue
  [Identity of additional specimens not confirmed;
  some may be E. alapalidora Pogue & Sullivan]
09684  Elaphria grata Hbn.
09688  Galgula partita Gn.
09689  Perigaea xanthoideae Gn.
09690  Conidia videns (Gn.)
  = Platysenta videns (Gn.)
09693  Conidia mobilis (Wlk.)
  = Platysenta mobilis (Wlk.)
09699  Conidia sutum (Gn.)
  = Platysenta sutum (Gn.)
09720  Ogoconata cinerea (Gn.)
09725  Azenia obtusa (H.-S.)
  = Stiriodes obtuso (H.-S.)
09766  Curtiphorus triangulifer Gn.
09815  Cosmia calami (Harv.)
09886  Lithophane patefector (Wlk.)
09892  Lithophane disposita Morr.
09893  Lithophane hemina Gn.
09905  Lithophane viridipallens Gn.
09910  Lithophane antennata (Wlk.)
09915  Lithophane groei Riley
09916  Lithophane unimoda (Lint.)
09929  Pyreferra hesperiodes (Gn.)
09930  Pyreferra citrombra Franc.
09933  Eupsilia vioulenta (Gn.)
09934  Eupsilia cyrriplea Franc.
09935  Eupsilia triagnata (Gn.)
09941  Sericaglaea signata (French)
09942  Xystopeplus rufago (Hbn.)
09943  Metaxaglaea invita (Gn.)
09944  Metaxaglaea viatica (Gn.)
09945.2  Metaxaglaea violacea Schweitzer
09946  Epiglaea decliva (Gn.)
09950  Chaetaglaea sericea (Morr.)
09952  Encyrophina pampina (Gn.)
09957  Agrochola bicolorao (Gn.)
  = Simyra bicolorao (Gn.)
09961  Anathis calina (Gn. & Rob.)
09989 a  Sutyn privata teelowo (Sm.)
10014  Psaphida rolandi (Gn.)
10016  Psaphida styracis (Gn.)
10019  Psaphida resumens Wilk.
10021  Capivaleria groei (Morr.)
10065  Homohadenina infixa (Wlk.)
  [All specimens originally reported as H. badisstra (Gn.)
  in Ludwig (2000) are now attributed to H. infixa.]
10304  Trichorhorda legitima (Gn.)
10368  Lacinipola meditata (Gn.)
10372  Lacinipola angina (Gn.)
10397  Lacinipola remigera (Steph.)
10405  Lacinipola lorea (Gn.)
10406  Lacinipola clvniae (Morr.)
10413  Lacinipola explicata McD.
10414  Lacinipola impicata McD.
10438  Mythimna unipuncta (Haw.)
  = Pseudaletia unipuncta (Haw.)
Leucania linda Franc.
Leucania adjuta (Grt.)
Leucania Ursula (Fbs.)
Orthosia rubescens (Wlk.)
Orthosia hibisci (Gn.)
Orthosia garmani (Grt.)
Orthosia hibisci (Gn.)
Crocigrapha normani (Grt.)
Himella fidelis (Grt.)
= Himella intractata (Morr.)
Egira alternans (Wlk.)
Achatia distincta Hbn.
Morrisonia confusa (Hbn.)
Morrisonia latex (Gn.)
Nephelodes minians Gn.
Homorthodes lindseyi (Benj.)
Orthodes majuscula H.-S.
= Orthodes crenulata (Bttr.)
Orthodes cynica Gn.
Orthodes detracta (Wlk.)
Orthodes goodelli (Grt.)
Tricholita signata (Wlk.)
Agratis gladiaria Mor.
Agratis venerabilis Wlk.
Agratis ipsislon (Hufn.)
Feltia subhirticola (F.)
Feltia tricosa (Lint.)
Feltia herilis (Grt.)
Dichagxris acclivis (Morr.)
= Richia acclivis (Morr.)
Ochropleura inpecta Laf.
Anicia illapsa (Wlk.)
= Euagrotis illapsa (Wlk.)
Anicia infecta (Ochs.)
Peridroma sanca (Hbn.)
Xestia dolosa Franc.
Xestia smithii (Snell.)
Pseudohermonassa bicaurea (Gn.)
= Xestia bicarnea (Gn.)
Agnorisma badnodiis (Grt.)
= Xestia badnodiis (Grt.)
Agnorisma bollii (Grt.)
= Xestia bollii (Grt.)
Xestia elimata (Gn.)
= Anomogyna elimata (Gn.)
Xestia dilucida (Morr.)
= Anomogyna dilucida (Morr.)
Cerastis tenebrifera (Wlk.)
Choephora funerson Gn. & Rob.
Protolampra bruneicollis (Grt.)
Noctua promuba (L.)
Abagrotis alternata (Grt.)
Pyrhia adela Laf. & Mikkola
Helicoverpa zeu (Boddie)
= Heliothis zeu (Boddie)
Heliothis subflexa (Gn.)
Heliothis virescens (F.)
Heliocheilus lupatus (Grt.)
[Specimen originally reported as Heliothis phloxiphagus Grt. & Rob. in Ludwig (2000)]
Schinia lynx (Gn.)
Schinia obscurata Stkr.
Schinia arcigera (Gn.)
Schinia rivulosa (Gn.)
Schinia trifascia Hbn.
Schinia mundina (Dru.)
FIRST RECORD OF THE EXOTIC INVASIVE 
VITEX ROTUNDIFOLIA (VERBENACEAE) IN 
VIRGINIA. — Vitex rotundifolia L.f., commonly 
referred to as beach vitex or roundleaf chastetree, is a 
low-growing, crawling, invasive shrub that was 
discovered growing wild on the backslope, crest, and 
foredune of Willoughby Spit in Norfolk, Virginia by 
L. Rosenberg in September 2008 (Fig. 1). This is the 
first documented record of V. rotundifolia in the 
Commonwealth of Virginia. Specimens were collected 
and verified on 10 October 2008 by the authors, and 
have been deposited in the herbarium, College of 
William and Mary, Williamsburg, Virginia.

Vitex rotundifolia is a perennial, deciduous, woody 
shrub indigenous to coastal sand dunes of eastern and 
southern Asia, Australia, and the Pacific Islands. It is a 
highly salt- and drought-tolerant species that is adapted 
to full-sun and grows well in dune and other sandy 
environments, well-drained soils, or disturbed sites 
(Socha & Roecher, 2004; Madsen et al., 2005). Vitex 
rotundifolia grows 0.5-1.0 m in height; however growth 
is primarily concentrated in a dense mat horizontally, 
with spreading branches up to 20 m long and 
approximately 5 m in width (Kim, 2004; Madsen et al., 
2005; Fig. 1). Nodal rooting of the branches contributes 
to this mat-like growth (Socha & Roecher, 2004).

Negative effects of V. rotundifolia on the local 
environment include the exclusion of native plants from 
beaches, increased rates of dune erosion, and lower 
rates of successful reproduction in sea turtles 
(Swearingen et al., 2002). It is also known to crowd out 
the federally threatened plant, seabeach amaranth 
(Amaranth pumilis Raf.) (Invasive Plant Atlas of the 
MidSouth). Native plants are excluded locally due to 
shading by the V. rotundifolia growth mat and the 
plant’s release of allelopathic compounds that make the 
soil hydrophobic (Ono et al., 2002). These changes 
cause both light and drought stress in less tolerant 
native species and result in vast dune monocultures of 
V. rotundifolia (Gresham & Neal, 2004). Ensuing 
monocultures trigger increased rates of dune erosion 
(Sea Grant North Carolina, 2006). Unlike the fibrous 
root structures of native dune grasses, V. rotundifolia 
features a deep tap root (Fig. 2) with minimal branches 
that provides little structure to the soil matrix (GISDB, 
2007). Furthermore, the low growth of V. rotundifolia 
makes it a poor catchment species for blown sand, 
thereby increasing wind erosion of dunes (ZhiQuan et 
al., 1996). Monocultures of V. rotundifolia also lead to 
increased mortality rates in young sea turtles. The dense 
growth of this invasive species decreases quality 
nesting areas for adults and entraps newly hatched 
turtles migrating to the water in its long, branching 
runters (Gresham & Neal, 2004).

The plant was originally introduced to the United 
States by North Carolina State University Arboretum 
for the purpose of dune stabilization and ornamental use 
in the mid-1980s (Socha & Roecher, 2004). Today, V. 
rotundifolia is categorized as an exotic, invasive species 
typically found in the coastal Carolinas and is described 
as a quarantine significant pest with medium-high risk 
potential (National Research Council, 2002; GISDB, 
2007). Because of the plant’s ability to: 1) survive in 
five U.S. hardiness zones, 2) create a large seed bank, 
and 3) reproduce at leaf nodes, spreading of V. 
rotundifolia from the Carolinas to other southeastern
coastal states has long been expected (Madsen et al., 2005). Transportation to new areas is accomplished via consumption and excretion of seeds by fauna, floating of vegetation in water currents and the subsequent deposition and rooting of vegetative fragments on beaches, and the continued sale and use of *V. rotundifolia* as a woody ornamental (Socha & Roecher 2004; GISDB, 2007).

In Norfolk, it is suspected that the main *Vitex* colony originated from plantings by local property owners, but this has not been substantiated. One possible source was suggested following a radio show on the issue, when L. Rosenberg received a call from a concerned homeowner stating that she had inadvertently planted *V. rotundifolia* in her yard as an ornamental. The caller’s property is located approximately four miles (6.4 km) from Willoughby Spit in the Lafayette River watershed in Norfolk; however, the site is not on any body of water. It was reported by the property owner that the *V. rotundifolia* specimens had been purchased from a nursery on the Eastern Shore of Virginia two years prior. Although seeds could have been moved from these specimens to the infested dune via ingestion and excretion by birds, this would appear to be highly unlikely because the specimens planted as ornamentals were highly stressed due to shading and, according to the homeowner, had not flowered or produced seeds during the past growing season (pers. comm. to Rosenberg). A more likely explanation for the invasive colony is that individuals were introduced via direct planting of the shrub in the dunes by other local property owners. *Vitex rotundifolia* is currently in the process of being registered as a Federal Noxious Weed (National Research Council, 2002; GISDB, 2007). If listed, its sale and transport within the United States would be strictly regulated. In the Carolinas, community involvement efforts have already been put in place to minimize the impact and spread of this species. Programs include promoting identification of new *V. rotundifolia* communities, and monitoring and eradicating existing communities (Sea Grant North Carolina, 2006).

Accepted practices for eradication include physical and chemical removal (Britton et al., 2002; GISDB, 2007). Physical removal may include hand-pulling and digging. Mechanical digging, however, is often discouraged due to the fragile nature of dunes and the risk of erosion caused by this method (Britton et al., 2002). During physical removal caution must also be taken to extract the entire root structure, as well as any remaining stem fragments, to minimize reestablishment (National Research Council, 2002; GISDB, 2007). Other physical methods include clipping flowering/fruiting stems and seaward runners to reduce species migration. All plant material should be disposed of in landfills in sealed plastic bags rather than mulched or composted to further decrease the risk of introduction (GISDB, 2007). Chemical treatment of *V. rotundifolia* can be accomplished in one of three ways: 1) cut the aboveground vegetation back to a stump and then apply a glyphosate paint to the exposed cut, 2) wound the stem and then apply a herbicide to the wound, or 3) apply an oil-based herbicide mixture to the stem in a 30-45 cm length band at the base of the stem (Gresham & Neal, 2004; Sea Grant North Carolina, 2006; GISDB, 2007). It is important to note that revegetation with native grass and dune species should be incorporated into any control program to prevent erosion and recolonization (ZhiQuan et al., 1996).

In Norfolk, the main colony of *V. rotundifolia*, as well as 20 additional plants found nearby, was treated with the herbicide Habitat on 10 October 2008. Individuals were cut at the base and then sprayed with the herbicide directly on the open wound per the recommendations of Hal Drotor of Clemson University. Initial treatments will be followed with a second herbicide treatment of Garlon in the spring on plants that exhibit new growth. Physical removal of dead plants will then occur following the spring treatment of Garlon. The City of Norfolk Environmental Services Division will also continue monitoring for new outbreaks of the plant and has notified adjacent localities and state agencies of the potential for further invasion into Virginia’s dune areas.

While it is likely *V. rotundifolia* will continue to migrate north by water currents, the planting of nursery stock by local residents remains the most likely source of introduction. In fact, while it has been confirmed that many local nurseries in the Hampton Roads area are aware of the invasive nature of *V. rotundifolia*, and do not sell the plant, at least one nursery located near the barrier islands of Virginia provided the plant for public sale as recently as 2008 (phone survey by L. Rosenberg). If the sale of this plant continues, and it reaches the beachhead of the undeveloped barrier islands, it will pose serious threats to this unique Virginia ecosystem.

*Note added in proof:* A temporary quarantine prohibiting the movement of *Vitex rotundifolia* was issued by the Virginia Department of Agriculture and Consumer Services in late October 2009. This quarantine has been made permanent, effective on 3 December 2009, and specifically restricts transport of the plant, or any of its parts, within or from Virginia Beach, Norfolk, Accomack County, and Northampton County, Virginia. Property owners are also being advised to contact their local cooperative agricultural
extension offices in the event that any new *V. rotundifolia* colonies are discovered.

**ACKNOWLEDGEMENTS**

This is a contribution from the Virginia Institute of Marine Science, School of Marine Science, College of William and Mary.

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**PHOTOGRAPHIC DOCUMENTATION OF BLUE-MORPH ROSS’S GOOSE (CHEN ROSSII) ON ASSATEAGUE ISLAND, VIRGINIA.** – The blue-morph Ross’s Goose (*Chen rossii*) is one of the rarer genetically-determined polymorphisms in birds (McLandress & McLandress, 1979; Mundy et al., 2004). Plumage polymorphism in Ross’s and Snow Geese is associated with a point substitution in the *melanocortin-1 receptor* (*MC1R*) gene (Mundy et al., 2004). The origin of the “blue” allele in Ross’s Geese is unknown, but it could have been introduced through...
hybridization with Snow Geese or it could have originated as a recurrent mutation of the \textit{MC1R} gene. Blue-morph individuals comprise less than 0.01\% of the wintering population of Ross’s Goose in California (McLandress & McLandress, 1979) and are similarly rare in the Mississippi and Atlantic flyways where wintering populations have increased dramatically during the past two decades (Ryder & Alisauskas, 1995). Records of blue-morph Ross’s Geese east of the Mississippi River have been limited to a few anecdotal reports posted by birders and waterfowl hunters on internet websites and a single peer-reviewed sight record from Assateague Island, Virginia (Graves, 2005). A probable blue-morph Ross’s Goose \textit{\times} Snow Goose (\textit{Chen caerulescens}) hybrid was later photographed on Assateague Island (Graves, 2007), but photographic documentation of pure blue-morph Ross’s Geese in the Atlantic flyway has yet to be obtained.

On 21 November 2007, I photographed a probable blue-morph Ross’s Goose in a flock of 2,000+ Snow Geese near the southern margin of Swan Cove Pond on Assateague Island, Chincoteague National Wildlife Refuge, Accomack County, Virginia (Fig. 1). I watched the diminutive goose from a distance of 50-60 m in good to fading afternoon light (15:50-17:00 EST) as it stood or swam in shallow water among white-morph and a few blue-morph Snow Geese. The following description was made from digital photographs taken with a Canon Powershot A570 camera (7.1 megapixels) through a spotting scope set at 20-30X (Swarovski HD-ATS 65).

The Ross’s Goose was significantly smaller than the adjacent Snow Geese and had a proportionally shorter neck and rounder, less angular head (Fig. 1). The plumage color pattern was similar to an adult class-6 blue-morph Snow Goose (Cooke & Cooch, 1968), but the black neck plumage extended anteriorly to the throat and up the back of the neck to the crown above the eyes forming a rounded white face patch. The back and breast were black, becoming charcoal gray on the sides, and pale gray on the lower belly and thighs. Undertail coverts were white. Exposed wing coverts were silvery-gray, the innermost secondaries and tertials were similarly colored but with a blackish stripe along the rachis. The small bill was dark pink, purplish-gray at the base, but lacked a black “grin” stripe typical of Snow Geese or Ross’s \textit{\times} Snow Goose hybrids (McLandress \& McLandress, 1979; Graves, 2007). The juncture between the base of the bill and facial feathering was only slightly curved as opposed to strongly arced as in Snow Geese. There was no evidence of ferrous staining on the goose’s head.

Discriminating pure Ross’s Geese from hybrids may be difficult under typical field conditions. F$_1$ hybrids may be identified by their intermediate size and shape and the presence of a thin black grin stripe (Trauger et al., 1971; McLandress \& McLandress, 1979; Maclnnes et al., 1989). It is not certain whether backcrosses (e.g., Ross’s \textit{\times} F$_1$ hybrid) can be reliably separated from pure Ross’s Geese in the field. In this case, I cautiously classified the blue-morph individual as a pure Ross’s Goose because of its (i) small body size, (ii) short neck and rounded head, (iii) small bill with a purplish-gray base, (iv) lack of black grin patch, and (v) rounded white facial patch. The degree of curvature of feathering at the base of the bill is often cited as a character distinguishing Ross’s Goose from Snow Goose (Ryder \& Alisauskas, 1995). However, there is considerable variation in this character in Ross’s Goose. The blue-morph individual on Assateague Island exhibited a slight curve that was well within the range of variation observed in museum specimens (n = 32) of presumably pure white-morph Ross’s Geese collected in California (pers. obs.; National Museum of Natural History, Smithsonian Institution). The critical field mark appears to be the black grin patch, present in the Snow Goose and Ross’s Goose \textit{\times} Snow Goose hybrids (McLandress \& McLandress, 1979) but absent in adult Ross’s Goose. However, geese must be observed under ideal conditions in order to distinguish a thin dark grin
patch, present in F₁ and backcross hybrids, from the shadow produced by the tomium of the maxillary ramphotheca in Ross’s Goose.

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TWO AUSTRAL WATER BEETLES NEW TO THE VIRGINIA FAUNA (COLEOPTERA: DYTISCIDAE, HYDROPHILIDAE). – The “Floridian” aspect of the fauna of southeastern Virginia continues to be emphasized by recent discoveries of insects previously known only from more southern distributions. We provide here documentation for two small water beetles which fall into that category, being previously unknown north of North Carolina.

DYTISCIDAE: Hydrophilinae: Bidessini

Anodocheilus exigus (Aubé)

In the faunistic study begun by Michael & Matta (1977), Anodocheilus was included in the key to dytiscid genera of eastern United States (and by context, of Virginia). However, this minute species (length 1.4-1.7 mm) remains unrecorded for Virginia, perhaps, in part, because its subfamily (Hydrophilinae) was not treated by these authors. Furthermore, Matta (1973, 1979) did not record A. exigus during his surveys of water beetles of the Dismal Swamp (cities of Chesapeake and Suffolk, Virginia, and adjacent North Carolina). It is the lone representative of Anodocheilus in North America, documented previously from North Carolina south to Florida and west to Texas (Ciegler, 2003). Ciegler (2003) provided six records for South Carolina, but we have not determined the basis for the earlier citation of North Carolina by Brigham (1982). The NCSU collection has no material from North Carolina nor was it listed for that state by Brimley (1938) or Wray (1967). Ciegler (2003) reported the habitats of this species as ponds and the sandy edges of lakes, streams, and ditches.

We have seen 14 specimens from Virginia: City of Chesapeake: without precise location (“Chesapeake, Va.”), 15 June 1972, J. F. Matta (USNM 4). City of Virginia Beach: “Site 55, Va. Beach, Va.”, 28 October 1970, Matta (USNM 6); without specification but probably the historic resort area (“Va. Beach, Va.”), 20 November 1970, Matta (USNM 2); same but 11 July 1972, Matta (USNM 1); False Cape State Park, Main Park Road, 1.4 km south of Wash Woods cemetery, 8 September 2006, UV light trap, S. M. Roble (VMNH 1).
There is some variation in development of the pronotal groove, which is almost obliterated in some specimens. In the VMNH specimen it is well defined, and laterally extends under each pronotal plica as a small pocket (Fig. 1, arrow). Otherwise, it agrees closely with the descriptions of the species published by Young (1974) and Ciegler (2003).

HYDROPHILIDAE: Hydrophilinae: Hydrophilini

Helobata larvalis (Horn)

This small beetle (5-6 mm) was not included in the survey of Virginia’s aquatic hydrophilids by Matta (1974), and apparently the species (and genus) has not been recorded for the state until now. Like the preceding species, H. larvalis is the lone representative of its genus in North America, inhabiting southeastern United States from North Carolina south to Florida and west to Texas; it also occurs in Central and South America and Cuba (Ciegler, 2003). In South Carolina, Ciegler (2003) recorded it on submerged leaves of Pontederia and at UV lights. We have at hand a small series from the extreme southeastern corner of Virginia, where it was collected by the second author at a UV light trap. City of Virginia Beach. False Cape State Park, Wash Woods Environmental Education Center, 6-7 July 2005, S. M. Roble (VMNH 3).

Brigham (1982) and Ciegler (2003) previously reported this species from North and South Carolina, respectively. Warren Steiner (pers. comm.) has collected H. larvalis at Buxton, Cape Hatteras, Dare Co., North Carolina (USNM), which appears to be the previous northernmost locality for the species. Dr. Andrew Short advised (in litt.) that he saw no Virginia material in the collections examined by him in connection with a survey of this genus.

ACKNOWLEDGEMENTS

We appreciate the help provided by Robert L. Blinn, Andrew Short, Warren Steiner, and Charles Staines during preparation of this note.

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Horseshoe crab (Limulus polyphemus), ventral aspect.
Original drawing by John Banister.
Reports

1. President’s Report

As detailed below, the most significant news for our society in 2009 was the symposium held this fall. Thanks to Tom McAvoy for his outstanding work in making the program highly successful and to all participants for an excellent array of presentations.

The society would also like to thank all those who submitted designs for the Virginia Natural History Society’s logo. After much consideration of all entries, including several prepared by members of the executive committee, the committee decided that none of the submissions fully met their expectations and a more focused effort was needed to design an appropriate logo. The committee thus brainstormed to identify the desired components of the logo. The final design (see cover of this issue) was prepared by society webmaster John White. It includes two of John Banister’s original drawings (a fern and shark’s tooth) and uses the same font (Caslon antique) that was originally selected in 1992 by our founding co-editors Joe Mitchell and Richard Hoffman for the cover of Banisteria.

Thanks to Janet Reid for her fine service during the past four years as a councilor. At our recent meeting, the executive committee voted unanimously to recognize Joe Mitchell as an Honorary Councilor to the Society. As many of you know, Joe was the primary force behind the formation of the Virginia Natural History Society in 1992. He has published frequently in and served as a co-editor of Banisteria, and has contributed in many other ways to the society and to Virginia’s natural history.

I would like to encourage all members to promptly renew their membership for 2010. Please encourage your colleagues to consider becoming members. As you know, the opportunities for publishing in Banisteria are outstanding and the absence of page charges for members is a significant benefit in these difficult economic times. If any of you has a new address or email, please send changes to me at bknisley@nnc.edu.

Barry Knisley, President
Virginia Natural History Society

2. Symposium Report

The Virginia Natural History Society’s symposium entitled “Historical Explorations into Virginia’s Natural History”, which was held on September 26, 2009, was a big success! The new Virginia Museum of Natural History in Martinsville provided the perfect venue for the 60 people who attended the symposium. Talks began at 8:30 AM and ended twelve hours later with our co-founder’s (Dr. Richard Hoffman’s) keynote address, “Nature, Natural History, and Naturalists in Virginia Since 1927, a Personal Evaluation.” Talks ranged from Thomas Jefferson’s contributions to recently discovered mussel biology to botanical work done nearly 400 years ago. Work is now under way to publish the presentations. Thanks to all of the people who helped organize the symposium:

Program Committee Members: Richard Hoffman, Barry Knisley, Michael Kosztarab, Joe Mitchell, Steve Roble, and John White.


The Society also thanks Beckie Smith and Bill Shear who took care of the mail-in registrations; Carolyn Seay of the Virginia Museum of Natural History; Lynn Pritchett, a Master Naturalist volunteer, who was in charge of the registration table during the event; and Dutch Inn who catered the symposium.

Symposium Presentations:

Abraham, B.J. Hampton University. Araneology in Virginia.


Jones, J. Virginia Tech. Natural History and Conservation of Freshwater Mussels in Virginia.


Rose, B. Old Dominion University. The Mammals.


Ward, L.W. Virginia Museum of Natural History. Virginia’s First Fossil Collections; the Earliest Known from North America.

Ware, D. College of William and Mary Herbarium. Plant Exploration and Herbarium-building in Virginia, 1900 to the Present.


Tom McAvoy, Program Coordinator

3. Secretary-Treasurer’s Report

As of November 30, 2009, the society has 122 members, including 18 institutions. This represents virtually no change in membership from July 2008 (120 members, 18 institutions). In December 2008, we had 133 members, including 19 institutions. Membership has declined over the past four years from the most recent high point in 2004, when we enrolled 165 members, including 22 institutions. This is an approximate 27% decline to the current number.

Our current bank balance is $7,122.62, a decline of $2,200.51 from July 2008. We collected $1,510.00 in registrations and sponsorships for the fall symposium, and paid out $2,116.08 for catering, etc., for a net loss of $606.08.

Respectfully submitted,
Bill Shear, Secretary/Treasurer

4. Webmaster’s Report

The table of contents for Banisteria 33, along with article abstracts, and a summary of the Virginia Natural History Society’s symposium “Historical Explorations into Virginia’s Natural History” have been posted on the website.

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We would like to thank the Conservation Management Institute (www.cmiweb.org) for hosting the VNHS website.

Respectfully submitted,
John White, VNHS Webmaster

5. Editor’s Report

I am happy to report that after a two-year effort of reviewing, editing, writing, and proofreading, the Festschrift honoring Richard Hoffman has been published by the Virginia Museum of Natural History. See the announcements section for more details.

More than a dozen manuscripts and notes were submitted for review since the last issue of Banisteria was published. Most of those papers appear in this issue while the others should be ready for the next issue. The papers exhibit increased diversity of subject matter, but we still desire an even greater diversity of topics. As a reminder to all prospective authors, Banisteria publishes papers on all aspects of natural history in Virginia (and neighboring states if relevant), including botany, zoology, ecology, archeology, anthropology, paleontology, geology, geography, and climatology.
Page charges are waived for members of the Virginia Natural History Society and are only $15 per page for non-members. The instructions for authors were recently revised and are posted on the society’s website.

Several more pdf files of past Banisteria papers were prepared for the website, but there are still many more to do before all published papers and shorter contributions are available for downloading. Whenever available, I will try to substitute color photos for black and white images in the pdf files. I will also investigate the approximate cost of publishing color figures in Banisteria for authors who are interested and willing to pay the appropriate higher page charges.

Finally, I would like to thank the following individuals for providing peer reviews during the past two years (* = reviewed more than one manuscript): Dave Almquist, John Ascher, Mike Barber, Steve Cardiff, Anne Chazal, Roger Clapp, Charlie Covell, Mike Donahue, Dave Etnier*, Art Evans*, Henri Goulet, Gary Graves, Kris Gremillion, John Guccion, Carola Haas, Steve Hall, Phil Harpootlian*, Richard Harris, Steve Harris*, Tom Henry*, Richard Hoffman*, Josh Jones, Paul Lago, Tom McAvoy, Joe Mitchell*, Dan Moerman, Jyrki Muona, John Pagels, Harry Pavulaan, Norm Platnick, Martin Rice, Mark Robbins, Bob Rose, Tai Roulston, Helen Rountree, Nathan Schiff, Don Schwab, Bill Shear, Len Smock, Charlie Staines*, Warren Steiner*, Bo Sullivan, John Townsend, Deb Waller, Bryan Watts, Al Wheeler*, Tom Whyte, Tom Wieboldt*, and Robert Wright. My apologies if I inadvertently forgot to include the names of any additional reviewers.

Steve Roble
Editor, Banisteria

Announcements

1. Richard Hoffman Festschrift

The proceedings of the September 2007 symposium cosponsored by VNHS that honored society co-founder Richard Hoffman’s 80th birthday and career were recently published by the Virginia Museum of Natural History (VMNH Special Publication No. 16). Entitled “A Lifetime of Contributions to Myriapodology and the Natural History of Virginia: A Festschrift in Honor of Richard L. Hoffman’s 80th Birthday”, the book was coedited by current and former Banisteria editors Steve Roble and Joe Mitchell. This 458-page, hardbound volume includes 32 chapters by 41 authors from four continents, with papers covering taxa ranging from salamanders, millipedes, centipedes, and crustaceans to insects, plants, and fossil mammals. Descriptions are presented for one new genus and 32 new species, 11 of which are named in honor of Dr. Hoffman. Several of these species occupy highly threatened habitats and are potentially threatened with extinction.

The cost of the Festschrift is $76 (includes postage to US addresses). Virginia residents must also add 5% sales tax. The museum accepts credit card orders over the phone or money orders. Address written correspondence to: Publications Sales, Virginia Museum of Natural History, 21 Starling Avenue, Martinsville, VA 24112; phone (276) 634-4141, extension 4319; email: brad.harris@vmnh.virginia.gov; website: http://www.vmnh.net/store.cfm

2. Membership Renewals and Councilor Election

A membership renewal notice for 2010 (includes Banisteria numbers 35 and 36) will be sent to all members soon. This mailing will also include a ballot for the election of a councilor to replace Janet Reid, whose term expires in December 2009.

Errata

The editor has been informed of the following errors that appeared in Banisteria 33:

In the paper “The Ant Community of a Riparian Forest in the Dyke Marsh Preserve, Fairfax County, Virginia, and a Checklist of Mid-Atlantic Formicidae” published in Banisteria 33, pages 3-17, replace the name *Viburnum molle* (Smooth Arrowwood) with *Viburnum dentatum* (Smooth Arrowwood) on page 4.

This same correction should be made in the paper entitled “Arthropod Community Heterogeneity in a Mid-Atlantic Forest Highly Invaded by Alien Organisms” that was published in Banisteria 23 (Table 1, page 29).

In the paper “Medically Significant Bite by a Nabid Bug (Heteroptera: Nabidae)” published in Banisteria 33, pages 60-61, the third author’s name was incorrectly listed as Dedra McCreary. The correct spelling is Dreda McCreary.
The Virginia Natural History Society (VNHS) was formed in 1992 to bring together persons interested in the natural history of the Commonwealth of Virginia. The VNHS defines natural history in a broad sense, from the study of plants, animals, and other organisms to the geology and ecology of the state, to the natural history of the native people who inhabit it. The goals of the VNHS are to promote research on the natural history of Virginia, educate the citizens of the Commonwealth on natural history topics, and to encourage the conservation of natural resources. Dissemination of natural history information occurs through publication of the journal *Banisteria*, named for John Banister (1650-1692) who was the first university-trained naturalist to work in Virginia. The first issue was published in 1992, and the journal is published twice per year in spring and fall. Articles cover a wide array of subjects, and prospective authors are encouraged to submit manuscripts on any aspect of natural history in Virginia; book reviews and biographies of relevance to natural history in Virginia are also welcomed. The editor of *Banisteria* will also consider manuscripts on any aspect of natural history from neighboring states if the information concerns a species native to Virginia or the topic is directly related to regional archaeology, anthropology, botany, ecology, zoology, paleontology, geology, geography, or climatology. Manuscripts are peer-reviewed for suitability and edited for inclusion in the journal. Page charges ($15/page) are waived for VNHS members. The society’s website contains instructions for authors, the titles (and abstracts beginning in 2004) of all *Banisteria* papers, and downloadable versions (PDF format) of numerous articles from past years.

**Memberships**

The VNHS is open to anyone with an interest in natural history and welcomes participation by all members in society activities and efforts to promote education and conservation. Membership includes a subscription to *Banisteria* and invitations to periodic symposia and BioBlitz surveys. Annual dues for members are $20 (per calendar year); library subscriptions are $40 per year. Checks should be sent to the Secretary/Treasurer, who also has back issues of *Banisteria* available at $10.00 each (except Nos. 1-6 are $5.00 and No. 13 is $18.00). The VNHS is a tax-exempt, nonprofit, society under Section 501(C)3 of the IRS. We welcome donations to support our mission in Virginia.

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**Application for Membership**

**Name**

**Address**

**Zip Code**

**Phone**

**Email**

**Area(s) of Interest**

**ANNUAL DUES AND SUBSCRIPTIONS TO BANISTERIA**

(memberships and subscriptions are by calendar year; subscribers/members outside the United States should add $3.00 for additional postage)

- $500.00 Life (not annual)
- $300.00 Benefactor
- $100.00 Patron
- $50.00 Supporting
- $40.00 Institutional
- $25.00 Family
- $20.00 Regular
- $5.00 Student (see below)

- I have added a contribution of $______

*Make checks or money orders payable to: Virginia Natural History Society*

*Send membership form and dues to:*

Dr. William Shear, Secretary-Treasurer
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Hampden-Sydney, Virginia 23943