BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA

Gulf Fritillary (*Agraulis vanillae*)

This butterfly species of the southeastern United States was found breeding for the first time in the Richmond, Virginia area during 2008 as discussed on pages 56-57 of this issue.

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B A N I S T E R I A

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Cover: Gulf Fritillary (*Agraulis vanillae*) caterpillar feeding on Maypops (*Passiflora incarnata*). Photo by Allen Belden, Jr.
Back cover: Mourning Scorpionfly (*Panorpa lugubris*). Photo by Arthur V. Evans.

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The Ant Community of a Riparian Forest in the Dyke Marsh Preserve, Fairfax County, Virginia, and a Checklist of Mid-Atlantic Formicidae

Daniel Kjar

Division of Mathematics and Natural Sciences
Elmira College
1 Park Place
Elmira, New York 14905

ABSTRACT

The ant community of the Dyke Marsh Preserve forest, Fairfax County, Virginia, was sampled using pitfall traps and Berlese extraction of soil-core samples, yielding 3,193 ants of 27 species. Inclusion of an earlier study from this riparian forest adds four species. The Chao2 species estimator predicted 32 ant species in the study forest based on data from both studies. The ant species found in this study are common in the eastern U.S. and mid-Atlantic riparian forests with two exceptions: *Lasius subumbratus* is south of its previously known distribution on the U.S. East Coast, and *Vollenhovia emeryi* is an alien myrmicine native to Japan. *Aphaenogaster rudis*, *Paratrechina faisonensis*, and *Prenolepis imparis* were the more abundant ant species in samples in the forest. The intraspecific abundance of these species was similar across sampling years, but the intraspecific abundance of the less-abundant ant species was not similar from year to year. The results of this study show that this ant community is composed of many habitat-generalists and common species.

Key words: Dyke Marsh Preserve, Formicidae, riparian forest, species estimators, *Vollenhovia emeryi*.

INTRODUCTION

Ants provide important services in eastern U.S. forests such as dispersing seeds, controlling arthropod populations, turning over and adding nutrients to forest soils, and providing habitat and a food source for many other organisms (Hölldobler & Wilson, 1990). Scientists have studied the ants of the U.S. mid-Atlantic region in detail for many decades. Studies have investigated nest movement and myrmechory (Culver & Beattie, 1978; Beattie et al., 1979; Smallwood & Culver, 1979); ant community structure, interference, competition, and foraging patterns (Lynch et al., 1980; Lynch, 1981; Lynch et al., 1988; Fellers, 1987, 1989); and ant and habitat associations (Wang et al., 2000, 2001; Kjar & Barrows, 2004). Lynch (1987) produced a checklist and key to the ants of the Chesapeake Bay region. There are an estimated 129 ant species in the mid-Atlantic region occupying various habitats (Barrows & Kjar, 2005). However, published ant-species lists exist for only a small number of areas in the region.

The goals of this study were to (1) describe the ant community of the Dyke Marsh Preserve (DMP) forest and changes in the abundance and richness of ant species across multiple sampling months and years; and (2) compare the DMP ant community with other eastern U.S. ant communities and with a theoretical community composed of the more common species found in those studies and lists.

MATERIALS AND METHODS

Study Forest

Dyke Marsh Preserve is part of the George Washington Memorial Parkway (GWMP) in Fairfax County, Virginia (38° 46′ N, 77° 03′ W). The GWMP is a national park bordering the western shore of the Potomac River. The DMP is 3.5 km long, 500 m wide at its widest point on an east-west transect, and located 15 km south of the Ronald Reagan Washington National Airport. The DMP has areas of flood-plain forests, open tidal freshwater marsh, and swamp forests (Johnston,

2000; Barrows et al., 2005). All of my sampling sites are within the DMP forest, which I divided into an eastern and western part for analytical purposes. The western part of the study forest was frequently submerged during high tide and some areas may be designated as a swamp forest. The eastern forest is 1-2 m above sea level, had standing water only during floods, and may be considered a flood-plain forest, or low forest.

The study forest is dominated by *Liquidambar styraciflua* (Sweetgum) and a dense understory of *Lindera benzoin* (Spicebush) and *Viburnum molle* (Smooth Arrowwood). Other trees common in the forest include *Acer negundo* (Boxelder), *Acer rubrum* (Red Maple), *Fraxinus americana* (White Ash), *Liriodendron tulipifera* (Tulip Tree), *Nyssa sylvatica* (Tupelo), *Quercus palustris* (Pin Oak), *Quercus phellos* (Willow Oak), *Quercus rubra* (Red Oak), *Sassafras albidum* (Sassafras), and *Ulmus americana* (American Elm).

A plant survey of the sites used in this study found nine alien and 42 native forest-floor species (excluding trees over 1 m tall), and 16 tree species. Alien plants made up more than 40% of all plant cover. The most common alien plant, *Lonicera japonica,* was found in 80% of the sites used in this study.

Site Selection

I selected 100 random sites within the DMP study forest using a geographical information system (GIS) and high-resolution aerial photography with the cooperation of the National Park Service GIS coordinator of the GWMP. I used the computer program Arcview™ 3 (ESRI, 2001) and the National Park Service's AlaskaPak extension (National Park Service, 2002), which randomly selects any number of points within a polygon and creates a list of coordinates for each point. Sites were in a predefined area of the forest whose borders were at least 10 m from trails or roads. This area was bordered by the Mt. Vernon Trail on the west, Haul Road and the Potomac River on the east, a large tidal channel on the south, and an area overgrown with *Ampelopsis brevipedunculata* (Porcelainberry) vines on the north.

I used a Trimble™ backpack global positioning system (GPS) to locate each of the sites in the forest. Forty of the 100 sites were not appropriate for analysis due to their location near or in a tidal channel that floods during high tides. Sites were chosen if they were accessible, not waterlogged, and at least 3 m from any other site. The decision to keep or reject a site was made during a dry year and some sites that were initially kept in the study were later found to be waterlogged or have standing water during much of my sampling period. Such sites were excluded from some analyses.

Ant Collection and Identification

I collected a soil core (70-mm diameter by 70-mm deep) from each site in the third week of June, August, and October of 2002 and 2003. Arthropods were extracted from the soil in Berlese funnels with 5 mm mesh plastic screen and air dried for 5 days in a room under 24 h of fluorescent lighting. Artificial heat was not used during extraction because test runs of this method found unacceptable mortality of diplurans, symphylans, and other soft-bodied arthropods before extraction. Arthropods were collected into jars containing 95% ethanol as the killing fluid.

A single collar and funnel pitfall trap was used at each study site (Kjar & Barrows, 2004). A 120-mm-diameter plastic container with a lid was placed in the center of each site so that the lid was level with the surrounding ground level. All pitfall traps were in position 1 mo before trapping began to reduce the impact of trap placement on sampling.

For each trapping bout, all lids were removed, and a 120-ml collection cup containing 95% ethanol was placed in the bottom of the plastic container. A collar around the top of the pitfall trap supported a plastic funnel leading into the collection cup. Soil was then carefully spread on the collar up to the edge of the funnel. A wooden cover 32-cm^2 with four 4-cm-long legs was placed over the trap and wired to the ground using 20-cm-long coffin nails to protect the trap from animals, weather, and falling plant material. This pitfall-trap design results in a high arthropod per trap hour catch (Kjar, 2002) and prevents non-target vertebrates from injuring themselves or damaging the trap.

The pitfall traps were run for 24 h, in the last week of June, August, and October during 2002 and 2003. Arthropods from pitfalls and soil cores were sorted into appropriate taxonomic units (Borror et al., 1981) under a dissecting microscope.

Additional trapping data from a previous DMP study (Kjar, 2002) were used in some descriptions in this study. In that study, pitfall traps of an identical design were used in four 100-m^2 plots located in the DMP low forest. Each plot had 10 randomly placed pitfall traps making a total of 40 pitfalls. Trapping occurred during August-October of 2000, and June-October of 2001.

Ants were identified using Bolton (1994), Creighton (1950), the U.S. National Museum of Natural History ant collection, and verified by David R. Smith, and Terry P. Nuhn (both of the USDA). A voucher

collection is located at the Laboratory of Entomology and Biodiversity, Georgetown University, Washington, D.C.

Data Analysis

I used the computer program EstimateS (Colwell, 2004) to calculate the species number estimator Chao2. Chao2 uses the number of singletons (species found once) and doubletons (species found twice) based on species absence or presence across all samples for each sampling event to formulate an estimate of the number of species that have not been detected during sampling (Chao, 1987; Colwell & Coddington, 1994; Coddington et al., 1996). This form of species estimation uses random resampling of sampling events to produce a mean species estimate for each cumulative sampling event. The data used in this study are the absence or presence of a species during a sampling event. Sampling events are the combined incidences of all soil-core samples, pitfall-trap samples, or both from a single month. There are eight sample events from 2000-2001, and six from 2002-2003.

Although trapping occurred in different areas of the study forest with some overlap among studies, the total number of pitfall-trap hours during each sampling event is the same for both pitfall-trap datasets alone, and the pitfall-trap design was the same as that used in the current study. Soil cores were not taken during the earlier study, and therefore, species estimators were used on both studies with and without soil-core data. For each sampling occasion, the number of samples in which an ant species was present was used as the species-incidence value rather than abundance data. Both incidence and abundance are used in this study since they both have value in describing an ant community.

Analysis of variance and the Student-Newman-Keuls *post hoc* test was used to determine significant differences in total ant species richness and abundance among months. The data used in ANOVA analysis included June, August, and September trapping dates from the 2000-2001 and 2002-2003 DMP studies. Mean monthly abundance and richness values were derived from all pitfall-trap samples collected during that month across all years.

I used coefficient of community similarity (CC) values to compare the similarity of the ant community of the DMP study forest with that of 15 other studies and lists from the eastern U.S., as well as the 31 ant species shared by the most studies and lists and the 31 ant species shared among those lists from the U.S. East Coast. This analysis will show whether the forest ant community of the DMP resembles the ant communities of urban forests, old forests, fields, or the most common ant species in this area. The coefficient of community similarity for each study or list was determined using the formula $CC = C_{ab}/(S_a+S_b)$, where S is the number of species in a study and C_{ab} is the number of species shared among studies. The species list of the DMP Area includes all ants captured in this study plus the ants caught in a previous study in the same forest (Kjar & Barrows, 2004).

I obtained information on feeding behavior, nesting sites, and habitats of the ant species found in this study from relevant literature (Talbot, 1934, 1943a, 1943b, 1945, 1946, 1951, 1965; Headley, 1943; Creighton, 1950; Nuhn & Wright, 1979; Deyrup & Trager, 1986; Deyrup et al., 1988; and others) and consulting myrmecologists (Stefan P. Cover, James P. Trager, Walter R. Tschinkel).

RESULTS

Ant Community

I obtained 3,193 ants from 27 species in pitfall traps and soil cores during this 2-yr study (Table 1). All 27 species were present in pitfall traps, and 15 were also present in soil cores. My study documented eight ant species not previously found at the DMP during an earlier 2-yr study (Kjar & Barrows, 2004). Furthermore, four species from the earlier study were not caught during this study: *Camponotus subbarbatus*, *Lasius claviger*, *Lasius subumbratus*, and *Myrmica emeryana* (Table 1). One species captured during this study, *Vollenhovia emeryi*, is newly recorded for Virginia, and is one of only four records of this ant in the U.S. (Kjar & Suman, 2007).

The more abundant ants in this study were *Aphaenogaster rudis*, *Paratrechina faisonensis*, and *Prenolepis imparis* (Table 1). Each of these species had more individuals captured than the abundances of all other ant species combined. These were also the more abundant species in the 2000-2001 study (Kjar & Barrows, 2004). Sample incidence, rather than abundance, shows that *A. rudis* is the most widespread species in this study (Table 2). Although *P. imparis* was more abundant in samples, it was found at fewer sites. This may be due to reduced foraging activity in *P. imparis* during warm summer months (Talbot 1943a; Lynch et al., 1980; Tschinkel, 1987; Fellers, 1989).

All native ant species caught during this and the previous study at the DMP are common forest ants except for *Solenopsis molesta* (Table 3). This species is commonly found in old fields or other open habitat (Headley, 1943), although it is occasionally found in forested areas in the mid-Atlantic region (Lynch, 1987).

Table 1. Ant species and their abundances in the forest pitfall-trap and soil-core samples, Dyke Marsh Preserve, Virginia. Species are ordered based on their total abundance in this study (2002-2003).

	2000-2001	2002-2003			2000-2003
Species	Pitfall traps	Pitfall traps	Soil cores	Both	Total
Aphaenogaster rudis	791	1012	4	1016	1807
Prenolepis imparis	1876	822	7	829	2705
Paratrichina faisonensis	780	463	254	717	1497
Pyramica rostrata	32	6	108	114	146
Lasius alienus	190	66	17	83	273
Myrmecina americana	34	12	65	77	111
Temnothorax curvispinosus	33	38	27	65	98
Ponera pennsylvanica	45	8	52	60	105
Tapinoma sessile		35	16	51	51
Stenamma brevicorne	42	26	9	35	77
Aphaenogaster fulva		28		28	28
Brachymyrmex depilis		1	26	27	27
Myrmica punctiventris	7	21		21	28
Camponotus chromaiodes		18		18	18
Pyramica ohioensis	5	3	10	13	18
Crematogaster cerasi	1	8		8	9
Lasius umbratus		1	6	7	7
Solenopsis molesta		5		5	5
Stenamma impar	10	3	1	4	14
Proceratium silaceum	1	1	2	3	4
Vollenhovia emeryi		3		3	3
Crematogaster pilosa	12	2		2	14
Camponotus pennsylvanicus	3	2		2	5
Aphaenogaster tennesseensis		2		2	2
Camponotus castaneus	4	1		1	5
Amblyopone pallipes	2	1		1	3
Camponotus nearcticus	2	1		1	3
Lasius claviger	3				3
Myrmica emeryana	3				3
Camponotus subbarbatus	2				2
Lasius subumbratus	1				1
Total species	23	27	15	27	31
Total abundance	3879	2589	604	3193	7072

The more abundant ant species found in pitfalls and soil cores tended to be non-specific in nest location (Table 3). The less abundant ant species (≤3 collected individuals) were predominately cavity-nesting species, and none of them commonly nest in forest litter (Table 3).

Comparison with Other Eastern U.S. Ant Surveys

The DMP ant community most closely resembles a hypothetical community comprised of the 31 most commonly reported species from regional species lists and studies (Table 4). The DMP ant community most closely resembles that found by King & Green (2005) in various urban forests around Philadelphia, Pennsylvania (Table 4). A study site in Illinois (Talbot, 1934) had the second closest ant community to that of DMP (Table 4). The study site least resembling the ant community at DMP was in West Virginia (Culver, 1974) and likely resulted from a limited sampling regime reporting only 17 species.

Of the 129 ant species that may be expected in the Washington, D.C., area, as described by Lynch (1987) and other studies and lists presented in Table 5, two common taxa were not found in DMP. The genus *Formica* was entirely absent and only one dolichoderine species was present, and that species, *Tapinoma sessile*, is common throughout temperate North America. Other genera with variable affinities for forest habitats which inhabit the mid-Atlantic region but were absent at DMP include most *Crematogaster* spp., most *Temnothorax* spp., all *Monomorium* spp.,

Table 2. Ant species found in the forest and their trap incidences, Dyke Marsh Preserve, Virginia. Species are ordered based on their total trap incidence in this study (2002-2003).

	2000-2001	2002-2003			2000-2003
Species	Pitfall traps	Pitfall traps	Soil cores	Both	Total
Aphaenogaster rudis	194	183	4	187	381
Paratrechina faisonensis	250	136	32	168	418
Prenolepis imparis	185	98	1	99	284
Lasius alienus	97	54	7	61	158
Ponera pennsylvanica	31	7	28	35	66
Tapinoma sessile		25	7	32	32
Temnothorax curvispinosus	27	22	6	28	55
Stenamma brevicorne	30	21	7	28	58
Myrmecina americana	32	8	17	25	57
Pyramica rostrata	20	3	18	21	41
Aphaenogaster fulva		13		13	13
Myrmica punctiventris	5	12		12	17
Crematogaster cerasi	1	8		8	9
Pyramica ohioensis	2	3	5	8	10
Brachymyrmex depilis		1	6	7	7
Campanotus chromaiodes		6		6	6
Stenamma impar	8	3	1	4	12
Proceratium silaceum	1	1	2	3	4
Vollenhovia emeryi		3		3	3
Aphaenogaster tennesseensis		2		2	2
Camponotus pennsylvanicus	3	2		2	5
Lasius umbratus		1	1	2	2
Solenopsis molesta		2		2	2
Amblyopone pallipes	2	1		1	3
Camponotus castaneus	4	1		1	5
Camponotus nearcticus	2	1		1	3
Crematogaster pilosa	8	1		1	9
Lasius claviger	3				3
Myrmica emeryana	3				3
Camponotus subarbatus	2				2
Lasius subumbratus	1				1

most *Myrmica* spp., and all *Pheidole* spp. (Table 5). Three ant species were shared among all studies: *A. rudis*, *Ponera pennsylvanica*, and *T. sessile*. *Lasius alienus* and *Temnothorax curvispinosus* were present in all but Talbot's (1965) study of a low old field in Michigan (Table 5). The only species present in DMP but absent from all other studies was *L. subumbratus*. *Vollenhovia emeryi* was listed in only one other study, and *Crematogaster pilosa* was found in two other studies. The remaining ant species found in DMP are common in the other studies and species lists (Table 5).

Ant Species Estimation

Using all incidence data from both Kjar & Barrows (2004) and this study, Chao2 species richness estimated 31.5 ant species in the DMP forest (Table 6). After 4 yr of trapping using two different trapping regimes, it is likely that most ant species present in the DMP study forest have been collected. Pitfall-trap sampling resulted in higher species estimates than soil-core sampling, and pitfall traps from the 2002-2003 study resulted in a higher species estimate after three sampling events than the entire eight sampling events of the 2000-2001 study.

Temporal Ant Distribution

Mean species richness was highest in August although this was not statistically significant (ANOVA, $F(2, 117) = 2.9$, $P = 0.06$; Fig. 1). Total ant abundance was lowest in June (ANOVA, $F(2, 117) = 2.9$, $P<0.001$; Fig. 1). Although the abundances of individual ant species were too low to analyze statistically, there were some patterns that are apparent from the 4 years of data. The psychrophile *P. imparis* was the most abundant ant during October (Fig. 2). *Aphaenogaster rudis* and *P. faisonensis* abundances decreased during both October 2002 and 2003 (Fig. 2). The common generalist ant *L. alienus* also decreased in

Table 3. Ant species nest location, feeding, and habitats, Dyke Marsh Preserve, Virginia.

	Nest location			Feeding behavior		Habitat		2000-2003
Species	Soil	Litter	Cavity*	Generalist	Specialist	Forest	Field	Abundance
Aphaenogaster rudis	x	x	x	x		x	x	1016
Prenolepis imparis	x			x		x	x	829
Paratrechina faisonensis		x	x	x		x		717
Pyramica rostrata		x			x	x		114
Lasius alienus	x	x	x	x		x	x	83
Myrmacina americana	x		x		x	x		77
Temnothorax curvispinosus			x	x		x		65
Ponera pennsylvanica	x		x	x		x	x	60
Tapinoma sessile	x	x	x	x		x	x	51
Stenamma brevicorne	x	x	x	x		x	x	35
Aphaenogaster fulva		x	x	x		x		28
Brachymyrmex depilis	x			x		x	x	27
Myrmica punctiventris	x		x	x		x	x	21
Camponotus chromaiodes			x	x		x		18
Pyramica ohioensis		x			x	x		13
Crematogaster cerasi	x	x	x	x		x	x	8
Lasius umbratus	x		x	x		x	x	7
Solenoposis molesta	x	x	x	x			x	5
Stenamma impar	x		x	x		x		4
Proceratium silaceum			x		x	x		3
Vollenhovia emeryi			x	x		x	x	3
Camponotus pennsylvanicus			x	x		x	x	2
Crematogaster pilosa			x	x		x		2
Amblyopone pallipes	x				x	x		1
Aphaenogaster tennesseensis			x	x		x		1
Camponotus castaneus			x	x		x	x	1
Camponotus nearticus			x	x		x	x	1
Lasius claviger	x				x	x		†
Camponotus subbarbatus	x		x	x		x		†
Lasius subumbratus	x			x		x		†
Myrmica emeryana	x			x		x	x	†

* Cavity includes spaces within twigs, fruits, fallen logs and branches, and any arboreal ant nests.

† These species are from the 2000-2001 study, and were not present in the 2002-2003 study.

abundance as the summer progressed during all 4 yr of these two studies (Fig. 3). Species with a lower abundance in the samples show less similar intraspecific abundances among years (Figs. 3-5). Few monthly abundance patterns can be detected in the other species besides a spike in abundance for some species such as *Aphaenogaster fulva*, *L. curvispinosus*, *P. pennsylvanica*, *Pyramica rostrata*, and *T. sessile* during August of most years (Figs. 3-5).

DISCUSSION

Ant Community of Dyke Marsh Preserve Forest

The ant community of DMP most closely resembled an urban forest and the hypothetical ant communities composed of the 31 more-common ant species (Table 4). The DMP forest is frequently disturbed by flooding from the Potomac River, and the ant community appears to be what would be expected for such a frequently disturbed forest. Ant species commonly found in relatively undisturbed second-growth forests nearby, such as *A. pallipes*, *A. fulva*, and *A. tennesseensis* are rare, and species common to fragmented and disturbed forests are common (Tables 1 and 2). The DMP ant community is composed of common species from eastern U.S. forest communities with only three exceptions: *L. subumbratus*, *S. molesta*, and *V. emeryi*. *Lasius subumbratus* in DMP is beyond its most southern previously known range on the East Coast (Wilson, 1955; Gregg, 1963) and is unlikely to be found in mid-Atlantic forests. The single record from the DMP may be a recent human introduction or a sign of new range expansion for this species.

Table 4. Coefficient of community similarity between the ant species of the Dyke Marsh Preserve, Virginia and other studies in the eastern United States.

Reference	Location	Habitat description	CC*	Species
King & Green 2005	Philadelphia County, PA†	Urban forests	0.52	38
Talbot 1934	Cook County, IL	Beech-maple, oak-maple old forests	0.49	24
Lynch et al. 1988	Allegany County, MD†	Floodplain forest	0.47	22
Lynch 1981	Anne Arundel County, MD†	Old forest, young forest, old fields	0.43	52
Carter 1962	Multiple Counties, NC†	Hardwood-bottomland forests	0.42	47
Lynch 1987	Anne Arundel County, MD†	Old and new forests and fields	0.41	62
Headley 1943	Ashtabula County, OH	Forests near Lake Erie	0.39	40
Wang et al. 2000	Augusta County, VA†	George Washington National Forest	0.35	27
Lynch 1981	Anne Arundel County, MD†	Sweetgum forest‡	0.35	15
Nuhn & Wright 1979	Durham County, NC†	Urban forests	0.34	28
Wang et al. 2000	Pocahontas County, WV	Monongahela National Forest	0.32	27
Cole 1940	TN and NC	Great Smoky Mountains National Park	0.25	66
Talbot 1965	Livingston County, MI	Low fields	0.23	28
Ellison et al. 2002	18 Counties, MA†	Bogs	0.22	25
Culver 1974	Greenbrier County, WV	Hardwood forest, old yard	0.20	17
More common species from all studies			0.59	31
More common species from all East Coast studies			0.55	31
Average number of species per study§				34.1

* CC = coefficient of community similarity

† U.S. East Coast Study

‡ The ants in this comparison are limited to those listed in this study's Sweetgum forest. The habitat of some species was not given in the relevant publication; therefore, this particular list may not be complete.

§ Average number of species does not include the two 31 more common species rows.

Solenopsis molesta, a common house-infesting ant, was found only in pitfall samples from one site on the edge of the southernmost part of the study forest. This ant may be more common upstream along the shoreline of the Potomac River which consists of manicured grass lawn for much of the area south of Washington, D.C. This tiny *Solenopsis* species (body length <1.5 mm), feeds on the brood of other ant species using underground galleries and is also a generalist forager in the litter layer (Creighton, 1950; Thompson, 1989). The subterranean foraging behavior of *S. molesta* could decrease the likelihood of capturing it in pitfall traps. However, no *S. molesta* were found in soil cores leading me to believe that its absence from samples is probably not sampling bias; rather *S. molesta* is not common in the DMP forest and may be occasionally entering the forest from more open habitats nearby (Lynch, 1987).

Vollenhovia emeryi is a recently discovered alien myrmicine ant from Japan, and appears to be spreading across the mid-Atlantic region (Kjar & Suman, 2007). The native range of this species spans the full length of the Japanese Islands (30-45° N), and thus it may have little problem acclimating from southern Virginia to southern New England along the U.S. East Coast. In its native habitat, this ant lives in very wet wood along riparian corridors (Kubota, 1984; Kinomura & Yamauchi, 1994).

Some species found in this study that are thought to be rare in eastern U.S. forests actually may be common but rarely caught. *Amblyopone pallipes, Proceratium silaceum*, *Pyramica ohioensis*, *and P. rostrata* have previously been regarded as uncommon and of low abundance when present. However, these species are unlikely to be observed or appear in trap samples due to their foraging behavior and nesting habits. *Amblyopone pallipes* has small nests of often less than 30 individuals, moves slowly, and feeds on centipedes. It lives in rotten logs or leaf litter. *Proceratium silaceum* also remains in the litter or within dead wood and is thought to prey on spider eggs. Both *Pyramica* spp. are highly modified, very small, litter-dwelling ants that feed on Collembola, small soft-bodied arthropods. Soil-core samples from the DMP had many *Pyramica* specimens, and these cryptic, slow-moving ants are apparently common in the Preserve's forest.

Although their populations may be large, all of these behaviors make these species less likely to be

Table 5. Frequencies of ant species from 16 lists and studies in the eastern and mid-eastern U.S. Species are arranged from most commonly reported through least commonly reported.

	Study*																
Species	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	Total
Aphaenogaster rudis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
Ponera pennsylvanica	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
Tapinoma sessile	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
Lasius alienus	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	15
Temnothorax curvispinosus	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	15
Myrmica punctiventris	x	x		x	x	x	x	x	x	x	x	x	x		x	x	14
Myrmecina americana	x	x	x	x	x	x	x	x	x	x	x	x	x				13
Prenolepis imparis	x	x		x	x	x	x	x		x	x	x	x	x		x	13
Crematogaster lineolata		x	x		x	x	x	x		x		x	x	x	x	x	12
Lasius umbratus	x		x	x		x	x	x		x	x	x	x	x	x		12
Temnothorax longispinosus		x	x	x	x	x	x	x		x		x	x		x	x	12
Amblyopone pallipes	x	x	x	x	x	x	x	x		x		x		x			11
Aphaenogaster fulva	x	x	x	x	x	x	x	x			x		x			x	11
Brachymyrmex depilis	x	x	x	x	x	x	x	x		x			x	x			11
Camponotus pennsylvanicus	x	x	x			x	x	x		x		x	x		x		10
Camponotus subbarbatus	x	x	x		x	x	x		x	x	x	x					10
Camponotus chromaiodes	x	x			x	x	x	x		x		x	x				9
Lasius claviger	x	x	x		x	x	x	x					x				8
Camponotus americanus					x	x	x			x	x	x	x	x			8
Camponotus nearcticus	x	x			x	x	x						x	x	x		8
Crematogaster cerasi	x	x			x	x	x	x	x					x			8
Formica subsericea		x			x		x			x	x	x	x		x		8
Temnothorax schaumii		x		x	x		x	x		x		x	x				8
Monomorium minimum					x	x	x			x	x	x	x			x	8
Paratrechina faisonensis	x	x		x	x	x	x		x		x						8
Solenopsis molesta	x		x		x	x	x	x			x		x				8
Stenamma brevicorne	x	x	x				x			x		x		x	x		8
Dolichoderus plagiatus							x			x		x	x	x	x	x	7
Pyramica ohioensis	x			x	x	x	x		x		x						7
Pyramica rostrata	x	x		x	x	x	x				x						7
Aphaenogaster tennesseensis	x		x		x		x	x					x				6
Camponotus castaneus	x	x	x		x		x						x				6
Camponotus noveboracensis		x			x			x	x					x	x		6
Formica fusca						x		x					x	x	x	x	6
Formica pallidefulva					x	x	x	x					x	x			6
Lasius nearcticus		x	x					x		x		x	x				6
Lasius neoniger					x		x	x					x	x		x	6
Temnothorax ambiguus					x		x	x	x					x	x		6
Proceratium silaceum	x	x		x	x	x		x									6
Stenamma diecki		x		x	x		x						x			x	6
Stenamma impar	x	x		x	x		x		x								6
Aphaenogaster lamellidens						x	x				x		x			x	5
Aphaenogaster treatae					x	x	x				x		x				5
Dolichoderus pustulatus					x	x	x							x	x		5
Myrmica emeryana	x		x					x					x	x			5
Pyramica ornata				x	x	x	x				x						5
Crematogaster clara					x	x	x		x								4
Formica schaufussi					x	x	x						x				4
Harpogoxenus americanus					x		x	x			x						4
Pheidole dentata					x		x				x		x				4
Lasius interjectus		x											x			x	3
Crematogaster pilosa	x				x		x										3
Forelius pruinosus					x		x						x				3
Formica neogagates								x		x		x					3
Formica rubicunda			x					x					x				3
Formica subintegra							x	x					x				3
Lasius flavus		x											x	x			3
Lasius speculiventris											x			x	x		3
Temnothorax pergandei						x	x						x				3
Myrmica americana					x		x	x									3
Myrmica pinetorum		x								x		x					3
Tetramorium caespitum					x		x					x					3
Aphaenogaster carolinensis						x							x				2
Camponotus caryae								x					x				2
Crematogaster ashmeadi						x							x				2
Formica exsectoides								x					x				2
Formica integra					x		x										2

Table 5 (continued).

	Study*																
Species	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	Total
Formica nitidiventris										x		x					2
Formica obscuriventris										x		x					2
Myrmica fracticornis								x						x			2
Pheidole bicarinata					x		x										2
Pheidole davisii					x		x										2
Pheidole morrisi							x						x				2
Polyergus lucidus							x							x			2
Ponera trigona						x							x				2
Proceratium croceum							x						x				2
Proceratium pergandei		x											x				2
Pyramica clypeata		x			x												2
Pyramica dietrichi					x		x										2
Pyramica pergandei						x					x						2
Stenamma meridionale						x					x						2
Stenamma schmitti		x					x										2
Strumigenys louisianae						x					x						2
Vollenhovia emeryi	x	x															2
Lasius latipes							x										1
Aphaenogaster texana													x				1
Camponotus impressus				x													1
Camponotus mississippiensis						x											1
Crematogaster laeviuscula													x				1
Crematogaster missouriensis													x				1
Crematogaster vermiculata						x											1
Cryptopone gilva													x				1
Dolichoderus mariae														x			1
Dolichoderus taschenbergi													x				1
Dorymyrmex bureni													x				1
Dorymyrmex grand													x				1
Formica argentea															x		1
Formica cinerea			x														1
Formica habrogyn													x				1
Formica incerta								x									1
Formica lasioides														x			1
Formica neorufibarbis															x		1
Formica sanguinea													x				1
Hypoponera opaciceps							x										1
Hypoponera opacior						x											1
Hypoponera trigona					x												1
Lasius minutus														x			1
Lasius pallitarsis														x			1
Lasius subumbratus	x																1
Leptothorax acervorum								x									1
Temnothorax texanus						x											1
Monomorium pharaonis								x									1
Myrmica brevinodis			x														1
Myrmica incompleta															x		1
Myrmica lobifrons															x		1
Myrmica sculptilis															x		1
Myrmica smithana															x		1
Neivamyrmex carolinensis													x				1
Neivamyrmex nigrescens													x				1
Paratrechina flavipes		x															1
Pheidole crassicornis													x				1
Pheidole dentigula													x				1
Pheidole pilifera							x										1
Pheidole tysoni													x				1
Pheidole vinelandica													x				1
Pyramica creightoni													x				1
Pyramica pilansis											x						1
Pyramica talpa						x											1
Trachymyrmex septrionalis		x															1
Total (129 ant species)	31	39	24	22	52	47	62	40	15	27	28	27	65	28	25	17	

*Study: a, this study (low forest); b, King & Green 2005 (urban forest); c, Talbot 1934 (old forest); d, Lynch et al. 1988 (riparian forest); e, Lynch 1981 (old woods, old fields, new fields); f, Carter 1962 (low woods); g, Lynch 1987 (old woods, riparian woods, old fields, new fields); h, Headley 1943 (old woods); i, Lynch 1981 (old woods); j, Wang et al. 2000 (old woods); k, Nuhn & Wright 1979 (urban woods); l, Wang et al. 2000 (old woods); m, Cole 1940 (old woods, old fields); n, Talbot 1965 (low fields); o, Ellison et al. 2002 (low woods, bogs); p, Culver 1974 (old woods, old fields, new fields).

Table 6. Chao2 species-accumulation estimates for the study forest, Dyke Marsh Preserve, Virginia.

Sampling period and method	Chao2 species estimates Mean ± SD
2000-2003	
Both methods	31.5 ± 1.0
Pitfall traps	33.8 ± 3.0
2000-2001	
Pitfall traps	26.6 ± 3.9
2002-2003	
Both methods	28.4 ± 1.8
Pitfall traps	30.9 ± 3.6
Soil cores	16.3 ± 2.2

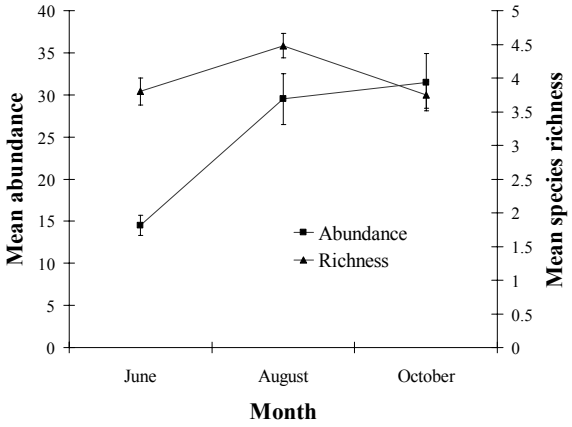

Fig. 1. Mean ant abundance and species richness in pitfall and soil-core samples at Dyke Marsh Preserve, Virginia, 2002-2003. Error bars are ± 1 standard error.

captured in pitfall traps. *Pyramica* spp. may have nests of at least 50 individuals in DMP (pers. obs.), yet they are distinctly under-represented in pitfall traps, particularly compared to soil cores in this study. Myrmecologists previously thought *Pyramica* spp. were rare, but with the increasing use of Winkler extraction of leaf litter and Berlese extraction of soil cores, these cryptic ants appear to be much more abundant and common world-wide (Bolton, 2000). *Brachymyrmex depilis* is another species with large colonies, and competes with *Lasius* and other common genera. I encountered it only once in pitfall trapping, but soil cores produced 26 specimens. These results agree with earlier work in the mid-Atlantic region that found *B. depilis* to be present predominately in soil and rarely found in the litter layer (Lynch et al., 1988).

The majority of ant species found in DMP are native and common in riparian forests in the mid-Atlantic region (Lynch et al., 1988; Table 3). A notable absence from the DMP forest is *Paratrechina flavipes*. This alien ant from Asia has displaced the native *P. faisonensis* in much of Rock Creek Park in Washington, D.C. (Stefan P. Cover, pers. comm.), but has apparently not reached the DMP or is rare in it. Several of the species found in the DMP forest are common around human habitations, including *L. alienus*, *P. imparis*, *S. molesta*, and particularly *T. sessile.* *Lasius alienus*, *P. imparis*, and *T. sessile* are competitive surface foragers and common in most areas of the U.S. All three are generalists with large colonies and may tend homopterans.

The Chao2 species estimator predicted 31.5 ant species in the DMP study forest, and the fact that *Lasius subumbratus* remains the only singleton after 4 yr of trapping, both lend support to the thoroughness of my ant survey (Tables 2 and 6). Although other methods of trapping and hand sampling may reveal more species, the combination of soil cores and pitfall traps, the number of sampling events (680 pitfalls, 360 soil cores), and the wide range of areas sampled within this small forest make it likely that all of the forest ant species are represented in my trap samples.

Temporal Distribution of Ant Species

Previous studies have examined the competitive interactions of common eastern ant species, in particular *P. imparis*, *P. faisonensis*, and *A. rudis* (Lynch et al., 1980; Fellers, 1987, 1989). These authors hypothesized that competition may be reduced in this ant group if each species forages at different times of the year. My results show that the sample catches of the common and abundant species are similar from year to year, and behave as previously reported in similar ant communities (Lynch et al., 1980; Fellers, 1989; Fig. 2). The abundance of *Aphaenogaster rudis* and *P. faisonensis* peaked during August and declined during October as *P. imparis* numbers rapidly increased (Fig. 2). *Prenolepis imparis* forages throughout the cold season in the mid-Atlantic region when temperatures are above freezing (pers. obs.). This is a competitive species which displaces *A. rudis* and *P. faisonensis* from baits (Lynch et al., 1980). However, whether or not the changes in ant abundance are a response to competition is debatable, and the results of this study only add another example of the predictability of this previously observed relationship. The decrease in *A. rudis* and *P. faisonensis* may be a result of competition with *P. imparis*, reduced activity due to declining temperatures, or both. The intraspecific abundances of less abundant ant species were not predictable from year to year. Overall, ant abundance in samples increased and ant species richness decreased in October (Figs. 3-5). The

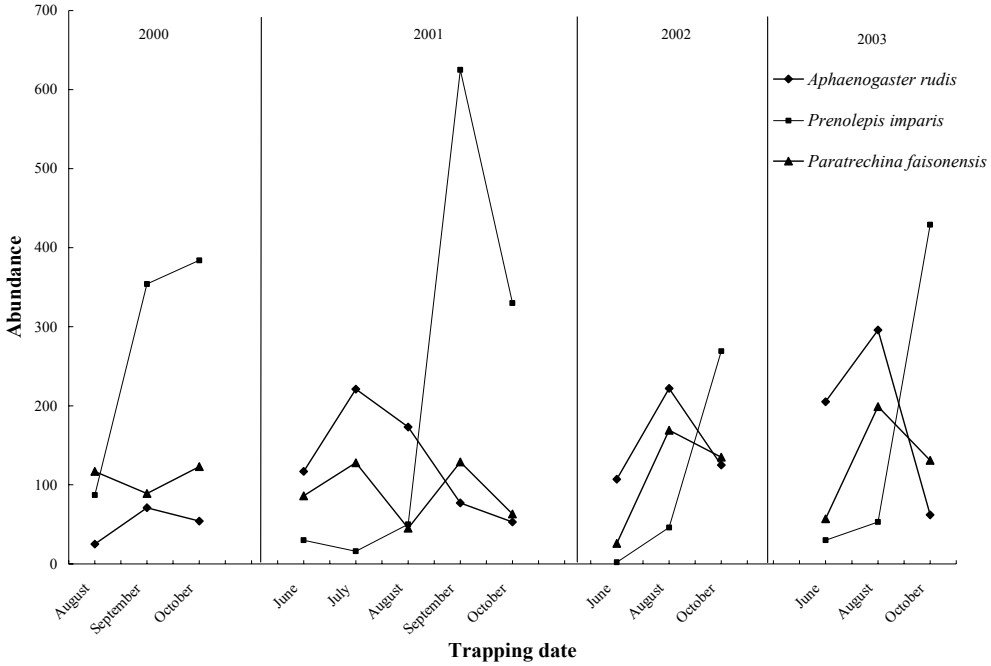

Fig. 2. Abundance of the three more abundant ant species in pitfall and soil-core samples for the years 2000-2003, Dyke Marsh Preserve, Virginia.

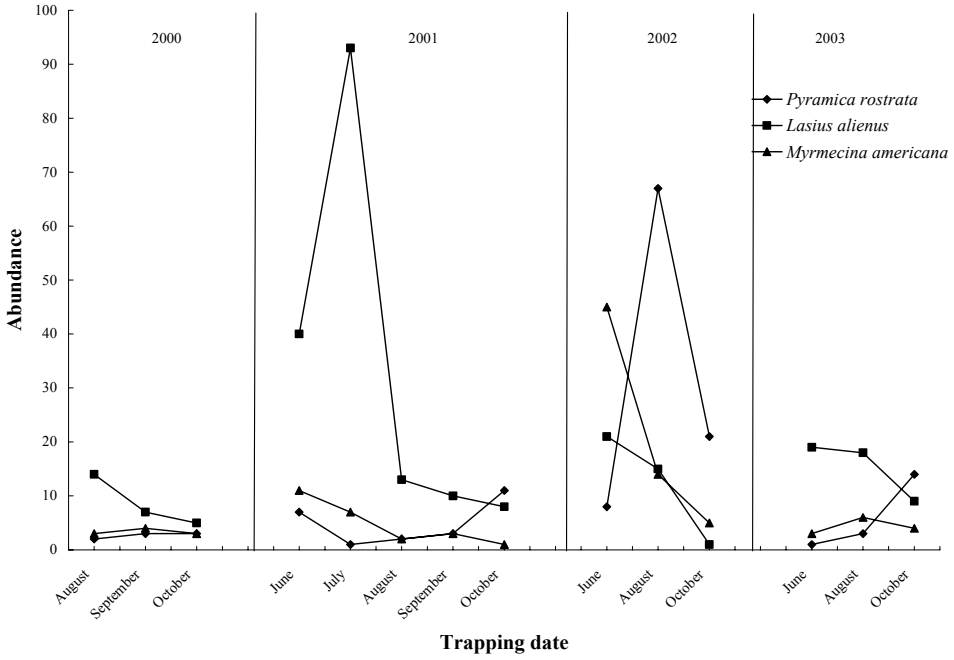

Fig. 3. Abundance of three ant species of lower abundance in pitfall-trap and soil-core samples for the years 2000-2003, Dyke Marsh Preserve, Virginia.

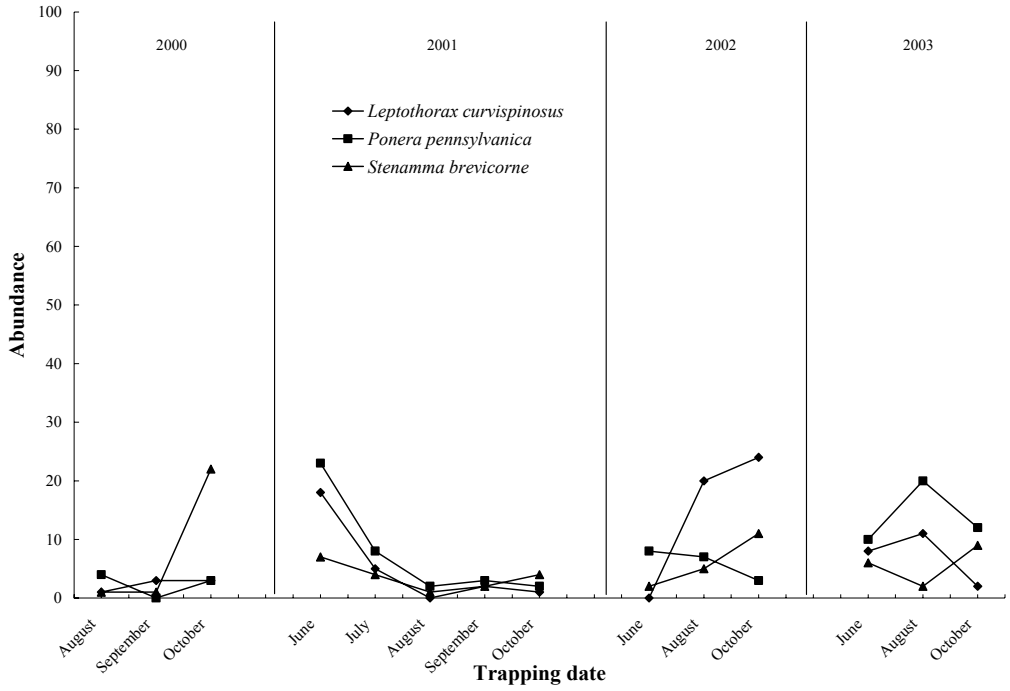

Fig. 4. Abundance of three ant species of lower abundance in pitfall-trap and soil-core samples for the years 2000-2003, Dyke Marsh Preserve, Virginia.

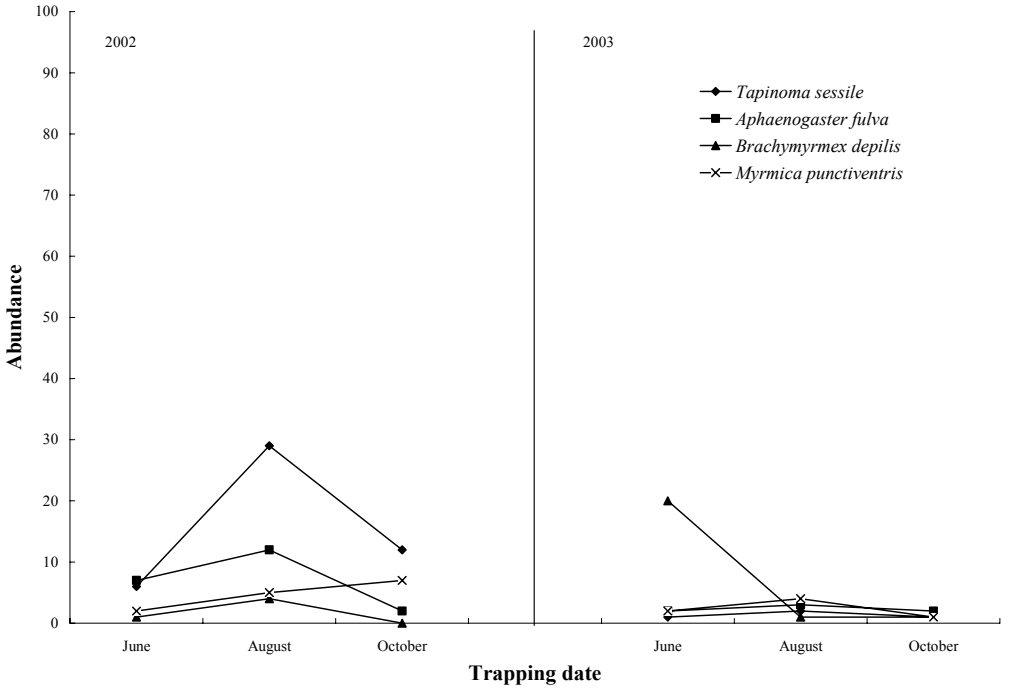

Fig. 5. Abundance of four ant species in pitfall and soil-core samples that were not present in the 2000-2001 study, Dyke Marsh Preserve, Virginia.

decrease in total ant richness may be the result of competition with *P. imparis* or more likely decreasing foraging activity as daily temperatures approach freezing at night (Fig. 1).

CONCLUSIONS

Pitfall-trap and soil-core samples yielded 3,193 ants of 27 species. Inclusion of an earlier study from this riparian forest adds four species. The ant community has many common eastern forest species; one not common to this region, *L. subumbratus*; and the introduced Japanese ant *V. emeryi*. Variation in trap samples across months shows that the most abundant species in trap samples, *P. imparis*, peaks in abundance during early fall. *Aphaenogaster rudis* and *P. faisonensis* have higher incidences in trap samples than all other ant species. Ant species richness in the DMP study forest was highest in August, while abundance was highest in October. The ant community of this small forest within DMP is now relatively well known, and the ant community of other areas in the Preserve should be examined as they may contain different and important ant species. To understand the importance of the unique habitats in the Preserve on the ant community better, trapping and hand collecting should be conducted in other forested parts of the Preserve, the ecotone between the forest and the marsh, the marsh, and along the many shorelines.

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Virginia Ground Spiders: A First List (Araneae: Gnaphosidae)

Richard L. Hoffman

Virginia Museum of Natural History
Martinsville, Virginia 24112

ABSTRACT

Forty-five species of ground spiders (gnaphosids) are documented as known members of the Virginia fauna, about 75% of an anticipated total of 60 to 65 species. Thirteen of the 45 species are listed for the state for the first time, some representing substantial range extensions, mostly from the south, but a capture of *Nodocion rufothoracicus* is the first record for that species east of the Mississippi River. One undescribed species, a minute form of *Drassyllus*, is known from Isle of Wight County. Twenty-four species are known from less than five counties, only six are known from more than 15; *Zelotes duplex* has been documented for 19 counties. Although many species are essentially statewide, at least at low elevations, 15 reflect lowland (austral) distributions, and five are chiefly or entirely restricted to higher elevations.

Key words: distribution, Gnaphosidae, ground spiders, Virginia.

INTRODUCTION

Ground spiders (gnaphosids) comprise an important and sometimes conspicuous element in the fauna of forest litter or dry open habitats, and are often taken in large numbers by standard pitfall trapping procedures. Some species, in both appearance and movement, are distinctive ant-mimics. Although the family has had its share of confusion and unsatisfactory taxonomy in the past, the North American species are now clearly defined and accessible for studies of their biology and distribution thanks to the series of excellent generic revisions generated by Drs. N. I. Platnick and M. Shadab (1975-1988). Because of their inclusion of spot maps, it is possible to learn quickly which species are known from particular areas, and those likely to be discovered by local field work.

As a result of extensive statewide inventory sampling carried out by the Virginia Museum of Natural History (VMNH), Division of Natural Heritage, Virginia Department of Conservation and Recreation (VDNH), and other parties involved in survey activities, knowledge of the Virginia fauna of gnaphosids has been substantially improved during the past two decades. Of the approximately 60 species whose known ranges imply local occurrence, 45 (or 75%) are now documented from captures within the Commonwealth. As this number obviously represents all of the abundant and widespread species (plus several of those seldom collected), it seems likely that a long time may pass before all of the remaining 25% are finally discovered and accounted in a definitive report. Some may in fact even be represented in the extensive backlog of unidentified gnaphosids now accumulated at VMNH with little or no possibility of being studied in the foreseeable future.

It is virtually a characteristic of small arthropods that within a particular group of species some will be captured during almost every collecting effort while others – even some with extensive ranges – seem to be found only occasionally by serendipity. It is uncertain whether the latter are actually rare in the sense of existing only in small, widely separated populations, or whether they occupy habitats likely to be discounted by the anthropocentric bias of collectors. Among local gnaphosids this situation is demonstrated clearly in the genus *Sergiolus*. Known distributions suggest that seven species should occur in Virginia. Only one, *S. capulatus*, is frequently taken, with records for 15 counties across the state. Two others, *S. minutus* and *S. ocellatus*, are each known from two localities. A third species, *S. cyaneiventris*, has been found only once. Three others have yet to be captured in Virginia although they are widespread in eastern North America and are known from adjoining states. In this case, collector bias does not seem to be relevant, inasmuch as pitfall traps have been set in all parts of the state, in a wide spectrum of habitat types, and operated throughout the year.

Another interesting feature of small arthropods is the frequency with which they exhibit totally unpredictable, disjunct, distributions. For instance, the gnaphosid

Nodocion rufithoracicus is common and widespread in western North America (P&S 1980, map 2), but was unknown east of the 104th meridian until an adult male was collected in a remote, natural habitat in central Virginia. An analogous case is afforded by the minute lygaeid bug *Botocudo modestus,* which ranges from Arkansas and Missouri west to California, but occurs also on Wallops Island, Virginia (Hoffman, 1999). Such sporadic distributions imply that almost any gnaphosid known from east of the Rocky Mountains has the potential of being discovered in very localized Virginia populations, and postpones almost indefinitely achievement of a definitive number of endemic species. I have not compiled lists of species for other eastern states from the papers by Platnick & Shadab, but suspect that around 60-70 may be the maximum number (increasing southward) to be expected for most. The list of Maryland spiders compiled by Muma (1945) contains only 16 gnaphosids, but was based on a sampling interval of only four years with minimal use of pitfall trapping. Kaston (1981) tabulated 39 species for all of New England. Heiss & Allen (1986) reported 40 species for the relatively well-collected Arkansas, Gaddy (1985) listed 19 for South Carolina, and the gnaphosid fauna of Michigan is credited with 47 species (Sierwald et al., 2005). In view of these circumstances, the present list – based on authoritative published information and material at VMNH – is merely a progress report which provides a baseline to be augmented by future activities. Half a loaf is better than none, and a start must be made sometime.

Unless specifically stated otherwise, all samples listed in the following entries are in the Virginia Museum of Natural History, the acronym VMNH is therefore omitted. Numbers of specimens by sex are indicated as (male/female). Collection dates for pitfall trap samples are provided when known (e.g., 3 June-12 July), but in many cases the collector recorded only the date of actual removal from the trap; generally a trapping interval of about one month is to be assumed in such cases. The abbreviation DF denotes capture in a drift fence-pitfall combination. The acronym AMNH specifies the American Museum of Natural History collection.

The baseline reference for the following account is the series of generic revisions prepared by Drs. Platnick and Shadab from 1975 to 1988. Reference to these various papers follows a conventional abbreviation of their surname initials: e.g., P&S 1980.

For the purposes of a local listing, simple alphabetical sequence at the level of both genera and species seems the most practical method of presentation. A distribution of our genera into subfamilies is accessible in the "Spiders of North America: An Identification Manual" (Ubick et al., 2005), which provides keys to the genera of North America and excellent illustrations of important structures. In the following list, species based on documented voucher specimens are numbered and set in **boldface** type; entries for probable additional taxa are placed in their correct position but are unnumbered and set in *italic* type.

ANNOTATED SPECIES LIST

1. **Callilepis pluto** Banks

This species is widespread in North America, from Maine to British Columbia, southward in the Appalachians and western mountain systems, but notably absent from the Mississippi embayment and the southeastern Coastal Plain (Platnick, 1975, fig. 1). In Virginia it is statewide, with collections from Augusta, Campbell, Fairfax, Giles, Greensville, Henrico, Henry, Isle of Wight, Mecklenburg, Northampton, Page, and York counties, and the City of Virginia Beach. The record for *C. imbecillis* from "top of Blue Ridge near Roanoke" by Crosby & Bishop (1926) is probably based on a specimen of *C. pluto*.

Callilepis imbecillis (Keyserling)

As documented by Platnick (1975, map 2), this species is almost completely allopatric with the foregoing, occurring along the Gulf Coast from southern Georgia to southern Texas, thence northward to Lake Superior and Ohio. Although no material intermediate between the two taxa has been reported, the illustrated differences in genital structures between them seem relatively trivial, and a case for subspecific relationship might be admitted. Inclusion of *C. imbecillis* as a possible member of the Virginia biota is based on a single male from First Landing State Park, Virginia Beach, which Dr. Platnick felt was this species although both male palpal organs seem a little deformed. Such an identification is at least plausible geographically.

Callilepis new species?

A specimen from Antioch Pines Natural Area Preserve, south of Zuni, Isle of Wight County, differs enough in palpal structure from the two eastern congeneric species that confirmation from larger series might justify recognition of the population as a distinct species.

2. **Cesonia bilineata** (Hentz)

This common and easily recognized eastern species occurs from Ontario to southern Florida, west and south through Texas to Tamaulipas, with outlying records for

Manitoba and New Mexico (P&S, 1980, map 1). It is widespread in Virginia although records are lacking for the higher mountains. Augusta, Campbell, Cumberland, Dickenson, Essex, Fairfax, Floyd, Greensville, Henrico, Isle of Wight, Loudoun, and York counties and the City of Virginia Beach (where it is abundant in First Landing State Park).

3. **Drassodes auriculoides** Barrows

The distribution of this spider is largely confined to northeastern United States (Cape Cod to Wisconsin, south to Tennessee, with a disjunct locality in the Ozarks). Virginia records are from Appomattox, Augusta, Cumberland, Giles, Greensville, Montgomery, Prince William, Page, and York counties, all but one at elevations below 1000 feet (300 m). Most collections are represented by single males only.

4. **Drassodes gosiutus** Chamberlin
New State Record

The curious distribution of this species does not seem to conform to any biogeographic pattern. The nuclear part of the range appears to be in the southern Rockies, but with representation in the Great Plains, the Great Lakes region, southern Alabama, eastern Tennessee, and southern New York and adjoining states. Perhaps this pattern of discontinuity results from condensation of a previously continuous distribution. Our single Virginia record extends the range slightly southward from New Jersey: *Accomack County*: Chincoteague National Wildlife Refuge, Assateague Island, White Hills blueberry swamp, 14 October-5 November 1998, S. M. Roble (1/0).

Drassodes neglectus (Keyserling)

As documented by P&S (1976, map 1), this species reflects a typical boreal distribution, from Quebec to Alaska, south through the western mountains almost to Mexico, and from Wisconsin to Connecticut, with a single disjunct record for Pendleton County, West Virginia. There can be little doubt that *D. neglectus* will be discovered in the high mountains of Virginia along the West Virginia border (not improbably even much farther south).

Drassyllus adocetus Chamberlin

With a "lower austral" distribution between Long Island and central Florida, this species is surely native to the coastal region of Virginia. The male palpal organ is one of the most distinctive in the genus, and permits identification with a degree of confidence not afforded by several other species of *Drassyllus*.

5. **Drassyllus aprilinus** (Banks)

This common species is widespread in eastern United States, from New England to Michigan, thence south to Florida and west to central Texas (with a disjunct site in San Luis Potosi). It competes with *D. novus* for the status of our most frequently collected *Drassyllus*, although virtually all of the VMNH pitfall captures consist of a single male. Although apparently statewide, *D. aprilinus* has so far not been collected in the southwestern third of the state, nor at any site above 300 m in elevation. Augusta, Botetourt, Carroll, Cumberland, Fairfax, Fluvanna, Greensville, Henrico, King George, Mecklenburg, Northampton, Page, Prince Edward, Sussex, Warren, and York counties, and the cities of Chesapeake and Virginia Beach. Collections were made in a wide variety of biotopes without any evident commonality.

6. **Drassyllus covensis** Exline
New State Record

This species is known from only a few widely scattered sites, most of them at low elevations in southeastern United States, and the majority in the Mississippi embayment region. The few Virginia localities correspond to the general pattern of an austral distribution. *Greensville Co.*: DF site at end of Rt 666, 1 mile east of Claresville, 19 May-3 June, 1993, (1/0), 25 May-30 June 1994 (1/1), both VMNH surveys; DF site 2.3 miles northeast of Slate's Corner, 18 June 1990, J. C. Mitchell (1/0). *Mecklenburg Co.*: Elm Hill Wildlife Management Area, 5-22 April 1991, VMNH survey (1/0). *City of Chesapeake*: Fentress Naval Air Station, 11 May 1989 (1/0), 6 June 1989 (8/0), 7 September 1989 (3/0), 27 April 1990 (1/0), all Fentress collections by K. A. Buhlmann.

7. **Drassyllus creolus** Chamberlin & Gertsch

The distribution of this species in southeastern United States closely parallels that of *D. aprilinus*; both appear to prefer lowlands with only a few localities in the Appalachians. It was documented by P&S (1982) from Fairfax County and Chesapeake City, to which we can add two sites in the central Piedmont region: *Cumberland Co.*: DF in recently clearcut woods, 2 km south of Columbia, 1 May 1990 (1/0) and 16 June 1990 (1/0), both J. C. Mitchell. *Pittsylvania Co.*: DF site in sandy bottomland, 1.5 miles ENE of Axton, 13 May 1992, VMNH survey (3/2).

8. **Drassyllus depressus** (Emerton)

This subboreal species is distributed widely across northern United States and southernmost Canada with extensions southward through the Rockies and disjunct populations in the Central Highlands and the Atlantic Coast. P&S (1982) cited a collection from Augusta County; we can extend the range slightly southward with the following records: *Montgomery Co.*: pitfall trap in corn field at Riner, June 1992, M.S. Clark (1/0). *Northampton Co.*: Savage Neck Dunes Natural Area Preserve, DF by interdunal ponds, 20 May-23 June 1999, A. C. Chazal & A. K. Foster (1/0).

9. **Drassyllus dixinus** Chamberlin
New State Record

Endemic to southeastern United States, this species ranges from eastern Texas to northern Florida, thence north in the interior to Illinois and along the Atlantic coast to Maryland. Most VMNH records are from submaritime sites, with two only for the central Piedmont. Accomack, Cumberland, Mecklenburg, Northampton counties and the City of Virginia Beach.

10. **Drassyllus dromeus** Chamberlin
New State Record

To a considerable extent, the known range of this species parallels that of *Drassodes gosiutus,* with a nuclear area in the southern Rockies and the Great Plains and apparently disjunct populations in Missouri, Alabama, and southern New England. Our single Virginia record (identity confirmed by Dr. Platnick) extends the distribution of the latter group about 120 miles (193 km) southward, insignificant spatially but useful in helping define this eastern segment of the overall range. *Accomack Co.*: Chincoteague National Wildlife Refuge, Assateague Island, White Hills swamp DF site, 1-25 June 1998, S. M. Roble (2/0).

11. **Drassyllus ellipes** Chamberlin & Gertsch
New State Record; new northern localities

P&S (1982, map 24) examined specimens of this manifestly austral species from only six localities in Arkansas, Alabama, Florida, Georgia, and North Carolina. The following records for Virginia suggest that the species is not uncommon in the northernmost end of its range: *Greensville Co.*: DF site 1 mile E of Claresville, 19 May-3 June 1993 and 25 May-30 June 1994, VMNH survey (6/4). *Henry Co.*: Martinsville, 24 April 1998, S. Wolen (1/0). *Mecklenburg Co.*: Elm Hill Wildlife Management Area, 5-22 April 1991, VMNH survey (3/0). *Pittsylvania Co*: DF site on Sandy River, ca 1.5 miles ENE of Axton, 13 May 1992, VMNH survey (3/0). *Prince Edward Co.*: Hampden-Sydney College, berleseate oak wood and litter, 14 November 1991, W. A. Shear (1/0). *City of Chesapeake*: Fentress Naval Air Station, 11 May 1989, K. A. Buhlmann (3/1). *City of Virginia Beach*: Oceana Naval Air Station, 3 May 1991, K. A. Buhlmann (2/1).

12. **Drassyllus eremitus** Chamberlin

The range of this species is almost exclusively confined to North America east of the Mississippi River, from southernmost Quebec to the tip of Florida. It was recorded by P&S (1982:11) from the City of Suffolk; VMNH records add the two "Eastern Shore" counties: *Accomack Co.*: Assateague Island, DF in the "White Hills" dune ridge, 26 June-10 July 1998, S. M. Roble (1/0). *Northampton Co.*: Savage Neck Dunes Natural Area Preserve, DF in north dunes, 9 May-1 June 2004, Dorothy Field (2/0).

13. **Drassyllus fallens** Chamberlin

A species of northeastern North America, *D. fallens* ranges from Nova Scotia to Wisconsin, and south through the Appalachians to northern Georgia. In Virginia it occurs in both the mountains and Piedmont, and is one of the few gnaphosids found at elevations above 4000 feet (1200 m). It was recorded for Amherst and Fairfax counties by P&S (1982:11); VMNH samples add the following localities: *Cumberland Co.*: DF in pine woods, 5.5 km SSW of Columbia, 1 August 1990, J. C. Mitchell (1/0). *Grayson Co.*: Grayson Highlands State Park, DF site below contact station, 4000 ft., 5-19 May 1991, (1/0), same site, 19 May-2 June 1991 (2/1), both VMNH surveys. *Patrick Co.*: Clark's Creek, 3 miles SW of Ararat on Rt.669, 27 June 1992, R. L. Hoffman (0/1). *Pittsylvania Co.*: DF site 1.5 miles ENE of Axton, 13 May-15 June 1992, (1/0), same site, 15 June-16 July 1992 (1/0), both VMNH surveys.

14. **Drassyllus frigidus** (Banks)

The range of this spider is similar to that of the preceding species but does not extend into peninsular Florida. P&S (1982:53) recorded it from Fairfax and Montgomery counties, VMNH material adds three more: *Augusta Co.*: DF in mature mixed hardwoods, ca 5 miles west of Stokesville, 24 April 1989, Barry Flamm (1/1). *Cumberland Co.*: DF in clearcut site 2 km SSW of Columbia, 1 May 1990, J. C. Mitchell (4/0). *Mecklenburg Co.*: DF beside Lake Gaston, Elm Hill Wildlife Management Area, 27 November 1975-24 February 1996

(1/0), VMNH survey. It probably occurs sporadically also in our Coastal Plain.

15. **Drassyllus louisianus** Chamberlin
New State Record; northernmost localities

Like *D. ellipes,* this rarely collected species is confined to the Coastal Plain of southeastern United States, known only from four localities in Louisiana, Mississippi, South Carolina, and North Carolina.

VMNH collections extend the known range northward some 150 miles (240 km) from Beaufort County, North Carolina, and open the possibility for discovery in Delaware and New Jersey. *Northampton Co.*: Savage Neck Dunes Natural Area Preserve, SW of Eastville, 9-28 May 2004, Dorothy Field (1/0). *York Co.*: ponds at Grafton, 21 March 1991, VDNH survey (2/0). *City of Chesapeake*: Fentress Naval Aviation Landing Field, 9 April 1990, K. A. Buhlmann (3/0). *City of Virginia Beach*: First Landing State Park, "mesic DF site", 14 April 1989, Buhlmann (5/0).

16. **Drassyllus novus** (Banks)

Ranging from northern New York to Wisconsin and southwest to Missouri, this species was not recorded by P&S (1982:45) from the Atlantic and Gulf Coastal Plains, and from only a single locality (Durham, NC) in the Piedmont. In Virginia, a statewide distribution is implied by captures in the following political entities: Augusta, Campbell, Chesterfield, Dickenson, Fairfax, Fluvanna, Greensville, Henrico, Isle of Wight, King George, Lunenburg, Mecklenburg, Northampton, Rockbridge, Rockingham, Warren, and York counties, and the City of Virginia Beach. The species has usually been found in considerable numbers at all of the sites where pitfall trapping was employed, and was especially abundant at First Landing State Park. Nonetheless, it seems to avoid upland regions, and none of our capture sites are above 2000 feet (600 m) ASL.

Drassyllus rufulus (Banks)

Having been recorded for North Carolina, Maryland, and West Virginia, this species will surely be established as a native of Virginia through future collecting.

17. **Drassyllus** new species
New State Record

A single minute male (length 2.5 mm!) from Antioch Pines Natural Area Preserve, Isle of Wight Co., was identified as an undescribed species by Dr. Platnick in August, 2008. Formal publication of a name for this spider is deferred pending accumulation of additional material.

18. **Gnaphosa fontinalis** Keyserling
New state record

The distribution of this species is largely confined to eastern United States, extending rather obliquely southwest from New York to Texas (and northern Mexico); there are no Coastal Plain records between North Carolina and Arkansas. The treatment by P&S (1975:54) cited relatively few collections, and none for Virginia, a curious circumstance in light of its status as our most abundant species of the family. Like *G. sericata*, it seems to largely avoid the Appalachian region, with no local capture sites above 1000 feet (300 m) ASL. Augusta, Botetourt, Cumberland, Dickenson, Essex, Greensville, Henrico, Henry, Isle of Wight, King George, King & Queen, Mecklenburg, Prince Edward, Roanoke, and York counties, and the cities of Chesapeake, Suffolk, and Virginia Beach.

Surface activity of adults is reflected by the distribution of captures, mostly pitfall (trapping periods which overlapped two months were not counted). Since a number of the pitfalls were operated throughout the year, the lack of records for August and December-March is not "collector bias." The following numbers represent collections, not individuals:

April	1	August	0
May	6	September	1
June	16	October	2
July	6	November	1

Most samples contained multiple individuals of both sexes, as many as 13 are documented but usually recorded simply as "many" or "numerous", even for the late-year collections in October. A survey of the collection sites produced no apparent common biotope features. Sandy, sea-level dunes, pine barrens, marshy swales, recent clearcut sites, floodplains, and mixed mesophytic forests all produced rich harvests of *G. fontinalis.* Notably, no specimens were taken during extensive pitfall trapping at two sites (Accomack and Northampton counties) on the "Eastern Shore" although the abundance of the species at First Landing State Park certainly reflects tolerance of maritime habitats.

19. **Gnaphosa muscorum** (L. Koch)
New State Record; southernmost Appalachian locality

This species is our single local gnaphosid with a Holarctic distribution: western Europe and boreal North America, where it extends across northernmost Alaska

and Canada, thence south through the western Cordillera almost to Mexico (where it surely must also occur). In the United States, *G. muscorum* is abundant in the Great Lakes region and New England, with a disjunct Appalachian locality at Spruce Knob, West Virginia. It is here documented as a member of the Virginia fauna: *Augusta Co.*: 5 miles W of Stokesville, 7 August 1989, pitfall in mature hardwoods, B. Flamm (3/0). Presence of the species elsewhere in the western tier of Virginia counties may be assumed.

20. **Gnaphosa parvula** Banks

This boreal spider ranges from Alaska to Nova Scotia, southward to Colorado and West Virginia. P&S (1975: 51) record it from Chincoteague Island, Accomack County, which is entirely plausible in light of numerous coastal records slightly to the north.

21. **Gnaphosa sericata** (L. Koch)

Although this spider is widespread in much of North America (New York to Utah, south through Mexico and Florida; one record for eastern Cuba), it seems to avoid the Appalachian region. Available Virginia records (all below 1000 ft. [300 m] ASL) reflect this preference for low elevations: Accomack, Campbell, Cumberland, Fairfax, Mecklenburg, and Roanoke counties, and the City of Virginia Beach. Our material was mostly taken by pitfall traps in a variety of biotopes, most apparently sandy or dry, the capture dates ranging from mid-April to early September.

22. **Haplodrassus bicornis** (Emerton)

Occupying two primary centers of abundance in the Cordilleran region and New England, this species is also represented southward by several apparently disjunct populations. P&S (1975:14) recorded material from Virginia Beach. Specimens accumulated at VMNH in the past two decades are from Accomack, Augusta, Cumberland, Fluvanna, Greensville, Isle of Wight, Mecklenburg, and Northampton counties, and the City of Virginia Beach. All but the Augusta County samples are from the non-mountainous part of the state, below 1000 feet (300 m) ASL.

Haplodrassus hiemalis Emerton

Transcontinental from Alaska to Newfoundland, south to Michigan and New Jersey with a disjunct enclave in Colorado and Wyoming, this species is certainly likely to be discovered in northern Virginia and/or on the Eastern Shore.

23. **Haplodrassus mimus** Chamberlin.

Another species with an austral distribution, *H. mimus* has been documented from mostly lowland localities between New Jersey and Louisiana; a record for Chicago, IL, appears a little aberrant in this overall context. The female type specimen was captured at Great Falls in Fairfax County, aside from this we have only a sample from *Mecklenburg Co.*: Elm Hill Wildlife Management Area, DF site by Lake Gaston, 24 February-3 April 1996, VMNH survey (13/1). This site is a sandy floodplain field subject to occasional cultivation, only a few yards from the lake shore.

24. **Haplodrassus signifer** (C. L. Koch)

Although this spider occurs from British Columbia to Newfoundland, and south into Florida and central Mexico, our Virginia localities suggest a lowland distribution within the Commonwealth: Accomack, Cumberland, Fairfax, Pittsylvania, and Sussex counties and the City of Virginia Beach. Most VMNH collections contain only single males; sizable samples were collected only in Virginia Beach (First Landing State Park).

25. **Herpyllus ecclesiasticus** Hentz

This common gnaphosid, easily recognizable among our local species by the conspicuous serrate light band on the abdominal dorsum, occurs everywhere in the United Sates east of the Rockies. In Virginia it is statewide, from sea level up to at least 3000 ft. (900 m) ASL: Accomack, Augusta, Caroline, Dickenson, Fairfax, Franklin, Giles, Henry, Highland, King George, Montgomery, Northampton, Rockingham, and Warren counties, and the cities of Norfolk and Virginia Beach. Habitats range from beach dunes and swales to recent clearcut sites and old growth mixed hardwoods. VMNH specimens have been taken inside residences more than all other members of the family collectively.

26. **Litopyllus temporarius** Chamberlin

A species confined to eastern United States, *L. temporarius* is essentially statewide in Virginia although most of our records are for sites below 2000 ft (600 m) ASL: Appomattox, Augusta, Dickenson, Fairfax, Greensville, Henry, Mecklenburg, Nelson, and Northampton counties, and the City of Virginia Beach.

Micaria browni Barnes

This scarce species, endemic to southeastern United States, was described from the Shackleford Banks, North

Carolina (only 125 miles [200 km] south of Virginia) and is likely to be found here. It does not appear to be restricted to littoral or submaritime habitats.

27. **Micaria delicatula** Bryant
New State Record

Although the majority of localities known for this near relative of *M. longipes* are clustered between New Jersey and Massachusetts, it has been recorded by P&S (1988: 52), on the basis of two females, from Aiken County, South Carolina. Although the following Virginia collection is located midway in the hiatus, confirmation of the SC locality from males would be desireable. *City of Virginia Beach:* Pendleton Navy Base, dune DF site, 21 September 1989, K. A. Buhlmann (2/0).

Micaria elizabethae Gertsch

Having been documented for New Jersey and North Carolina, this species will almost certainly be found in Virginia through future collecting efforts.

Micaria emertoni Gertsch

This species of continent-wide distribution perhaps affords another case of extreme fragmentation of a formerly continuous distribution. It occurs in the Coast Range of Oregon, the Rockies from Alberta to the Mexican Plateau, the Great Lakes region, and a coastal strip from Maine to Maryland. The record for Dorchester County in the latter state implies presence of *M. emertoni* in the nearby Eastern Shore counties of Virginia.

28. **Micaria longipes** Emerton

The extensive distribution of this species in North America excludes only the Pacific Coast states and the southeastern Coastal Plain east of Texas. Although it has been recorded from the Blue Ridge in western North Carolina, the few Virginia records are dominantly from the lower eastern half of the state: Accomack, Augusta, Cumberland, Fairfax, and Prince Edward counties, and the City of Suffolk. At the DF sites in both Augusta and Cumberland counties, the species was captured only in recently clearcut stands to the exclusion of adjacent plots of undisturbed broadleaf forest similarly sampled with pitfalls. The site in Accomack County is in open dune country only a few meters above sea level. P&S (1988: 50) reported a number of captures in "cultivated fields, grasslands, pastures, prairies, and sand" as noted on collection labels, collectively suggesting a preference by this species for dry open habitats.

Micaria longispina Emerton

Eastern records for this rare species extend from Nova Scotia to Florida, but restriction to a coastal habitat seems excluded by inland records for Arkansas, the Great Lakes region, and Alberta, collectively suggesting a continent-wide range now in the last stages of condensation.

29. **Micaria punctata** (Banks)
New State Record; new northeasternmost locality

Although the distribution of this tiny spider is extensive – Nebraska and Texas east to Florida and northward to North Carolina – it embraces relatively few capture localities. Our single Virginia site constitutes only a negligible extension of the known range: *City of Virginia Beach*: Dam Neck Navy Base, 14 May 1991, K. A. Buhlmann (1/0).

Micaria riggsi Gertsch

While the majority of the range of this species occurs in the Cordilleran mountain systems and the Great Lakes region, a disjunct record for the Great Smoky Mountains implies that *M. riggsi* may be expected in the higher mountains of western Virginia.

Nodocion floridanus (Banks)

A widespread species over most of eastern United States, *N. floridanus* has been found just a few miles west of the Virginia state line in Pocahontas County, West Virginia, leaving little doubt that it occurs in many of our western counties.

30. **Nodocion rufithoracicus** Worley
New State Record; disjunct eastern locality

Known to P&S (1980, map 2) only from west of the 100th meridian, this species has appeared – against all probability – in a Virginia pitfall collection. *Cumberland Co.*: pitfall site in recent clearcut, 5.5 km south of Columbia, 15 August 1990, J. C. Mitchell (AMNH 1/0). While the shape of the retrorse tibial apophysis of the male palp readily distinguishes this species from the common eastern *N. floridanus,* the identification of our specimen was further verified by Dr. Platnick. As the pitfall sample was sorted in the VMNH laboratory under my direct supervision, the possibility of a clerical error in labeling can be excluded. That only one specimen was obtained by a year-long sampling effort suggests local rarity. Conceivably, although improbable statistically, the specimen may have been introduced into the remote and undeveloped Virginia locality through some form of

commerce, or, equally unlikely, blown in on an air current when still a juvenile.

Sergiolus bicolor Banks

Although only a few localities are known for this species, they collectively embrace most of eastern United States and it thus seems probable that the species may be discovered in eastern Virginia.

31. **Sergiolus capulatus** (Walckenaer)

Represented over much of North America east of the Great Plains, this colorful species is likewise widespread in Virginia, from sea level to above 4000 ft. (1200 m) ASL in the western mountains. It has been found in a wide variety of biotopes, including residences, and is frequently found running in open places during the day. Records are for Augusta, Bland, Dickenson, Fairfax, Grayson, Greensville, Henrico, Henry, Isle of Wight, Mecklenburg, Northampton, Prince Edward, Rockingham, Warren, Wythe, and York counties, and the City of Virginia Beach. It probably occurs in every county in the state.

32. **Sergiolus cyaneiventris** (Simon)
New State Record

With a chiefly lowland range extending from New England to Texas, this species was not represented by Virginia specimens when the genus was revised by P&S (1981), and seems to be rarely collected north of Florida. VMNH has only a single specimen (identity verified by Dr. Platnick) from *York Co.*: Naval Weapons Station, in hardwoods DF site, 16 July 1990, VDNH survey (1/0).

33. **Sergiolus minutus** (Banks)
New State Record

Having been documented by P&S (1981) from North Carolina and the District of Columbia, this small species could reasonably be expected to occur also in Virginia. VMNH material is from *Mecklenburg Co.*: Elm Hill Wildlife Management Area, DF in sandy open field by Lake Gaston, 10 July-1 August 1995, VMNH survey (1/0). *City of Virginia Beach*: Dam Neck Navy Base, DF in swale, 7 September 1990, VDNH survey (0/1).

Sergiolus montanus (Emerton)

Dominantly a species of the Cordilleran region and West Coast, this species occurs sparingly in the Great Lakes region and is known from a few sites as far south as Texas and South Carolina. It seems likely that specimens will eventually be captured in Virginia.

34. **Sergiolus ocellatus** (Walckenaer)

This spider occurs widely in North America, from Saskatchewan to Nova Scotia, south to eastern Texas and southern Georgia; in peninsular Florida it is replaced by *S. kastoni.* In Virginia it is rarely collected, but apparently occurs nearly statewide. P&S (1981) cited specimens from Giles County, VMNH adds *Roanoke Co.*: Back Creek District, Bandy Road, in swimming pool, 14 June 1993, M. W. Donahue (1/0) and *City of Virginia Beach*: Dam Neck Navy Base, DF in swale, 7 September 1990, VDNH survey (1/1); DF in dunes, 1 August 1989, VDNH survey (1/0)

35. **Sergiolus tennessensis** Chamberlin

This rarely collected spider is widespread in northeastern United States, from North Dakota and Colorado east to Virginia; there are no records for either the southeastern states or New England. P&S (1981) cited material from *Giles Co.*: no locality given but almost certainly Mountain Lake, 9 July 1935, Horton H. Hobbs, Jr. (AMNH 0/1) and *Page Co.*: east of Luray, 5 July 1933, W. J. Gertsch (AMNH 0/2).

Sergiolus unimaculatus Emerton

Another seldom-collected species, *S. unimaculatus* is known only from several collections in the Great Lakes region, and along the Atlantic coast from Maine to Florida. That R. D. Barnes (1953) obtained specimens on three occasions at Beaufort, North Carolina, suggests that this spider will surely be collected in maritime habitats in the Virginia Beach region and the Eastern Shore counties.

36. **Sosticus insularis** (Banks)

Although peripheral areas are very poorly represented in collections, the range of this species generally extends southwest from New England to Texas. In Virginia, the few records are grouped in the extreme southeast and along the western border of the state. Absence of Piedmont localities may be only an artifact of inadequate collecting efforts. *Augusta Co.*: 5 miles west of Stokesville, DF site in recent clearcut, mixed hardwoods forest, 7 September 1988 (1/0), 15 October 1988 (1/0), 9 July 1989 (1/1), all Barry Flamm. *Dickenson Co.*: Breaks Interstate Park, 4 miles north of Haysi, 1-14 July 2000, R. Vigneault (0/1). *Greensville Co.*: DF site 1 mile east of Claresville, 25 May-30 June 1994, VMNH survey (1/0). *City of Virginia Beach*: First Landing State Park, dune DF site, 26 July 1989, VDNH survey (1/0).

37. **"Synaphosus" paludis** (Chamberlin)
New State Record; new northernmost locality

Southeastern United States: southern Illinois to Texas, east to Georgia. Our single Virginia capture thus represents a substantial northward extension of the range along the Atlantic Coast. *City of Virginia Beach*: Back Bay National Wildlife Refuge, 0.3 km south of Black Gut, 21 May-22 June 2000, Duran & Farrell (1/0).

The status of this species was mentioned by Ovtsharenko et al. (1994) as not congeneric with the type species *Synaphosus syntheticus* (Chamberlin) or other members of this genus now known to be largely endemic to Eurasia and Africa. They postulated that the North American occurrence of *S. syntheticus* – from Georgia to California – is the result of anthropochoric influences. To date, *paludis* has not been relocated in its correct genus, although Ovtsharenko et al. (1994) presumed that it too is an "introduced" species from a source area perhaps in East Africa. This possibility does not account for the typical Lower Austral range of the species nor that the known capture sites do not show a close correspondence with urban situations, port cities, or such likely habitats for an alien spider to occupy.

38. **Talanites echinus** (Chamberlin)

The relatively small geographic range of this spider seems to be centered on the Southern Appalachians (West Virginia to Georgia), and our few Virginia records from the central Alleghanies conform to that pattern. *Botetourt Co.*: Roaring Run Furnace, off Va. 621, ca. 6 miles northeast of Eagle Rock, 25 May 1996 (3/1) and 27 April-4 May 1996 (2/1), M.W. Donahue & R. S. Hogan. *Giles Co.*: Mountain Lake (P&S, 1976). *?Roanoke Co.*: "Poor Man's Mountain", without collector or date (P&S, 1976), is probably an error for Poor Mountain, south of Salem.

The generic name *Rachodrassus,* used for this species by P&S (1976), was subsequently considered a junior subjective synonym of *Talanites* by Platnick & Ovtsharenko (1991).

39. **Urozelotes rusticus** (L. Koch)

With a dispersal ability matched by very few other spiders, this species has achieved a cosmopolitan synanthropic distribution. In their review of this genus, Platnick & Murphy (1984) established a list of 20 junior synonyms based on specimens of *U. rusticus* collected nearly everywhere in the world except the Indo-australian region; they also provided our only Virginia record, Fairfax County, without further attribution.

Presumably it may be expected in any of our metropolitan centers.

Zelotes aiken Platnick & Shadab

Although most records for this species are in Texas and the Ozark region, it has been documented as close to Virginia as eastern South Carolina, and is therefore a likely candidate for discovery in Virginia.

40. **Zelotes duplex** Chamberlin

Eastern United States, from Massachusetts and Michigan south to Florida and southern Texas. In Virginia it ranks as one of the five most common gnaphosids, and occurs statewide, from sea level to 4000 ft. (1200 m) ASL in the Alleghanies. Alleghany, Amelia, Augusta, Bath, Bland, Botetourt, Dickenson, Fairfax, Floyd, Giles, Greensville, Henrico, Isle of Wight, King George, Northampton, Pittsylvania, and York counties, and the cities of Suffolk and Virginia Beach. As the biotopes at the capture sites vary greatly, from coastal dunes to northern hardwood forests, the species may be considered as truly euryzonal.

41. **Zelotes exiguoides** Platnick & Shadab
New State Record

This species is known from only a few localities dispersed across North America from Washington to New Hampshire. Our single Virginia locality represents only a minor southern extension from Westmoreland Co., Pennsylvania, but additional captures farther south in the Alleghanies seem very likely. *Clarke Co.*: Blandy Farm, 3 km south of Boyce, 21 May 1991, D. R. Smith, ex Malaise trap (1/0).

Zelotes fratris Chamberlin

The range of this spider is truly boreal, extending across North America from the Yukon to Nova Scotia, southward in the western states through most of California, Arizona, and New Mexico. In eastern North America all of the known localities lie north of the limits of glaciation except for disjunct sites on Roan and Grandfather mountains, North Carolina. These latter records open the possibility that *Z. fratris* may be expected to occur in the Mount Rogers-Whitetop range above 5000 feet (1500 m), although it was not found during prolonged pitfall trapping at that elevation at Grayson Highlands State Park and on Whitetop Mountain.

42. **Zelotes hentzi** Barrows

Vancouver Island to Nova Scotia, southward to Colorado, east Texas, and Florida. The apparent absence

from the southwestern states is notable. Virginia records indicate a statewide distribution from sea level to nearly 5000 feet (1500 m) at Mount Rogers, and a variety of biotopes. Accomack, Augusta, Cumberland, Fairfax, Floyd, Grayson, Henry, Montgomery, Warren, and York counties, and the City of Virginia Beach. Most samples contain only single specimens.

Zelotes laccus Barrows

This scarce species was known to P&S (1983, map 19) from less than a dozen localities dispersed widely across eastern North America. Records for New Jersey, Ohio, and North Carolina imply that *Z. laccus* probably occurs in at least the western mountainous parts of Virginia.

43. **Zelotes lymnophilus** Chamberlin
New State Record; northernmost locality, disjunct from Georgia

One of the more localized members of the genus, *Z. lymnophilus* is known only from Florida and Georgia, with a single remote locality in Texas. Our single specimen from Virginia (identification confirmed by Dr. Platnick) extends the range some 400 miles (640 km) northeast from Screven Co., Georgia, along the Coastal Plain: *City of Suffolk*: South Quay pine barrens, ca. 10 km SE of Franklin, 4 April-6 June 2003, S. M. Roble (1/0).

The record for "Raven Ranch" in Kerr Co., Texas, attributed to D. Mulaik and R. Scott, may be held in suspicion: experience with other arthropod groups has shown that specimens in R. V. Chamberlin's collection from "Raven Ranch" were often mislabeled (including species endemic to Costa Rica and Peru) and that most of Russell Scott's material probably came from Tennessee rather than Texas. The possibility that *Z. lymnophilus* does occur naturally in eastern Texas and other Gulf Coast states, certainly may not be excluded, however.

44. **Zelotes pseustes** Chamberlin

Although the majority of known records for this species are clustered in central Texas and Tamaulipas, a few captures have been made from Florida to Long Island. Virginia localities observe this general Lower Austral pattern: *Greensville Co.*: DF site 1 mile E of Claresville, 25 May-30 June 1994, VMNH survey (0/1). *Mecklenburg Co.*: Elm Hill Wildlife Management Area, DF beside Lake Gaston, 1-29 October 1995, VMNH survey (2/0). *City of Suffolk*: South Quay pine barrens, 10 km SE of Franklin, 16 September-5 November 2003. S. M. Roble (4/0); same site, 18 December 2002-4 April 2003. *City of Virginia Beach*: First Landing State Park, 8-13 June 1970, R. L. Hoffman (AMNH 1/0); scrub DF site, 16 November 1989, K.A. Buhlmann (1/0).

45. **Zelotes pullus** (Bryant)

The great majority of localities for this species are limited to the Atlantic Coastal Plain between Massachusetts and Florida. P&S (1983) cited Fairfax County and Norfolk City. VMNH samples are from farther inland: *Henry Co.*: Martinsville, Beaver Creek meadow, 2 September 2008, R. L. Hoffman (1/0). *Roanoke Co.*: Back Creek, in pool strainer, 29 August 1994, M. W. Donahue (1/0).

SUMMARY

Barring unpredictable and improbable future discoveries like that of *Nodocion rufothoracicus,* existing information justifies an estimate of about 60 species of gnaphosids native to Virginia. We have records for 45, or 75% of that total, which while admittedly incomplete does allow for the compilation of a few statistics and definition of some apparent distributional patterns occupied by these spiders.

Of the 45 species now listed for Virginia, no fewer than 13 are additions to the previously known fauna. While most of these merely fill in existing lacunae between documented states, others represent range extensions of some magnitude: *Drassyllus louisianus*, ca. 150 miles (240 km) northward from North Carolina; *Zelotes lymnophilus* ca. 400 miles (640 km) northeast from Georgia, and *Nodocion rufothoracicus,* ca. 1200 miles (1930 km) east from Colorado.

Although this tabulation is obviously only a first stage in our knowledge of Virginia gnaphosids, a few generalizations may be drawn from the existing data. One is that most species are generally statewide, except perhaps only at lower elevations; some reflect dispositions toward boreal climates (psychrophilic), others for austral conditions (thermophilic).

Some species are abundant in the sense of being captured almost everywhere collection has been done. In terms of county/city records, 24 species are known from less than five, only six from more than 15. The most abundant species are *Zelotes duplex* (19 counties), *Drassyllus aprilinus, D. novus,* and *Gnaphosa fontinalis* (all 18), *Sergiolus capulatus* (17), and *Herpyllus ecclestiacus* (16).

A pervasive pattern noted during examination of numerous distributional maps for gnaphosids in the Platnick & Shadab revisions involves ranges, often discontinuous, centered on the central and southern Rocky Mountains, the Great Lakes region, and New England-eastern Canada. In a number of cases (e.g.,

Drassodes gosiutus, Drassyllus dromeus, and *Gnaphosa pumila*), the latter area extends southward along the Atlantic seaboard at least as far as Virginia. Even in those cases in which the Rocky Mountains are not occupied, the Great Lakes–coastal extension remains evident. A similar pattern (which could be informally designated as "Lacomaritime") has been noted for a variety of other animals, among them insects:

1. *Teratocoris discolor* Uhler (Miridae: Heteroptera), cf. Hoffman, 1999;
2. *Limnephilus moestus* Banks (Limnephilidae: Trichoptera), cf. Hoffman & Parker, 1997 (with map);
3. *Neoconocephalus lyristes* Rehn & Hebard (Tettigonidae: Saltatoria), cf. Walker, 1978, map p. 31.;
4. *Hygrotus impressopunctatus* Schaller (Coleoptera: Dytiscidae), cf. Cross, 1972.

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The Dytiscidae, Gyrinidae, Haliplidae, Hydrochidae, Aquatic Hydrophilidae, and Noteridae (Insecta: Coleoptera) of the North Tract of the Patuxent Research Refuge, Maryland

C. L. Staines

Department of Entomology, MRC 187
National Museum of Natural History
Smithsonian Institution
P. O. Box 37012
Washington, DC 20013-7012
stainesc@si.edu

ABSTRACT

Inventory work conducted at Patuxent Research Refuge, Laurel, Maryland from March 1999 to October 2001 found 17 species of Dytiscidae, two species of Gyrinidae, six species of Haliplidae, one species of Hydrochidae, 17 species of aquatic Hydrophilidae, and one species of Noteridae. These 44 species represent 23.6% of the known Maryland fauna of these families. The most unusual finds were the woodland pool specialists *Hoperius planatus* Fall and *Agabetes acuductus* (Harris) (Dytiscidae), candidates for Maryland threatened/endangered species status.

Key words: aquatic species, Coleoptera, Dytiscidae, Gyrinidae, Haliplidae, Hydrochidae, Hydrophilidae, Maryland, Noteridae, Patuxent Research Refuge.

INTRODUCTION

Aquatic insects are an extremely important but under-appreciated resource. These insects, important in the diet of fish and waterfowl (Wilson, 1923), are predators on other aquatic invertebrates (Wilson, 1923), are indicators of water quality (Brown, 1972), and have been proposed as indicators of overall biodiversity (Ribera & Forster, 1993; Sánchez-Fernández et al., 2006).

Aquatic Coleoptera in many regions of North America have not been thoroughly inventoried and the biogeography of aquatic beetles is poorly understood (Hilsenhoff, 1991). There is a need for inventories of the aquatic beetles of the mid-Atlantic states with an emphasis on sampling as many different habitats as possible. This project was undertaken to help meet this need.

The Patuxent Research Refuge (39.08168ºN 76.77217ºW) was established in 1936 and presently contains 5162 ha. The Refuge is mostly forested, but contains meadow and wetland habitats as well. It is divided into three tracts. The work here summarized was conducted on the 3279 ha North Tract that was transferred to the Refuge from Fort George C. Meade in 1991.

Aquatic resources in the North Tract include the Patuxent and Little Patuxent rivers, numerous small streams, permanent and temporary ponds, marshes, swamps, and seasonal wetlands.

The purposes of this study were to collect and identify aquatic beetles in as many aquatic habitats as possible and to develop baseline data upon which to monitor and manage the natural resources of the Refuge.

METHODS

A standard aquatic net was used along pond, stream, and river margins as well as in the deeper or more interior sections. The "floatation" method involved stirring and agitating the submerged leaf litter along the pond, pool or stream margin by hand and holding it submerged for about a minute, causing beetles, especially smaller species, to float to the surface where they were easily visible and could be captured with a

fine-mesh net. Blacklights were also used to capture numerous species. No formal attempt was made to sample for a specified period of time, nor was any effort made to capture terrestrial hydrophilid species. Field work was conducted from March 1999 to October 2001.

RESULTS

A total of 44 species was found, including 17 Dytiscidae, two Gyrinidae, six Haliplidae, one Hydrochidae, 17 aquatic Hydrophilidae, and one Noteridae. In the following listing of species, each entry contains a general habitat description, endangerment status in Maryland, and details of specific collections on the refuge. Voucher specimens were deposited in the collection of the National Museum of Natural History, Smithsonian Institution.

Dytiscidae

Acilius fraternus (Harris) is most often collected in shaded ponds and pools with some leaf litter and no vegetation; it is also found in lakes, ditches, streams, and swamps; adults are taken at lights (Michael & Matta, 1977; Larson et al., 2000; Ciegler, 2003; Bergsten & Miller, 2006). Specimens were collected at blacklight in May 2001.

Agabetes acuductus (Harris) is a woodland pool species found among dense leaf litter (Spangler & Gordon, 1973). A single male was collected in flooded woods on 20 April 2000. This species is under consideration for endangered or threatened status in Maryland (Anonymous, 2003).

Agabus aeruginosus Aubé is found in emergent vegetation in marshy areas (Michael & Matta, 1977); it is also found in shallow ponds (Hilsenhoff, 1993) and open temporary pools (Matta, 1986b). Specimens were collected at blacklight in May 2001.

Agabus anthracinus Mannerheim is found in grassy margins of ponds (Michael & Matta, 1977) and other permanent lentic habitats (Hilsenhoff, 1993). Larson (1989) reported that the species is usually found in dense emergent vegetation. Specimens were collected among emergent vegetation in ponds in July 1999.

Agabus gagates Aubé is most commonly found in woodland pools, generally where the water is shaded and cool and has an accumulation of organic debris on a soft substrate; it is also found in beaver ponds, flooded pastures, tire ruts, and stream margins; adults are attracted to lights (Michael & Matta, 1977; Larson et al., 2000; Ciegler, 2003). Specimens were collected in woodland pools in April and June of 2000.

Bidessonotus inconspicuous (LeConte) is found in ditches, marshes, ponds, streams, woodland pools, and adults are taken at light (Larson et al., 2000; Williams et al., 2007). Specimens were collected in roadside ditches in April 2000.

Copelatus chevrolati Aubé is a pioneer species found in just about any aquatic situation (Zuellig et al., 2006). Specimens were collected at blacklight in July 1999.

Copelatus glyphicus (Say) is another pioneer species that is abundant in temporary pools; adults are commonly taken at lights (Spangler, 1962). It feeds on copepods, ostracods, ceratopogonid larvae, and *Podura aquatica* L. (Insecta: Collembola) (Spangler, 1962). Specimens were collected in temporary pools in May and June of 2000 and 2001.

Coptotomus interrogatus (Fabricius) is found in ponds, ditches, and lakes; adults are attracted to light (Ciegler, 2003). Barman (2004) reported that this species breeds in temporary pools. Specimens were collected in ponds in July 1999.

Hoperius planatus Fall is an uncommon species found in woodland pools lacking emergent vegetation but containing decaying leaves (Spangler, 1973); adults are taken at lights (Ciegler, 2003). Two specimens were taken at blacklight on 1 June 2000. This is the second record of the species west of the Chesapeake Bay in Maryland. It is under consideration for endangered or threatened status in Maryland (Anonymous, 2003).

Hydrocolus oblitus (Aubé) is found in small, sandy-bottomed streams, cool springs (Larson et al., 2000), and moss in seepages (Ciegler, 2003). Specimens were collected in temporary pools in April and May of 2000 and 2001.

Hydroporus niger Say is found among emergent vegetation in sunny ponds, pools, ditches, swamps, marshes, and other lentic habitats (Barman, 1972; Hilsenhoff, 1995a; Ciegler, 2003; Williams et al., 2007). Specimens were taken in temporary pools in April 2000.

Hygrotus sayi Balfour-Brown is found in a wide variety of aquatic habitats but most often in small pools (Hilsenhoff, 1994), ponds and bogs with weeds and algae (Barman, 1972). Specimens were collected in temporary pools in April 2000.

Laccophilus maculosus maculosus Say is a pioneer species, often the first to find a new body of water. It is found in both forested and grassland shallow pools and ponds usually with emergent vegetation; adults are collected at blacklight (Zimmerman, 1970; Michael & Matta, 1977; Larson et al., 2000; Ciegler, 2003). Specimens were collected in ponds in July 1999.

Matus bicarinatus (Say) is found in ponds and streams (Young, 1953); woodland ponds as well as in

unshaded ponds and roadside ditches; adults are collected at lights (Spangler & Gordon, 1973). Hilsenhoff (1993) collected this species from permanent ponds and marshes which were near or associated with larger streams. Alarie et al. (2001) reported this species in ponds among cattails and decaying leaves; the larvae burrow in mud. Specimens were collected in July 2001 in ponds.

Neoporus clypealis (Sharp) is found in streams of various sizes, backwaters, spring ponds, and ponds adjacent to streams, rarely in other types of ponds or ditches (Hilsenhoff, 1995a); it is also found in emergent vegetation along the margins of slow marshy streams, in beaver ponds, small lakes (Larson et al., 2000), rivers, and swamps; adults are attracted to lights (Ciegler, 2003). Specimens were taken at blacklight in June 2000.

Neoporus undulatus (Say) is found in ditches, rivers, lakes, pools, ponds, swamps, and marshes; adults are attracted to blacklight (Barman, 1972; Ciegler, 2003; Williams et al., 2007). Hilsenhoff (1995a) reported the species as most common in permanent ponds but also in ditches and stream margins. Specimens were taken in temporary pools in May 2001.

Gyrinidae

Dineutus discolor Aubé is found in streams, lakes, rivers, creeks, and swamps (Hilsenhoff, 1990; Ciegler, 2003). Hatch (1925) reported that adults are found in slowly moving streams or slowly flowing areas of swifter streams. Specimens were collected in ponds in May 2001.

Dineutus emarginatus Say is found in ponds, lakes, slow moving rivers and swamps; adults are attracted to lights (Ciegler, 2003; Realzola et al., 2007). King et al. (2000) found this species in cypress-gum swamps. Specimens were collected in ponds in July 1999.

Haliplidae

Haliplus fasciatus Aubé has been collected in permanent pools, temporary pools, the margins of slow-flowing streams, ditches, lakes, ponds, creeks, marshes, and swamps (Matta, 1976a; Ciegler, 2003; Williams et al., 2007; Staines & Mayor, 2008). Specimens were collected in ponds in July 1999.

Haliplus tropsis Say is found in lakes, ponds, rivers, and streams; adults are attracted to light (Hilsenhoff & Brigham, 1978; Ciegler, 2003; Williams et al., 2007). Specimens were collected in ponds in July 1999.

Peltodytes duodecimpunctatus (Say) is frequently collected in ponds (Matta, 1976a), the margins of streams (Hilsenhoff & Brigham, 1978), and ditches (Williams et al., 2007). Specimens were collected in ponds in July 1999.

Peltodytes edentulous (LeConte) is found at the margins of bodies of permanent standing water (Matta, 1976a) and occasionally along the margins of streams (Hilsenhoff & Brigham, 1978). Specimens were collected in ponds in July 1999.

Peltodytes sexmaculatus Roberts is found in lakes, rivers, ditches, slow streams, pools, and mud flats; adults are taken at lights (Matta, 1976a; Hilsenhoff & Brigham, 1978; Ciegler, 2003). Hickman (1931) found that adults and larvae feed on *Spirogyra* algae. Larvae are found in masses of this algae as they can not swim or float, and must reach the surface to breathe by crawling over the algal surface. Specimens were collected in ponds in July 1999.

Peltodytes shermani Roberts is found in ditches, lakes, rivers, streams, pools, and swamps; adults are attracted to light (Ciegler, 2003; Williams et al., 2007). Faulds & Fairchild (1999) reported that this species feeds on *Spirogyra* algae. Specimens were collected in ponds in July 1999.

Hydrochidae

Hydrochus squamifer LeConte is found in shallow edges of lake and ponds, in swamps, marshes, roadside ditches (Smetana, 1988), and margins of streams (Hilsenhoff, 1995b). Specimens were collected along the margins of ponds in June 2001.

Hydrophilidae

Berosus exiguus Say is usually found in standing water associated with algal mats. Individuals have been collected in ditches, farm ponds, woodland ponds, swamp margins, lake margins, and grass-filled streams; adults are attracted to blacklights (Matta, 1974; Testa & Lago, 1994). However, the species is not commonly found (Van Tassell, 1966). Specimens were collected in temporary pools in May 2000.

Berosus fraternus LeConte is found in a wide variety of aquatic habitats but prefers pools and ponds with a large amount of debris; adults are attracted to lights (Matta, 1974; Ciegler, 2003). Hilsenhoff (1995b) reported the species mostly from permanent ponds and occasionally in streams. Specimens were collected in ditches in July of 1999 and 2000.

Berosus peregrinus (Herbst) prefers quiet water along streams or ditches but is occasionally found in ponds and temporary pools (Van Tassell, 1966; Williams et al., 2007); adults are attracted to lights (Hilsenhoff, 1995b). Specimens were collected at

blacklight in July 1999.

Berosus striatus (Say) inhabits ponds of various types, as well as streams, algal mats, lakes, ditches, marshes, temporary pools, and swamps; adults are attracted to lights (Testa & Lago, 1994; Williams et al., 2007; Staines & Mayor, 2008). Matta (1974) stated that this species seems to prefer deeper water. Specimens were collected at blacklight in June of 2000 and 2001.

Cymbiodyta chamberlaini Smetana is a habitat generalist being found in both lentic and lotic situations (Smetana, 1974). Specimens were collected in ditches in June and July of 1999 and 2000.

Cymbiodyta semistriata (Zimmerman) has been collected at lights (Smetana, 1974) and in temporary pools (Staines & Mayor, 2008). A single specimen was collected in a pond on 22 July 1999.

Enochrus cinctus (Say) is most commonly collected in very shallow, temporary woodland pools with abundant rotting vegetation as well as in marshes, streams, and ditches; adults are attracted to lights (Gunderson, 1978; Testa & Lago, 1994; Hilsenhoff, 1995c; Staines & Mayor, 2008). Specimens were collected at blacklight in July of 1999 and 2001.

Enochrus consors (LeConte) is found in lakes, ponds, swamps, and at lights (Gunderson, 1978). Specimens were collected in temporary pools in May 2001.

Enochrus consortus Green is an uncommon species that is found in pools or ponds with emergent vegetation or a layer of debris on the bottom and swamps and ditches; adults are attracted to lights (Gunderson, 1978; Testa & Lago, 1994; Williams et al., 2007; Staines & Mayor, 2008). Hilsenhoff (1995c) reported this species from ponds, marshes, and the margins of lakes and streams. Specimens were collected at blacklight in July of 1999 and 2000.

Enochrus perplexus (LeConte) is common in temporary pools and ponds of various types, as well as in marshes, bogs, and margins of streams; adults fly readily when taken out of water (Gunderson, 1978; Hilsenhoff, 1995c). Specimens were taken at blacklight in June 2001.

Enochrus pygmaeus nebulosus Say is found in quiet waters with rotting leaves and other plant debris (Gunderson, 1978). Testa & Lago (1994) found this species in every type of aquatic habitat and adults are often taken at lights. Specimens were collected in various aquatic situations from May to July of 1999 to 2001.

Helochares maculicollis Mulsant is found in emergent vegetation at the margins of rivers, lakes, marshes, and ponds (Ciegler, 2003; Williams et al., 2007) and prefers quiet water (Archangelsky, 1997). A single specimen was collected in a pond in June 2001.

Hydrochara obtusata (Say) is found in shallow ponds and marshes (Hilsenhoff, 1995); in ditches (Williams et al., 2007); adults commonly come to lights (Smetana, 1980). Specimens were collected at blacklight from May to August during 1999 to 2001.

Paracymus nanus (Fall) is found in lakes, ponds, emergent vegetation, and at light (Ciegler, 2003). Specimens were collected in ponds in May 2001.

Paracymus subcupreus (Say) is found in a wide variety of aquatic habitats but prefers shallow, standing water with abundant organic matter (Wooldridge, 1966). Smetana (1988) also reports this species from semiaquatic habitats such as wet moss and grass tufts. Adults are attracted to lights (Hilsenhoff, 1995b). Specimens were collected in temporary pools in June 2001.

Tropisternus blatchleyi d'Orchymont seems to prefer shallow pools and ponds but may be found in any quiet water habitat; adults are attracted to lights (Matta, 1974). Testa & Lago (1994) found the species in brackish ponds with salinity from 3.5 to 10.0 ppt. Specimens were collected in ponds in June and July during 1999 and 2000.

Tropisternus collaris (Fabricius) is found in shallow standing water with other *Tropisternus* species; it is commonly found in lakes, ponds, temporary pools, streams, and ditches; adults are attracted to lights (Matta, 1974; Staines & Mayor, 2008). Specimens were collected in pools, ponds, and at blacklight throughout the survey.

Noteridae

Hydrocanthus iricolor Say is a habitat generalist but prefers ponds with debris in the bottom and emergent vegetation; adults are attracted to lights (Staines, 1988; Hilsenhoff, 1992; Ciegler, 2003). Specimens were collected in ponds in July 1999.

DISCUSSION

There are few published inventories of Maryland aquatic beetles. Staines & Staines (2005) reported 42 species from three families from Eastern Neck National Wildlife Refuge. Staines (2008a, b) reported 36 species from three families on Plummers Island. Staines (in press) reported 39 species from six families from Fort Washington and Piscataway National Parks.

Staines (1986a) reported 13 species of Haliplidae, four species of Noteridae, 20 species of Gyrinidae, and 84 species of Dytiscidae from Maryland. Staines (1986b) reported three species of Helophoridae, 13 species of Hydrochidae, and 48 aquatic Hydrophilidae from Maryland. This is a total of 186 species in the

families included in this inventory. The 44 species found at Patuxent Research Refuge represents 23.6% of the known Maryland fauna and suggests a diverse and healthy water beetle fauna for the Refuge. Hopefully, the data reported here will provide a baseline for future monitoring to track changes in populations and species at the Refuge.

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Phyllophaga spreta (Horn), A Rare Species of June Beetle New to the Fauna of Virginia, North Carolina, and Pennsylvania (Coleoptera: Scarabaeidae)

Arthur V. Evans[1]

Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street
Richmond, Virginia 23219

ABSTRACT

The presence of the widespread, but rarely collected June beetle, *Phyllophaga spreta* (Horn) is reported from North Carolina, Pennsylvania, and Virginia as new state records. A brief review of its distribution, identification, and natural history is presented, along with possible reasons for its apparent rarity and suggestions for future survey work.

Key words: Alabama, Breaks Interstate Park, Bull Run Mountains, Great Smoky Mountains National Park, Iowa, North Carolina, Pennsylvania, *Phyllophaga*, rare species, Virginia.

INTRODUCTION

Phyllophaga is a large genus of melolonthine scarabs with 860 named species in North, Central, and South America, 214 of which occur in the United States and Canada (Evans & Smith, 2007). Of these, 46 are known or suspected to occur in Virginia (Evans, unpub.). The fauna of eastern North America is well known and stable, with only three new species described since 1953 (Woodruff & Beck, 1989; Polihronakis, 2007). In the eastern United States, the larvae are sometimes serious crop, turf, and pasture pests because of their root-feeding activities, while the nocturnal feeding activities of the adults occasionally result in serious defoliation of deciduous trees and shrubs (Evans, 2002).

While conducting beetle surveys in 2008 and 2009 at Breaks Interstate Park (Dickenson County), Bull Run Mountains Natural Area Preserve (Fauquier and Prince William counties), and Powell Mountain Karst Preserve (Wise County) in Virginia, I collected fourteen specimens (9 males, 5 females) of *P. spreta* (Horn) at blacklight traps. These collections represent a NEW STATE RECORD based on the following collecting data: USA: VA, Dickenson County, Breaks Interstate Park, motor lodge, rms. 101/102, N37.28571º W82.29588º, 1-4 June 2008, A.V. Evans, UV light (1 male); USA: VA, Prince William Co., Bull Run Mountains NAP, Mountain House, N38.82433º W77.70539º, 26 May 2008, A.V. Evans, UV light (1 male, 1 female); USA: VA, Prince William Co., Bull Run Mountains NAP, vic. NW of Mountain House, N38.82621º W77.70735º, 26/27 May 2008, A.V. Evans, uv light trap (2 females); USA: VA, Prince William Co., Bull Run Mountains NAP, boardwalk, Fern Hollow Tr. W of Mountain Rd. Tr., N38.82495º W 77.7106º, 26/27 May 2008, A.V. Evans, uv light trap (2 males, 1 female); USA: VA, Wise Co., Powell Mountain Karst Preserve, Cedar Ridge, uv trap 1, ca. 1.3 km E Cracker Neck Church, N36.85483º W082.69983º, 27-29 April 2009, C.S. Hobson, A.V. Evans (1 male); USA: VA, Wise Co., Powell Mountain Karst Preserve, uv trap 2, NW of campground, ca. 1.3 km E Cracker Neck Church, N36.85527º W082.70014º, 27-29 April 2009, C.S. Hobson, A.V. Evans (1 male); USA: VA, Wise Co., Powell Mountain Karst Preserve, uv trap 3, ca. 1.3 km E Cracker Neck Church, N36.85484º W082.69856º, 27-29 April 2009, C.S. Hobson, A.V. Evans (1 male); USA: VA, Wise Co., Powell Mountain Karst Preserve, uv trap 4, ca. 1.3 km E Cracker Neck Church, N36.85480º W082.69595º, 27-29 April 2009, C.S. Hobson, A.V. Evans (1 male, 1 female). Two specimens are deposited in the Virginia

[1]Current address: 1600 Nottoway Avenue, Richmond, VA 23227; arthurevans@verizon.net

Museum of Natural History, Martinsville, VA, while the remaining specimens are deposited in the Virginia Department of Conservation and Recreation, Division of Natural Heritage in Richmond, VA, and my personal collection.

The site northwest of Mountain House is located in the northern Piedmont physiographic region on a steep, xeric, well-drained, southwest–facing upper slope at the south end of a ridge. According to Fleming (2002), the surface substrate consists primarily of organic matter (83%), flat flaggy quartzite/muscovite schist fragments 8-25 cm in diameter (10%), non-vascular plant cover (10%), larger flat stone fragments >25 cm (5%), and decaying wood (2%). The hardwood forest is dominated by mountain or rock chestnut oak (*Quercus montana* Willdenow) and some black oak (*Q. velutina* Lamarck in J. Lamarck et al.) that show evidence of gypsy moth defoliation. Other tree and shrub species include red maple (*Acer rubrum* L.), black gum (*Nyssa sylvatica* Marsh.), black huckleberry (*Gaylussacia baccata* (Wangenh.) K. Koch), mountain laurel (*Kalmia latifolia* Linnaeus), pink azalea (*Rhododendron periclymenoides* (Michx.) Shinners), American beech (*Fagus grandifolia* Ehrhart), white oak (*Q. alba* L.), and sassafras (*Sassafras albidum* (Nutt.) Nees.). The oak stand was logged perhaps 60 or more years ago and has largely regenerated from stump sprouts. The sparsely vegetated understory consists primarily of low, ericaceous shrubs, such as Blue Ridge blueberry (*Vaccinium pallidum* Aiton) and deer berry (*V. stamineum* L.).

At the Bull Run Mountains NAP, seven additional species of *Phyllophaga* were collected in the vicinity of Mountain House on the same night, including *P. anxia* (LeC.), *P. crenulata* (Froelich), *P. ephilida* (Say), *P. fervida* (Fab.), *P. fraterna* Harris, *P. fusca* (Froelich), *P. horni* (Smith), and *P. marginalis* (Horn).

I located two males of *P. spreta* in the Casey collection at the National Museum of Natural History labeled "Penn" and without any additional information. These specimens also represent a NEW STATE RECORD.

A Google search for *P. spreta* led to the Louisiana State University's beetle database, which revealed a single male from North Carolina, also a NEW STATE RECORD. This specimen is housed in the University of Tennessee's Department of Entomology and Parasitology collection and bears the following locality information: NC, Swain Co., Great Smoky Mountains National Park, Noland Creek, 7 June 1989, light trap at 789m, D. Paulsen. It was collected as part of a study of beetles associated with northern red oak, *Quercus rubra* (P. Lambdin, pers. comm.). According to Adriean Mayor (pers. comm.), the trap was set next to the creek near some red oaks on a dirt road below the bridge, and drew in about 4,000 specimens of *Phyllophaga*, of which only one proved to be *P. spreta*.

DIAGNOSIS

Phyllophaga spreta is 16.5-19.0 mm, shining chestnut or reddish brown, without any dorsal pubescence. The antennae are 10-segmented and clypeus is not distinctly emarginated (Fig. 1). The stout lower spur of the male hind tibiae is distinctly fused at its base and only two thirds the length of the upper spur (Fig. 2), while it is articulated and nearly equal in the female (Fig. 3). The male and female genitalia are as in Figs. 4-7 and 8, respectively.

DISTRIBUTION AND SEASONALITY OF *PHYLLOPHAGA SPRETA*

Phyllophaga spreta was originally described by Horn (1887) in the genus *Lachnosterna* from two males collected in Maryland and Iowa. Images of the Maryland specimen appear on the Museum of Comparative Zoology Type Database at Harvard Entomology (http://insects.oeb.harvard.edu/MCZ/FMPro?-DB=Image.fm&-Lay=web&-Format=images.htm&Species_ID=8064&-Find). Luginbill & Painter (1953) noted that *P. spreta* is "very rare" and listed it from Alabama, Illinois, Ohio, and Wisconsin. Sanderson (1936) had previously noted its presence in Missouri. Pike et al. (1977) included all seven states in a map suggesting a range from Iowa, Wisconsin, and Maryland south to Missouri and Alabama. Therefore, it is not unexpected to find *P. spreta* in Virginia and North Carolina. Despite the aforementioned published state records from Alabama, *P. spreta* was not included

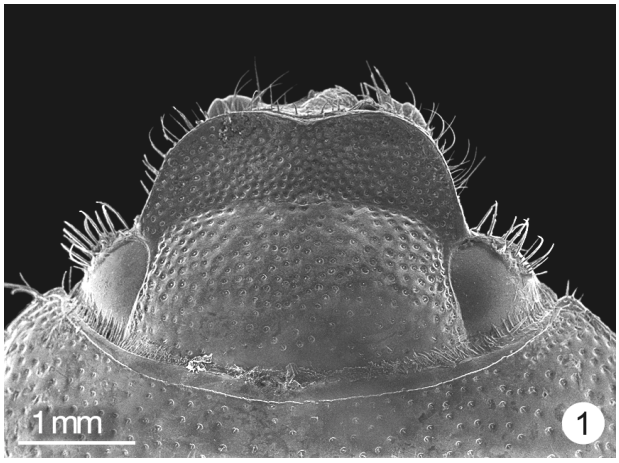
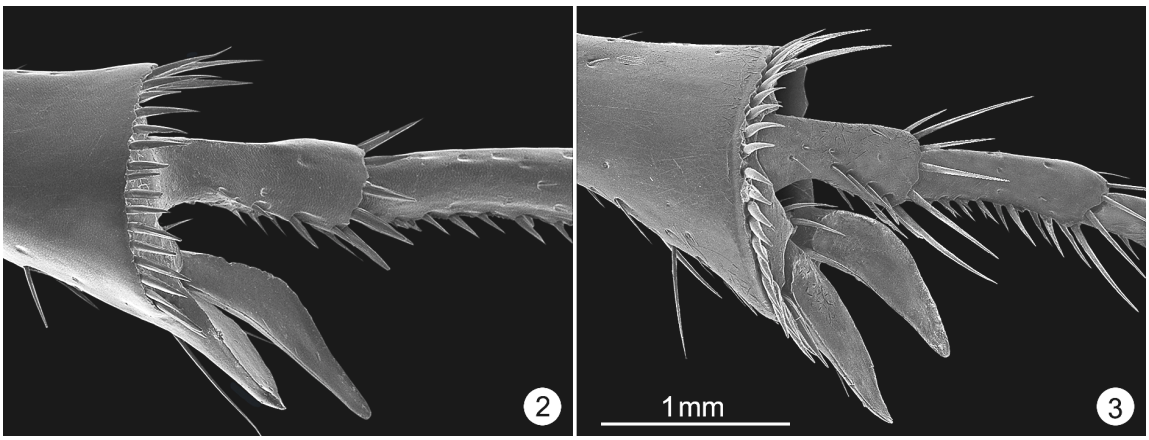
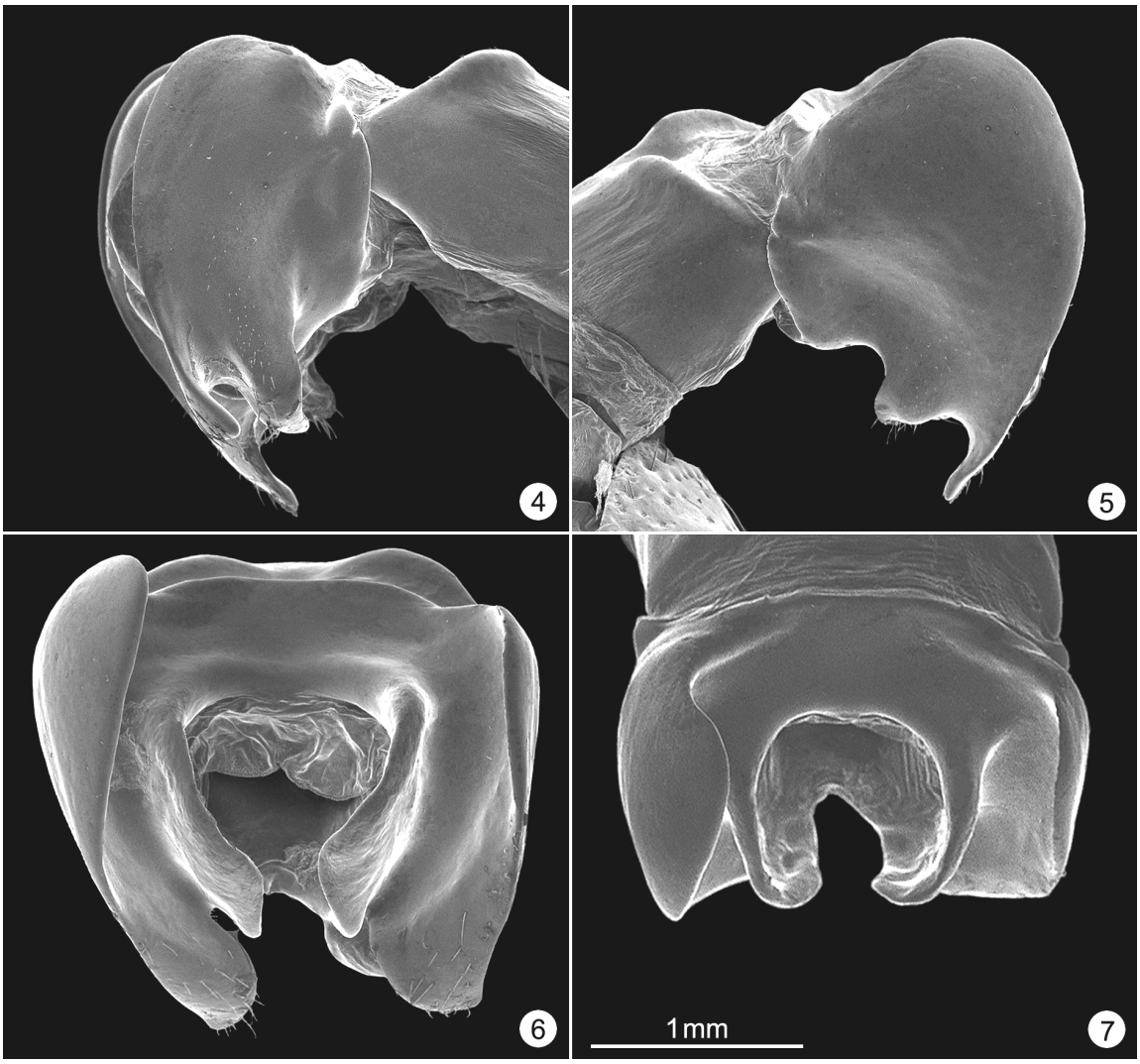


Fig. 1. *Phyllophaga spreta*, male. Head showing clypeal margin.



Figs. 2-3. *Phyllophaga spreta.* 2. Male; the stout lower spur of the hind tibiae is fused at its base and only two-thirds the length of the upper spur. 3. Female; the lower spur of the hind tibiae is articulated at the base and nearly equal in the female.



Figs. 4-7. *Phyllophaga spreta*. 4. Male, lateral view of left paramere. 5. Male, lateral view of right paramere. 6. Male, dorsal view of parameres. 7. Male, caudal view of parameres.

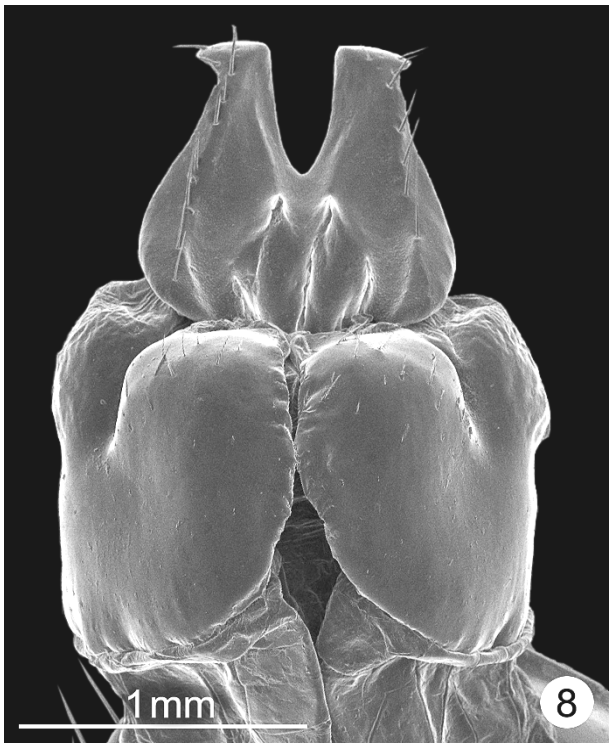


Fig. 8. *Phyllophaga spreta*, female. Ventral view of genitalia.

in a review of *Phyllophaga* in southeastern United States (Forschler & Gardner, 1990).

Most recent specimens of *P. spreta* were collected in Alabama and Iowa, all at lights. Paul Lago (pers. comm.) collected more than 75 specimens in April and May of 2005 from Jackson and Madison counties in the hills near Huntsville, Alabama. All of the specimens were collected in deciduous hardwood forests with few pines at about 1,300 feet (400 m) in elevation.

Rice & Riley (2000) found *P. spreta* in May and early June in an old growth hardwood forest in Story County, Iowa, that had not been cut in more than 100 years. The canopy cover is about 95%, and is dominated by northern red oak (M. Rice, pers. comm.). Fifteen specimens were collected in May from the same site over a three-year period (1992-94) out of 1,580 *Phyllophaga* specimens. Eight additional specimens were collected in Allamakee, Appanoose, and Pottawattamie counties, Iowa in May and early June 2004-08 from localities in upland and riparian woods, and woods at the edge of a prairie (E. Freese, D. Veal, pers. comm.). The Pottawattamie County record is only three miles from the Nebraska state line (M. Paulsen, pers. comm.), but *P. spreta* is not yet known from this state (Ratcliffe & Paulsen, 2008). This species is also known from Johnson County in eastern Iowa (Wickham, 1911).

Most of the other known specimens of *P. spreta* were collected in April or May, including specimens from Crawford County, Wisconsin (Kriska & Young, 2002), and Platte (Sanderson, 1936) and St. Louis counties, Missouri (M. Paulsen, pers. comm.).

Knaus (1899a, b) collected four specimens in June 1896 at lights at McPherson, Kansas. Curiously, this record appears to have been overlooked by subsequent workers. Knaus' collection was deposited in the Entomological Museum of the Kansas State Agricultural College (now Kansas State University) in Manhattan (Horn & Kahle, 1937). However, these specimens were not located in either the Kansas State University (G. Zolnerowich, pers. comm.) or University of Kansas (J. Cole, pers. comm.) collections. Either they were misidentified or the presence of *P. spreta* in Kansas must await confirmation by the collection of additional specimens.

ON THE RARITY OF *PHYLLOPHAGA SPRETA* AND FUTURE SURVEY WORK

Rice & Riley (2000) note that *P. spreta* is a truly rare species across most of its range. Based on previous field experiences with the spring species *Phyllophaga xerophila* Saylor (Evans, unpub.) and other nocturnally active melolonthines in the genera *Serica*, *Diplotaxis*, and *Coenonycha* in Arizona, California, and Nevada (see Evans, 1985; Evans & Smith, 1986), the rarity of *P. spreta* in collections may be due, in part, to the fact that feeding and mating adults are not readily attracted to lights and/or the adult activity period peaks before most collectors set up their light traps.

Adults of many species of *Phyllophaga* eat the leaves of a wide variety of plant species (20-50) in several families (Ratcliffe & Paulsen, 2008). Luginbill & Painter (1953) list black walnut, *Juglans nigra* L., as a host for *P. spreta*. One of the Wisconsin specimens in the NMNH collection bears a label with "Hickory" (M. Paulsen, pers. comm.). Until its feeding preferences are known, no deciduous trees or shrubs should be overlooked when searching for adults of *P. spreta*.

The Platte County specimen in the University of Kansas collection has a label indicating that it was collected from "topsoil in a grove" (J. Cole, pers. comm.). This is the beetle that was noted by Sanderson (1936) as the third known specimen of *P. spreta*. He stated that it was collected "…under dead leaves, and in the first inch or so of top soil beneath trees situated in groves." Five additional species of *Phyllophaga*, along with specimens of *Serica* and *Diplotaxis*, were also found in the same habitat.

Rice & Riley (2000) consider the genus *Phyllophaga* as a useful indicator of biodiversity and "a

benchmark for monitoring influences in future habitat alterations." This is especially true in the Midwest, where they note that several intensive surveys were conducted over the past 100 years that offer opportunities for comparative studies over time. Virginia is not so fortunate because its beetle fauna is, for the most part, poorly documented. Future beetle surveys, especially those conducted in early spring and late fall, that do not rely solely on light trapping will undoubtedly provide useful and interesting baseline data on *P. spreta* and other species thus far unknown or considered "rare" in Virginia.

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Banisteria, Number 33, pages 43-46

Hybosorus illigeri Reiche Confirmed as Part of the Virginia Beetle Fauna, With Notes on *Germarostes* (Coleoptera: Hybosoridae)

Arthur V. Evans[1]

Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street
Richmond, Virginia 23219

ABSTRACT

Hybosorus illigeri Reiche is confirmed as part of the Virginia beetle fauna. A brief overview of the current taxonomic status of the subfamilies Ceratocanthinae and Hybosorinae is presented, along with new Virginia county records and natural history notes for *Germarostes aphodioides* (Illiger) and *G. globosus* (Say).

Key words: arboreal, Ceratocanthinae, *Ceratocanthus*, *Germarostes*, Hybosoridae, *Hybosorus*, saproxylic, tree canopy, Virginia.

INTRODUCTION

Hybosorus illigeri Reiche is recorded from Alabama, Arizona, Arkansas, Florida, Georgia, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas (Ocampo, 2002). Ocampo also listed one specimen from Virginia without any further locality information. A single specimen of this species was located among unidentified beetles in the insect collection of the Virginia Museum of Natural History (VMNH), Martinsville, VA, with the following label data: City of Chesapeake, Northwest River Park, ca. 5 mi. SE Hickory, 18-25 July 2005, R. Vigneault.

Hybosorus illigeri is an Old World species native to "temperate Europe, all of Africa except the Sahara desert, and from the Middle East to Viet Nam and China . . . at altitudes from sea level to nearly 2,000 m" (Ocampo, 2002). They were apparently introduced into the New World in the 19th century via the slave trade, or through some other type of commerce (Ocampo, 2002). In the New World, *H. illigeri* is found across the entire southern third of the United States (including California), Mexico, Central America, Venezuela, and several islands of the Caribbean (Ocampo, 2002; California Beetle Project, 2008).

Adults of *Hybosorus illigeri* are collected at light, and in carrion and dung (Ocampo, 2002). This species also scavenges dead beetles at lights, suggesting that they are present in dung and carrion as insect predators rather than dung or carrion feeders (Woodruff, 1973; Ocampo, 2006). Adults are active from February through December, with the vast majority of specimens collected in June and July (Ocampo, 2002, 2006). Buss (2006) trapped individuals from April through December in Gainesville, Florida, and nearly year-round in Fort Lauderdale. She noted that peak adult activity at both sites was in May and June, with a second, smaller peak in August and September, suggesting that at least part of the Florida population is double-brooded. Adults were observed emerging from burrows in golf courses. Although they do not harm turf, their abundance and the small mounds they make are considered nuisances by golfers and greens keepers (Buss, 2006).

The larvae of *H. illigeri* develop in the soil and have been collected among the roots of fennel (*Foeniculum* sp.) in Georgia, and Bermuda grass turf (*Cynodon dactylon* (L.) Pers.) in Texas (Grebennikov et al., 2004).

[1]Current address: 1600 Nottoway Avenue, Richmond, Virginia 23227; arthurevans@verizon.net

NOTES ON OTHER VIRGINIA HYBOSORID BEETLES

The ceratocanthines have been treated as a tribe of the Trogidae (Martínez, 1968), a family of the Scarabaeoidea (Lawrence & Newton, 1995; Jameson, 2002; Smith, 2006; Ratcliffe & Paulsen, 2008), a subfamily of the Scarabaeidae (Woodruff, 1973; Hoffman, 2006), or as a subfamily of the Hybosoridae (Ocampo & Ballerio, 2006). Based on the strong evidence provided by phylogenetic analyses of molecular and larval data presented by Grebennikov et al. (2004) and Ocampo & Hawks (2006), Ocampo (2006) treated them as a subfamily of the Hybosoridae. Four of the five North American species of Hybosoridae occur in Virginia: *Hybosorus illigeri* Reiche, 1853 (Hybosorinae), and *Ceratocanthus aeneus* (MacLeay) 1819, *Germarostes aphodioides* (Illiger, 1800), and *Germarostes globosus* (Say, 1835) (Ceratocanthinae) (see Hoffman, 2006).

Germarostes aphodioides was recorded from Buckingham County by Robinson (1918), while Hoffman (2006) added Dickenson and Lee counties. To these I add Caroline, Fairfax, Madison, and Prince William counties. Most of the specimens were collected in June and July at UV light traps. Robinson (1918) collected three specimens under the bark of a recently killed black oak, *Quercus velutina* Lam. I found the Prince William County specimens at night about a meter high or more on the standing bole of a dying, fungus-ridden American tulip tree (*Liriodendron tulipifera* L.) near Mountain House in the Bull Run Mountains Natural Area Preserve at the end of May.

Germarostes globosus is known from the Virginia counties of Appomattox, Bath, Brunswick, Buckingham, Dickenson, Dinwiddie, Essex, Fairfax, Greensville, Halifax, Isle of Wight, Lee, and Prince William, and the cities of Suffolk and Virginia Beach (Robinson, 1918; Hoffman, 2006). To these I add Caroline, Chesterfield, Hanover, and Powhatan counties, and the City of Richmond. Most of these specimens were collected in May and June in UV light traps. The Powhatan County record was taken in an unbaited Lindgren funnel trap (C. Wirth, pers. comm.). The City of Richmond specimen was collected in July about midbole under the loose bark on a recently downed oak (*Quercus* sp.) tree. Robinson (1918) collected four specimens under the bark of a recently killed black oak.

Adults of North American ceratocanthines are collected at light, under bark, beating dead limbs and vines, and at carcasses (*Germarostes*) (Blatchley, 1910; Woodruff, 1973). They probably feed on fungi (Ratcliffe & Paulsen, 2008), a hypothesis that appears to have been borne out by gut content analyses on adults of all three species in Florida (D. Almquist, pers. comm.).

The larva of *G. aphodioides* was collected under the bark of a standing oak in Maryland (Ritcher, 1966). Woodruff (1973) reared *G. globosus* from frass collected in the burrows of bess beetles, *Odontotaenius disjunctus* (Illiger) (Passalidae).

A recent study in Africa suggests that some ceratocanthines are arboreal. In western Uganda, Ballerio & Wagner (2005) reported that nearly 700 individuals representing five species of ceratocanthine scarabs in four genera were collected from the canopy of understory trees in a semi-deciduous rainforest during a fogging study using an insecticide.

The North American ceratocanthine fauna may also be decidedly arboreal in habit. In Florida, Choate (1987) found both adults and larvae of *Ceratocanthus aeneus* (MacLeay) in a tree hole about 1.5 feet (0.5 m) above the ground, while D. Almquist (pers. comm.) collected a small series of *C. aeneus* in a window trap suspended about 15 feet (5 m) in the tree canopy.

In a study on habitat associations of saproxylic beetles in South Carolina, Ulyshen & Hanula (2008) found both *G. aphodioides* and *G. globosus* on standing dead water oak (*Quercus nigra* L.) and sweetgum (*Liquidambar styraciflua* L.) at mid-bole, or higher, including the crown. In Florida, Almquist (pers. comm.) has found both species of *Germarostes* relatively common in Lindgren funnel traps, set at ground level and baited with moist sawdust.

It is entirely possible that the fungal-ridden cavities in the boles of living trees and snags in the deciduous woodlands of eastern North America, especially in the Southeast, may harbor all stages of ceratocanthines in abundance. Direct investigations and specialized trapping methods that target this niche at various heights may be the first step toward a better understanding of this poorly known segment of the North American beetle fauna.

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Anne Chazal (DCR-DNH), and Chris Wirth (Powhatan, VA) provided specimens of *Germarostes* used in this study. Alberto Ballerio (Brescia, Italy) promptly provided pertinent literature and offered helpful suggestions. Dave Almquist (Florida Natural Areas Inventory, Gainesville, FL) generously shared unpublished data from his work in preparation on ceratocanthines in Florida. Bruce Gill (Canadian Food Inspection Agency, Ottawa, ON) and Federico Ocampo (Instituto de Investigaciones de las Zonas Aridas, Mendoza, Argentina) graciously reviewed this manuscript to improve its accuracy and readability. I also thank Steve Roble and two anonymous reviewers for their comments on the manuscripts. Finally, I thank Richard Hoffman (VMNH) for granting me access to the museum collection and his generous hospitality while working at the museum.

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Notes on *Valgus seticollis* (Palisot de Beauvois) (Coleoptera: Scarabaeidae) in Virginia

Arthur V. Evans[1]

Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street
Richmond, Virginia 23219

ABSTRACT

Notes on the distribution and natural history of *Valgus seticollis* (Palisot de Beauvois) in Virginia are presented, along with characters to distinguish it from *V. canaliculatus* (Olivier).

Key words: Bull Run Mountains, *Reticulitermes*, *Valgus*, Virginia.

INTRODUCTION

Of the five species of Valgini found in the New World, two are recorded from Virginia: *Valgus canaliculatus* (Olivier) and *V. seticollis* (Palisot de Beauvois) (Jameson & Swoboda, 2005). The adults of both of these species are found throughout much of eastern North America on flowers (Ratcliffe & Paulsen, 2008) and in association with termites (Jameson & Swoboda, 2005).

The biology of *V. canaliculatus* has been described in some detail (Jameson & Swoboda, 2005), but relatively little has been published on the natural history of *V. seticollis*. Both species are sympatric throughout much of their range and often occur together in the same logs (Ritcher, 1966), suggesting that their habitat preferences and life histories are similar. The observations below reinforce this supposed similarity.

On 20 August 2008, while conducting a beetle and macromoth survey in the Bull Run Mountains Natural Area Preserve in Fauquier and Prince William counties, Virginia, I encountered a population of *V. seticollis* under the bark of a dead chestnut oak (*Quercus prinus*

[1]Current address: 1600 Nottoway Avenue, Richmond, VA 23227; arthurevans@verizon.net

L.), standing just a few meters from the western bank of Catharpin Creek in Jackson Hollow (elevation 700 feet (213 m); N38.87875 W77.68927). The bole of this snag was about 18 inches (0.5 m) in diameter at breast height. The first 6 feet (1.8 m) of the bole was teeming with worker and soldier eastern subterranean termites, *Reticulitermes flavipes* (Kollar). The tunneling, feeding, and nest-building activities of the termites had filled the narrow spaces between the wood and bark with bits of wood, termite frass, and extremely fine soil. This habitat was quite similar to the conditions in which I had found *V. californicus* in the mountains of Southern California (Evans, 1986).

Adults, pupae, and one larva of *V. seticollis* were found in cells within the caked wood/frass/soil matrix approximately 10 inches (25 cm) above the ground on the south side of the tree. The adults were either fully developed or teneral. The pupae (Fig. 1) appeared to be freshly eclosed and still had their larval exuviae attached to the tips of their abdomens. The size of the larva's head capsule is comparable to the head capsule of the larval exuviae with the pupae and it is assumed that the grub (Fig. 2) is a third-instar larva. Additional adults were found singly all around the tree, the highest about six feet (1.8 m) above the ground. All of these beetles were found in cells constructed within a substrate consisting primarily of termite frass. A second pocket of adults, pupae, and one larva was found just above ground level on the eastern side, also in cells formed from frass. Perhaps six or more additional larvae were observed at ground level on the south and east sides of the snag. Fitch (1858) found adults and pupae in similar circumstances just above the surface of the ground beneath loose pine bark covering termite-ridden stumps in New York.

The total collection of *V. seticollis* at this site consisted of 6 fully developed adults (5 males, 1 female), 3 teneral adult males, 2 pupae, and two third-instar larvae, which are deposited in my collection (AVEC) and that of the Virginia Museum of Natural History (VMNH) in Martinsville, VA.

In comparison to my observation, Ritcher (1958) noted that females are more common under bark than males, while Casey (1915) found males and females in equal numbers. The male to female ratio of 8:1 at Catharpin Creek may have been due to the fact that males mature earlier than females. The additional larvae observed could have been mostly females. It is possible that the sex ratios observed by Casey and Ritcher were the artifacts of season. Ritcher's (1958) data may have been gathered after the males had left the log or stump in search of food and mates, while Casey's observations could have been earlier in the year. I found four adults of *V. seticollis*, females only, close together in termite frass under loose pine bark on a snag in early April, but persistent searching and beating of nearby shrubs in bloom failed to produce any male *Valgus*.

Fig. 1. Pupa of *Valgus seticollis*. Note larval exuviae still attached to the tip of the abdomen. ©2008, Arthur V. Evans

Fig. 2. Larva of *Valgus seticollis*. ©2008, Arthur V. Evans

DISTRIBUTION

Valgus seticollis ranges from Massachusetts south to Georgia, west to southeastern Nebraska and eastern Texas (Jameson & Swoboda, 2005). It was first reported in Virginia from Fairfax County by Jameson & Swoboda (2005). Additional records from 18 specimens housed in AVEC and the VMNH include Augusta, Franklin, Halifax, Hanover, Louisa, Mecklenberg, Prince William, Roanoke, and York counties, and the City of Richmond.

BIOLOGICAL NOTES

The larva of *V. seticollis* is described by Ritcher (1945, 1966) and illustrated in Böving & Craighead (1931) as *V. canaliculatus* (Ritcher, 1966). As in *V. canaliculatus*, the larvae of *V. seticollis* probably feed on the walls of old termite galleries in logs or standing dead trees (Ritcher, 1958). Pupation occurs in summer within small oval cells constructed from one or more of the following substrates: wood fragments, frass, and soil (Ritcher, 1945). The entire life cycle takes about one year to complete (Ritcher, 1958).

Ritcher (1958) notes that all stages of *Valgus* are found in decaying wood associated with termite colonies. Adults of both *V. canaliculatus* and *V. californicus* mate within termite galleries in stumps and fallen trees (Ritcher, 1958; Evans, 1986). *Valgus seticollis* probably does so also.

Blatchley (1910) observed adults of *V. seticollis* in spring and summer on flowers of dogwood (*Cornus* spp.) and hawthorn (*Crategus* spp.). They are collected from March to July and September through November (Jameson & Swoboda, 2005). During the winter, adults will gather together beneath logs or in clumps of dead mullein (*Verbascum* spp.) leaves (Dillon & Dillon, 1961).

The ecological data gleaned from other collections of adults in Virginia housed in AVEC and the VMNH includes “under pine bark with termites,” “human feces pit fall trap,” “Malaise trap,” and “Lindgren funnel trap baited with turpentine and ethanol.” The temporal distribution of these specimens is as follows: April (8), May (8), and June (2).

Fig. 3. Adult male of *Valgus seticollis*. ©2008, Arthur V. Evans

Fig. 4. Adult female of *Valgus seticollis*. ©2008, Arthur V. Evans

IDENTIFICATION

The genus *Valgus* is distinguished from other scarabs in Virginia by its small size (4.2-7.5 mm), flattened and squarish body, widely separated metacoxae, and scales on both upper and lower surfaces of the body. The margins of the elytra are not emarginated behind the humeri and cover the mesepimera from above (Ratcliffe & Paulsen, 2008).

Valgus seticollis is generally larger (6.4-7.5 mm) (Figs. 3, 4) than *V. canaliculatus* (4.2-5.3 mm) (Fig. 5). The elytra are reddish brown in the male *V. seticollis* and blackish in the female. In *V. canaliculatus*, both the male and female have reddish brown elytra, but the female has a long, straight spine on the propygidium, whereas the male does not.

Jameson & Swoboda (2005) remarked on the considerable degree of intraspecific variation in *V. seticollis* as expressed in the form of the male genitalia and illustrated five distinct forms. However, based on the lack of external features that correlate with these genitalic forms, these authors opted to consider all forms to be variants of the same species. Four males from the Bull Run Mountain population were dissected and all had the genitalic form depicted in Fig. 31 of Jameson & Swoboda (2005), who found this form in Illinois, Kentucky, Ohio, and Missouri. This form is significantly different from their Fig. 35, which belongs to a specimen collected only 30 miles to the east in Washington, DC.

High intraspecific variation may be the result of biogeographic response to the expansion and contraction of forest ecosystems triggered by glacial-interglacial cycles during the Wisconsin maximum (~18,000 yr BP) (Jameson & Swoboda, 2005). It would be an interesting morphological exercise to dissect and compare the male genitalia of *V. seticollis* from populations throughout Virginia to determine how many discernible genitalic forms occur in the state. An

Fig. 5. Adult male of *Valgus canaliculatus* on New Jersey tea, *Ceanothus americanus* L. ©2007, Arthur V. Evans

analysis of the distribution of these forms may reveal a correlation with montane and lowland habitats. Combined with molecular analysis, these data may provide insights toward an understanding of the effects of dispersal, isolation, hybridization, and other evolutionary and biogeographical processes that affect character plasticity (Jameson & Swoboda, 2005).

ACKNOWLEDGEMENTS

The beetle survey of the Bull Run Mountains Natural Area Preserve was funded by the Bull Run Mountains Conservancy and the Virginia Department of Conservation and Recreation, Division of Natural Heritage (DCR). I thank Michael Kieffer and Jennifer Helwig (Bull Run Mountains Conservancy) for providing access and logistical support during the survey. I am indebted to Faye McKinney (DCR) for her able assistance with administrative matters related to the survey. Paula Evans reviewed the first draft of the manuscript. I also take this opportunity to extend my appreciation to Richard L. Hoffman, Curator of Recent Invertebrates at VMNH. Since my arrival in Richmond in 2000, Dr. Hoffman has been a tremendous source of inspiration and encouragement toward my studies in the Virginia beetle fauna and has graciously afforded to me unfettered access to the VMNH insect collection. Special thanks to my friend and colleague Mary Liz Jameson who reviewed this manuscript. It was her research with Katherine Swoboda on the North American valgines that largely inspired this note. Thanks also to Steve Roble and two anonymous reviewers for their comments on the penultimate draft of this manuscript.

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Banisteria, Number 33, pages 50-52

First Records of *Notapictinus aurivillii* (Bergroth), a Little-known Flatbug, for Virginia and the Carolinas (Heteroptera: Aradidae)

Richard L. Hoffman

Virginia Museum of Natural History
Martinsville, Virginia 24112

ABSTRACT

Notapictinus aurivillii (Bergroth), family Aradidae, heretofore documented only from a few localities in Georgia, Florida, and Louisiana, is reported for the first time from 13 sites in Virginia and one site each in North Carolina and South Carolina. Comparison is made with other local genera of the family, and some useful taxonomic features are noted and illustrated.

Key words: anatomy, Aradidae, distribution, *Notapictinus*, Virginia.

Under the name *Pictinus aurivillii*, a miniature flatbug was described by Ewald Bergroth (1887) from "Georgia." It was subsequently documented from Bayou Sara, Louisiana, and Crescent City, Florida, by Heidemann (1904). Blatchley's manual (1926) and Froeschner's catalogue of Nearctic aradids (1988) cited only these three states in their accounts of the species, and that is apparently the extent of our present knowledge of its distribution. The species was referred to the new genus *Notapictinus* by Usinger & Matsuda (1959) and entered in a key to the 25 species of this genus by Kormilev (1964), although he did not specify actually having seen any specimens.

Since 1989, specimens of a tiny aradid have been accumulating at the Virginia Museum of Natural History under the assumed status of a form of *Mezira* and were not examined closely until recently, when comparison with named specimens of *Mezira*, *Neuroctenus*, and *Aneurus* showed that a different genus was involved. Reference to Blatchley's manual suggested the species could belong in *Notapictinus,* although such an identity seemed improbable because of both the geographic disjunction and the frequency with which it had been found in Virginia. Eventually, specimens were sent to Dr. Thomas J. Henry, who confirmed their identity with material of *N. aurivillii* from Florida and Georgia in the National Museum of Natural History.

Curious that an insect apparently very rare in the Gulf Coastal Plain should be frequently collected in Virginia, I inquired of several regional museums in an attempt to locate additional, unreported specimens. Although no attempt was made to conduct an exhaustive survey of all possible resources, it became evident that museum collections are generally very deficient as far as this species is concerned.

The following new records are listed in a north to south sequence. All specimens cited from Virginia are housed in the Virginia Museum of Natural History, those in other repositories are identified by the following codons: NCSU: North Carolina State University, UGA: University of Georgia; FSCA: Florida State Collection of Arthropods.

VIRGINIA: *Accomack Co.*: Chincoteague National Wildlife Refuge, "White Hills" DF site, 28 June-8 July 1998, S. M. Roble (1). *Cumberland Co.*: 7 km S of Columbia, berleseate in mixed hardwoods, 20 April 1996, VMNH survey (2). *Fluvanna Co.*: Kent's Store, 16 April-4 May 1995, VMNH survey (1). *Greensville Co.*: 2.5 mi NW of Skippers, from pitfall, 18 June 1990. J. C. Mitchell (1). *Isle of Wight Co.*: Antioch Pines Natural Area Preserve, 10 km S of Zuni, pitfall, 30 April 2002, VDNH survey (1). *Mecklenburg Co.*: Elm Hill Wildlife Management Area, 5-22 April (2), and 5-19 June 1991 (2), both VMNH survey. *Prince William Co.*: Prince William Forest Park, floodplain DF site, 3 October 1988, D. A. Young (1). *York Co.*: Grafton Ponds, 11 June 1990, C. A. Pague (1), 19 October 1990, K. A. Buhlmann (1); Cheatham Annex, Naval Supply Station, 30 May 1990, K. A. Buhlmann (1). *City of Suffolk:* South Quay pine barrens, 6 mi SSE Franklin, 4 November 2003, S. M. Roble (2). *City of Virginia Beach:* Fentress Naval Air Station, 9 April 1990 (1), 6 June 1989 (2), both K. A.

Buhlmann; First Landing State Park, dune DF site, 8 September 1989, Buhlmann (1); Fort Story, 22 July 1995, D. A. Young (1); Little Creek Amphibious Base, 3 June (1), 21 June (1), 24 July 1989 (1), all Buhlmann; Munden Point, 2 miles south of Creeds, 18 June 1990, N. L. Bland (1).

NORTH CAROLINA: *Bladen Co.*: Bladen Lakes State Forest, 5.5 km SW of Ammon, 8 September 1991, J. Zhang (NCSU 1). *Wayne Co.*: Goldsboro, 19 March 1993, T. Daggy (NCSU 1).

SOUTH CAROLINA: *Georgetown Co.*: Hobcaw Plantation, 14 December 1974, J. F. Cornell (NCSU 2).

GEORGIA: *Clarke Co*.: Georgia Botanical Garden, 13 May 1975 (UGA). *Decatur Co.*: without specific locality (FSCA 1). *Tift Co.*: Tifton, 10 May 1975 (UGA).

FLORIDA: *Alachua Co.*: Gainesville (FSCA 2). *St. Johns Co.*: without specific locality, 25 March 1949 (3), T. Daggy (NCSU).

While most of the foregoing localities are in the Atlantic Coastal Plain, three of the Virginia sites are well inland in the central Piedmont, as are the sites in Clarke and Decatur counties, Georgia. The northernmost locality, in Prince William Co., Virginia, is less than 30 miles (50 km) from the District of Columbia, and evokes surprise that the species was not found there by such skilled early collectors as E. A. Schwarz, Otto Heidemann, and Henry Ulke (nor by anyone since).

Most of the scant information to be gleaned from pin labels suggests that the majority of specimens were captured in pitfall traps, most of which, in Virginia at least, appear to have been sited in dry, sandy habitats. However, the two bugs from Cumberland County were taken by Berlese extraction of litter from broadleaf mesophytic forest. Labels with the pair from Georgetown Co., South Carolina, carry the notation "*Neotoma* nest." In Blatchley's key (1926: 317) to eastern genera of mezirine Aradidae, *Notapictinus* is identified by the combination of distally acute pronotum (against broadly rounded in *Aneurus*) and absence of venation in the hemelytral membrane (present in other genera). In the material at my disposal, the appearance of the membrane varies substantially within the general rugulose-vermiculate condition, with occasional vestiges of an antecedent venation evident. If this somewhat ambivalent character is overlooked as diagnostic, the most similar local relative appears to be *Neuroctenus*, which is, however, easily distinguished by the presence of a sharp submarginal ridge between the stigmata and lateral edges of the sterna.

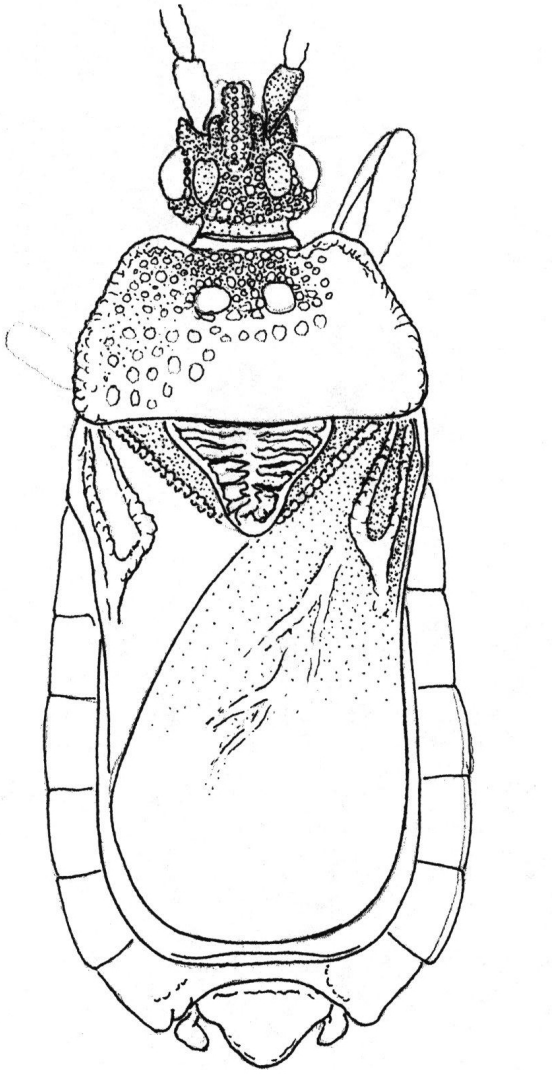

Fig. 1. Habitus sketch of *Notapictinus aurivillii*, dorsal aspect, showing transverse rugae of scutellum and vestiges of hemelytral venation.

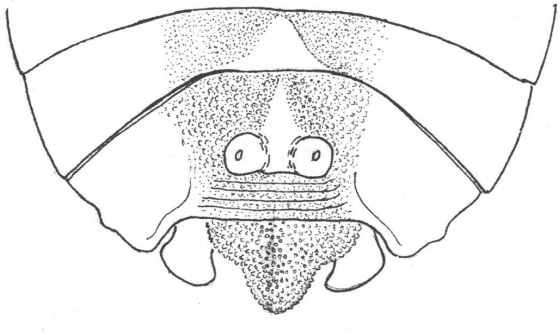

Fig. 2. Same specimen as in Fig. 1, ventral aspect of terminal abdominal segments showing modifications of 5th sternum peculiar to the male sex.

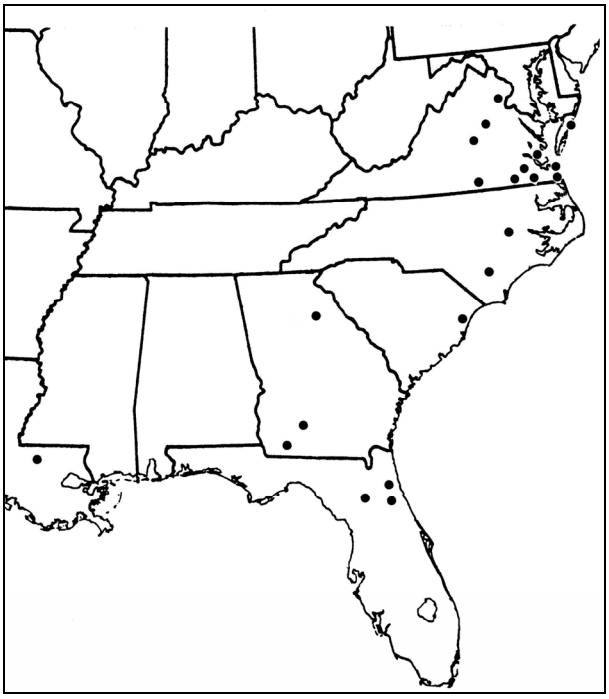

Fig. 3. Distributional records for *Notapictinus aurivillii.*

There remains to be explained the anomalous distributional pattern (Fig. 3) of a member of a dominantly tropical genus being most frequently collected at the northern extremity of its "Lower Austral" distribution in southeastern United States.

ACKNOWLEDGEMENTS

I am indebted to Robert L. Blinn (NCSU) for access to that collection, and to Cecil L. Smith (UGA) and David Ziesk (FSCA) for searching through aradid material under their care for additional records for *Notapictinus.* Most of the Virginia specimens came to VMNH through the interest of Virginia Division of Natural Heritage (VDNH) zoologists Christopher A. Pague and Steven M. Roble. Thomas J. Henry (Systematic Entomology Lab, USDA) confirmed my identification by comparison with named specimens in the U. S. National Museum.

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SHORTER CONTRIBUTIONS

Banisteria, Number 33, page 53

AN OBSCURE SAWFLY, *KERITA FIDALA* ROSS (HYMENOPTERA: TENTHREDINIDAE), NEW TO VIRGINIA, A LEAFMINER OF VIRGINIA BLUEBELL, *MERTENSIA VIRGINICA* (L.) PERS. EX LINK (BORAGINACEAE).

– *Kerita fidala* was described from Illinois by Ross (1937) without host information. It was later recorded to "leaf mine in *Mertensia*" by Ross (1951) and from "*Mertensia virginica* (L.)" by Maxwell (1955). Smith (1976) added Indiana to its distribution in a revision of the genus. These constitute the only distribution and host plant records of this sawfly. The only other two species of *Kerita* were described by Smith (1976), *K. atira* and *K. difala*, both from western North America, but their host plants are unknown. Specimens of *K. fidala* recently collected in Turkey Run Park, Fairfax County, Virginia, represent a new state record which can be added to the list of Virginia sawflies (Smith, 2006) under Tenthredinidae, Nematinae, page 10.

Kerita fidala is a small, ca. 4 mm long, black sawfly with white tegulae and pale orange legs. Adults fly in early spring, 5-28 April in Illinois and Indiana (Smith, 1976) and the end of March and in April in Fairfax County. Its apparent rarity probably is due to its small size, early flight period, and restricted habitat. Therefore, it easily can be missed during general collecting.

Specimens were collected at Turkey Run Park, in Malaise traps on the floodplain of the Potomac River near extensive beds of Virginia bluebell, *Mertensia virginica* (L.) Pers. ex Link (Boraginaceae). Specimen data are as follows: USA: Virginia, Fairfax Co., Turkey Run trap, 38º 57.9′ N, 77º 09.4′ W, 29 March-25 April 2007, D. Smith, Malaise trap (1♀), same except 12 March-2 April 2008 (1♀), 3-16 April 2008 (3♀); USA: Virginia, Fairfax Co., Turkey Run, west trap, 38º 57.968′N, 77º 09.674′W, 13-28 March 2007, D. Smith, Malaise trap (1♀), same except 3-16 April 2008 (1♀); USA: Virginia, Fairfax Co., Turkey Run, stream trap, 38º 57.931′N, 77º 09.70′W, 3-16 April 2008, D. Smith, Malaise trap (1♀). Specimens are deposited in the collection of the National Park Service (George Washington Memorial Parkway) at Turkey Run Park, Virginia, and the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Kerita fidala has not been reported as a pest of Virginia bluebell even though the bluebell is often a garden plant. Nothing is known about either the insect's life history or the type of larval mine it produces. Adults presumably fly around or near the host plants concurrently with early spring growth. They were found only in three traps adjacent to extensive beds of *Mertensia*. No specimens were caught in four other traps in Turkey Run and Great Falls parks, nor during my extensive collections in Virginia (Smith, 2006). Shortly after flight, some type of mine must appear in the host leaves. This could be a blotch mine or serpentine mine which must discolor the leaf in some way. Mines may be easier to find than adults and could be apparent toward the end of April and first part of May. Collection records indicate that *K. fidala* is univoltine. Further observations will be of interest in learning more about this sawfly.

A grant from the George Washington Memorial Parkway, U. S. National Park Service entitled "A taxonomic survey of selected groups of insects (Class Insecta) at Great Falls Park and Turkey Run Park," Study #GWMP-00052, is acknowledged for permission to collect in the parks.

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David R. Smith
Systematic Entomology Laboratory, ARS, USDA
c/o National Museum of Natural History
Smithsonian Institution
P.O. Box 37012, MRC 168
Washington, DC 20013-7012

Banisteria, Number 33, pages 54-55

A RANGE EXTENSION OF THE HISPID COTTON RAT, *SIGMODON HISPIDUS*, IN VIRGINIA. – We report recent captures of Hispid Cotton Rats (*Sigmodon hispidus virginianus*) at Addison Field (Caldwell Fields complex, Jefferson National Forest; UTM NAD83 Zone 17N, 4132500N, 559900E, elevation 510 m) in Montgomery County, Virginia (Ridge and Valley physiographic province). Addison Field is a 5.5-ha, fire-maintained early successional habitat dominated by a mixture of native and exotic herbaceous vegetation (*Verbesina occidentalis*, *Rubus hispidus*, *Lespedeza cuneata*, *Andropogon gerardi*, and *Andropogon virginicus*). We surveyed Addison Field for eight nights (19-22 May 2008, 29 June-3 July 2008) with snap traps, Sherman traps, and squirrel- and raccoon-sized tomahawk traps (944 trap-nights). We captured four live Hispid Cotton Rats (3 adult males, 1 juvenile male) in Shermans. All were subsequently measured, ear-clipped, and released near the point of capture; none were recaptured. Three additional individuals (2 adult males, 1 adult female) were taken in snap-traps; two were prepared as museum specimens and were deposited in the Radford University Biology Department's natural history collection (Accession ID #RU 2139, RU 2140). The skin and skull of one badly damaged adult male specimen were discarded. Other species captured at this site included Meadow Vole (*Microtus pennsylvanicus*), Southern Bog Lemming (*Synaptomys cooperi*), White-footed Mouse (*Peromyscus leucopus*), Deer Mouse (*P. maniculatus*), Least Shrew (*Cryptotis parva*), Northern Short-tailed Shrew (*Blarina brevicauda*), and Eastern Cottontail (*Sylvilagus floridanus*). All trapping was completed with prior approval by the Radford University Animal Care and Use Committee and under state scientific collection permit # 031158 (Francl).

Based on published reports, we discovered that these Hispid Cotton Rat captures in Montgomery County were new county records and suggest that this species may be extending its range northward and westward in Virginia. In Virginia, the cotton rat was not discovered until 1940, apparently emigrating north from North Carolina (Patton, 1941). Since then, this species has been most commonly captured in the south-central portion of the state, but captures in the Great Dismal Swamp (Rose et al., 1990) and extreme southwestern Virginia (Lee County; Davis & Barbour, 1979) also have been recorded (Linzey, 1998). This range extension is not limited to Virginia; indeed, the Hispid Cotton Rat has been expanding its range over the past century (e.g., Anderson, 1959; Clark, 1972), including northward range extensions (e.g., Genoways & Schlitter, 1966) and with increased elevation (Dunnum et al., 2002). One statewide range map is available for the Hispid Cotton Rat: Linzey's (1998) map is based upon verified museum specimens and brief literature review (D. Linzey, pers. comm.). His map appears to follow the physiognomy of the state (and therefore includes portions of some counties).

We contacted (via e-mail) 48 colleges and universities (including all 4-year institutions in the Commonwealth of Virginia) and independent natural history museums to determine: 1) if their museum collection housed cotton rats; and, if so 2) in which counties they were collected. We also utilized MaNIS (Mammal Networked Information System; http://manisnet.org), the on-line mammal museum collection search engine available to query dozens of museums in a single search, and literature on cotton rat captures in Virginia (e.g., Patton, 1941; Pagels & Adleman, 1971; Pagels, 1977).

We received 24 responses from queried institutions, and discovered that the Hispid Cotton Rat was captured in two additional counties not previously documented in Linzey's (1998) map – Montgomery (described above) and Botetourt (housed at the Virginia Museum of Natural History [VMNH], Martinsville, Virginia; Fig. 1). We also report captures of the Hispid Cotton Rat in Nelson County from the mid-1990s, at elevations ranging from ca. 850-1040 m, from the Wintergreen Resort. Although no specimens could be taken, J. A. Cranford (VPI&SU), J. F. Pagels (VCU), and R. Reynolds (VDGIF) captured them from at least two sites at the resort (J. F. Pagels, pers. comm.; also anecdotally cited in Bellows et al. [2001]). As noted in Fig. 1, these new captures demonstrate that Hispid Cotton Rats are located in every physiographic province in the Commonwealth.

Reasons for these additional counties may simply be attributed to the lack of adequate surveys, or the lack of adequate data sharing. For example, the Botetourt specimen was captured in 1980 (collected on 19 April 1980 by J. E. Campbell, 5.1 km from Pines Campground; N. Moncrief, VMNH, pers. comm.), yet did not appear on any current range map. However, as data from collections are increasingly being made available in a digital format (e.g., MaNIS), these limitations may not hold true for long. Secondly, our findings may actually be documenting a true range extension, as others have suggested may be a result of a warming climate (Linzey, 1998; Mengak & Laerm, 2007). Continued trapping efforts throughout the state will increase our understanding of this species as it continues its presumed expansion northward and westward.

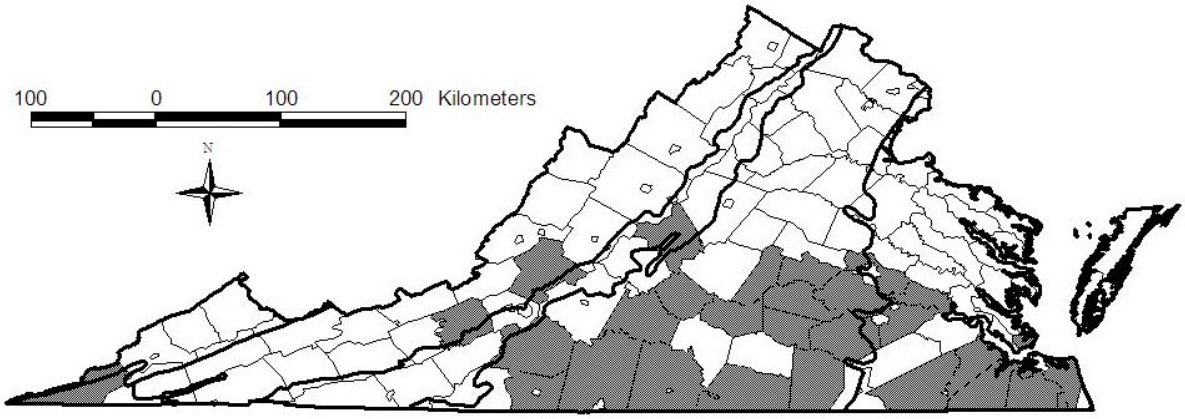

Fig. 1. Range map of *Sigmodon hispidus* in Virginia counties, based on confirmed museum records and literature reports (shaded counties). Physiographic province boundaries (from west to east: Cumberland Plateau, Ridge & Valley, Blue Ridge, Piedmont, Coastal Plain) are heavily outlined to demonstrate that Hispid Cotton Rats have been documented in every province in the Commonwealth.

ACKNOWLEDGMENTS

We thank the 24 responding institutions for providing information (or lack thereof) on Hispid Cotton Rats in their museum collections. We especially thank N. Moncrief (Virginia Museum of Natural History) for providing additional information regarding the specimen collected in Botetourt County.

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Karen E. Francl and Dwight E. Meikle
Biology Department
Radford University
Radford, Virginia 24142

Banisteria, Number 33, pages 56-57

THE GULF FRITILLARY (*AGRAULIS VANILLAE*): BREEDING IN RICHMOND, VIRGINIA. – The Gulf Fritillary (*Agraulis vanillae*) is a tropical and subtropical species that has infrequently been reported from Virginia. Opler et al. (2006) show records for the species from the following Virginia localities: Northampton and Roanoke counties and the cities of Danville, Roanoke, Suffolk, and Virginia Beach. Glassberg (1999) claims that the Gulf Fritillary is an irregular migrant north to North Carolina and a rare stray in the East as far north as New Jersey. Young (2000) reports having seen the Gulf Fritillary many times in late summer on Virginia's Eastern Shore barrier islands. Taber (2003) lists the Gulf Fritillary as a species rarely seen during 1995-2003 butterfly surveys in Northampton County near the southern tip of the Delmarva Peninsula. Opler & Krizek (1984) report that temporary late summer breeding populations occur rarely as far north as Illinois, Missouri, and Virginia. Their range map for the Gulf Fritillary, however, includes only the outer portion of the Coastal Plain for Virginia.

Many records for the Gulf Fritillary in Virginia are from the Norfolk-Virginia Beach area. Clark & Clark (1951) report Virginia records for this species only from Norfolk and Princess Anne County (now the City of Virginia Beach). Cech & Tudor (2005) state (citing Roble et al., 2000) that this species occasionally forms temporary breeding colonies as far north as southeastern Virginia. Knudson (2009) writes that members of the Butterfly Society of Virginia, an organization based in the Norfolk-Virginia Beach area, saw more adult Gulf Fritillaries in 2008 than in recent years. It is the policy of the society to encourage its members to collect butterfly and moth caterpillars in the wild, raise them in captivity, and release the adults back into the wild. Knudson (2009) reports that 54 Gulf Fritillary adults were released in 2008. I know of no records or sightings of the species in the Richmond area prior to 2008.

From 21 August through 7 November 2008, I sighted Gulf Fritillaries on 21 occasions in the downtown Richmond area. One to three individuals were seen at each sighting for a total of 37 sightings of single butterflies. Of these 37 sightings, 23 were of males, 10 of females, and four were of undetermined sex. Undoubtedly, in many instances a single individual was seen on more than one occasion. In fact, several individuals had distinctive identifying markings such as a notch in a particular place on the wing margin or, in one case, white blotches on the upperwings where scales had apparently been scraped off.

The sightings were made at six locations centered around the James River: A flower garden 0.60 km north of the James River in Maymont Park, a residential yard 1.25 km south of the river, a butterfly garden on the south bank of the river in James River Park, flower gardens 0.12 km north of the river near the Federal Reserve Building, a small sandy island in the river 0.74 km SSE of the Virginia State Capitol and 20 m from the river's north bank, and the weedy bank of the river just north of this island. The area that encompasses these six locations covers about 454 ha. Most of these locations are planted gardens where the butterflies showed a preference for nectaring on Brazilian verbena (*Verbena bonariensis*), lantana (*Lantana* cf. *camera*), and butterfly bush (*Buddleia davidii*), none of which are native to Virginia.

A search was made for Gulf Fritillary caterpillars, which feed on passionflowers (*Passiflora* spp.). Both species of passionflowers native to Virginia occur in the Richmond area: Yellow passionflower (*Passiflora lutea*) and maypops (*Passiflora incarnata*). The former is an herbaceous vine with small, inconspicuous, pale greenish-yellow flowers that is common in floodplain forests along the James River and as a garden weed in nearby residential areas. The latter, also an herbaceous vine, has large, showy purple and white flowers and is occasionally found in open floodplain forests along the river and in disturbed habitats such as fences along roads and alleys. Maypops is also sometimes planted as a garden ornamental.

After searching for many weeks, caterpillars were found on 8 October 2008 on the small (ca. 24 x 98 m), sandy island (mentioned above) located near the north bank of the James River. The caterpillars were feeding on a fairly dense colony of maypops sprawled out on the sandy substrate within a 14 x 21 m area adjacent to the water's edge and extending about 3 m up into several scattered trees. A census was made on 9 October: 18 Gulf Fritillary caterpillars were counted, ranging in size from 0.4 to over 4.0 cm and mostly located on the undersides of leaves. Numerous exuviae were observed, but no eggs were found. A female adult was observed flitting just above the passion-flower plants. One chrysalis was located and collected. This chrysalis was situated about 30 cm above the ground on a small mimosa (*Albizia julibrissin*) sapling.

A second census of this area was made on 14 October by Steven M. Roble and the author. The estimated number of caterpillars seen on that day was 25-30. Again, a female was seen flitting above the host plant. A second chrysalis was located about 45 cm above the ground on a slippery elm (*Ulmus rubra*).

Fig. 1. Gulf Fritillary (*Agraulis vanillae*) caterpillar feeding on maypops (*Passiflora incarnata*) near the James River, Richmond, Virginia.

Three additional caterpillars were found on 9 October feeding on a second patch of maypops located on the same island about 27 m to the west. This maypops colony occupied a 12 x 14 m ground surface area and extended up into scattered trees for 6 m. Several Variegated Fritillary (*Euptoieta claudia*) caterpillars had been seen feeding here on 9 September 2008.

Another population of Gulf Fritillary caterpillars was located on 15 October by Catherine Byrd in a residential yard located 1.25 km south of the James River. Five caterpillars, ranging in length from 1.5 to 4.0 cm, were found in a 2 x 2 m area of weedy garden dominated by bearded iris (*Iris germanica*). The caterpillars were feeding on yellow passionvine, several small plants of which grew in the iris bed and on the adjacent chainlink fence. A single adult Gulf Fritillary had been seen on three occasions (7 September, 2 October, and 13 October) nectaring on a butterfly bush located a few meters away. Caterpillars were seen here until 21 October, after which colder weather set in.

The chrysalis collected on 9 October was kept on a screened-in porch and then brought inside on 23 October when the weather turned cold. The adult, a female, emerged on 5 November and was released outside, apparently healthy, on 7 November during a late-season warm spell.

Steven M. Roble, Zoologist, Virginia Department of Conservation and Recreation, Division of Natural Heritage, received three other reports of Gulf Fritillary sightings in the City of Richmond in the fall of 2008 and one report of a sighting in Giles County (pers. comm.). These reports, along with the large number of sightings in the Norfolk-Virginia Beach area, suggest that 2008 was a banner year for Gulf Fritillaries in Virginia.

ACKNOWLEDGMENTS

I wish to thank Steven M. Roble and Catherine Byrd for assistance with fieldwork and Steven M. Roble for helpful advice on the manuscript.

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Allen Belden, Jr.
Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street
Richmond, Virginia 23219

Banisteria, Number 33, pages 58-60

THE MOURNING SCORPIONFLY, *PANORPA LUGUBRIS*, IN VIRGINIA (MECOPTERA: PANORPIDAE). – Early in 2006, O. S. Flint, in conjunction with G. W. Byers (University of Kansas), W. Bicha (Oliver Springs, TN), and D. W. Webb (Illinois Natural History Survey), began collecting records of Mecoptera found in Virginia. While searching the collection of the Virginia Museum of Natural History (VMNH) in Martinsville, Flint discovered a long series of the mourning or black scorpionfly, *Panorpa lugubris* (Swederus), that had been taken in the vicinity of the University of Richmond campus between 1935 and 1959. These visually striking and somewhat uncommon insects immediately aroused our interest and other collections were examined that contained specimens from scattered localities in southeastern Virginia that were taken from 1929 to 1974. No further examples of this species were known until two males were taken in a drift fence-pitfall trap at the Elm Hill State Game Management Area, Mecklenburg County, in 1995.

Panorpa lugubris (Fig. 1) is easily distinguished from all other species of *Panorpa* in North America by its mostly black wings with a few scattered white spots and its reddish orange body. It inhabits both the Atlantic and Gulf coastal plains, from Virginia south through the Carolinas, Georgia, and west across the Florida panhandle to Louisiana (Byers, 1993). Adults seem to prefer sandy soils in open habitats or habitats with scant tree cover, especially sandhills and old fields (Byers, 1993). Somma & Dunsford (2008) consider *P. lugubris* the most abundant and widespread *Panorpa* species in Florida, where it is found throughout all but the extreme southern part of the peninsula. Most adults are collected from September through December, but smaller numbers of individuals are sometimes encountered from mid-April through early June; additional specimens were taken in August and January (Byers, 1993).

Fig. 1. Female mourning scorpionfly, *Panorpa lugubris* (Swederus).

In Virginia, the known specimens of *P. lugubris* were collected primarily in September and October, with records for Chesterfield, Fluvanna, King & Queen, Mecklenburg, and Nottoway counties and the cities of Chesapeake, Newport News, Petersburg, Richmond, Suffolk, and Williamsburg. More recently, populations of *P. lugubris* were located in the sandhills of the Blackwater Ecological Preserve (BEP) in Isle of Wight County and Chub Sandhill Natural Area Preserve in Sussex County.

On 11 September 2008, Allen Belden, A.V. Evans, and Darren Loomis (Virginia Department of Conservation and Recreation, Division of Natural Heritage) joined Flint at the BEP to search for *P. lugubris*. Around noon, Loomis observed and collected the first individual, a male, as it landed in the middle of a dirt road that cut through a closed-canopy of longleaf pine (*Pinus palustris* Mill.)/turkey oak (*Quercus laevis* Walter) sandhill community at BEP (N36.82346º W76.85551º).

The next two individuals of *P. lugubris* were encountered on the same day in a section of the BEP known to local land managers as "burn unit 2" (N36.82161º W76.85197º). This area (Fig. 2) was subjected to a prescribed burn in 2007. The open overstory consists of longleaf pine, pond pine (*Pinus serotina* Michx.), and the occasional loblolly pine (*P. taeda* L.). The sandy substrate below is patchily covered with a low-growing understory consisting primarily of dwarf huckleberry, *Gaylussacia dumosa* (Andres) Torr. & A. Gray, blue huckleberry, *G. frondosa* (L.) Torr. & A. Gray ex Torr.), and sheep laurel (*Kalmia angustifolia* L.).

Panorpa lugubris was observed in the vicinity flying across the scattered open areas that were covered with a thin layer of mostly dried pine needles and huckleberry leaves. These open patches are bordered by slightly taller and denser stands of bracken fern (*Pteridium aquilinum* (L.) Kuhn var. *pseudocaudatum* (Clute)). Taller sprigs of red maple (*Acer rubrum* L.), sweetgum (*Liquidambar styraciflua* L.), sweetbay (*Magnolia virginiana* L.), coastal sweet-pepperbush (*Clethra alnifolia* L.), and Piedmont staggerbush (*Lyonia mariana* (L.) D. Don) punctuate the site's periphery.

In addition to *P. lugubris*, six specimens of *P. gracilis* Carpenter, one of *P. virginica* Banks, and 16 of

Fig. 2. The most productive habitat for *Panorpa lugubris* at Blackwater Ecological Preserve (Isle of Wight County, Virginia) consists of an open overstory of mostly pond pines and longleaf pines with sandy openings patchily covered with low-growing huckleberry and sheep laurel.

P. rufescens Rambur were taken during the day. Unfortunately, several different habitats were visited the same day and the other species of scorpionflies were not separated by exact location. However, many of these were taken from 2-4 foot (60-120 cm) high roadside shrubs, another series was taken from about a foot (30 cm) high shrubby vegetation on a low, dry riverside bench beside the Blackwater River, near the border with Antioch Pines Natural Area Preserve (N36.82640º W76.85590º). Others were taken in burn unit 2 among the higher, shrubby growth. By 1530 h, all scorpionfly activity had virtually ceased and the search for them was discontinued. In North Carolina, *P. lugubris* was observed to fly from dusk until just before dark (J. Jones, pers. comm.).

Evans revisited BEP burn unit 2 at 0930 h on 18 September 2008, but did not locate any *P. lugubris* until 1000 h when the temperatures had warmed up to the mid 60s to low 70s (ºF). At the beginning of the flight period, males and females were observed perched with their heads upward at a slight angle on the vertical stems of huckleberry. When disturbed, they would fly short distances and either land on nearly vertical leaf surfaces or dive into the center of a plant clump. When pursued, they would land and run short distances over open ground with amazing speed. Still others secreted themselves almost immediately among the plant detritus on the ground, or would lie motionless on their sides (see Sherman, 1908).

The height of *P. lugubris* activity was between 1000 and 1100 h. By noon the insects were scarce, but the search continued until about 1300 h. Only eleven females were collected, but approximately another dozen individuals of both sexes were observed.

On 23 September 2008, Evans, Flint, and Loomis revisited the Blackwater site between 1000 and 1500 h and collected 13 individuals at burn unit 2. At the Blackwater riverside bench, Loomis collected an additional specimen, and two more were taken in the low growth along the road to the entrance gate. Most of the vegetation at the gate is the same as previously described for burn unit 2, plus an abundance of giant cane, *Arundinaria gigantea* (Walker) Muhl. ssp. *tecta* (Walter).

Collections made at different sites this time were kept separate. In addition to one *P. lugubris* specimen, the river bench along the Blackwater River yielded 15 specimens of *P. gracilis*. From the taller, shrubby vegetation around burn unit 2 and along the road, 18 examples of *P. rufescens* were taken. As before, many individuals of all species, especially *P. lugubris*, were very elusive and escaped capture.

On 26 September 2008, Loomis observed hundreds of *P. lugubris* at the Chub Sandhill NAP in Sussex County. This tract of land is a pine/scrub sandhill community dominated by loblolly pine, and southern red oak, *Quercus falcata* Michx. However, the actual habitat where *P. lugubris* was observed is a weedy, sandy field with longleaf pine in the grass stage and little or no leaf litter. The field had been fallow since 2006 and was planted with longleaf pine in April of 2008 (Loomis, pers. comm.).

Flint and S.M. Roble returned to the Chub site (36º52.482′ N, 77º10.597′ W) on 24 October 2008. Collecting commenced around 1000 h, but the first individuals were not found for another half hour. Searching continued in the old fields, especially in the plowed strips where the seedling longleaf pines had been planted. Nineteen specimens were collected, mostly along a weedy dirt road. After 1400 h, scorpionfly activity stopped and collecting was terminated. No other species of *Panorpa* were seen.

Specimens of *P. lugubris* were deposited in the collections of the VMNH, National Museum of Natural History (USNM), and A.V. Evans (AVEC).

Additional Natural History Notes

Sherman (1908) and Mampe & Neunzig (1965) found adult *P. lugubris* abundant in open fields and harvested tobacco fields in North Carolina in early September through November, while the population reached its peak during the first week of October. However, some individuals were still active in December and January. They were observed feeding on dead grasshoppers and parasitized tobacco hornworms (*Manduca sexta* Johannson). In captivity, the adults accepted dead grasshoppers, required drinking water, and laid their eggs one at a time in cracks in the soil

(Mampe & Neunzig, 1965).

The larva of *P. lugubris* was described in detail by Mampe & Neunzig (1965) and Boese (1973). In captivity, the larvae primarily ate dead insects, including grasshoppers and flies, but they also consumed mushrooms, tobacco stalks, and tobacco seed capsules.

ACKNOWLEDGEMENTS

We thank Lytton Musselman (BEP Manager, Old Dominion University, Norfolk, VA) for his cooperation with the Virginia Department of Conservation and Recreation, Division of Natural Heritage (DCR-DNH). DCR-DNH southeast region steward Darren Loomis called to our attention the first specimen of *P. lugubris* that prompted this report and provided access to the BEP, Antioch Pines, and Chub Sandhill Natural Area Preserves. Both Loomis and DCR-DNH field botanist Allen Belden provided the plant identifications used to describe the habitats of *P. lugubris*. Evans thanks J. Jones for his observations of *P. lugubris* in North Carolina. Flint thanks Steven Roble (DCR-DNH) for providing support and guidance to the Chub Sandhill NAP. Richard Hoffman, (Virginia Museum of Natural History, Martinsville) provided access to material in that collection. Paula Evans, Darren Loomis, Steve Roble, and two anonymous reviewers read drafts of the manuscript and offered several helpful suggestions.

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Arthur V. Evans[1]
Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street
Richmond, Virginia 23219

Oliver S. Flint, Jr.
Department of Entomology
National Museum of Natural History
Smithsonian Institution
P.O. Box 37012, MRC 169
Washington, DC 20013
flinto@si.edu

[1]Current address: 1600 Nottoway Avenue, Richmond, Virginia 23227; arthurevans@verizon.net

Banisteria, Number 33, pages 60-61

MEDICALLY SIGNIFICANT BITE BY A NABID BUG (HETEROPTERA: NABIDAE). – The famed commercial icon and exponent of dietary chicken, Harlan B. Sanders, was once chided by onlookers seeing him enter a restaurant that specialized in steaks. "Well, boys, even I get a hankering for red meat once in a while" was the Colonel's rejoinder (Dr. Stuart E. Neff, pers. comm., 1964). One gains the impression that the same impulse must affect a number of normally phytophagous hemipterans to judge from published indications that implicate species in a variety of taxa, even the innocuous tingids, as imbibing fluids from various animal sources.

Of course, bites inflicted upon *Homo sapiens* by bugs that are obligate predators on other insects or even mammals (reduviids are high on the list) are so commonplace and expectant as to merit no special notice. It is only when the physiological reaction of a human victim is more severe than mere local soreness, swelling, and itching, that documentation seems justifiable. The following brief case history was taken by McCreary, and relayed along with the insect to Gaines, by whom the latter was transmitted to Hoffman for identification.

In early July 2007, a health-care worker at a family practice clinic in Virginia Beach experienced unusually severe reactions to injury inflicted by a nabid bug, identified by Dr. Thomas J. Henry (USDA, ARS, SEL) as *Nabis roseipennis* Reuter, a species common and widespread over much of eastern United States. Apparently the species has not previously been implicated in negative human interactions. In decades of removing insect captures from sweep-netting, RLH

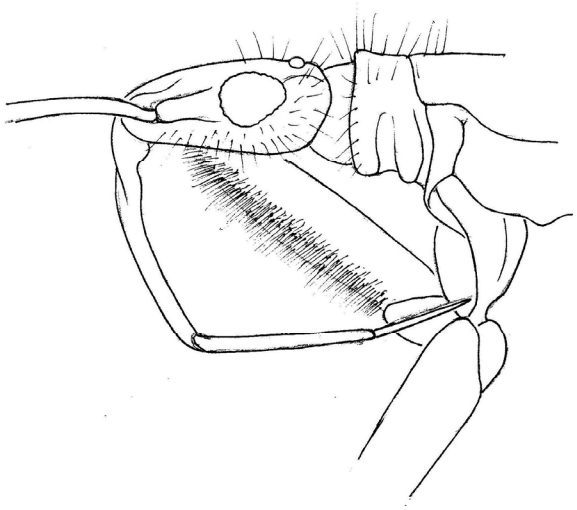

Fig. 1. Head of *Nabis roseipennis* Reuter, showing beak.

has picked up scores of nabids with scarce concern for a possible defensive bite and never had reason to regret such nonchalance.

During the process of donning latex gloves prior to performing an EKG test on a patient, the victim became aware of some foreign object inside the 4th finger of one glove. Snapping the latex several times resulted in the death of an insect at the site, but not before it had bitten her about five times on the web between the 3rd and 4th fingers. The pain was immediate and intense, despite self-medication with Benadryl© at the time of injury and for some days subsequently. Her finger began to swell, with a numb and tingly sensation. By the following day, both fingers and adjacent part of the hand had swollen to about twice normal size, and did not return to normal for more than a week. Two months later, some local bruising was still evident at the site of injury.

The severity of the reported reactions seems remarkable, of a level expected from a bite by an assassin bug (Reduviidae), and suggests some idiosyncratic complicating factor, such as low tolerance of some particular antigen in the nabid's saliva. In this case, the facts strongly suggest that the insect was simply reacting reflexively to major stress, without overt aggressive behavior implied, and certainly no investigation of a possible food source. Nonetheless, nabid bugs are adequately equipped to inflict puncture wounds, as the drawing (Fig. 1) clearly shows.

Richard L. Hoffman
Virginia Museum of Natural History
Martinsville, Virginia 24112

David N. Gaines
Virginia Department of Health
109 Governor Street
Richmond, Virginia 23219

Dedra McCreary
Public Works Department
3556 Dam Neck Road
Virginia Beach, Virginia 23453

Miscellanea

Reviews

McMillan, Patrick D. 2007. *Rhynchospora* (Cyperaceae) of South Carolina and the Eastern United States. Biota of South Carolina. Volume 5. Clemson University, Clemson, SC. 267 pp. Softcover. $40.00 from Clemson University Public Service Publishing at http://dprod4.clemson.edu/olos/asp/searchmain.asp

I have often complained that book reviewers are not tough enough when considering the merits of the texts they are charged to critique and so I was determined to closely scrutinize *Rhynchospora* (*Cyperaceae*) *of South Carolina and the Eastern United States* by Patrick D. McMillan. This is the first volume of the Biota of South Carolina series that does not treat a beetle group. The text treats all 74 eastern North American *Rhynchospora* taxa, 58 of which are known from South Carolina.

After careful consideration, I have very little to criticize. The volume is thorough, lavishly-illustrated, and accessible to readers with only a basic knowledge of botany. The first 25 pages provide introductory material. Most helpful were the illustrations and photographs to show the general structures of *Rhynchospora*, as well as the narrative and 18 color photographs that feature South Carolina natural communities where beaksedge species can be found.

Following this introduction, a 13-page dichotomous key is provided to the 74 eastern taxa found within 14 sections. The key is followed by 221 pages of treatments for the taxa. Each treatment includes literature citations, type collection citation, synonymy, common name, a list of South Carolina specimens examined for this book, a morphological description, habitat, range including a map of the taxon's distribution in South Carolina, and a discussion. The treatments are excellent with robust discussions covering topics ranging from type specimen determinations to taxonomic/nomenclatural issues, to identification difficulties. Species are illustrated by both specimen photographs and pen and ink illustrations of the achenes drawn by the author.

Within the taxa treatments, there are section introductions that provide a detailed analysis of the section members' features such as bristles, tubercle, and achenes to aid in identification (often overlapping measurements between species may occur). In a number of sections, the author uses scanning electron micrographs and various ordination diagrams to clarify the discussions.

A bibliography and index follow, making for a complete and outstanding reference to this diverse southeastern sedge genus. I recommend this monograph to all botanists, ecologists, and naturalists interested in the Cyperaceae, eastern U.S. graminoids, or the flora and vegetation of the southeastern U.S.

J. Christopher Ludwig
Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street
Richmond, Virginia 23219

Reports

1. President's Report

This is an exciting year for the Society with the recent publication of the special issue of *Banisteria* on the Potomac Gorge BioBlitz. Special thanks to Steve Roble for his exceptional editorial efforts in preparing this issue for publication. As you can imagine this was a major task. Thanks also to the dedicated work of our retiring councilor Art Evans for his contributions during the past year and to our retiring president, Tom McAvoy for leading the Society and especially for organizing the upcoming symposium on the history of natural history in Virginia.

We strongly encourage all members to support our Society by renewing their membership if they have not yet done so and by attending the symposium in September (see next to last page of this issue for details and registration information).

Barry Knisley, President
Virginia Natural History Society

2. Secretary-Treasurer's Report

Ralph Eckerlin ran unopposed for Vice President and Oliver Flint was elected as a councilor to succeed Art Evans. Only 85 members have renewed for 2009 as of July 1, down from 137 members last year. An e-mail reminder will be sent to all 2008 members who have not yet renewed for 2009. We encourage all active members to recruit new members for the Society. As of July 7, 2009, the bank balance is $9,139.81.

Please submit all inquiries about membership or back issues of *Banisteria* to: Dr. Bill Shear, Virginia Natural History Society, Box 96, Hampden-Sydney, Virginia 23943, or email, wshear@hsc.edu.

Respectfully submitted,
Bill Shear, Secretary/Treasurer

3. Webmaster's Report

The entire contents of *Banisteria* #32 – Potomac Gorge BioBlitz (2006) Report – were posted on the VNHS website as well as information regarding the VNHS 2009 Symposium.

Recent website activity:

Month	Page Loads	Unique Visitors	First Time Visitors	Returning Visitors
Dec-08	79	49	41	8
Jan-09	79	53	47	6
Feb-09	160	105	67	38
Mar-09	149	105	79	26
Apr-09	172	151	139	12
May-09	186	137	105	32
Jun-09	226	148	139	9
Total	1051	748	617	131
Average	150	107	88	19

DEFINITIONS:
Page Loads - The number of times the front page has been visited.
Unique Visitors - Total of the returning visitors.
First Time Visitors - First time visitor to the VNHS website.
Returning Visitors - A person returning to our website for another visit an hour or more later.

Location of recent VNHS website visitors:

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

Respectfully submitted,
John White, VNHS Webmaster

4. Editor's Report

Much of my spare time during the past 18 months has been spent editing and preparing manuscripts for the Festschrift honoring Richard Hoffman. At long last, I am happy to report that the finalized manuscript was recently submitted to the printer and copies of this 458-page book should be available later this summer. Two-thirds of the 32 chapters have direct or partial relevance to the biota of Virginia (most others concern millipeds from various parts of the world), and include descriptions of 10 species new to science that inhabit the state (and another that may occur here).

As you have probably noticed, this issue of *Banisteria* is heavily biased toward insect papers. This is entirely a function of recent submissions. I welcome papers on other taxa such as plants, vertebrates, and other groups of invertebrates, as well as those concerning the ecology, archeology, anthropology, paleontology, geology, geography, and climatology of the state and surrounding region. I already have nearly enough manuscripts accepted or in review for the fall issue and hope to finish it later this year. I am now soliciting manuscripts for the 2010 issues of *Banisteria*.

Steve Roble
Editor, *Banisteria*

Announcements

1. Virginia Natural History Society Symposium

A VNHS-sponsored symposium entitled ***"Historical Explorations into Virginia's Natural History"*** will be held on Saturday, September 26, 2009, at the Virginia Museum of Natural History in Martinsville. It will be preceded by a social reception on Friday evening, September 25. **Pre-registration is required.** See the announcement and registration form on the following pages for more details. This will be a unique and important addition to the history of Virginia and natural history. Plan to attend!

2. Richard Hoffman's Retirement

Richard Hoffman, co-founder of VNHS in 1992, an original co-editor of *Banisteria* (1992-1999), and currently (since 2000) an associate editor of the journal, officially retired on April 1, 2009, after more than 48 years of service to the Commonwealth of Virginia. For the past 20 years, he has been the Curator of Recent Invertebrates at the Virginia Museum of Natural History (VMNH) in Martinsville. Previously, he taught for 28 years in the Biology Department at Radford University. Dr. Hoffman has been the most prolific contributor of articles and notes to *Banisteria* since its inception, and he continues to actively conduct research and curate the VMNH collection. A Festschrift honoring his career and 80th birthday (2007) will be published this summer by VMNH. The VNHS congratulates Dr. Hoffman on his outstanding career and wishes him well in his retirement.

Announcement of The Virginia Natural History Society

"Historical Explorations into Virginia's Natural History"

Saturday, September 26, 2009
Virginia Museum of Natural History
21 Starling Avenue, Martinsville, VA 24112

This symposium will present the contributions of the leading naturalists over the past 400 year history of Virginia in the fields of:

FOSSILS, CAVES, PLANTS,
MARINE AND ESTUARINE INVERTEBRATES,
MUSSELS, SPIDERS, INSECTS,
MARINE AND FRESHWATER FISHES,
AMPHIBIANS, REPTILES, BIRDS, MAMMALS

Plus a presentation on the contributions of Thomas Jefferson to Natural History

Costs: $10 for the symposium only or $25 for the symposium plus banquet on September 26. Lunch will be available for purchase at the Museum's cafeteria.

Location and schedule: The symposium will be held at the Virginia Museum of Natural History's new facility in Martinsville which opened in the spring of 2007. **A social reception on Friday night (5-8 PM) and banquet on Saturday night (6-8 PM) will be held in the museum's exhibit hall. The presentation sessions on Saturday (8:30 AM-5:00 PM) will take place in the lecture hall.** Martinsville is located in southwestern Virginia, approximately 50 miles south of Roanoke at the junction of U.S. Routes 58 and 220. Directions to the Virginia Museum of Natural History (phone: 276-634-4141) can be found on the museum's website at http://www.vmnh.net/index.cfm/topic/directions.

Conference Lodging: A block of rooms has been reserved at the Quality Inn/Dutch Inn, 2360 Virginia Avenue, Collinsville, VA, 24078, at the significantly reduced rate of $45.00 per room. **Mention "Virginia Museum of Natural History" to get this rate.** Please reserve your room as soon as possible before the rates are increased or the rooms are released to other customers.
Quality Inn/Dutch Inn: Phone: (276) 647-3721; Fax: (276) 647-4857
Website: http://www.qualityinn.com/hotel-collinsville-virginia-VA381

More information is available at the Natural History Society website: http://fwie.fw.vt.edu/vnhs/

If you have any questions please contact Tom McAvoy at 540-231-6320 or tmcavoy@vt.edu

This will be a unique and important addition to the history of Virginia and natural history.

Plan to Attend!

REGISTRATION FORM

Historical Explorations into Virginia's Natural History SYMPOSIUM

Name(s) _____

Address _____

_____

Email _____

Phone _____

Names for name tags (if different from above) _____

___ I will be staying at the Quality Inn/Dutch Inn.

Registration fee @ $25.00 per person
Includes Friday night reception, attendance at symposium, and
Saturday night banquet = $ _____ Vegetarian _____

Non-Banquet tickets @ $10.00 per person
Includes Friday night reception and attendance at symposium = $ _____

Total payment $ _____

We can only accept checks or money orders
Checks or money orders should be made payable to:
"Virginia Natural History Society Symposium"

Return this form with your check or money order to:

William Shear
Box 96
Hampden-Sydney College
Hampden-Sydney, VA 23943
wshear@hsc.edu
FAX (276) 634-4199

Deadline for receipt of registration form is September 15, 2009