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New land snail (Gastropoda: Pulmonata) distribution records for New York state

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ABSTRACT.—Recent land snail inventories in New York State have led to the discovery of new state geographic distribution records for seven species: *Carychium nannodes* Clapp, 1905; *Gastrocopta procera* (Gould, 1840); *Lucilla scintilla* (R.T. Lowe, 1852); *Striatura meridionalis* (Pilsbry and Ferriss, 1906); *Trochulus hispida* (Linnaeus, 1758); *Vertigo cristata* Sterki, 1919; and *Vertigo paradoxa* Sterki, 1900. Most are native species of eastern North America, although *T. hispida* is introduced from Europe. These species were found mainly by field searches in a variety of habitats – roadsides, fields, forested rock talus and limestone outcrops, and coastal freshwater wetlands - but in one case through verification of specimens at the New York State Museum.

Key words: land snail, New York, *Carychium nannodes*, *Gastrocopta procera*, *Lucilla scintilla*, *Striatura meridionalis*, *Trochulus hispidus*, *Vertigo cristata*, *Vertigo paradoxa*.

INTRODUCTION

Terrestrial mollusks occur globally and are widespread in eastern North America, where there are more than 500 native species (Hubricht, 1985). These land snails are usually ubiquitous and abundant; they are indicators of site conditions (e.g. Nekola, 2003; Martin and Sommer, 2004; Yanai et al., 2005); and they play important ecosystem roles such as hosting mammalian parasites (e.g. Bird and Garvon, 2005) and cycling calcium (e.g. Graveland et al., 1994; Pabian and Brittingham, 2008).Understanding their specific geographic distributions is thus useful.

The physiography of New York State varies widely. At 141,090 square kilometers it includes Atlantic coastal lowlands, Great Lakes and St. Lawrence River Valley plains, Tug Hill and Appalachian Plateaus, Catskill Mountain peaks, and central Adirondack Mountain highlands. State elevations range from sea level in Long Island to Mt. Marcy at 1,629 m asl, and major watersheds drain north to the Great Lakes and St. Lawrence River or east to the Atlantic via the Hudson and Delaware Rivers, with a small portion of the southwest in the Ohio River drainage. New York's climate is temperate, with average precipitation ranging up to 152 cm per year on the Tug Hill Plateau and highlands of the Adirondack and Catskill Mountains. Ecological communities in New York include marine, estuarine, riverine, lacustrine, palustrine, subterranean, and terrestrial groupings (Reschke, 1990), with land snails in the latter four categories.

New York State has a long history of land snail collecting by amateur and professional malacologists. Land snail inventory work began in the middle of the 19th Century and has been widespread, though patchy, since that time. Published accounts are from the areas in and around Long Island and New York City (Hubbard and Smith, 1865; Flipse, 1948; Bretet and Carswell, 1952; Jacobson and Emerson, 1961), the Capital District (Aldrich, 1869; Ingram, 1946; Muchmore, 1959), southern Adirondacks (Lewis, 1872; Jacobson, 1945), the Mohawk Valley (Lewis, 1860; Lewis, 1872; Blakeslee, 1947), Finger Lakes (Walton, 1891; Banks, 1892), and western New York (Baker, 1897; Letson, 1909; Pinney and Coker, 1934; Robertson and Blakeslee, 1948; Teskey, 1952). More recent taxonomic research has included some New York sites (Hoagland and Davis, 1987; Emberton, 1988). In addition to literature reports, there are many land snail specimens from New

York State in museum collections in Northeastern North America. Review of the published works suggests that the best-collected regions are counties near New York City, the Capitol District and Buffalo, and along the Erie Canal-Mohawk River corridor, each of which typically has more than 60 reported species. However, the apparent absence of many widespread species in some counties (see e.g. Letson, 1905; Wurzinger, 1975; Hubricht, 1985), clearly suggests that parts of New York are not thoroughly explored. Such under-collected areas include rural central-western counties, St. Lawrence Valley, Catskill Mountains, Adirondack Mountains, and Tug Hill Plateau.

Since 1997 we and other volunteers, expert amateurs, and professionals have been collecting land snails in New York through various projects and forays, but not as part of a coordinated effort. In this paper we report seven species found in New York State that have not previously been mentioned in the literature, nor, excepting one, found in specimen records of nine regional public malacology collections.

METHODS

Recent land snail inventory in New York State has been conducted by the authors and by several others, both casually and as part of formal studies. Systematic field collections were: inventory of various habitats ranging from Niagara Falls to Whitehall and base-poor coastal plain sites on Long Island by J.C. Nekola from 1997-2004; inventory of a dozen selected rock talus sites around the state by K.P. Hotopp and T.A. Pearce in 2004; and an inventory of selected fens in the Harlem Valley by K. Schmidt in 2005-2008. Collection techniques varied widely depending upon the collector or project, but included visual searches and leaf litter sieving. To determine whether species represented a new collection for New York State, occurrences were compared to published species lists in the citations above and to a database of approximately 5,600 specimen records compiled from nine regional museums: Academy of Natural Sciences of Philadelphia; American Museum of Natural History, New York; Buffalo Museum of Science, Buffalo; Carnegie Museum of Natural History (CM), Pittsburgh; Delaware Museum of Natural History, Wilmington; Field Museum of Natural History (FMNH), Chicago; Museum of Comparative Zoology, Cambridge; National Museum of Natural History (NYSM), Washington, D.C.; and the New York State Museum, Albany. The museum specimen records were compiled from a variety of source material, including specimen labels, paper records, digital records, and an online database. Specimen records at the New York State Museum were verified by K.P. Hotopp in 2004.

RESULTS

Seven land snail species not reported in the literature for New York State have been recently discovered. They are distributed across the state in 13 counties (Figure 1), reported below alphabetically by generic name:

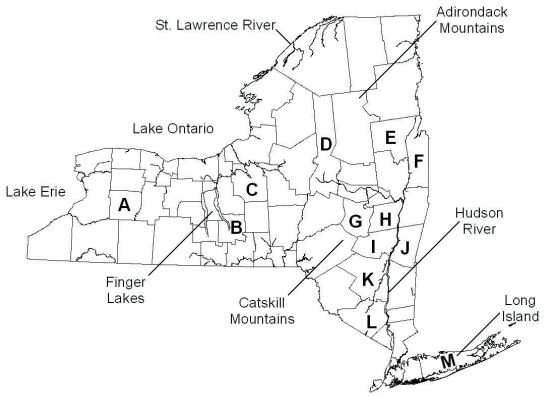

Fig. 1. New York State geographic records of land snails by county occurrence: A, Wyoming (*Lucilla scintilla*); B, Tompkins (*Trochulus hispida*); C, Onondaga (*Striatura meridionalis*, *Vertigo paradoxa*); D, Herkimer (*Vertigo cristata*); E, Warren (*Vertigo cristata*); F, Washington (*Lucilla scintilla*, *Vertigo cristata*, *V. paradoxa*); G, Schoharie (*Trochulus hispidus*); H, Albany (*Carychium nannodes*); I, Greene (*Gastrocopta procera*); J, Columbia (*Lucilla scintilla*); K, Ulster (*Lucilla scintilla*); L, Orange (*Vertigo cristata*); M, Suffolk (*Gastrocopta procera*, *Striatura meridionalis*). Map by James T. List.

***Carychium nannodes* Clapp, 1905**

CM76990, CM77005, CM77027, Albany County, John Boyd Thacher State Park, hardwood forest rocky slope below the Helderberg Limestone escarpment, K.P. Hotopp and K.R. Hotopp, May 2004.

Remarks.—On this north-facing slope *C. nannodes* occurs with *Carychium exile* Lea, 1842 and *Carychium exiguum* (Say, 1822) as well as several other calciphilic micro-snails.

***Gastrocopta procera* (Gould, 1840) (Figure 2)**

CM69740, Greene County, Catskill, foot of a limestone road cut along Rt. 23, K. Schmidt November 2002 and June 2004.

NYSM28497, Suffolk County, Sag Harbor, R.C. Latham, *circa* 1940. Originally identified as *Gastrocopta corticaria*, re-identified as *G. procera*, K.P. Hotopp.

Lucilla scintilla (R.T. Lowe, 1852)

K. Schmidt personal collection, Columbia County, Greenport, quarry cliff, K. Schmidt, June 2003.

CM76669 Wyoming County, Letchworth State Park, leaf litter on steep, rocky, rich wooded slopes dominated by *Acer saccharum*, T.A. Pearce and A.W. Doolittle, June 2004.

CM77092, CM77108, Washington County, Warner Hill, The Nature Conservancy preserve, rocky, northwest-facing, mixed forest slopes, K.P. Hotopp and K.R. Hotopp, June 2004.

K. Schmidt personal collection, Ulster County, near Kingston, road cut, K. Schmidt, July 2006.

***Striatura meridionalis* (Pilsbry and Ferriss, 1906)**

CM105367, Suffolk County, margin of Calverton Pond, acid coastal plain vegetation dominated by *Smilacina rotundifolia* and *Clethra alnifolia*, J.C. Nekola, August, 2004.

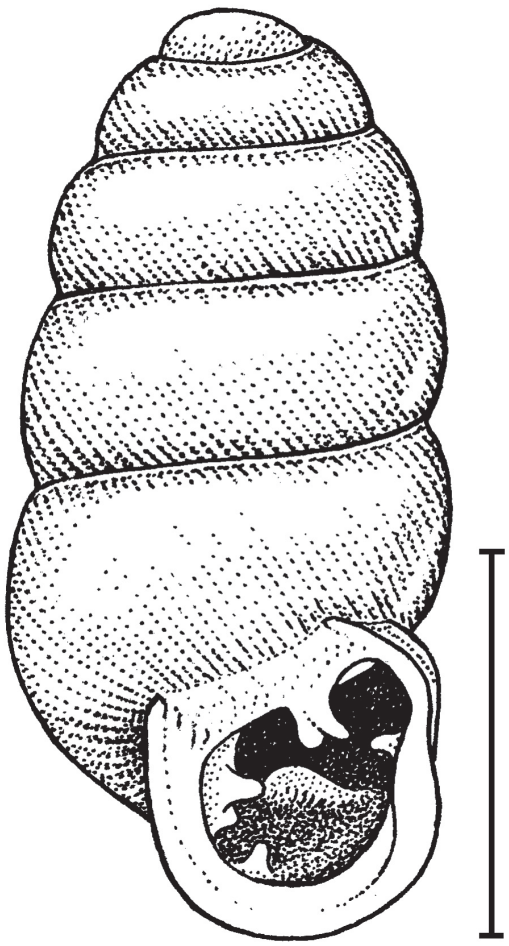

Fig. 2. *Gastrocopta procera* based upon New York specimens, by Kathleen Schmidt ©. Scale bar = 1mm.

CM100656, Onondaga County, Clark Reservation State Park, forest with *Acer* spp., *Quercus* spp. and *Thuja occidentalis*, M. Cornell, May, 2009, identified by T.A. Pearce.

***Trochulus hispidus* (Linnaeus, 1758)**

FMNH78676, FMNH267850, Schoharie County, roadside 1.4 miles south of Sharon, L. Hubricht, February 1958.

FMNH267849, Schoharie County, wooded hillside 3.4 miles northwest of Richmondville, L. Hubricht, May 1981.

K.P. Hotopp personal collection, Schoharie County, Howes Cave, Myers Rd., old field and roadside ditch, K.R. Hotopp and B. Winslow, April 2004.

CM70366, Tompkins County, 2km south of Ithaca, under wood debris near a small pond at an inn, H.G. Lee, November 2004.

CM100190, Tompkins County, Taughannock Falls State Park, 350m southwest of the falls, grass and shrub roadside, T.A. Pearce, K. Schmidt, R.W. Taylor, and J. Cordeiro, July 2009.

Remarks.—At the latter three sites this introduced European species has been found in anthropogenic early-seral habitats dominated by non-native vegetation.

***Vertigo cristata* Sterki, 1919**

J.C. Nekola personal collection, Washington County, Warner Hill, The Nature Conservancy preserve, J.C. Nekola, July 2002.

CM76374, CM76402, Orange County, Black Rock Forest, T.A. Pearce and A.W. Doolittle, May 2004.

CM76476, CM76543, CM76561, CM76578, Warren County, Bloomer Mt. and Deer Leap, forested rock outcrops and talus, K.P. Hotopp and K.R. Hotopp, June 2004

CM76780, Herkimer County, Moss Lake Mt., lower talus slope dominated by *Picea rubens* and *Betula allegheniensis*, K.P. Hotopp and K.R. Hotopp, June 2004.

Remarks.—At each occurrence this species has been found at cool, forested, bedrock outcrop talus features.

***Vertigo paradoxa* Sterki, 1900**

J.C. Nekola personal collection, Washington County, Warner Hill, The Nature Conservancy preserve, J.C. Nekola, July 2002.

CM77073, CM77084, Washington County, Warner Hill, The Nature Conservancy preserve, K.P. Hotopp and K.R. Hotopp, June, 2004.

CM105368, Onondaga County, Syracuse, Clark Reservation, J.C. Nekola, March, 2007.

J.C. Nekola personal collection, Onondaga County, Syracuse, State University of New York, College of Environmental Science and Forestry South campus, crevice in limestone pavement near a parking lot, J.C. Nekola, March, 2007.

Remarks.—This species has been found at cool, moist, north-facing limestone cliffs dominated by *Thuja occidentalis*, excepting the last site, which was a limestone pavement with a single *T. occidentalis*.

DISCUSSION

While *Carychium nannodes* is apparently frequent in the southern Appalachians, Cumberland and Allegheny plateaus, it is known only from widely scattered locations north of Maryland, with the most northern populations occurring along the Niagara Escarpment in southern Ontario (Oughton, 1948; McMillan et al., 2003). Further inventory of mesic limestone bedrock outcrops may discover more occurrences.

Gastrocopta procera ranges throughout the southeastern USA north to SW South Dakota, west-central Wisconsin, and northern Ohio east (Nekola and Coles, 2010). The New York sites reported here are at the northeastern limit for this calciphile.

Lucilla scintilla is the senior synonym for what has been previously reported in North America as *Lucilla inermis* (Falkner et al., 2002; Horsák et al. 2009). This taxon is widespread in the Eastern United States, occurring south to Florida, and west to Michigan and Texas (Hubricht, 1985). The *Lucilla scintilla* populations in New York, along with those in adjacent Ontario (Nekola, 2009) represent the known northeastern range limit for this species.

We have used the generic name *Lucilla* (Lowe, 1872) following Bank et al. (2001), Roth and Sadeghian (2003), and others. These taxa were formerly classified in the subgenus *Hebetodiscus* H.B. Baker, 1929 in the genus *Helicodiscus* Morse, 1864, but *Hebetodiscus* was elevated to full genus by Bequaert and Miller (1973) who noted that it lacks the spiral lirae and internal teeth that are present on the shells of *Helicodiscus* s.s. However, this description is inaccurate as some species in this putative genus (*H. barri*, *H. punctatellus*) do bear spiral epidermal sculpture though not the calcareous lirae of *Helicodiscus* s.s. (Hubricht, 1985). Others (*H. tridens*, *H. roundyi*) also possess internal lamellae (Slapcinsky and Coles, 2004). The existence of these forms would appear to indicate the need for revision of the Helicodiscidae. Falkner et al. (2002: 118) discussed the synonymy, concluding that *Hebetodiscus* is a junior synonym of *Lucilla*.

Striatura meridionalis ranges from southern Lake Michigan and the Ohio River valley to the Gulf Coast, central Missouri to SE Kansas, eastern Oklahoma, and across the Rockies from southern Colorado to northern Arizona. Recent finds in New York are a new northeastern range limit for this species.

Although the European snail *Trochulus hispidus* has been discovered by several people in agricultural areas in the central-interior of New York State, it does not appear in previously published accounts. New York specimen records are among those collections by L. Hubricht for the Field Museum of Natural History dating back to 1958. Its introduction to New York may date much earlier to the establishment of European-style agriculture in the region. It is reported from eastern Canada, northern and coastal Maine, and Martha's Vineyard in Massachusetts (Pilsbry, 1939; Nekola, 2008).

The North American native *Vertigo cristata* has been found at cool, forested bedrock outcrops at each New York site. It is distributed throughout taiga and mixed forests from western Ontario and northwestern Minnesota east to Newfoundland and Massachusetts and south to Wisconsin and West Virginia (Nekola and Coles, 2010). In addition to the discoveries in New York, this species has been found at a west-facing talus slope with cold-air drainage in the eastern panhandle of West Virginia (K.P. Hotopp, unpublished data), and may occur at other cold and acidic forest or peatland sites in nearby states.

In New York, *Vertigo paradoxa* has generally been found on cool, moist, north-facing limestone cliffs dominated by *T. occidentalis*. These *V. paradoxa* populations represent the southern range limit for the species, which extends from western Newfoundland and the northern shore of the St. Lawrence in eastern Quebec to northeastern Wisconsin, northern Minnesota, central Manitoba and interior Alaska (Nekola and Coles, 2010). Although typically treated as a full species (Hubricht, 1985), recent conchological (Nekola and Coles, 2010) and DNA sequence (Nekola et al., 2009) data demonstrate that this taxon is conspecific with *Vertigo arthuri* (von Martens, 1884) and *Vertigo hubrichti* (Pilsbry, 1934). At some eastern Ontario alvar sites, all three may be found co-occurring along with all possible intergradations (Nekola, 2009). As a result, it may be best to consider *Vertigo paradoxa* a simple conchological form of *Vertigo arthuri* (Nekola and Coles, 2010).

For the newfound species collectively, six of the seven possess adult shells smaller than 3mm at their greatest dimension, with the lone larger species representing a European introduction. This bias toward smaller sizes suggests that distributions of the smaller land snails are not as well-known as those for larger snails. This difference may be due in part to greater species richness at smaller sizes, along with challenges in detecting and collecting

tiny snails, especially rare taxa. Of the six small native snails, four species are at or near their northeastern limit (*C. nannodes*, *G. procera*, *L. scintilla*, *S. meridionalis*), and two are at or near their southeastern limit (*V. cristata*, *V. paradoxa*).

An expanding network of field sites is rapidly improving our understanding of the biogeography of New York State's terrestrial mollusks. The reports here indicate that even in a region considered to be well documented, there can remain much to be done, both in terms of collecting unexplored habitats and studying museum specimens. Further inventory is expected to reveal more populations of these newfound species in New York. Some species are likely to be widespread and abundant, such as the introduced *T. hispidus*, which is associated with common agrarian habitats found throughout the rural central counties. Others may remain uncommon, such as *V. paradoxa*, which is restricted to cool carbonate cliffs with *T. occidentalis*. None of the newly-found taxa are globally rare, and further work will be needed to determine if some may be vulnerable to local disturbances or wider impacts such as global climate change.

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