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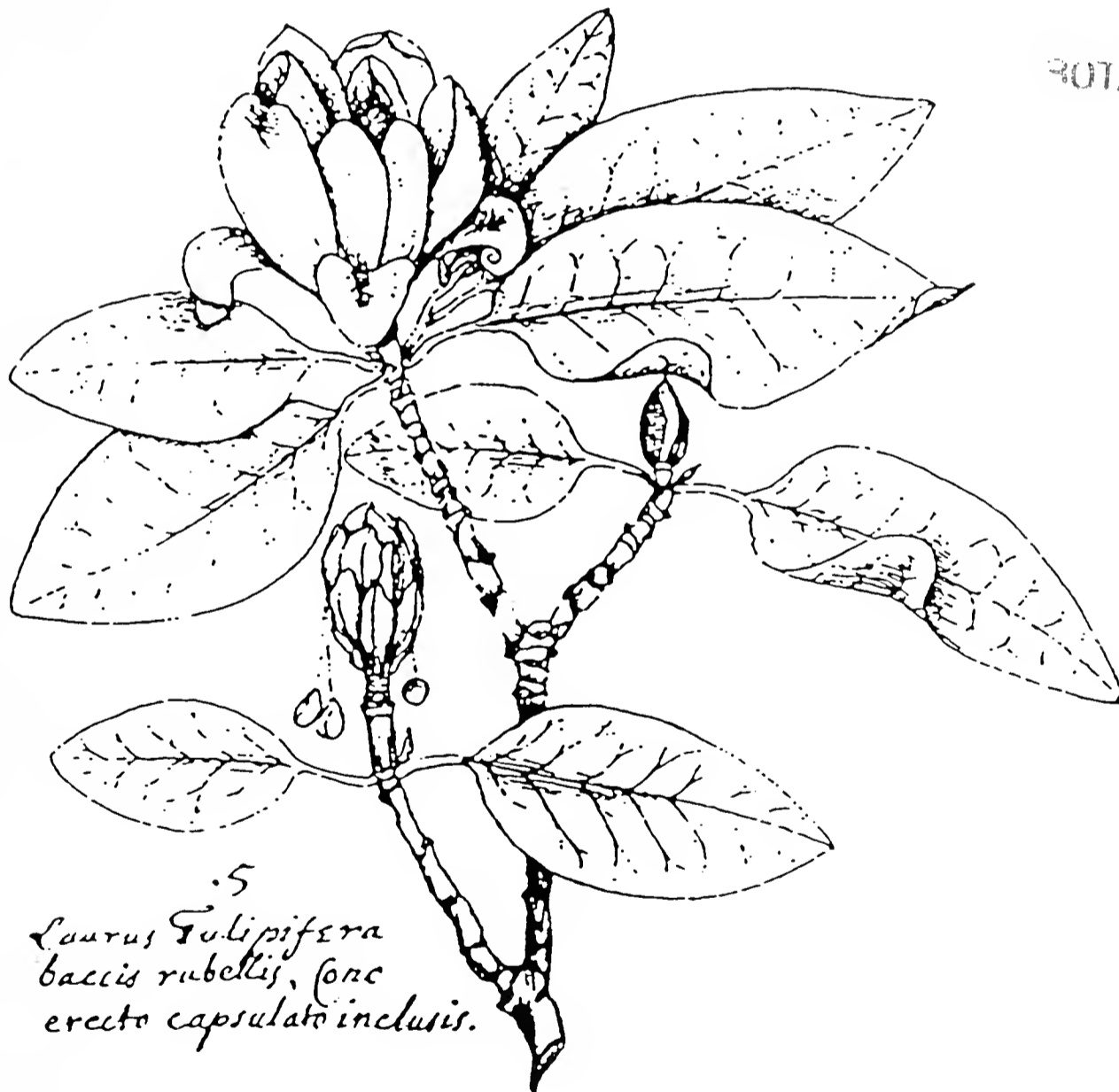
BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA

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BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA

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Survey of the Freshwater Mussel Fauna of Unsurveyed Streams of the Tennessee River Drainage, Virginia

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INTRODUCTION

The freshwater mussel fauna of the upper Tennessee River drainage in southwest Virginia has been surveyed extensively over the last 25 years (Neves et al., 1980). Most of these surveys have occurred in mainstem rivers of the drainage: Clinch River (Stansbery, 1973; Bates & Dennis, 1978; Ahlstedt, 1991); Powell River (Ahlstedt & Brown, 1979; Dennis, 1981; Wolcott & Neves, 1994); North Fork Holston River (Stansbery, 1972; Stansbery & Clench, 1974a); Middle Fork Holston River (Stansbery & Clench, 1974b); and South Fork Holston River (Stansbery, 1977). Except for three major tributaries to these rivers; Copper Creek (Ahlstedt, 1981), Little River (Church, 1991), and Big Moccasin Creek (Neves & Zale, 1982), most other tributaries have received little if any survey effort. Ferguson (1992) conducted spot checks in 55 tributary streams of southwest Virginia, and reported mussels in ten of those tributaries. He recommended more thorough surveys in those ten streams and several other tributaries seemingly suitable for mussels.

Because several federally endangered species and other species of concern were known to occur in headwater habitats of southwest Virginia, a thorough examination of unsurveyed and under-surveyed streams was warranted. The objective of this project was to seek new populations of species under federal protection and to assess the general status of those populations. This report summarizes efforts, collections, and conclusions from the surveys.

METHODS

A tentative list of streams for survey was compiled based on information and experience gathered over the last 15 years by the second author (Neves) and from

Ferguson's (1992) recommendations. During the summers of 1995 and 1996, 24 streams were surveyed for freshwater mussels (Fig. 1). Survey methods consisted of a two-person team walking stream banks at various access points to locate suitable mussel habitat. At suitable sites, the survey team snorkeled each stream reach to locate live mussels and shells. Effort expended in surveying upstream or downstream from each access point varied depending on apparent suitability of a reach as habitat for mussels, to include substrate, water quality, stream size, and presence and density of live mussels and shells. All live and fresh-dead mussels and relic shells were recorded, as were the specific locations of high densities of mussels and individuals of rare species. Time spent surveying was recorded as a measure of effort (man-h). All common and scientific nomenclature is according to Turgeon et al. (1988).

RESULTS

Survey effort ranged from 1.5 to 113.0 man-hours total for each stream (Fig. 2). In general, more time was spent snorkeling in streams with more species. Streams with notable species richness (7 to 18 species), as determined by the presence of live individuals or shells, were as follows: Clinch River headwaters, North Fork Clinch River, Blackwater Creek, Indian Creek at Cedar Bluff, Possum Creek, and Laurel Creek (Fig. 2). These streams contained the species of potential federal interest (Table 1).

In particular, live individuals of the tan riffleshell (*Epioblasma florentina walkeri*), a federally endangered species, were found in the Clinch River headwaters and in Indian Creek at Cedar Bluff. The population in Indian Creek was previously unreported and seemed to be in higher densities than in the Clinch River

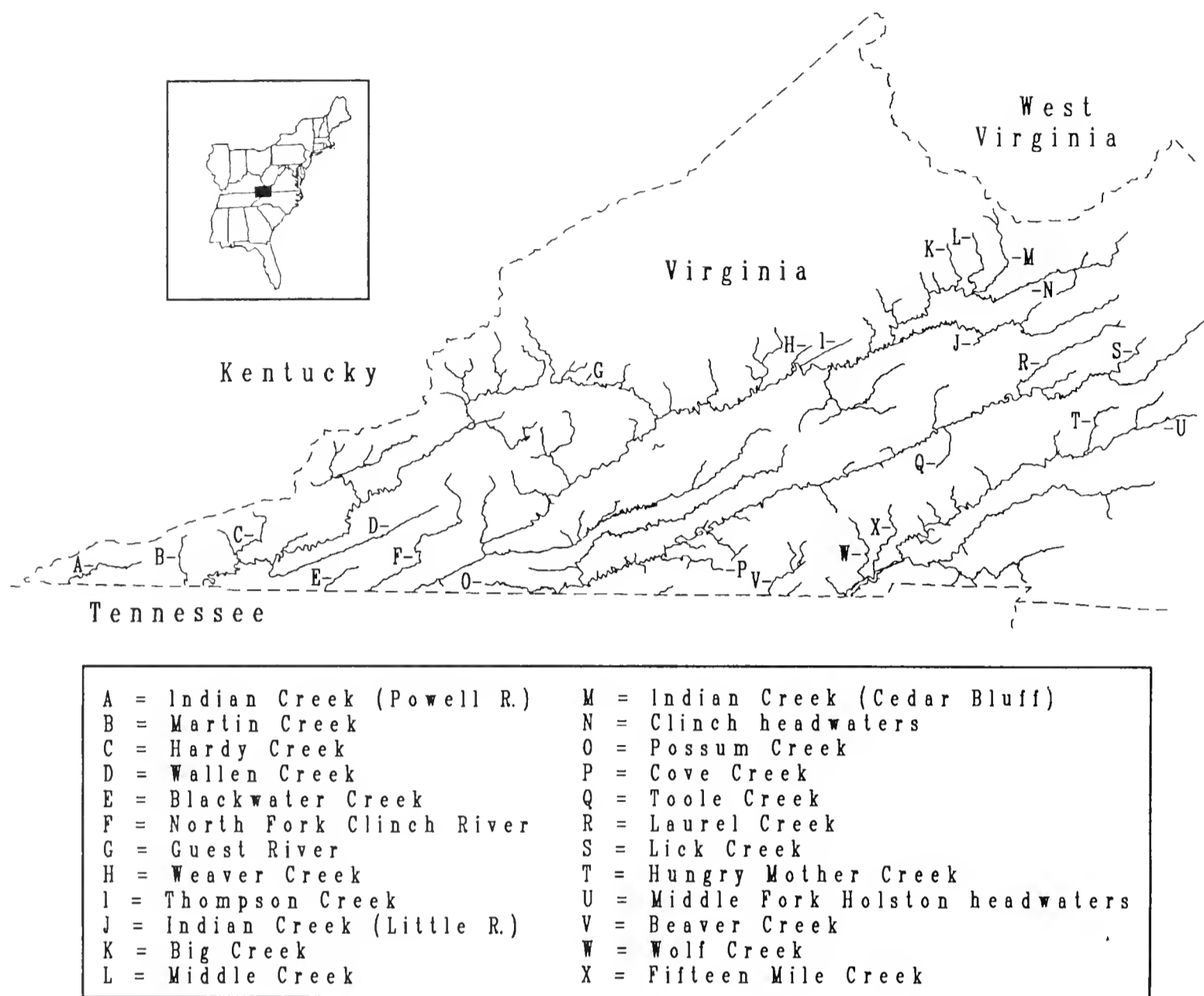


Fig. 1. Third-order and larger streams of the upper Tennessee River system in Virginia. Tributaries and headwaters surveyed for mussels in 1995 and 1996 are labeled beginning with A for the downstream-most stream in the Powell system and ending with X for the upstream-most stream in the South Fork Holston system.

headwaters. A very small (13 mm), live individual was found in Indian Creek, indicating successful reproduction by this species. Two fresh-dead tan riffleshells were found in a large riffle about 1 km downstream of the known population in the Clinch River headwaters, and one relic shell was found about 1 km upstream of the known population. Subsequent to our survey, more intensive sampling has been conducted to delineate the range of the tan riffleshell in Indian Creek (Brian Watson, pers. comm.).

One fresh-dead individual and many relic shells of the fine-rayed pigtoe (*Fusconaia cuneolus*), a federally endangered species, were found in Possum Creek, as well as a variety of species now known to occur only in the North Fork Holston system above Saltville. The shells identified as fine-rayed pigtoes were atypical in color and

unusually slow growing, but the tooth and beak structure was similar to other specimens of similar age. Our identification of these shells as fine-rayed pigtoes was confirmed by D. H. Stansbery of Ohio State University.

Shells of three other federally endangered species also were found. The purple bean (*Villosa perpurpurea*), recently listed as federally endangered, was known only from the Clinch River mainstem and lower Copper Creek (Neves 1991). Four relic shells were found in Indian Creek at Cedar Bluff. Relic shells of the purple bean, the federally endangered shiny pigtoe (*Fusconaia cor*), and the recently listed rough rabbitsfoot (*Quadrula cylindrica strigillata*) were found in the Clinch headwaters in a large riffle about 1 km below the confluence with Indian Creek at Cedar Bluff. A shell of the rough rabbitsfoot was also found in Possum Creek.

The Tennessee pigtoe (*Fusconaia barnesiana*), a state protected species, was collected in 11 of the 18 streams surveyed, making it among the most common species collected. It and the Tennessee clubshell (*Pleurobema oviforme*) were particularly widespread in the Clinch

was found in Laurel Creek. This species is extremely rare in the Tennessee River system and is perhaps a distinct subspecies from its otherwise widespread distribution in Atlantic-drainage basins.

Specific locations and numbers of individuals

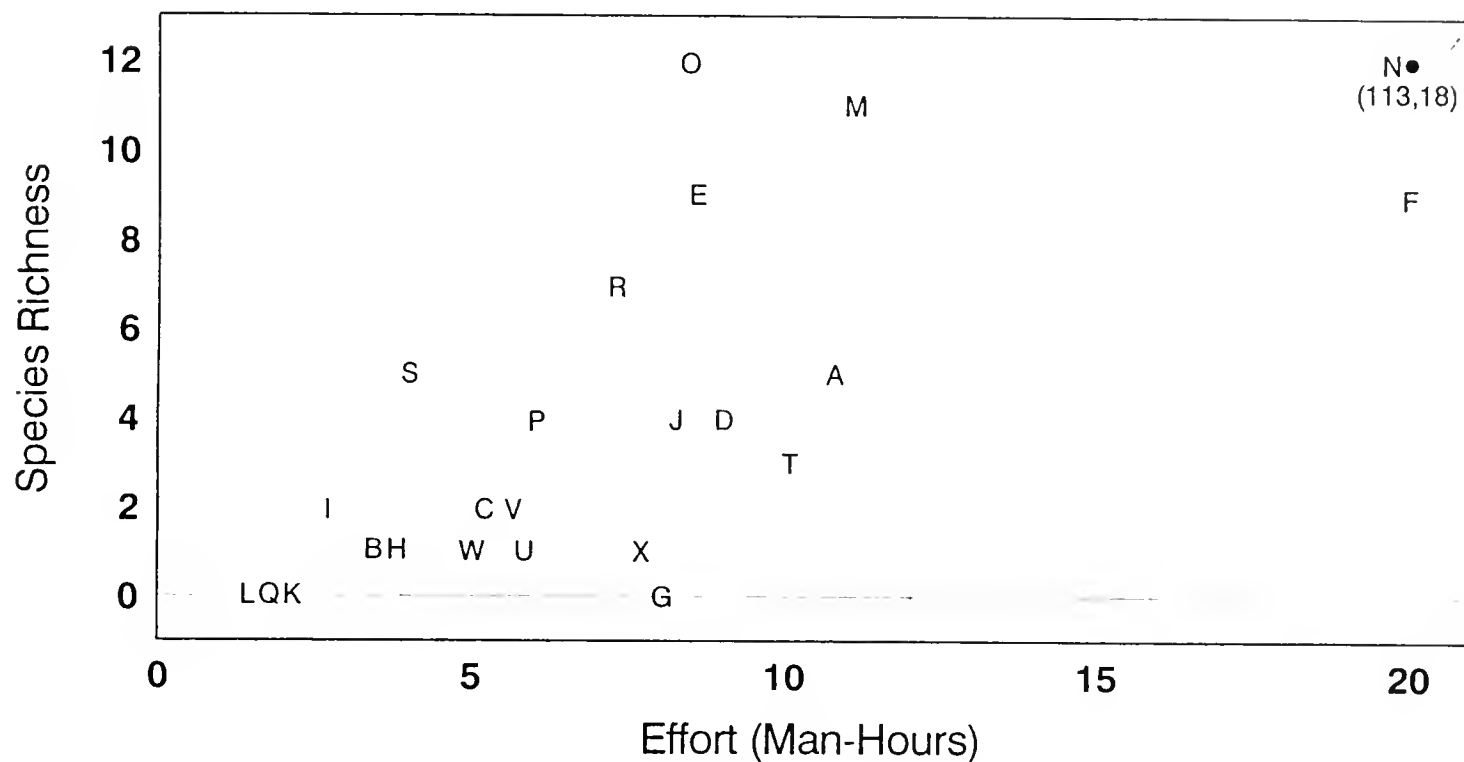


Fig. 2. Total sampling effort (man-hours) versus species richness in each stream. Species richness includes live individuals, and fresh-dead and relic shells of all species. Streams in the upper left quadrant merit further survey effort. Labels are defined in Fig. 1.

River headwaters, being found in 12 and 8 reaches, respectively, of the 13 reaches surveyed. The Tennessee pigtoe was the only species found in Fifteen Mile Creek; 179 live individuals were counted and relic shells were abundant. The Tennessee clubshell was the only amblymine found in Lick Creek, where 24 live individuals and six shells were found; and in Cove Creek, where two live individuals and 12 shells were found. These streams might be good locations for glochidial studies of these species. What was probably two live slabside pearlymussels (*Lexingtonia dolabelloides*) were found in the Clinch River headwaters in the large riffle adjacent to the residential area along Route 707 in Cedar Bluff; however, identification was uncertain. The state protected Tennessee heelsplitter (*Lasmigona holstonia*), recommended for endangered status by Neves (1991), was found in a previously unknown location: 16 live individuals were found in East Fork Blackwater Creek in a long, shallow pool about 50 m above the Route 600 bridge. We also confirmed known population occurrences in the headwaters of Middle Fork Holston River and Clinch River (Neves, 1991) and North Fork Clinch River. A relic squawfoot (*Strophitus undulatus*)

collected of the federally endangered species are provided in Table 2. For all other species, detailed descriptions of locations of survey sites within streams, mussels found at each survey site, and habitat descriptions are included in Winston & Neves (1996).

DISCUSSION

Those streams showing high richness despite relatively low survey effort (Blackwater Creek, Indian Creek at Cedar Bluff, Possum Creek, and Laurel Creek) are the most likely to have as yet undiscovered populations of rare species. Further efforts at finding rare species should be concentrated in these streams. Streams showing high richness with higher survey effort (North Fork Clinch River below Duffield and Clinch headwaters above Richlands) may also contain populations of rare species since even the recorded effort may have been insufficient to find extremely rare species. The slippershell mussel (*Alasmidonta viridis*) and the little-wing pearlymussel (*Pegias fabula*) are particularly difficult to locate, not only because of their rarity, but also because of their small body sizes. Both species are known to occur in smaller streams and, although we

never found it, the little-wing pearl mussel had been found previously in the Clinch headwaters in an area that we surveyed (Church 1991).

In Possum Creek, fresh-dead and relic specimens of the fine-rayed pigtoe and the rough rabbitsfoot were found both at the mouth and 7 km upstream. The entire stream reach between these sites likely contains mussels and is in need of a thorough survey. Indian Creek and Possum Creek, which contain federally endangered species, flow through residential areas. This suggests that residential development can be compatible with mussel populations as opposed to the concentrated sewage outfall resulting from urban areas (Church 1991; Goudreau et al. 1993). This observation was further exemplified by two streams that we surveyed flowing through Abingdon. Fifteen Mile Creek supported a fairly dense population of Tennessee pigtoes along most of its length downstream of Abingdon. Conversely Wolf Creek, which had extensive reaches of seemingly good substrate for mussels, was devoid of mussels except in the higher gradient reach in mid-town above the wastewater treatment plant.

Goudreau et al. (1993) reported that mussels were absent from the Clinch River for 3.75 km below the Tazewell wastewater treatment plant in a 1985 survey. We also surveyed this reach and, despite the abundance of seemingly suitable substrate for mussels, found only one adult Tennessee pigtoe and two rainbow mussels (*Villosa iris*). We noted many muskrat middens with large numbers of shells of asian clams (*Corbicula fluminea*) but with no mussel shells. Given that the three mussels we found could easily have washed down from the sizeable populations in Plum Creek and above the Tazewell wastewater treatment plant, we concluded that there was no evidence of colonization of mussel populations in this reach.

The population of the state-protected Tennessee heelsplitter in the North Fork Clinch River was downstream of the wastewater outfall from Duffield. Live rainbows, mountain creekshells (*Villosa vanuxemensis*) and wavy-rayed lampmussels (*Lampsilis fasciola*) also were found there. The Duffield area likely will continue to experience economic development, especially because Highway 58 is being upgraded to 4-lane across all of southwest Virginia. The resultant increase in treated wastewater will jeopardize these populations of mussels unless effective dechlorination or ultraviolet treatment is used at the wastewater treatment plant.

The lower reaches of Blackwater Creek and North Fork Clinch River were atypical for streams of the Tennessee River in Virginia. Channel gradient was low, substrate was composed mostly of sand and silt, and stream banks were high and incised. The water was

turbid even though tributaries and upper reaches were clear. We found no evidence of high densities of mussels or the presence of rare species in these lower reaches, although survey conditions (turbidity) were not optimal. Although most species were found in the middle reaches, both the lower and middle reaches of these streams merit further survey effort.

Physical habitat of Laurel Creek was very different from that of Blackwater Creek and North Fork Clinch River. It was higher in gradient, substrate was coarser, and water was very clear. We surveyed this stream in late October when the water was cold and high; thus, further survey effort in summer may locate additional species.

In summary, this mussel survey recorded possible new populations of five federally endangered species, one federal species of concern, and three state-protected species. One state-protected species was found to be quite common in tributaries to the main river channels. Further survey effort in tributaries of the Powell, Clinch, and Holston rivers in Tennessee, in addition to more intensive surveys of Blackwater Creek, North Fork Clinch River, the Clinch River headwaters, Possum Creek, and Laurel Creek, may discover additional populations of endangered species of freshwater mussels.

ACKNOWLEDGMENTS

Funding for this survey was provided by the United States Fish and Wildlife Service. All sampling was conducted under collecting permit numbers SCP9629 and ESP9607 issued by the Virginia Department of Game and Inland Fisheries. We thank Mary Winston for help with the field work.

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Table 1. Mussel species collected (live, fresh-dead, or relic) in the 24 streams surveyed in southwest Virginia, 1995-1996. Stream labels are defined in Fig. 1.

Common Name	Scientific Name	Streams Where Collected
Cumberland moccasinshell	<i>Medionidus conradicus</i> (Lea)	A,D,E,F,J,M,N,O,R,S,T
fine-rayed pigtoe ¹	<i>Fusconaia cuneolus</i> (Lea)	O
fluted kidneyshell	<i>Ptychobranthus subtentum</i> (Say)	N
fluted-shell	<i>Lasmigona costata</i> (Rafinesque)	M,N,O
kidneyshell	<i>Ptychobranthus fasciolaris</i> (Rafinesque)	M,N,O
mountain creekshell	<i>Villosa vanuxemensis vanuxemensis</i> (Lea)	A,B,C,D,E,F,J,M,N,O,P,S,T,V,W
pheasantshell	<i>Actinonaias pectorosa</i> (Conrad)	M,N
pink heelsplitter	<i>Potamilus alatus</i> (Rafinesque)	F
pocketbook	<i>Lampsilis ovata</i> (Say)	E,M,N,O

purple bean ¹	<i>Villosa perpurpurea</i> (Lea)	M,N
rainbow	<i>Villosa iris</i> (Lea)	A,C,D,E,F,H,I,J,M,N,O,P,R,S,T
rough rabbitsfoot ¹	<i>Quadrula cylindrica strigillata</i> (Wright)	N,O
shiny pigtoe ¹	<i>Fusconaia cor</i> (Conrad)	N
slabside pearlymussel ³	<i>Lexingtonia dolabelloides</i> (Lea)	N
spike	<i>Elliptio dilatata</i> (Rafinesque)	F
squawfoot ⁴	<i>Strophitus undulatus</i> (Say)	R
tan riffleshell ¹	<i>Epioblasma florentina walkeri</i> (Wilson & Clark)	M,N
Tennessee clubshell ²	<i>Pleurobema oviforme</i> (Conrad)	E,F,N,P,R,S
Tennessee heelsplitter ³	<i>Lasmigona holstonia</i> (Lea)	E,F,N,U
Tennessee pigtoe ³	<i>Fusconaia barnesiana</i> (Lea)	A,D,E,F,I,J,M,N,O,R,V,X
threeridge	<i>Amblema plicata plicata</i> (Say)	E,O
wavy-rayed lampmussel	<i>Lampsilis fasciola</i> (Rafinesque)	A,E,F,M,N,O,P,R,S

¹ Federally endangered

² Federal species of concern

³ State protected

⁴ Extremely rare in the Tennessee River system

Table 2. Locations and numbers of five federally endangered species collected during this survey.

Species	Location
fine-rayed pigtoe	<p>Possum Creek, North Fork Holston drainage, Scott County, Kingsport Quadrangle, Latitude: 363548, Longitude: 823608. Upstream of confluence with North Fork Holston River (creek mile 0.0). Nine relic shells found.</p> <p>Possum Creek, North Fork Holston drainage, Scott County, Kingsport Quadrangle, Latitude: 363606, Longitude: 823708. Upstream of Rte. 639 bridge (creek mile 3.7+). One fresh-dead and two relic shells found.</p>
purple bean	<p>Indian Creek (at Cedar Bluff), Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370518, Longitude: 814558. From confluence with Clinch River upstream to private bridge (downstream of first Rte. 631 crossing). Four relic shells found.</p> <p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370453, Longitude: 814637. Large riffle adjacent to residential area along Rte. 707. One relic shell found.</p>
rough rabbitsfoot	<p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370453, Longitude: 814637. Large riffle adjacent to residential area along Rte. 707. One relic shell found.</p> <p>Possum Creek, North Fork Holston drainage, Scott County, Kingsport Quadrangle, Latitude: 363606, Longitude: 823708. Upstream of Rte. 639 bridge (creek mile 3.7+). One relic shell found.</p>
shiny pigtoe	<p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370453, Longitude: 814637. Large riffle adjacent to residential area along Rte. 707. One relic shell found.</p>
tan riffleshell	<p>Indian Creek (at Cedar Bluff), Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370518, Longitude: 814558. From confluence with Clinch River upstream to private bridge (downstream of first Rte. 631 crossing). Two live, seven fresh-dead, and 17 relic shells found.</p> <p>Indian Creek (at Cedar Bluff), Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370522, Longitude: 814550. From first private bridge to next private bridge (upstream of first Rte. 631 crossing). Two relic shells found.</p> <p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370453, Longitude: 814637. Large riffle adjacent to residential area along Rte. 707. Two fresh-dead, one relic shell found.</p> <p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370503, Longitude: 814519. Just above bridge going to racetrack just upstream of Cedar Bluff. One relic shell found.</p>

Some Important Virginia Specimens in the National Institution for the Promotion of Science

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History has taught us that early natural history museums were often disbanded and private collections were either lost or later purchased by other individuals or organizations. From those museums and collections, some important records were often lost, but fortunately, in many cases original records still exist for review and study by modern natural historians. Such has been the case for The National Institution for the Promotion of Science.

It was organized in Washington, DC on 15 May 1840 and had as its stated objectives "to promote Science and the Useful Arts, and to establish a National Museum of Natural History, &c., &c." By federal charter granted by Congress in 1842, it was officially known as the National Institute for the Promotion of Science (NIPS), and more or less existed as such until its final dissolution in 1863 (Anonymous, 1971). Joining NIPS was the Columbian Institute in 1841 (donating its "effects, books and papers") and the American Historical Society in 1840. Because of deteriorating interest and dwindling financial support, NIPS gradually transferred its collections to the Smithsonian Institution over a period of time through 1863.

For several years NIPS had oversight over several significant government collections (such as the Wilkes Expedition), these being housed in the Patent Office. This oversight role, coupled with the NIPS program of acquiring collections of natural and physical objects, was probably a model upon which the Smithsonian Institution was planned (Conway, 1995).

Upon its inception the National Institute immediately began an active program to collect specimens of natural history, physical objects of historical interest, and library materials. It initiated correspondence with scientists, scholars, and collectors in the United States and abroad. Over the years a steady stream of specimens and their proper preservation in the Patent Office Building became serious problems,

especially because Congress never appropriated funds for NIPS. At first the collections were housed and displayed in the basement, but later, as the collections increased in volume, the first floor was also used.

From its formation until 1846, the Institute published four bulletins, each containing proceedings of stated meetings, which usually took place on a monthly basis. At each meeting, and hence published in the *Bulletin[s] of the Proceedings of the Institute*, lists were provided of donations (1) "For the Cabinet," and (2) "For the Library." As might be expected, donations for the Cabinet included almost every conceivable item, from gold ore and clothing to art objects, Indian artifacts, zoological and botanical specimens, old coins, and fossils. Similarly, the Library donations were old manuscripts, books, and historical papers.

In scanning the lists of biological donations for the Cabinet, as described in the *Bulletins*, I found a number of items from Virginia, previously unknown or unrecognized to modern scientists. Some are of considerable historical importance, as indicated below. The donations are listed here, but it is unlikely that many still exist. Modern names for fossil shells [in brackets] have been provided by Dr. Lauck Ward.

Meeting, 8 November 1841 (Bull. 2, p. 117):

"Living Owl, (*Strix virginiana* [=*Bubo virginianus*, Great Horned Owl])--From Jonathan P. Felt, Spottsylvania County, Virginia."

"Fossils, (*Pecten*) from James River, Virginia.--From Wm. Knowles, Georgetown, D.C."

Meeting, 10 January 1842 (Bull. 2, p. 133):

"Silk Fan, woven by silk worms trained by Miss E. Tutt, of Virginia.--From Dr. Marcus C. Buck, U. S. A."

Meeting, 14 February 1842 (Bull. 3, p. 149):

"Fossils from James River.--From Robert Brown."

"Antlers of Elk (*Cervus canadensis*.)--From Col. Joseph Tuley, of Virginia."

(pp. 171-193):

A lengthy article, "Observations on a Portion of the Atlantic Tertiary Region, with a Description of New Species of Organic Remains," by T. A. Conrad. From the lower Tertiary, he describes a new species of oyster, *Ostrea* [= *Cubitostrea*] *sellaeformis*, from the James River, Virginia, a few miles below City Point.

Meeting, 12 September 1842 (Bull. 3, p. 252):

"Fossils...from the foot of Knobby Hill, Virginia.--From Dr. Causten."

(pp. 253-254)

"Box of Fossil Shells, Eocene and Miocene of Virginia.--Presented to the Institute for Exchanges [for recent shells], by Edmund Ruffin, Petersburg, Virginia."

Miocene

Ostrea virginiana [= *Conradostrea sculpturata* (Conrad, 1840)], Coggin's Point

Ostrea disparilis [= *Ostrea raveneliana* (Tuomey & Holmes, 1855)], Gloucester County

Cardita granulata [= *Cyclocardia granulata* (Say, 1824)], Coggin's Point and generally

(2 kinds) *Astarte undulata*, Coggin's Point and generally

Several species *Crepidula*, Coggin's Point and Yorktown

Carditamera arata, Coggin's Point

Pectunculus pulvinatus [= *Glycymeris americana* (DeFrance, 1829)], Dinwiddie, Williamsburg

Pectunculus suboratus [= *Costaglycymeris subovata* (Say, 1824)], Prince George

Venus Rileyii (?) [= *Mercenaria corrugata* (Lamarck)], Coggin's Point

Venus tridachnoides [= *Mercenaria corrugata* (Lamarck)], Coggin's Point

odd v. *Arca* [= *Dallarca* sp.], Hanover, Surrey

Arca incile [= *Noetia incile* (Say, 1824)], Dinwiddie

Arca centenaria [= *Striarca centenaria* (Say, 1824)], Coggin's Point

broken arca(?) [= *Granoarca propatula* (Conrad, 1843)] (large and rare), Ware River in Gloucester

Cytherea Sayana [= *Pitar sayana* (Conrad, 1843)], Yorktown

Lucina anodonta [= *Stewartia anodonta* (Say, 1824)], Prince George

Lucinia crepsaria, Prince George

Lucinia divaricata, Prince George

Plicatula marginata, Coggin's Point

Petricola centenaria, King William

Astrea [= *Septerastrea marylandica* (Conrad, 1841)], Coggin's Point

Dentalium [= probably *D. attenuatum* (Say, 1824)], Coggin's Point

Panopaea [= probably *P. reflexa* (Say, 1824)], Dinwiddie,

Pecten Clintonius [= probably *Placopecten pricepoides* (Emmons, 1858)], Coggin's Point

Pecten septemnarius [= *Chesapecten septemnarius* (Say, 1824)], Coggin's Point

Pecten decemnarius, Coggin's Point

Pecten Jeffersonius [= *Chesapecten jeffersonius* (Say, 1824)], Coggin's Point

Pecten virginianus [= *P. decemnarius*], Coggin's Point

Pecten arboreus [= *Carolinapecten eboreus* (Conrad, 1833)], Coggin's Point

Chama corticosa [= *Pseudochama corticosa* (Conrad, 1833)] Dinwiddie, York, Coggin's Point

Chama congregata, Dinwiddie, York, Coggin's Point

Oliva [= probably *O. canaliculata* (H. C. Lea, 1845)], Coggin's Point

Serpula [= probably *Sepulorbis granifera* (Say, 1824)], Coggin's Point

Spatangus (very rare) [= *Echinocardium orthotum* (Conrad, 1843)], Prince George

(3 kinds) *Fissurella* [= *Diadora* sp.], Coggin's Point, Dinwiddie

Artemis acetabulum [= *Dosinia acetabulum* (Conrad, 1832)], Coggin's Point, Dinwiddie

(2 kinds) *Turritella*, Coggin's Point, Dinwiddie

Fasciolaria mutabilis [= *Scaphella mutabilis* (Conrad, 1834)], Dinwiddie

Venus (?) [= *Mercenaria* sp. ?], Hanover

Natica [= *Polinices* sp.], Dinwiddie

Crassatella marylandica [= *Marvacrassatella undulata* (Say, 1824)], Dinwiddie

Crassatella undulata [= *Marvacrassatella undulata* (Say, 1824)], Coggin's Point

Crassatella melina [= *Marvacrassatella melinus* (Conrad, 1832)]

Cardium [= *Chesacardium acutilaqueatum* (Conrad, 1839)]

Eocene

Ostrea sellaeformis [= *Cubitostrea sellaeformis* (Conrad, 1832)], Coggin's Point, Hanover, King William on Pamunkey River

Ostrea (new ?), Waterloo on Pamunkey

Ostrea (new ?), Waterloo on Pamunkey

Ostrea compressirostra [= *Ostrea sinuosa* (Rogers & Rogers, 1837)], Evergreen on James River

Ostrea (very heavy) [= *Ostrea sinuosa* (Rogers & Rogers, 1837)], Evergreen

Pecten ?, Coggin's Point

Sundry small Eocene shells from Pamunkey Green Sand Beds.

Meeting, 14 November 1842 (Bull. 3, p. 262):

"*Columba migratoria* [= *Ectopistes migratorius*, Passenger Pigeon] from Virginia--From W. M. and S[pencer]. F. Baird, Carlisle, Pennsylvania." Inasmuch as all records of the Passenger Pigeon from Virginia are important, I searched Spencer Baird's catalog in the Smithsonian Archives, but found no entry for this bird. Perhaps he obtained it in an exchange and did not list it. Hence, we know nothing other than the state and approximate date.

Meeting, 12 December 1842 (Bull. 3, p. 270):

"Box of fossils, &c., from the coal mines near Richmond, Virginia, with a journal of minutes kept in the mine.--From A. S. Wooldridge." ["These would be thin slabs of slate and shale, mainly with impressions of Triassic ferns and cycads. Possibly some fish."--Dr. Lauck Ward]

Meeting, 9 October 1843 (Bull. 3, p. 309-310):

"Box of locusts, (*Cicada septemdecim*)--From Dr. Robert E. Peyton, Fauquier County, Virginia.

"Box, containing Fossils and River Shells...from mouth of Potomac Creek, Virginia; Fossil Shells, Bones, Teeth, and Clay from Stafford or Hollis' Cliff, Virginia...--From J. G. Bruff."

"Specimens of Ovi-Positor of the *Cicada septemdecim*, and of Branches of Trees in which the Eggs are deposited.--From Robert E. Peyton, Fauquier County, Virginia, to accompany and illustrate his paper on that insect."

Meeting, 11 December 1843 (Bull. 3, p. 322):

"A perfect skin of a large Buck Elk (*Cervus americanus*).--From Joseph Tuley, Virginia." On p. 331 is mention of correspondence "From Joseph Tuley, Millwood, Virginia, November 14, 1843: Presenting a perfect skin of a fine buck elk, killed in his park, &c."

Meeting, 8 January 1844 (Bull. 3, p. 339):

"Specimens of Tobacco of Lynchburg, Virginia, prepared in two different ways.--From Judge H. W. Garland, Virginia."

Meeting, May 1844 (Bull. 3, p. 347):

"A Bag, containing skin of a Female Elk, from Virginia.--From Joseph Tuley, Virginia."

Meeting, 9 December 1844 (Bull. 3, p. 369):

Two boxes of Minerals, Shells, &c., &c.--From Dr. Frederick A. Davisson, Hillsborough, Loudoun County, Virginia.

In Bulletin 4 (p. 487) is mention of a communication "From Frederick A. Davisson, M. D., Loudon [sic] County, Virginia, February 25, 1846, stating that he has sent to the Institute a box of shells and reptiles, &c., of Virginia."

Donations of library materials from or pertaining to Virginia are few:

Meeting, 14 November 1842 (Bull. 3, p. 264):

"Col. Edmund Scarborough's Expedition from Virginia to Annesessecks and Manokin, pursuant to an act of the General Assembly of Virginia, in 1663--From L. D. Teackle."

Meeting 8 January 1844 (Bull. 3, p. 341):

"Description of new fossil Shells, from the Tertiary of Petersburg, Virginia, by I. Lea, Philadelphia.--From the author."

I have found only two publications alluding to National Institute collections of birds. May Thacher Cooke (1929), in her accumulation of bird records from Washington, DC, and vicinity, showed her knowledge of NIPS records for the Double-crested Cormorant, Surf Scoter, Snow Bunting, and Old-squaw. all deemed by her as "the first records of some of the rarest species on our list." W. L. McAtee (1918), by carefully searching *Bulletin(s) of the Proceedings...*, found other

rare bird records from the Washington area. One was a Yellow Rail (*Ortygometra (=Coturnicops) noveboracensis*), which was "killed on the Potomac river, opposite Washington" and donated on 14 November 1842 (Bull. 3, p. 320). Research on this record indicates that the location was in Virginia (Johnston, in press).

From the mid-1840s onward, the Smithsonian Institution for the most part replaced the National Institute as a repository for natural history specimens. The Institute, however, apparently continued to receive some bird specimens until its expiration in 1863. For example, existing catalogs in the Bird Division of the National Museum of Natural History ("Smithsonian") show entries of dozens of birds sent from the National Institute or the Patent Office between 1859 and 1863. Most of these birds were from Brazil, Cuba, and other foreign countries, with a few coming from Pennsylvania, Maryland, and Washington, D.C. One of the latter specimens is of interest here: *Actodromas maculata* [= *Calidris melanotos*, the Pectoral Sandpiper] taken in April 1845. Beside the locality of "Washington," someone added to the catalog entry in pencil "Aquia Co., Va.," which is also on the specimen's label. "Aquia" undoubtedly referred to Aquia Creek and not County. The specimen, according to the catalog, was sent "To Chicago Acad. Sci. May 20, 1872. Ret'd in 1919." The specimen is now No. 45642 in the Bird Division, National Museum of Natural History, and probably represents the oldest existing bird specimen from Virginia.

Although the records do not show the state affiliations of the Institute's Resident Members (328 in 1845), the following Virginians were Corresponding Members in 1845. The list shows the wide interest in Virginia's natural history at that time.

Brown, William, M. D., Fredericksburg
 Burke, Ethelbert, Mount Gilead, Loudoun Co.
 Cocke, Capt. Harrison H., U.S. Navy, Cabin Point
 Davisson, F. A., M. D., Hillsborough, Loudoun Co.
 Dew, Thomas R., Pres., College of William and Mary
 Ellis, Thomas, Richmond
 Gardner, Capt. William H., Norfolk
 Hardy, J. W., Randolph-Macon College
 Harrison, Benjamin, Buckley
 Hayden, C. B., Abington
 Huger, Capt. Benjamin, Fort Monroe
 Kennedy, Commodore E. P., U. S. Navy, Norfolk
 Maury, Lieut. M. F., U. S. Navy, Fredericksburg
 Minor, B. B., Richmond
 Peyton, Robert E., M. D., The Plains, Fauquier Co.
 Reynolds, J. C., L. L. D., Richmond
 Rogers, Prof. W. B., Virginia State Geologist
 Skinner, Charles W., U. S. Navy, Norfolk

Slaughter, Daviel F., Culpepper
 Thompson, Robert A., Senate of Virginia
 Tucker, George, Prof. of Moral Philosophy, Univ. Virginia
 Tuley, Col. Joseph, Clark County
 Upshur, Hon. Abel P., Eastville
 Warner, Prof. A. L., Richmond
 Wheeler, Col., Charlotte, Mecklenburg County
 Williamson, Thomas, Norfolk
 Wooldridge, A. S., Midlothian (President of the Mid Lothian Mining Co.)

Beginning on 1 April 1844, the Institute held what amounted to an annual meeting or convention in Washington, with sessions held in the Presbyterian Church on 4 1/2 Street and the Unitarian Church near the City Hall. The library hall of the Treasury Department contained a variety of objects of interest and was used during the whole period as a place of reunion and rendezvous.

Meetings were held mornings and evenings through Saturday morning, 6 April, and beginning again on Monday, 8 April, making 10 sessions in all. Two Virginians gave presentations on 2 April: "On the Gulf Stream" by Lieut M. F. Maury, U. S. Navy; "On the Dangers most to be guarded against in the Future Progress of the United States" by George Tucker, Professor of Moral Philosophy, University of Virginia.

The opening address on 1 April was by John Tyler, President of the United States: "Congress, impressed with its importance, has given it a corporate existence..." Even so, the Congress never appropriated any funds for the Institute, and it was this lack of support, plus the emerging Smithsonian Institution with its substantial endowment, that contributed to the demise of the Institute.

ACKNOWLEDGMENTS

William Cox, Curator at the Smithsonian Archives, kindly helped me locate unpublished material on the National Institute. Dr. Lauck Ward of the Virginia Museum of Natural History supplied modern names for the fossil shells.

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Dendroecological Potential of *Juniperus virginiana* L. Growing on Cliffs in Western Virginia

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[**Note:** The following is an abridged version of a report by the same title prepared during the Fourth Annual North American Dendroecological Fieldweek, 4-11 June, 1993. Mountain Lake Biological Station, Pembroke, Virginia. The work was performed by a group of participants led by Dr. Doug Larson and comprised of Sylvain Archambault, Jaroslav Dobry, Bob Keeland, Jeff Matheson, Kiyomi Morino, David Williams, and Diana Wolfram, all of whom are authors of the original report. This version, condensed by Thomas F. Wieboldt (Massey Herbarium, VPI & SU, Blacksburg, Va.), adheres very closely to the original text. It is abridged with the intent of conveying life history and ecological information of interest to *Banisteria* readers while omitting other details of interest principally to dendrochronologists.]

Exposed limestone cliffs in western Virginia support a sparse forest composed of *Juniperus virginiana* L. (eastern red cedar), a few shrubby angiosperm species and a rich array of pteridophytes, bryophytes and other cryptogams. The structure of this forest superficially resembles that of exposed limestone cliffs of the Niagara Escarpment, southern Ontario, Canada (Larson et al., 1989), where a presettlement forest of stunted *Thuja occidentalis* (arbor-vitae) has been shown to

occur (Larson & Kelly, 1992). Kelly et al. (1992) successfully crossdated the slow growing and deformed stems of *T. occidentalis* and demonstrated the dendroecological potential for this cliff species. Given the ecological similarity between cliff habitats in Ontario and Virginia, and the largely mutually exclusive continental distributions of *J. virginiana* and *T. occidentalis*, we decided to explore the dendroecological potential of *Juniperus virginiana* growing on cliffs in the southeastern United States.

Juniperus virginiana has a broad ecological amplitude (Burns & Honkala, 1990); on good sites, growth to 1.0 m diameter at breast height (DBH) and 25 m height can occur in 60 years, while on poor sites, trees ca. 400 years old with DBH < 20 cm and 'height' of 2 m have been found (Butler & Walsh, 1988; Guyette et al., 1980; Guyette et al., 1982). This broad range of growth rate and a generally inverse relationship between longevity and growth rate is similar to that of *T. occidentalis* (Burns & Honkala, 1990; Larson & Kelly, 1992; Archambault & Bergeron, 1992). Maximum longevity of 1032 years in *Thuja* trees less than 20 cm basal diameter and 2 m height has been described, but all such old trees show pronounced strip-bark growth. Mature (>100 yr.) *Thuja* trees occur at a very low density on cliff faces

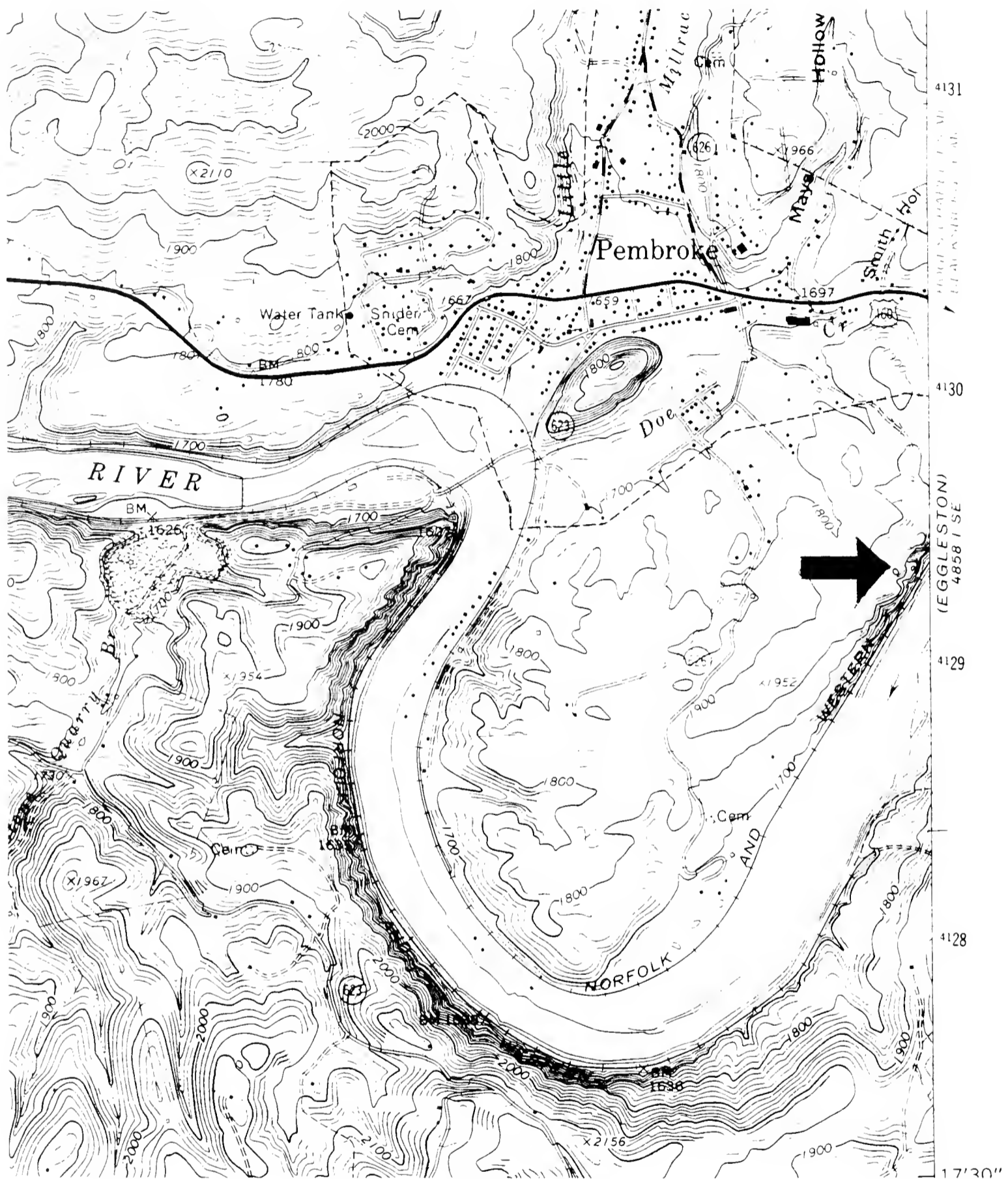


Fig. 1. A portion of the USGS topographic map (7½'), Pearisburg Quadrangle, showing location of the study site.

(ca. 100-150 trees per 100 m of cliff edge, or 200 trees per ha), and most of these trees occur towards the upper sections of cliff-faces and along the edge where the cliff-face borders the level-ground forest. Nothing is known, however, about the density, growth rate, or developmental architecture of *J. virginiana* on cliff habitats.

Past dendroecological studies on *J. virginiana* have been few in number and difficult to execute because of a high frequency of intra-annual rings (Guyette et al., 1980; Kuo & McGinnes, 1973) that complicate the search for annual increments of growth. Such false rings complicate the precise dating of growth increments required for accurate crossdating and

subsequent climate reconstructions (Fritts, 1976). The dendroecological potential of this species, therefore, must include a direct examination of the form of the intrusion of false rings and the patterns of intra-ring width variability. In contrast to *J. virginiana*, the frequency of false rings in *T. occidentalis* is exceptionally low. Still, few dendro-ecological studies using *T. occidentalis* have been conducted due to its northeastern distribution in mesic parts of North America and a widespread belief that its maximum age was too low to be of interest to dendrochronologists.

The objective of this research was to evaluate the dendroecological potential of *J. virginiana* growing on limestone cliffs in western Virginia, and to compare this potential with that of *T. occidentalis* occurring on similar cliffs in southern Ontario, Canada.

Eight persons sampled cliff edges and faces during 4-11 June 1993. An area approximately 100 m long was sampled, but workers did not descend further than 15 m down the cliff face. Few trees were present below this zone. Safety harnesses, climbing rope and webbing were worn by workers to help guarantee the safety of personnel.

The total number of living and dead stems of *J. virginiana* was used as an approximate measure of the density of trees on the cliff. The location, diameter at increment coring height, and stem height were recorded for each tree. Paired core samples were taken from living trees and cross-sections were taken from dead trees found during the survey. Cores and cross sections were prepared using standard methods (Cook & Kairiukstis, 1990) and examined

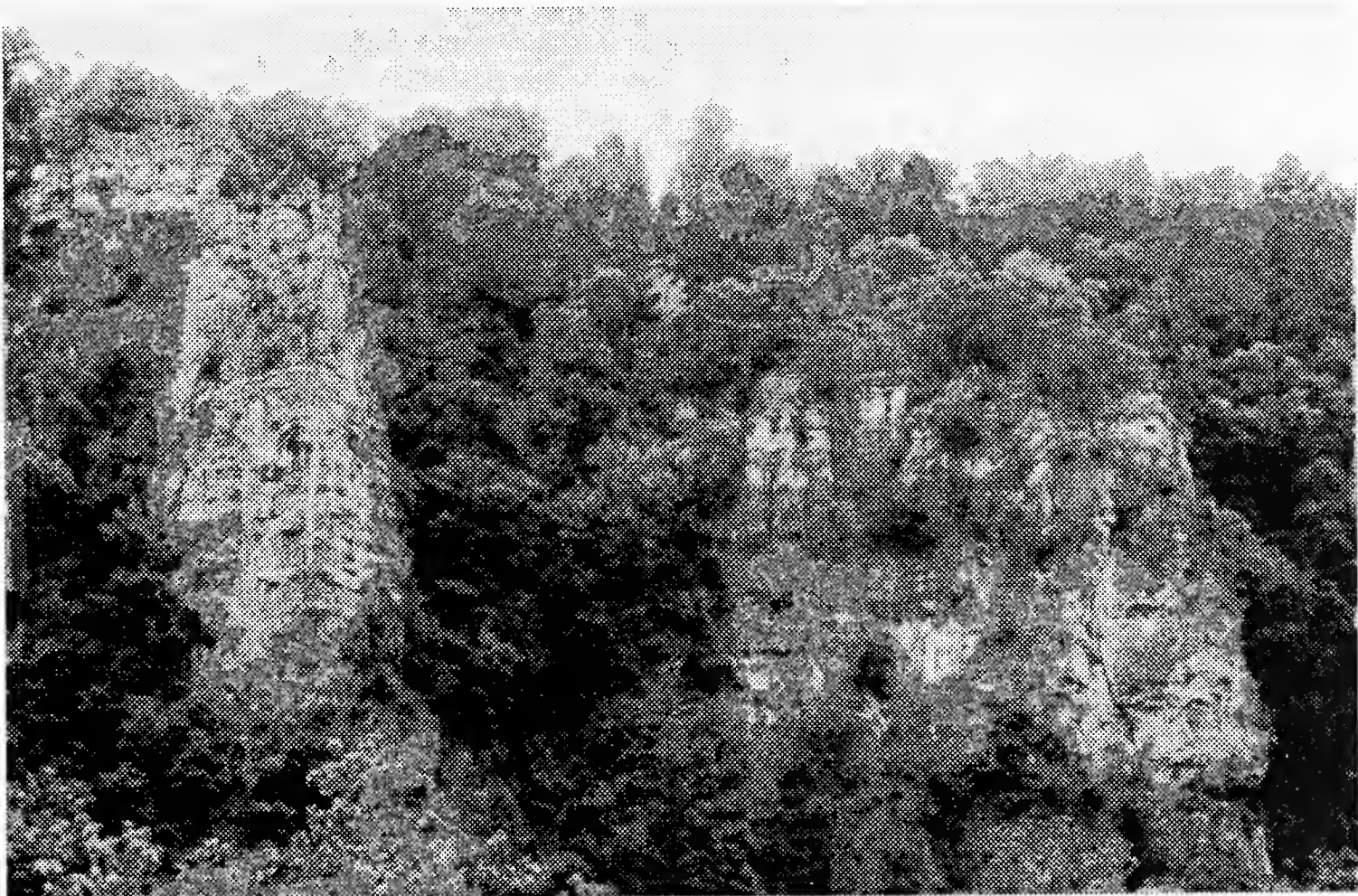


Fig. 2. Limestone cliff along New River, Giles County, Virginia, the site of the present study.

METHODS

The study site was a southeast-facing cliff near the town of Pembroke, Giles County, Virginia. (Lat. 37°18'30", Long. 80°37'30") (Fig. 1 & 2). Little evidence of disturbance was seen on the cliff face, although several fire scars on *J. virginiana* and hardwood species present in the level-ground forest at the top of the cliff were observed.

under dissecting microscopes to permit ring-counts.

Chronology development

False rings were common in rapidly growing *J. virginiana* collected from the top of the cliffs. Although not as common in slower growing material, they posed a sizable dating problem. Since false rings occurred with high frequency only on precise years, they could

be used as complementary information (Stokes & Smiley, 1968). Tree-rings were compared to the regional climatic data for divisions 05 and 06 to assess the strength of the species growth/climate response at this site. Two climatic divisions were used because the study site was located exactly at the boundary between the two divisions.

RESULTS

Tree density was very low. Given that 100 m of cliff edge were surveyed, the average mature tree density was less than one per linear meter for 15 m of vertical cliff edge.

The largest stems found in the survey were approximately 41 cm in diameter and showed 398 growth rings. Both dead and living trees with over 400 rings were found. Stems, which averaged about 6 m in height, showed a mean diameter of 20 cm and varied in ring count from approximately 120 years to 450 years. Stem VIC22 and VIA22 had the greatest number of growth rings at 469 and 473, respectively, and were 24 and 14 cm in diameter, respectively. The entire stem of

VIA22 was harvested and had an air dried wood mass of 3.18 kg yielding an increment of 6.9 g yr⁻¹. Evidence for such low growth rates applied to younger as well as older trees. Saplings 20-30 cm high frequently showed 20 growth rings and several samples of this age had a diameter of 4 mm. Constrained growth is clearly displayed by *Juniperus virginiana* growing on cliffs.

Crossdating was possible because of the synchronous occurrence of false rings in the majority of the samples. Since both climatic divisions yielded basically the same results, only those for division 06 will be discussed. Comparison of the residual chronology with climatic data showed a clear precipitation signal for current summer, with significant correlations for May (R=0.52), June (R=0.23) and July (R=0.30) precipitation (Fig. 3). A positive significant signal was also found with previous August precipitation (R=0.33). A strong relationship exists between the residual chronology and total precipitation for the May - June period (R=0.31). Temperature is not significantly related to growth although a slight negative influence of current summer temperature is observable.

Relation between total May-July ppt and the Eastern red cedar chronology

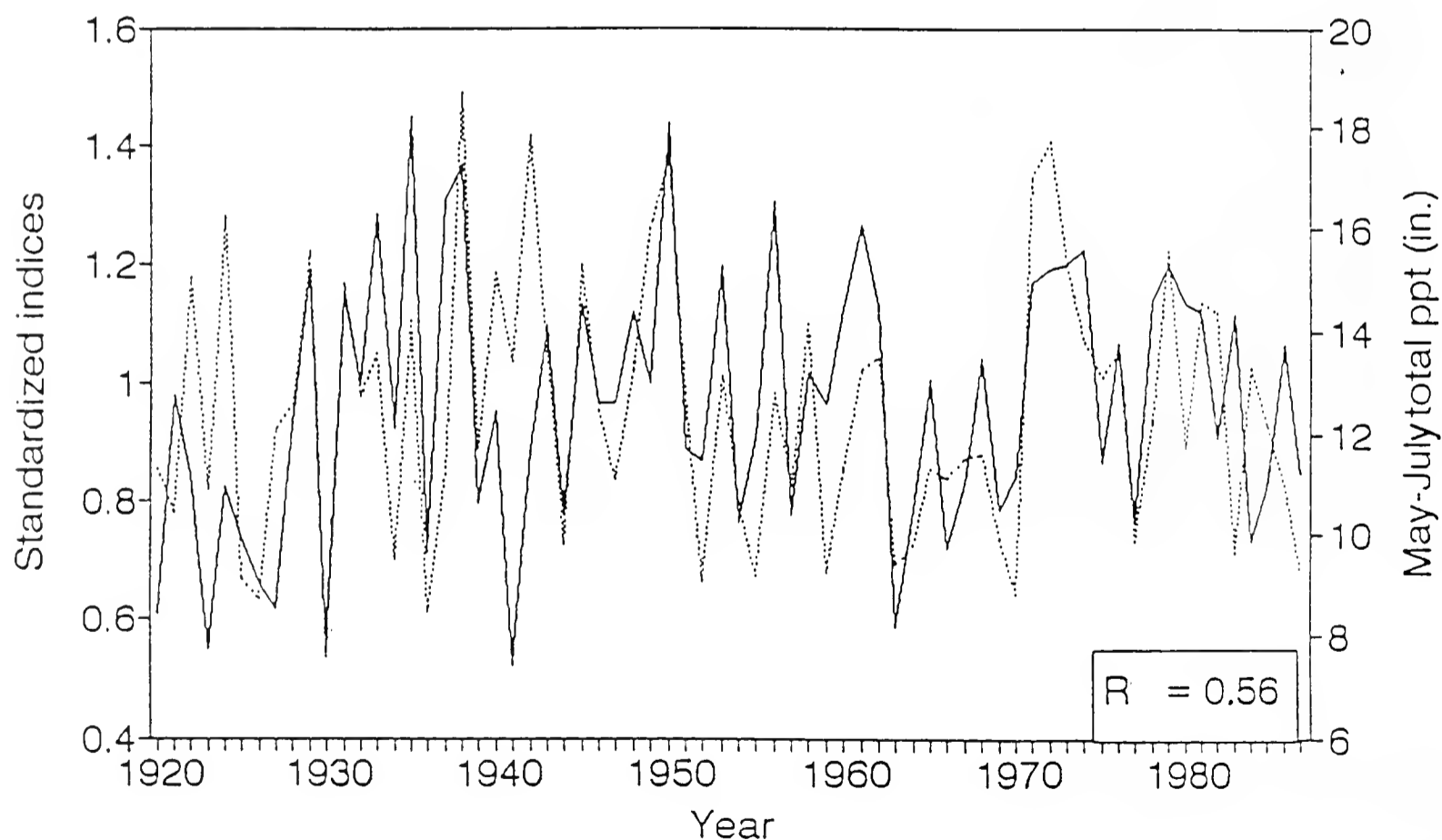


Fig. 3. Simultaneous plot of the annual tree-ring chronology of *Juniperus virginiana* (solid), and the May to July total precipitation for climate division 5 (Central Mountain) western Virginia (dotted). The simple correlation value is 0.56 indicating that portion of a substantial three growth can be explained by these climate data.

DISCUSSION

Limestone cliffs along the New River in western Virginia appear to support a presettlement forest of *Juniperus virginiana* of broadly similar structure and function to the *Thuja occidentalis* forests on the exposed limestone cliffs of the Niagara Escarpment (Larson & Kelly, 1991; Kelly et al., 1992). Tree population density, individual tree growth rates, longevity, and associated properties such as stem and canopy symmetry are very similar to *T. occidentalis* when growing on vertical limestone cliffs. Arbor-vitae most often shows stem asymmetry for trees greater than 300 years of age but this was not observed for *J. virginiana* on cliffs in Virginia. Maximum known tree age appears to be 475 years, but when one considers that only one cliff was sampled, and that only 101 adult trees were sampled, it is highly probable that much older trees will be found when other cliffs are explored. Given more time to carefully analyze the large collection of cores and cross-section of living and dead material, it is likely that this chronology can be extended beyond the pith date of the living trees (1517 AD). Since many of the trees that were harvested in Virginia had a similar weathered appearance to the *Thuja occidentalis* that occur on the Niagara Escarpment (Kelly et al., 1992), and since the latter trees have been shown to resist decay for many hundreds of years following death, it is entirely possible that a chronology could eventually be prepared from these trees that extends to ca. 1200 A.D.

Monthly precipitation and temperature records for regions adjacent to the study site were examined for trends since 1910. Early seasonal precipitation (May) showed a positive relationship to growth and there was an interesting but non-significant inverse relationship to temperature. In other words, *J. virginiana* displays increases in growth during cool and wet springs, and displays slow growth in May if conditions are dry and warm. This pattern of thermal and moisture relations is identical to *T. occidentalis* growing on rocky islands in boreal Quebec (Archambault & Bergeron, 1992) and similar to that found for *T. occidentalis* growing on cliffs of the Niagara Escarpment (Kelly et al., 1994).

Considering the magnitude of these correlations and the opportunities for extending the tree-ring chronology back several centuries, it appears that *Juniperus virginiana* has considerable dendroecological potential and research effort should be undertaken to exploit this species to the to the fullest extent possible.

SUMMARY

The dendroecological potential of *Juniperus*

virginiana growing on vertical limestone cliffs in western Virginia was explored and compared to *Thuja occidentalis* growing on cliffs of the Niagara Escarpment, Ontario, Canada. One hundred and one core samples and cross sections of adult trees were obtained from ca. 100 m of cliff edge and face, and from these samples estimates were made of population density, tree growth rate, longevity, and xylem architecture. The results showed a high degree of similarity between forest and tree structure on New River cliffs and those of the Niagara Escarpment. False rings did not represent an impediment to chronology preparation. A tree-ring index was prepared for the period 1920-1992, and this chronology showed a high degree of correlation with May precipitation and a lesser negative correlation with summer air temperature. This chronology is the only one available for low elevation sites in Virginia, but by expanding it to include both living and dead tree-ring series, it could become a significant source for paleoclimatic reconstructions.

ACKNOWLEDGMENTS

The cooperation of Dr. Larson and fieldweek co-organizer Paul J. Krusic (TRL Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY) for signing-off on this version is gratefully acknowledged. The photograph used for Figure 2 was taken by Dr. Larson and made available through the assistance of Dr. Uta Matthes-Sears whose help is gratefully acknowledged. In addition, this abridged version was improved by reviews by Drs. Joseph C. Mitchell and Thomas J. Rawinski who suggested a number of minor textual changes.

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Two Orthopteroid Insects New to the Virginia Fauna (Saltatoria: Conocephalidae; Blattaria: Blattidae)

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Although there are no published lists of the various insects groups formerly included in the order Orthoptera known to occur in Virginia, a number of fairly comprehensive accounts for the state fauna (e.g., Fox, 1917; Rehn & Hebard, 1916) or specific regions (e.g., Davis, 1926; Hebard, 1945) collectively give an impression of these insects in the Commonwealth. It is clear, however, that a considerable number remain to be collected and recorded, a good example being the camel crickets, genus *Ceuthophilus* as evident from the distribution maps in Hubbell's 1936 revision of that group. The extreme southeastern and southwestern parts of the state seem most likely to yield overlooked resident hexapods, and I provide here some documentation on two species inhabiting the former

area. One is large but apparently not common, the other is small but widespread and actually extremely abundant at most of its known localities.

Order Saltatoria (Orthoptera)

Family Conocephalidae

Pyrgocorypha uncinata (Harris)

Blatchley (1926: 511) stated that "...the species is known to range from Clarksville, Tenn., and Raleigh, N. Car., west and south to Arkansas, Texas, Cuba, Mexico, and Central America, though very few records of its occurrence in the United States

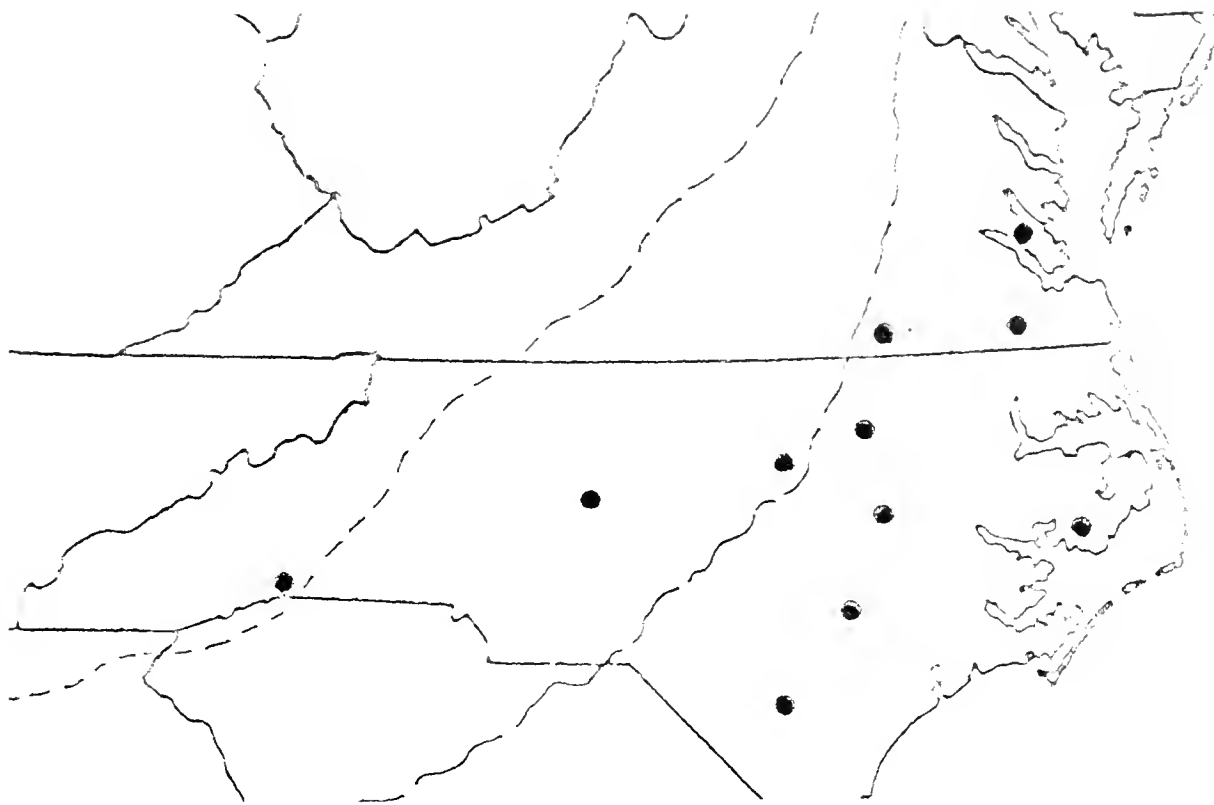


Fig.1 Distributional localities for *Pyrgocorypha uncinata* in Virginia and North Carolina. Dashed lines show east and west boundaries of the Piedmont.

have been made.” Brimley’s list (1938) of North Carolina insects added no localities further north or east than Raleigh, and I am not aware of any published for Virginia. Specimens recently seen by me, however, establish this species as a member of our Coastal Plain fauna.

City of Suffolk: Holland, at the Virginia Agricultural Experiment Station, 9 June 1975, J. W. Jenkins (VPISU 1o). **Greensville Co.:** ca, 1 mi/1.6 km east of Claesville, end of Cty. Rte. 666, 25 March 1994, museum survey (VMNH 1o). **James City Co.:** Williamsburg, collector not specified (USNM 2)

These localities imply that *uncinata* probably occurs throughout the southeastern Virginia Coastal Plain, north at least as far as the York-James Peninsula. The Williamsburg locality extends the known range of the species about 150 mi./240 km northeast of Raleigh.

The Holland specimen was taken at a black light trap in a region which, although extensively cultivated, retains several nearby wooded stands. The Greensville locality is on a small sandy knoll in a small grove of sweetgum and yellow pine, surrounded by cultivated fields. Blacklight traps have been operated there on several occasions during the summer months of 1993-1996 without attracting any arboreal conocephalid. The specimens from Greensville County and Williamsburg were taken relatively early in the year for adult tettigonids, and may represent recent emergence from overwintering sites.

In North Carolina (Fig. 1), *uncinata* occurs across the Piedmont as far as Tryon, in the Blue Ridge foothills. Records for Asheboro and Raleigh suggest the possibility of Piedmont populations in Southside Virginia as well, perhaps in the vicinity of Buggs Island Lake.

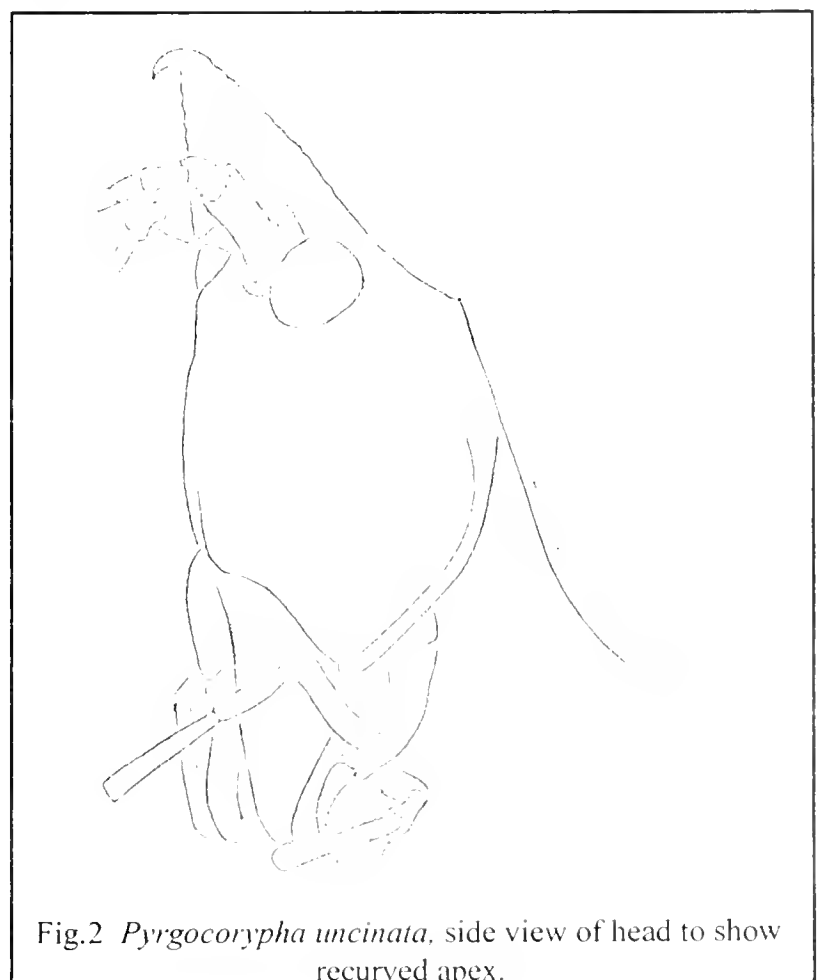


Fig.2 *Pyrgocorypha uncinata*, side view of head to show recurved apex.

Pyrgocorypha uncinata is one of the "cone-headed" katydids, so-called because of the elongation of the head above the eyes. From other Virginia members of this group, *uncinata* is easily distinguished by the small but acute apical hook of the cone (Fig. 2) to which the specific name refers.

Order Blattaria

Family Blattidae

Cariblatta lutea lutea (DeSaussure & Zehntner)

The "Little Yellow Cockroach" has been recorded from as close to Virginia as Raleigh and Roanoke Island, North Carolina (Brimley, 1938). With these as northernmost localities, it was almost inevitable that the species would be found in eastern Virginia, and it was in fact collected at Cape Henry many decades ago by entomologists from the National Museum of Natural History. (this record has apparently never been published). The species does not seem to be readily taken by conventional hand-collecting and black-lighting, but the recent application of pitfall techniques in southeastern Virginia reveals it to be actually common and widespread (Fig. 4). VMNH has about 700 prepared specimens (most still in alcohol), and undoubtedly many more are in unsorted pitfall samples. Our material was collected at the following localities:

City of Chesapeake: Fentress Naval Air Station (2).
City of Virginia Beach: Seashore State Park (580); Munden Point (76); Oceana Naval Air Station (24).
Greensville Co.: 1 mi./1.6 km east of Claesville, end of Cty. Rte. 666 (13); 2.3 mi./4 km ENE of Slate's Corner (5).
Mecklenburg Co.: 1.0 mi/1.6 km N of Norvelle (1); 3 mi/5 km S of Boydton (3); Elm Hill

State Game Management Area (1). **York Co.:** Yorktown Naval Weapons Station (3); ponds at Grafton Natural Area Reserve (1).

The present lack of records elsewhere in southeastern Virginia may be only the result of inadequate collection. Pitfalling has been conducted in this lacuna only at the Zuni Ecologic Reserve in westernmost Isle of Wight Co., and perhaps the traps there were placed in a habitat unsuitable for this cockroach. The low numbers of individuals taken at the peripheral localities suggest fairly recent immigration to the north and west.

A midsummer peak in surface activity (chiefly but not exclusively by adults) is dramatically shown by the following breakdown of capture dates by month:

January.....	0
February.....	0
March.....	3
April.....	2
May.....	41
June.....	263
July.....	296
August.....	23
September.....	3
October.....	1
November.....	0
December.....	2

In contrast to the monotonous brown shades of other Virginia cockroaches, the color pattern of *C. lutea* is complex and attractively variegated (Fig. 3).

ACKNOWLEDGMENTS

The generous cooperation of Christopher A. Pague and Kurt A. Buhlmann (formerly zoologists, Virginia Division of Natural Heritage, DCR) and Joseph

C. Mitchell in donating extensive pitfall captures to VMNH is acknowledged with pleasure and appreciation.

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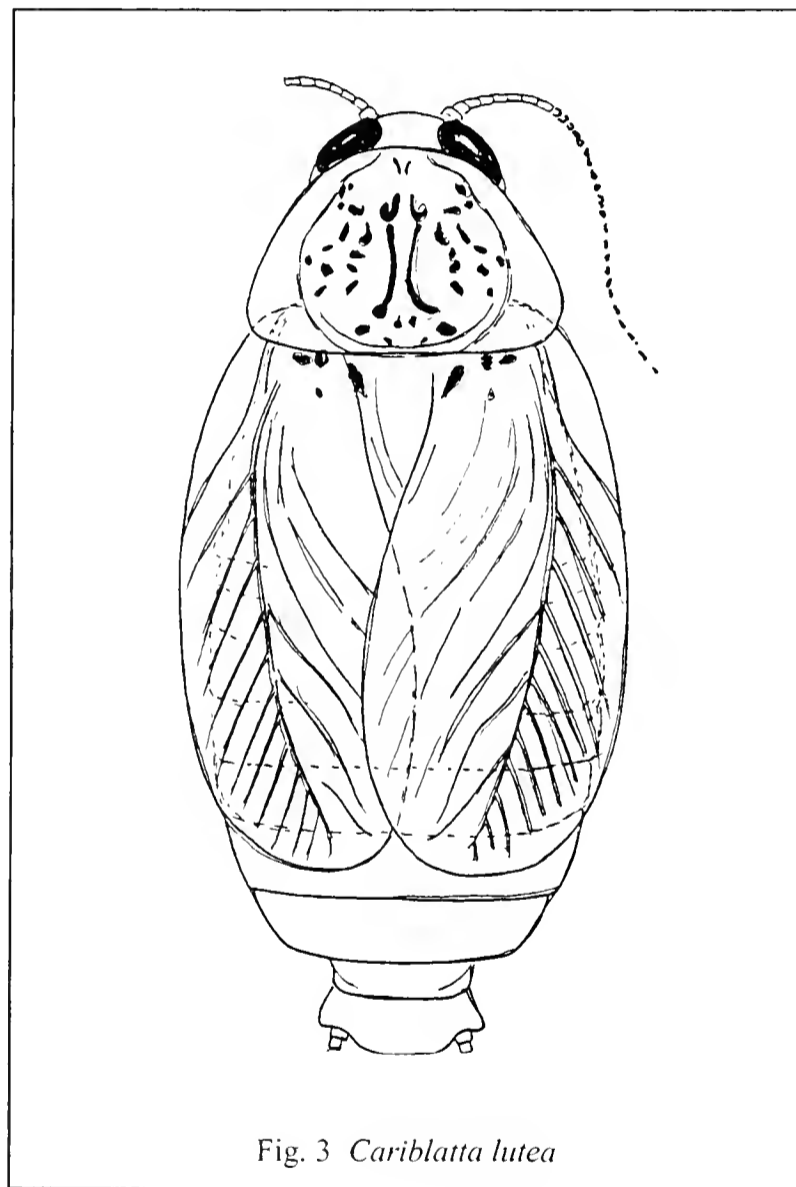


Fig. 3 *Cariblatta lutea*

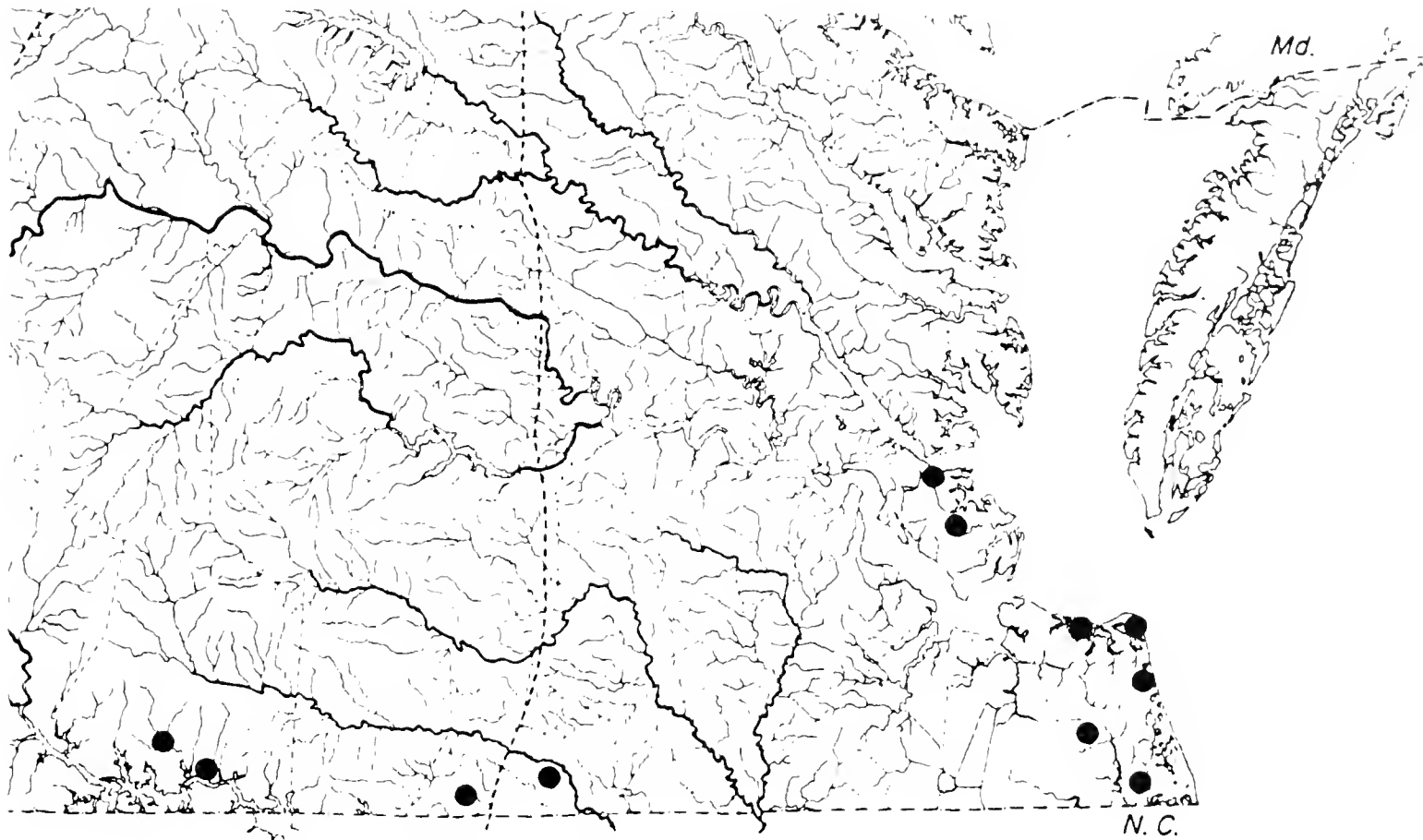


Fig.4 Distributional records for *Cariblatta lutea* in southeastern Virginia

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First Records of Freshwater Mussels on the Eastern Shore of Virginia

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The freshwater mussel fauna of eastern North America is the richest in the world (Williams et al., 1992). Among the various states in the region, Virginia ranks fifth behind Alabama (171), Tennessee (123), Kentucky (100) and Georgia (98) with a total of 80 species, all belonging to the family Unionidae (Starnes & Bogan, 1988; Lipford, 1989; Cicerello et al., 1991; Williams et al., 1992; Lydeard & Mayden, 1995). The majority of these species inhabit the upper Tennessee River system, which encompasses the Clinch, Holston, and Powell river drainages in the southwestern portion of the Commonwealth (Ortmann, 1918; Stansbery, 1973; Stansbery & Clench, 1974, 1975, 1978; Bates & Dennis, 1978; Ahlstedt & Brown, 1980; Dennis, 1981; Ahlstedt, 1982; Neves & Zale, 1982; Wolcott & Neves, 1994). Many of these species are currently listed as threatened or extirpated from Virginia (Lipford, 1989; Neves, 1991). In comparison, the Atlantic Slope freshwater mussel fauna of Virginia is less diverse, being more comparable to states further north in terms of total number of species (Johnson, 1970). This fauna includes several species listed as threatened or endangered at the state level (e.g. brook floater), *Alasmidonta varicosa* [Lamarck, 1819], and Atlantic pigtoe, *Fusconaia masoni* [Conrad, 1834] as well as two federally-endangered species, namely the dwarf wedgemussel, *Alasmidonta heterodon* (Lea, 1829) and the James spinymussel, *Pleurobema collina* (Conrad, 1837).

Counts et al. (1991) presented the results of a detailed survey of the freshwater mussel fauna of the Delmarva Peninsula, which comprised 307 sampling stations in Delaware, Maryland, and Virginia. These

authors failed to find any freshwater mussel populations south of the Maryland-Virginia state line, despite surveying approximately 60 sites in the Virginia portion of the peninsula, including stations in both Accomack and Northampton counties (C. L. Counts, pers. comm.). The exact locations of their survey sites are unknown to us. The two southernmost sites for freshwater mussels documented on the Maryland portion support *Lampsilis radiata* (Gmelin, 1971), the eastern lampmussel, and *Ligumia nasuta* (Say), the eastern pondmussel, respectively, and are approximately 20-25 km north of the Virginia border (Counts et al. 1991). Of greater significance was the discovery of a population of *A. heterodon* on the Eastern Shore of Maryland. This prompted us to conduct further surveys of streams in the Virginia portion of the peninsula in the hope of locating additional populations of this rare species.

METHODOLOGY

Our surveys were limited to the nontidal sections of Coastal Plain streams on Virginia's Eastern Shore. Jenkins & Burkhead (1993) noted that there are no major river systems in this area of the state. Initially, we determined the watershed size for the apparent upstream limit of an *A. heterodon* population in Stafford County, Virginia, using USGS 1:100,000 maps and a planimeter. The watershed area was calculated to be approximately 3,000 ha (7,400 acres). We proposed to limit our surveys to nontidal streams that had a watershed of approximately equal or greater area within the Eastern Shore bayside drainages. Sampling stations

visited by PHS in 1992 were selected on the basis of the watershed area upstream of the sampling station.

The fortuitous discovery in 1992 of freshwater mussels in a stream receiving input from a much smaller watershed (290 ha) enlarged the set of potential sites to examine in subsequent years. Stations surveyed by SMR during 1993 and 1994 included streams on both the Chesapeake Bay and Atlantic Ocean drainages. These surveys were initially performed by visually inspecting any potential habitat that was encountered at road crossings. Many sites were deemed unsuitable for freshwater mussels after a very brief inspection and no detailed surveys were conducted at these sites.

The most promising sites were searched visually while walking along the stream course. A waterscope was employed in the case of deeper streams. Field surveys were conducted by PHS in October of 1992, and by SMR in August, October, and December of 1993, and July of 1994. A total of 15 sites were surveyed in detail.

Common names used in this report are taken from Turgeon et al. (1988).

RESULTS AND DISCUSSION

Freshwater mussels were found at only two survey sites, but these are apparently the first documented records of representatives of the family Unionidae on the Eastern Shore of Virginia. Most of the streams that we examined were unsuitable for unionids owing to their small size, inadequate flow, or inappropriate substrate. These streams were generally ill-defined channels in hardwood swamps. These habitats tend to be dominated by thick organic detritus and muck with generally small areas of sand substrate present, if at all.

The eastern elliptio, *Elliptio complanata* (Lightfoot, 1786), was the only unionid mussel species found during our surveys. It was documented at the following sites (located 4.8 km apart) in Accomack County. Guilford Church Branch at Cty Rte 681 in the town of Bloxom, 27 October 1992, PHS; Katy Young Branch at jct Cty Rtes 658 and 674, 1.5 km NW of Parksley, 29 October 1993, SMR. The former site was revisited on 26 July 1994 by SMR to obtain additional voucher specimens. Both of these streams drain into Chesapeake Bay. The nearest confirmed localities for *E. complanata* on the Delmarva Peninsula are from Wicomico County, Maryland (Counts et al., 1991), approximately 70 km north of the Virginia sites. We did not encounter the Asian clam, *Corbicula fluminea* (Muller, 1774), or the Zebra mussel, *Dreissena polymorpha* (Pallas, 1771), two invasive exotic species, during our surveys.

Both of the streams in which *E. complanata* was found during our surveys are very small (1-2 m wide), although they possess moderately good flow despite rather flat terrain. The elevations of the areas where mussels were found are approximately 5 m and 3 m ASL for Guilford Church Branch and Katy Young Branch, respectively. The substrates of these streams are predominantly sand and gravel. Guilford Church Branch is considerably shallower than Katy Young Branch, being only 2-5 cm deep in some stretches. The eastern elliptio was quite common in both streams considering their small size and limited watersheds. Mussels were particularly abundant in Katy Young Branch, where SMR counted forty live adults along a 100 m section of the stream (1.5-2 m wide) that paralleled Cty Rte 674. Approximately half as many individuals were observed in Guilford Church Branch.

The section of Guilford Church Branch upstream of the mussel site receives runoff laden with fertilizers from a vegetable farm, as well as runoff from State Route 316. We found mussels only in a short reach (<100 m) of this stream that flowed through the backyards of a residential neighborhood. Less than 50 m downstream of this section, the stream becomes weed-choked and sluggish. Of the two streams, Katy Young Branch appears to offer better potential habitat for *A. heterodon*, although this species was not found during our surveys and we believe that it is unlikely that this rare mussel occurs on the Eastern Shore of Virginia.

Jenkins & Burkhead (1993) reported that the ichthyofauna of the Delmarva Peninsula is depauperate. They indicated that only 22 (11.5%) of the 192 species of freshwater fishes native to Virginia (both figured include some estuarine species as well as anadromous and catadromous forms) are believed to occur naturally within the lower portion of the Peninsula. Of the six confirmed host fishes for *E. complanata* that were listed by Watters (1994), only the banded killifish, *Fundulus diaphanus* (LeSueur), is native to the Eastern Shore of Virginia. Curiously, all three of the documented Eastern Shore localities for this species plotted in Jenkins & Burkhead (1993) are from streams in Accomack County that drain toward the Atlantic Ocean.

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The U. S. Fish and Wildlife Service funded our surveys directed at *A. heterodon*. We thank Richard L. Hoffman for sharing the results of his unsuccessful efforts to find unionids on the Eastern Shore of Virginia. Voucher specimens have been deposited in the Virginia Museum of Natural History.

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Limnephilus moestus Banks, a Northern Caddisfly in the Atlantic Coastal Plain (Trichoptera: Limnephilidae)

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Limnephilid caddisflies as a group tend to be distinctly psychrophilic, with northern continental distributions. As one consequence of this condition "The larvae of the limnephilids are in general rather closely restricted to cold, clear, well oxygenated water" (Flint, 1960: 3). Most members of the Nearctic fauna occur most widely in Canada, with southern extensions -if any - along the Appalachians and Rocky Mountains. Heretofore, *Limnephilus moestus* (Banks, 1908) has been an exemplar of such biogeographic constraints. It ranges across North America from Greenland to British Columbia, southward to Utah and Colorado in the Rockies and to West Virginia and Delaware in the East. Nearly all of the localities east of the Great Plains lie within the area covered by Wisconsin stage glaciation. While it is not unusual for plants and animals with obviously boreal distributions to occur southward in eastern United States, such disjunct outliers are normally associated with high elevations which provide the requisite cool habitats. Contrary to this logical constraint, *Limnephilus moestus* has been found in recent years virtually at sea level from New Jersey to southeastern North Carolina.

The earliest Coastal Plain collection seems to have been made by the first author at Lake Drummond in the Dismal Swamp, City of Chesapeake, Virginia, on 19 May 1963. Using a sheet illuminated by a gasoline lantern at a former hunting lodge located at the entry of the Jericho Ditch into the lake, he obtained a sample of nine species of Trichoptera. Dr. Herbert H. Ross, who identified the material (all in INHS), wrote (in litt. to RLH 16 October 1963) that "The remarkable circumstance about this list is that it is typical of a spring fed stream in Long Island or in the Adirondacks rather than what we consider to be the fauna of a

southern swamp." At the time, RLH knew nothing about caddisfly distribution and attached no special significance to the appearance of *Limnephilus moestus* (7 ♂♂) in Ross's list (although, obviously, it is one of the species that evoked his comment). A second Virginia record was obtained through a single male (VMNH) taken at a blacklight trap operated by Steven M. Roble at the Blackwater Ecologic Preserve, ca. 4 mi. S of Zuni, Isle of Wight Co., Virginia. In identifying this material, the second author realized its geographic significance and his comment about it (in litt. to RLH) evoked the memory of the Lake Drummond list and led to a search of literature relevant to the "normal" range of this species.

A record for the Coastal Plain of Delaware has been published (Lake, 1984), based on a single female taken at Middletown, New Castle Co., on 30 May 1981. Dr. Flint pointed out his own capture of 14 specimens (USNM) at Lakehurst, Ocean Co., New Jersey, adding the Coastal Plain of this state to the register. Lastly, and certainly most noteworthy, is a series of three *moestus* in the USNM collection from Lake Waccamaw, Columbus Co., North Carolina, taken 10 May 1985 by W. E. Steiner and Andy Gerberich. This locality is 300 km southwest of Lake Drummond, and the presence of *moestus* there must be regarded as remarkable, perhaps the southernmost known record of the genus in North America. The occurrence of *moestus* in Lake Drummond at least has a palaeoecological explanation: as recently as 18,000 YBP the entire region (then pre-swamp!) was invested in northern spruce-fir-jack pine forest (Whitehead, 1973). Survival of populations of boreal species remaining behind during postglacial warming intervals and biome shifts would have been enhanced by the influence of cold springs along the

western edge of the Dismal Swamp. Explanation of the population near Zuni is less facile. The specimen could have only come from the nearby Blackwater River, an appropriately named low-gradient Tidewater stream characterized by midsummer warmth and lowered oxygen content. Near the collecting site, however, the river courses near the base of steep bluffs some 5-10 m in height; cold springs or seeps at the base of these bluffs, feeding into floodplain pools, could produce microhabitats capable of sustaining this relict waif species. Environmental conditions at the Lake Waccamaw capture site are unknown to us.

Limnephilus moestus becomes another facet of the increasingly complicated mosaic, in the Virginia Coastal Plain, of boreal relicts of postglacial warming existing sympatrically with austral relicts left behind from post-Hypsithermal cooling of local temperatures. At Lake Drummond, it was taken along with the holotype of the thermophilic caddisfly *Ceraclea protonepha* Morse & Ross, there near the northeastern extremity of that species' distribution.

In the central Appalachians, the southernmost records for the species are in eastern West Virginia: Blackwater Falls, Spruce Knob Lake, and Cranberry Glades (all USNM), in high, cool, subboreal situations in which *moestus* might be expected to occur. So far there are no records for Virginia despite considerable collecting effort only a few miles from the Spruce

Knob site; almost certainly however a Virginia population will be located somewhere in Alleghany, Bath, or Highland counties.

ACKNOWLEDGMENTS

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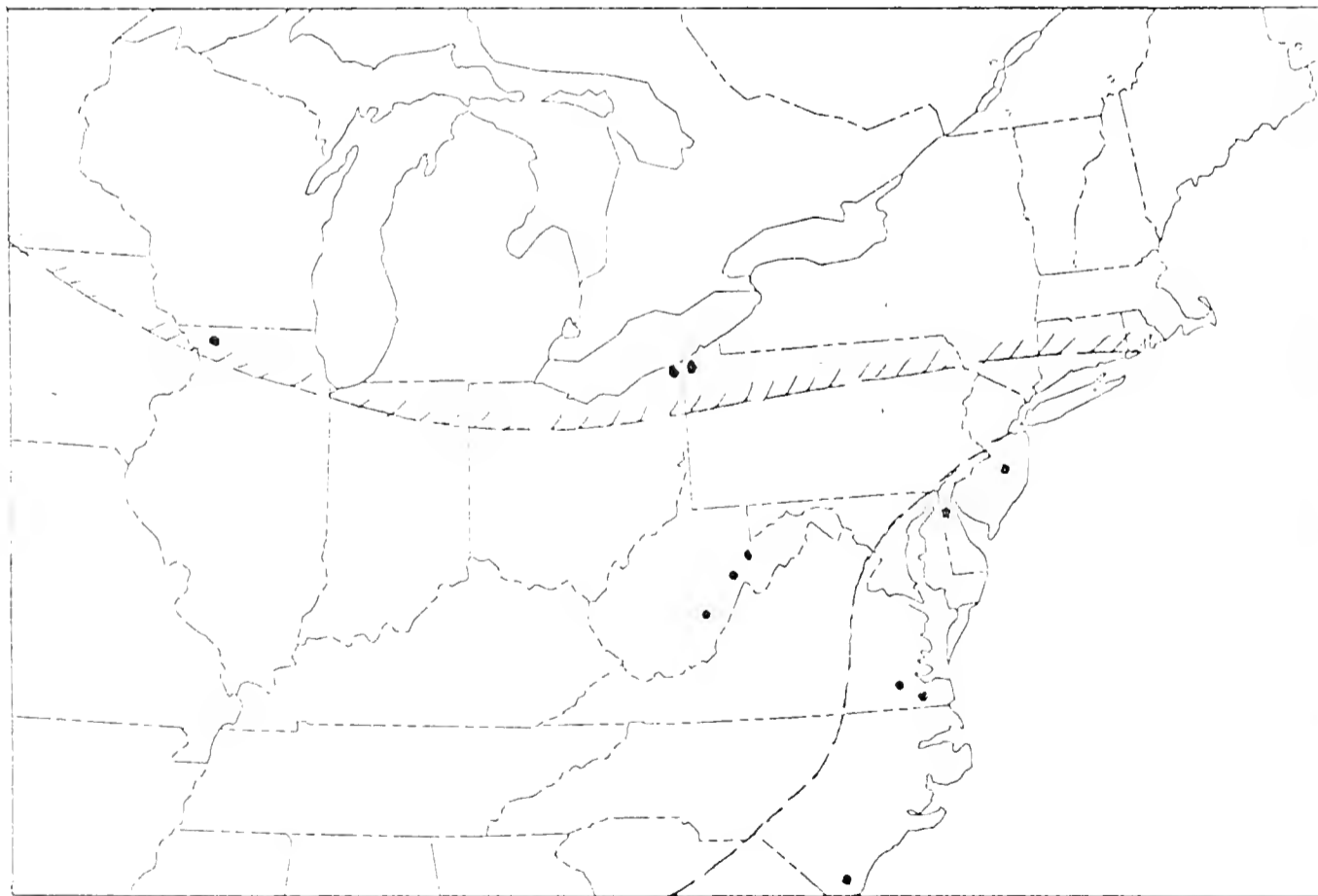


Fig. 1. Central eastern North America, showing the conterminous range of *Limnephilus moestus* (north of the hatched line, with the southernmost known Appalachian records in West Virginia and the Coastal Plain localities discussed in this paper.

Shorter Contributions

Banisteria, Number 10, 1997

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NEW FIELD RECORDS FOR LONGEVITY IN ALLEGHENY WOODRATS (*NEOTOMA MAGISTER*) — The Allegheny woodrat (*Neotoma magister*) is a species of special concern in Virginia due, in part, to its decline and disappearance from states in the northern part of its range including New York, New Jersey, and Pennsylvania (Beans, 1992; Hicks, 1989). As part of a long-term monitoring and assessment project investigating the status and distribution of the Allegheny woodrat in Virginia, animals were live-trapped, ear-tagged and immediately released at the site of capture. Study sites have been retrapped at least once each year and, since spring 1996, two sites have been trapped bi-monthly. Field records for longevity in this species were established by two individuals collected from the long-term monitoring site located in Giles County, Virginia, approximately 10 km west of Mountain Lake in the George Washington and Jefferson National Forest.

The first record is from a male woodrat initially caught on 3 October 1992 as a 245 g adult. It was caught a total of 7 times with the last capture on 18 June 1996; it survived for at least 1,352 days or a period of at least 45 months in the wild. My work with woodrats over 7 years indicates that this individual was probably a late-spring birth and has thus survived over 50 months in the wild. At this site, peak reproduction occurs between April and June (Mengak, unpubl. data).

The second record is from a female woodrat first caught on 17 October 1993 as a 230 g subadult. It was also caught a total of 7 times during the period of 17 October 1993 and the last capture date of 29 May 1997. Time from first capture was 1,318 days (44 months) and assuming a period of 5 months between birth, in the period April to June, and first capture, she has survived at least 49 months in the wild.

This is the longest reported life span for a wild Allegheny woodrat. Previously, the Allegheny woodrat has been considered a subspecies of the eastern woodrat (*N. floridana*). Recently, strong morphologic and genetic evidence was presented that supports the elevation of the Allegheny woodrat to species status (Hayes and Harrison 1992; Hayes and Richmond, 1993). The previously reported lifespan for eastern woodrats in the wild is 991 days (Finch and Rainey, 1956). Landstrom (1971) reported longer lifespans for captive woodrats of the genus *Neotoma*. He reported

lifespans up to 67 months for captive *N. lepida* and 60 months for laboratory-reared *N. albigula*. Poole (1940) reported *N. magister* survived to at least 48 months of age in captivity.

The Allegheny woodrat is a poorly known component of Virginia's native fauna. Information on many aspects of woodrat natural history are unknown, unclear or controversial. Longevity information is important in understanding long-term trends in population size and impacts conclusions from presence/absence surveys.

Acknowledgments

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ON THE TYPE LOCALITY OF *ORCONNECTES VIRGINIENSIS* HOBBS (DECAPODA: CAMBARIDAE) — Hobbs (1951) described the stream-dwelling crayfish *Orconectes virginienensis* from specimens collected by other workers in Dinwiddie, Brunswick, and Greensville counties, Virginia. Using information given to him by ichthyologist E.C. Raney, Hobbs (1951:124-125) gave the type locality of the species as "Rowanty Creek, a tributary of the Nottoway River, 3.3 miles south of Reams Station on U. S. Hy. 301., Dinwiddie County, Virginia." He later repeated essentially the same description (Hobbs, 1989:38), changing it only by adding the phrase "5.3 km" as an equivalent of "3.3 miles." The range of *O. virginienensis* was characterized by Hobbs (1989:38) as the "Chowan drainage system in North Carolina and Virginia," and the species is also known to occur in the lower Roanoke River system in North Carolina (Cooper & Cooper, 1977; Cooper & Braswell, 1995:106). All published records for the species in Virginia are for the Chowan drainage, which includes the Nottoway River and Meherrin River systems, draining all or part of 14 counties in the southern Piedmont and Coastal Plain. As part of my studies of the crayfish fauna of Virginia, I planned in early 1997 to visit the type locality of *O. virginienensis* in order to collect topotypes. But after searching various maps, other printed references, and communicating with several individuals, I became convinced that the type locality of *O. virginienensis* as described by Hobbs does not exist and that a revision of its description of this species is in order.

At no point does US 301 pass through Dinwiddie County, Virginia, nor has it at any time since its construction, though it does come within a few hundred meters of the county's border (US Department of Agriculture, 1944; US Geological Survey 1967, 1969; Charles Gill, pers. comm.). Thus, if the holotype (USNM 91659) of *Orconectes virginienensis* was

collected in Dinwiddie County, it could not have been taken at any site along US 301. Also, while US 301 does cross Rowanty Creek, it does so in Sussex County a short distance south of the Prince George County border. Reams Station, mentioned in the description of the type locality, is today identified on most maps simply as Reams and is located in Dinwiddie County. It was established on a railroad line, thus meriting the descriptor "Station," and was the site of the Battle of Reams Station (25 August 1864) during the U.S. Civil War. However, US 301 does not pass through Reams and apparently never has. Reams is about 12.2 km (7.6 miles), north of the US 301 crossing of Rowanty Creek, and about 4.3 km west of US 301 (by air) on Cty Rte 606. Another Dinwiddie County community, Carson, is located on US 301 about 5 road km north of the Rowanty Creek bridge, but is not mentioned in the description of the type locality of *O. virginienensis*.

Two reasonable possibilities suggested themselves. One was that the type locality might actually be 3.3 miles south of Reams and in Dinwiddie County, but not on US 301. No stream crossing is found at this point, though a nearby possibility might be the crossing of Cty Rte 703 (old State Route 141) over Rowanty Creek. But this site is over 6 km south-southwest of Reams, further if measured along the secondary roads between the two. If this were the actual collection site, we would have to assume that the distance to it was measured incorrectly, that "south" in the type locality description is a rough approximation, and that the actual collection site was not on US 301. The second possibility is that the type locality might be 3.3 miles south of Carson rather than Reams, which would correspond to the site where US 301 crosses Rowanty Creek. This would involve the mistaken recording of Reams Station rather than Carson in the locality data, as well as a mistake in recording the county where the collection was made. While possibilities other than these two might be forwarded, all involve assuming even greater errors in identification of stream name, compass direction, distance, town names, or more than one of these, and no evidence exists that any such greater errors occurred.

In the belief that additional clues might be provided by the description of the stream given by Raney to Hobbs and recorded by the latter in the species description (Hobbs, 1951:125), I visited the two possible sites identified above on 5 June 1997. Unfortunately, I could not distinguish between the two based on the descriptions given by Hobbs. Rowanty Creek has stained water, a similar width, and flows through a swampy area at both of these sites. The presence of Interstate 95 adjacent to the US 301 site in Sussex County caused additional uncertainty. The

interstate has been constructed alongside US 301 since the collection by Raney and crosses Rowanty Creek a few meters east of the US 301 crossing. It is unclear whether habitat conditions at this site were altered by construction, but it is certainly possible that they were.

A solution to this puzzle was provided when I reviewed the collection data recorded by Raney and his associates and preserved with the fish they collected at the same site. Hobbs specified that the holotype for *O. virginensis* was collected along with fish taken by Raney and three associates in Rowanty Creek on 27 March 1949 (Hobbs 1951:125). Most of these fish are now part of the Cornell University Ichthyology Collection; individuals representing at least 16 species were taken. According to data kept with these specimens, Raney and his associates took them at the US 301 crossing of Rowanty Creek. The locality data on the Cornell collections read as follows: "USA, Virginia, Sussex" and "Rowanty Cr., trib. of Nottoway R., 3.3 mi. S of Reams Station on Hwy. 301." Thus it appears that the description of the site as 3.3 miles south of Reams originated with Raney, though he was aware that the site where the collection was made was in Sussex County. Raney's field number for the Rowanty Creek collection was ECR 1504B; another collection with the field number ECR 1504 and now stored at Cornell was made in the Monocacy River, Maryland, in July 1948. Raney was not the collector of the Maryland specimens, but is listed as providing their identifications. It is uncertain whether confusion resulting from this near-duplication of field numbers was a cause of the confusion of geography evidenced in the labeling of collection ECR 1504B, but they do not appear to be related.

It remains unclear how "Dinwiddie County" was substituted for "Sussex County" in the *O. virginensis* type locality description. Hobbs may have realized that a point 3.3 miles south of Reams would be in Dinwiddie County and made the change when he prepared the description of *O. virginensis*, not noticing that this point would be on neither Rowanty Creek nor US 301. Alternately, he may have been simply repeating information given to him by Raney, who could have changed the data at some time after making the collection. In any case, since the type specimens for *O. virginensis* were collected with the fish taken by Raney, the location of that collection must be recognized as the type locality of this crayfish, and this location has been given incorrectly in the literature until now. The correct type locality of *Orconectes virginensis* is as follows: Rowanty Creek, a tributary of the Nottoway River, Chowan River drainage, at the crossing of U.S. Highway 301, Sussex County, Virginia, 4.8 (air) km south of Carson.

Acknowledgments

Data on Raney's fish collections were made available by the staff of the Cornell Ichthyological Collection via MUSE software in July 1997. J. Clark confirmed data associated with *Orconectes virginensis* specimens in the United States National Museum collection. Charles Gill of the Virginia Department of Transportation provided information on the routing of US 301 in Prince George and Sussex counties. Tom Jones commented on the manuscript.

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FIRST RECORDS OF A HOLARCTIC ORB-WEAVING SPIDER (*ARANEUS SAEVUS* [L.KOCH]) IN VIRGINIA. — A large, dark-colored species of its genus, *Araneus saevus* is widespread but uncommon in the western Palearctic region, in fact it was not described until 1872, from specimens taken in the Dolomites near Bolzano, Italy. The species also occurs in North America from Newfoundland to Alaska, and was described by J. H. Emerton under two new species names: *Epeira solitaria* (from Massachusetts) and *Epeira nigra* (from Alberta), and under the former name was treated in Kaston's "Spiders of Connecticut" (1948). That these names might apply to *saevus* was first suggested by Wiehle (1963) and more recently confirmed by Levi (1971).

That author's treatment of the species as it occurs in North America provided numerous excellent illustrations and a spot map based on material examined by him. This map portrayed a classical "boreal" range extending entirely across Canada and southward into New England and down the Rocky Mountains into Utah and Colorado. The southernmost locality plotted for eastern United States appears to be in extreme eastern Pennsylvania.

By contrast with other members of its genus, *saevus* seems to be much less frequently collected, perhaps it is more arboreal than its close relatives. It is therefore not surprising that it has not been recorded from farther south in the Appalachians, nor that in fact it does occur in these mountains. Recently pitfall trapping for terrestrial arthropods in the Blue Ridge physiographic province in Virginia has obtained *saevus* at two localities: **Warren Co.**; Smithsonian Conservation and Research Center, 4 miles southeast of Front Royal, from pitfall open all winter and cleared 15 March 1994, rich mesic woods near small stream (VMNH 2). **Amherst Co.**: pitfall site on east side Tarjacket Ridge, off FS 1167, 21 October 1997, rich oak woods with fern understory at 3500 ft. (VMNH 1).

VMNH also has an immature female, determined as *saevus* by H. W. Levi (after publication of his monograph) from West Virginia: **Raleigh Co.** Grandview State Park, 21 May 1966, W. A. Shear leg. et don. This locality is almost exactly due west of that in Amherst Co., Va. Collectively these records extend the known range of *saevus* about 330 mi./530 km southwest of Levi's southernmost station, and permit the assumption that the species may occur as far as western North Carolina and/or eastern Kentucky at higher elevations.

The three adults from Virginia are piceous black, without evident banding on the carapace or white

ventral abdominal markings. The tibiae and metatarsi of legs 3 and 4 have a well-defined broad basal orange band. The largest specimen is 18.5 mm in length, and was obviously larger prior to the abdomen being shrunken by preservation. This is distinctly larger than the maximum of 17 mm cited by Levi, and may indicate a trend for size increase southward.

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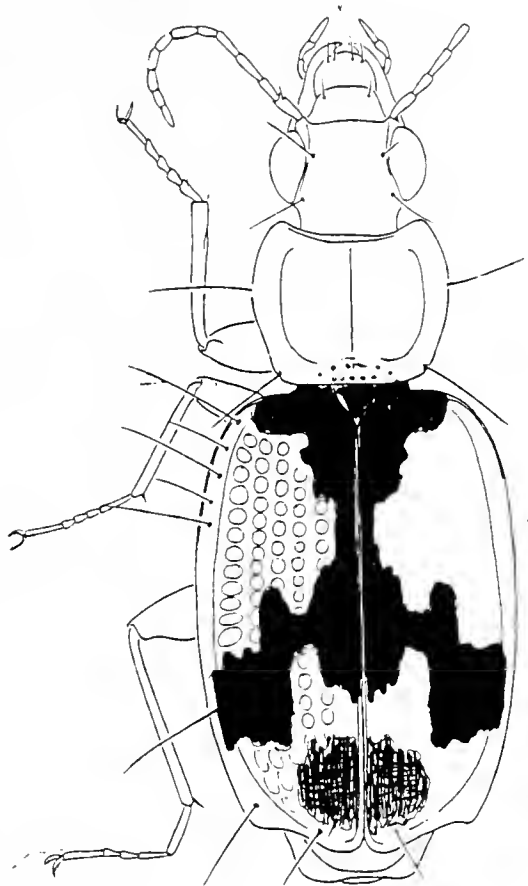
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PHLOEOXENA SIGNATA (DEJEAN), ANOTHER SOUTHERN GROUND BEETLE DISCOVERED IN VIRGINIA (COLEOPTERA: CARABIDAE). — The recent catalogue of North American ground beetles (Bousquet & Laroche, 1993) accounted a total of 446 species of Carabidae for Virginia, some of them on the basis of unpublished data from museum specimens. Papers by Davidson (1995) and Anderson et al. (1995) added seven and five more species respectively, giving a current total of 458. That an approach to closure of the list may be near cannot be asserted, however, since a substantial number of still unlisted species are at hand in the VMNH collection, and the presence of still others - known from nearby states - cannot be doubted. A total of near 500 resident species seems entirely probable.

On 3 July 1997, in company with C. S. Hobson (VDNH/DCR), I collected insects in the densely wooded floodplain of the Hyco River, just downstream from the US 501 bridge in southern Halifax County. During this activity, removal of loose bark from a standing tree disclosed a very agile small beetle which was captured as much by its apparent complicity as by any skill on my part. Inspection on the site suggested it

to be a species of the large genus *Lebia*, an impression which carried over into (and severely impeded) the first attempts at identification. Eventually, by recourse to the fine generic revision by Ball (1975) I was able to establish the species to be *Phloeoxena signata* (Dejean), the northernmost member of a predominantly Neotropical genus.



The species was described as *Coptodera signata* by Count Dejean in 1825, from a specimen with no closer locality than "Georgia." Not long afterward (1848) J. L. LeConte redescribed the species, again from Georgia material, under the name *Coptodera collaris*. In 1869, Baron Chaudoir transferred *signata* into his new genus *Phloeoxena* at the same time synonymizing *collaris* under *signata*, and describing a very similar species from Panama as *P. maculicollis*. In 1883, Henry Bates added another new species, *P. hoegi* from Guatemala, and in 1915 C. W. Leng proposed the subspecific name *P. signata nigripennis* for Florida specimens with mostly dark elytra. Having restudied most of the available material of this genus, Dr. Ball (1975:213) concluded that all of the names mentioned above were based on a single variable species, and so established an extensive geographic range for *signata*: North Carolina to Florida and southward through Middle America as far as Panama.

Ball examined specimens from Southern Pines, N. C., a locality already cited by Brimley (1938:31). This appears to be northernmost point at which the species has been recorded. However, the insect collection at

North Carolina State University contains four specimens taken at Raleigh, N. C., about 75 km northeast of Southern Pines, and likewise on the Fall Line.

Upon making the identification of the Halifax Co. specimen, I was able to match it quickly with another such beetle residing among the undetermined carabid material at VMNH. This individual was collected by me *ca* 6 miles northeast of Mineral, Louisa Co., Virginia, on 7 July 1975 (unfortunately without notation about habitat). This locality extends the known range of *signata* 360 km (260 mi) northeast of Southern Pines. While this distance is trivial *vis-à-vis* the enormous range of the species, it is significant in the sense of extending the northern periphery of a tropical beetle. It also emphasizes the superficiality of current knowledge of the Virginia insect fauna.

Chaudoir's selection of a generic name for these pretty carabids was auspicious. *Phloeoxena* is a composite of two Greek words meaning "bark guest", because all of the species live under loose bark. I think that *signata*, at least in Virginia, may be partial to the bark of standing trees, because I have peeled bark from fallen trunks for decades, looking for aradid bugs, without ever finding a *Phloeoxena*.

Ball (1975: 218-220) analyzed geographic variation in the coloration of *signata*. Curiously, the elytral pattern of the two Virginia specimens (see figure) are somewhat more similar to those depicted by Ball (Fig. 111) from Oaxaca than from North Carolina. Dr. Ball already remarked "The most interesting aspect of the color pattern is its change in detail." But so long as most of the few known localities for the species are represented by one or a few specimens only, the extent of local variation remains largely unknown, rendering speculation futile.

Search through the NCSU collection was facilitated by Robert L. Blinn, collections manager. Prof. George E. Ball reviewed an early draft of the manuscript.

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Miscellanea

Book Review

A Field Guide to the Life and Times of Roger Conant. By Roger Conant. SELVA, an imprint of Canyonlands Publishing Group, PO Box 1957, Sandy, Utah 84091-1957. xix + 498 pages. 1997. \$49.95 postpaid.

This is a monumental autobiography by a man who exerted great influence in natural science and education in the 20th century. Roger Conant, now 88 years of age, has had two careers, zoo biology and academic/field herpetology, and he excelled in both. This 8½ by 11 inch book has 64 chapters spanning the period of about 1909 to the present, four essays, 18 short anecdotes (stories), vignettes of 20 well known herpetologists and 15 zoo personalities, and 31 color and 155 black and white photographs. The stories in this book are an impressive collection of behind-the-scenes tales of a professional scholar, curator, administrator, and adventurer. Roger's fluid writing style and his impeccable attention to detail make these stories entertaining as well as informative. I cannot begin to describe all the stories and exciting adventures that fill this book. I will, however, describe some aspects of the book, and tell a couple of stories of my own that I hope will inspire readers of this journal to pick up their own copy. They, like me, will have a difficult time putting it down.

I first met Roger Conant at a scientific meeting in 1982. However, it was not until the fall of 1989 that my wife, Wendy, and I became friends with Roger and his wife, Kathryn. We were in Canterbury, England, participating in the First World Congress of Herpetology. We had a day off during the meeting and Wendy and I decided that we would take the bus trip to Paris. We boarded the bus at 0530 and headed off to Dover where we took a ferry, bus and all, across the English Channel to Normandy. From there we blitzed to Paris in the rain, having only about three hours for the actual tour. We were able to get off the bus only at the Eiffel Tower and Notre Dame. Somewhere in those hours we had long conversations with Roger and Kathryn and by the time we were on the evening ferry heading back to Canterbury we had all become fast friends. That trip gained the reputation as the most grueling field trip of the conference and those of us who took it retain fond memories. Roger was 80 when he made that long bus trip and it reflected his never-failing love of adventure. This book is about many of

those adventures over a long, illustrative, and productive lifetime.

Roger was born in 1909 and lived most of his youth in New Jersey. After graduating from high school at 16, he obtained a part-time job at a private zoo. There he got hooked on the zoo field while learning how to handle a wide array of animals. His primary career was in the zoo field, spending 6 years at the Toledo Zoo and the remainder of his career at the Philadelphia Zoo (1935-1973). He got the job with references from Marlin Perkins, of Wild Kingdom fame. At Philadelphia he served as curator of reptiles, chief of public relations who gave weekly radio programs to the public about the zoo and its animals for 33 years, and ultimately served as the Director.

Roger's zoo career was only the backdrop for his other major accomplishments and interests. These include the first scholarly treatise on the reptiles of a single state (Ohio), numerous papers on the systematics of North American watersnakes, development and production of three editions of the most widely read herpetology book in the world (the field guide to eastern amphibians and reptiles in the Peterson Field Guide series), and completion with his long-time friend Howard Gloyd (and the assistance of his wife Kathryn) of a world-class treatment of the snake genus *Agkistrodon* published in 1990. He conducted extensive field work in the New Jersey Pine Barrens where he lived much of his adult life, in Delmarva, Big Bend Texas, and several parts of Mexico. His wife, Isabelle Hunt Conant, who illustrated the field guides, died in 1975, a loss that is lamented over and over in this book. Roger visited Gloyd soon thereafter and learned of his terminal illness. After his death, Roger married Gloyd's wife Kathryn. They have been companions ever since, traveling all over the world in pursuit of information and specimens for the *Agkistrodon* book.

The Gloyds lived in Tucson, Arizona, and Kathryn continues to maintain a condominium there. In early 1992, I was involved in discussions to move the Gloyd library, then housed in their condo, to a university where it would be used by the scientific community. In January of that year, I flew to Albuquerque, New Mexico, where Roger lives, and he drove us in his Volkswagen van to Tucson, stopping overnight in Deming. Along the way I heard some of his adventure stories. We packed up the library amid many memories and lots more stories and on 5-6 January I drove a rental truck to Texas, where Gloyd's collection of

books, reprints, and snake data now form the nucleus of a herpetological research library at the University of Texas at Arlington. I got to know Roger on that trip and learned of his efforts to publish this autobiography.

This book is actually several books in one. It is a history of the zoo business, it is a review of herpetology as it developed in this century, it is a series of adventure stories to exotic places, and it is a love story. Many people, many of whom contributed to the zoo world and scientific community in their own right, crossed Conant's path. All of them are mentioned. The ones no longer with us are captured in the one- to three-page vignettes. These alone offer insights into the world of herpetology and zoos in times past.

The stories are brought to life by Roger's clear prose and descriptions of events, animals, and people. Roger is an excellent writer and editor. I know about the latter because I have felt the other end of his editorial pen. There are too many delightful, funny, seriously scientific, and sad stories to relay here. Chapters at the end cover Roger's concern about the changing environment and the changes in the herpetological and zoo worlds. He clearly laments the loss of habitat and wildlife he has witnessed in his lifetime. He blames most of it on human GREED and BREED, the title to a near final chapter. He believes strongly that many of society's ills are due to overpopulation and bases his conclusions on an experiment with mice in a cage left to their own reproductive madness. But most of all, he misses his wife with whom he spent most of his life, and he is happy that he was able to see and do so many things. His concluding chapter suggests that he will retire from it all but in the end, he notes, "Oh, what the hell. I can't just loaf. I've still too many things to do. How many frequent flier miles do Kathryn and I still have available?" I fully expect that Roger will continue to make contributions to herpetology in the coming years and travel to more exotic places. His biography is far from being complete.

Two sections of the book may be of special interest to Virginians, the herpetological surveys of Delmarva and the struggles to pull together the field guide. Roger started his investigation of Delmarva herps in 1938. He spent most of his field time in Delaware and parts of northern Maryland but he explored the Virginia barrier islands in 1947, 1948, and again in 1975. Roger and his wife visited Hog, Parramore, Revel, and Smith islands, the former two twice. Their second visit was only two weeks after a hurricane struck on October 5, 1947 that completely inundated Hog Island's freshwater habitats. There are three chapters under the title of "Attempting the Impossible" that describe the difficulties and

adventures Roger and Isabelle endured during preparation of the first herp field guide for the Peterson series. Accurate color photography was not available in the early 1950s and the Conants had to rely on other methods. All the illustrations in the published plates are of animals in natural poses arranged by Roger and photographed in black and white and hand colored by Isabelle. Most of the stories about the field guide are about seeking photographs and information on all the amphibians and reptiles of eastern North America. The first edition appeared in 1958. The second, which appeared in 1975, expanded its coverage westward to cover the gap created by the western field guide that did not include Big Bend, Texas. Two additional chapters on herping in Big Bend and three on the New Jersey Pine Barrens add more stories related to the field guides.

I could go on for pages about the contents of this book but I guess I should say some things about the book itself. It is a big book with nearly 500 pages. The paper is a little thin and I understand it had to be printed off rolls to cut down cost, rather than from single sheets, some 30 pages at a time. The result of that is that some of the pages are slightly crinkled. The two-column layout and the font size makes it easy to read. I found only a couple of typographical mistakes and no obvious errors in photograph captions or layout. There is no bibliography and no index. The price is quite reasonable, especially for today's books of this size.

If you want to delve into how field herpetology and zoo biology were conducted over the past eight decades, if you want to read adventure and travel stories, or if you simply want to read a well-written book, then buy this one. You do not have to be a herpetologist to enjoy it. I obviously have a personal interest in this book and its contents, but I recommend it highly because it really is a good book.

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Reports

1. Fourth Annual Meeting of the Virginia Natural History Society

The annual meeting of the VNHS was held on 22 May 1997, VPI&SU, Blacksburg, VA, in conjunction with the Virginia Academy of Science in the Natural

History and Biodiversity Section. The following papers were presented:

Aquatic studies by the Governor's School at Dabney S. Lancaster Community College: 1994-1996. H.S. Adams, E.J. DeGroot, S.K. Evans, S.W. Hiner, and W. VanWart.

Effects of environmental changes on freshwater mussels in southwestern Virginia. B.B. Beaty and R.J. Neves.

Foraging ecology of the Madagascar fish-eagle, *Haliaeetus vociferoides*. J. Berkleman and J.D. Fraser.

Seasonal activity and movement patterns by bog turtles, *Clemmys muhlenbergii*, in southwestern VA. S.L. Carter, C.A. Haas, and J.C. Mitchell.

Tail lability in the smoky shrew (*Sorex fumeus*). J.D. Ferguson and J.F. Pagels.

Bird artists in Virginia's history. D.W. Johnston.

Establishment and phenology of *Galerucella californiensis* (L.) and *G. pusilla* (Duft.), Coleoptera: Chrysomelidae: biological control agents of purple loosestrife, *Lythrum salicaria* L. (Lythraceae) in southwest Virginia. T.J. McAvoy and L.T. Kok.

Waterfowl use of natural seasonal ponds in York County, Virginia, during a "wet" year. T.J. Rawinski.

Effects of prolonged flooding on the herbaceous flora of natural seasonal ponds in York County, Virginia. T.J. Rawinski.

The piney woods of Virginia: a vision for a self-sustaining biopreserve. P. Sheridan and B. Scholl.

Status, ecology, and conservation of the nilgiri tahr in the Mukurthi National Park, India. S. Sumithran and J.D. Fraser.

Life history characteristics of two federally endangered freshwater mussels (Family Unionidae). B.T. Watson and R.J. Neves.

2. Report of the Secretary/Treasurer

The membership of the VNHS is an interesting thing. In 1996, we had 146 members, including

institutions. As of October 1997, we have 142 members, including institutions. What happened? We have 21 new members in 1997, but some of our 1996 members did not renew! What we need to do is work on keeping our members, and you can help by talking to your colleagues and friends interested in the natural history of our state. Tell them that together we can achieve the goals of our Society, and that **Banisteria** is an interesting and useful journal for people with a more than passing interest in natural history.

We have continued to send out the spring issue to all those who were members in the previous year with a reminder notice, whether they have renewed or not. This has worked fairly well, but as you can see from our numbers above, we are still losing some members. With this issue, you should receive a notice about 1998 membership and an envelope in which to include the renewal form and dues. Please send your 1998 membership renewal soon. Feel free to copy the membership notice and pass it to your friends so that next year we will show a definite increase in membership. If each member gets one new membership this year, then we will be in great shape.

Our balance in the treasury as of 1 October 1997 was \$5,709.62. We will use about a fifth of this to pay for this one issue of **Banisteria**.

Respectfully submitted,
Anne Lund
Secretary/Treasurer

3. Report of the Editors

Neither of the co-editors was able to be present at the meeting in May. Although we were unable to do it in person, we still need to pressure our colleagues and VNHS members to generate enough manuscripts to fill each issue of **Banisteria**. We have just enough papers to make a relatively thin issue for the Fall of 1997 (Number 10) but are hopeful that commitments are kept so that we have a surplus for Spring 1998 (Number 11).

All recent issues have been produced with the able assistance of Carl Hoffman on his home computer. We have experienced no major difficulties (although several smaller ones always seem to surface) and continue to enjoy editing and producing this journal.

Respectfully submitted,
Joseph C. Mitchell and Richard L. Hoffman
Co-editors

Announcements

1. Forthcoming meetings

Association of Southeastern Biologists - 15-18 April 1998. Contact: Kim Tolson, Department of Biology, Northeast Louisiana University, Monroe, LA 71209, (318-342-1805), bitolson@alpha.nlu.edu.

VNHS - to be announced.

2. Mark Catesby's Original Natural History Paintings in Virginia

An exhibition of 52 of Mark Catesby's original watercolor paintings is coming to the DeWitt Wallace Gallery in Williamsburg, Virginia, from 20 November 1997 through 16 February 1998. These original Catesby hand-colored illustrations are on loan from Windsor Castle. They are considered the first truly great illustrations of the natural history of the New World, and were the first to consider these animals in their natural settings. These paintings appeared in his several volume series "The Natural History of Carolina, Florida, and the Bahama Islands." The paintings are acclaimed for being not only scientifically accurate but with images that are "surprisingly playful, with delightful bits of unexpected whimsy." Some of the species depicted are extinct today. This is the first time they have been displayed in the United States. This may be a once-in-a-lifetime opportunity to see these historical paintings. A well-written, very well-illustrated book based on this exhibition is available.

3. Forthcoming Symposia

The George Washington and Jefferson National Forest (now combined administratively) is planning to organize a one-day symposium on the history, physical environment, and natural history of the Big Levels sinkhole pond area of Augusta County. This area is rich in human and natural history and has been the target of numerous biotic investigations. The area is well known for its northern and Coastal Plain disjunct populations and for several unique species. Dr. Daniel Downey will host the meeting at James Madison University, Harrisonburg, VA. The date has not yet been determined, but is planned for 1998. Plans include the publication of the papers given at this symposium in an issue of **Banisteria**. For additional information, contact Dr. Joseph C. Mitchell (Co-editor).

4. Congratulations

The members of the VNHS extend their congratulations to two of our fellow members for their recent awards by The Southern Appalachian Botanical Society.

Donna M. E. Ware, curator of the herbarium at the College of William and Mary, received the 1997 Elizabeth Ann Bartholomew Award for her distinguished service to the discipline of botany and the Southern Appalachian Botanical Society. She was President of that society for 1988-1989 and served in a variety of other capacities.

Thomas F. Wiebolt, Curator of the Herbarium at Virginia Tech, along with co-authors Daniel F. Brunton and Donald M. Britton, received the 1997 Richard and Minnie Windler Award for the best systematic botany paper published in the society's journal during the preceding year. Their paper was "Taxonomy, identity, and status of *Isoetes virginica* (Isoetaceae)" and appeared in *Castanea* 61(2):145-160.

5. New section forthcoming in *Banisteria*

One of the original intentions in the design of **Banisteria** was to add an historical dimension to our knowledge of natural history on Virginia. We have accomplished that with the publication of several articles in previous numbers; future articles are planned. However, one aspect of our history not well explored and, indeed, one found almost entirely only in obituaries, is biographies of persons who paved the way for us. Thus, in **Banisteria** number 11, we will begin the publication of a new section entitled "Natural History Biographies." This section will include biographical sketches, vignettes, personal recollections, and full-length papers. Such articles may include black and white photographs, descriptions of his or her contributions to the natural history of Virginia, unpublished information or observations, and bibliographies (annotated or not). There is no minimum or maximum length requirement (although we do not want a book), but the article should improve our understanding of the contributions made by that person. All such manuscripts should be submitted to the co-editor, Joseph C. Mitchell, Department of Biology, University of Richmond, Richmond, VA 23173; queries: phone/FAX 804-740-7086, e-mail jmitchel@richmond.edu.

Instructions for Contributors

Banisteria accepts manuscripts of one to several pages in length that contribute to the public and scientific knowledge of the natural history of Virginia. This publication is intended to be an outlet for the kind of information that is useful but would not be accepted in the mainstream journals. Information found in field notebooks and files that never made it into scientific journals is especially important. **Banisteria's** focus is classical and therefore slanted toward organismal biology.

Manuscripts should be sent in duplicate to one of the Co-editors, who will assign them to an appropriate section editor, who in turn will seek one or sometimes two reviews. Reviews of manuscripts written by a section editor will be handled by a different editor. Authors should retain both the original typescript and figures until final acceptance for publication. Photocopies are adequate for review purposes.

Manuscripts must be written on one side of standard size paper (21.5 x 28 cm) using double spacing throughout. Words should not be hyphenated. Use single spacing between sentences.

Manuscripts should be arranged in the following order: **title, author's name, author's address, text, acknowledgments, literature cited, tables, figure legends, figures.** Long manuscripts should have standard sections, e.g., Materials and Methods, Results, and Discussion. Short manuscripts (<4-6 pages) should not have these sections. All pages should be numbered, including tables. The title should be concise but informative. It, and the author's name and address should be centered at the top of the first page. The text should begin on the first page beneath the author's address. Use good judgment on arrangement of sections when other than the standard approach is necessary. Use underlines for species' scientific names.

References: Use the following as a guide. Spell out journal names in full.

Journal article with 1 author:

Scott, D. 1986. Notes on the eastern hognose snake, *Heterodon platyrhinos* Latreille (Squamata: Colubridae), in a Virginia barrier island. *Brimleyana* 12: 51-55.

Journal with 2 authors:

Tilley, S. C., & D. W. Tinkle. 1968. A reinterpretation of the reproductive cycle and demography of the salamander *Desmognathus ochrophaeus*. *Copeia* 1968: 299-303.

Journal with 3+ authors:

Funderburg, J. B., P. Hertz, & W. M. Kerfoot. 1974. A

range extension for the carpenter frog, *Rana virgatipes* Cope, in the Chesapeake Bay region. *Bulletin Maryland Herpetological Society* 10:77-79.

Book:

Harris, L. D. 1984. *The Fragmented Forest*. University of Chicago Press, Chicago, Illinois. 211 pp.

Chapter in a book:

Gentry, A. H. 1986. Endemism in tropical versus temperate plant communities. Pp. 153-181, *in*: M. Soule (ed.), *Conservation Biology*. Sinauer Associates, Inc., Sunderland, Massachusetts.

Report:

The Nature Conservancy. 1975. *The preservation of natural diversity: A survey and recommendations*. Report to the U.S. Dept. of Interior, Washington, D.C., 189 pp. (include report series and number if present).

Tables: Each table should be typed on a separate sheet of paper. A legend for each table should follow the number and must be on the same page as the table. Ruled, horizontal lines should be avoided except at the top and bottom of the table.

Figures: Black and white line drawings are acceptable for publication. They should be less than 21.5 x 28 cm in size. The back of each figure should be labeled with the author's name.

Photographs: **Banisteria** will accept high contrast black and white photographs. Submit at least 5x7 inch photos and mount them if possible.

Abbreviations: The following common abbreviations are accepted in **Banisteria**: n (sample size), no. (number), SVL (snout-vent length; define on first usage); yr (years), mo (months), wk (weeks), h (hours), min (minutes), s (seconds), P (probability), df (degrees of freedom), SD and SE (standard deviation and standard error), ns (not significant), l (liter), g (gram), mm (millimeter), and C (degrees Celsius). Do not abbreviate "male" and "female", or dates, or undefined terms.

Electronic transfer of manuscripts: Once a manuscript has been accepted for publication, one paper copy and an electronic copy on a 3.5" diskette should be sent to R.L. Hoffman at the Virginia Museum of Natural History. If possible, use IBM-compatible systems with Word Perfect or Microsoft Word.

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Muscipula Regia, f.
Sychnis viscosa flore
amplo coccineo.

