

# INTRODUCTION OF THE MILLIPED, *CLEIDOGONA NANTAHALA* SHEAR, IN NEW ENGLAND, U.S.A. (DIPLOPODA, CHORDEUMATIDA, CLEIDOGONIDAE)<sup>1</sup>

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ABSTRACT: The milliped *Cleidogona nantahala* Shear, 1972, is recorded from the New England states of Connecticut and Rhode Island, around 700 mi (1,120 km) northeast of its native area in western North Carolina. This is the third record of a species of *Cleidogona* from glaciated territory in eastern North America, and it is also the first documented case of a native diplopod's being transported by human agency to another part of the continent and becoming established there. The species is believed to have been transported to New England after 1950 in association with rhododendrons and other Appalachian plants, and with 50 mi (80 km) between the Rhode Island and Connecticut sites, two introductions may have occurred.

KEY WORDS: *Cleidogona nantahala*, New England, U.S.A., Diplopoda, Chordeumatida, Cleidogonidae

The milliped fauna of the northeastern United States and eastern Canada is depauperate compared to that farther south (Shelley 1988). As an arbitrary southern limit, if one extends the Mason-Dixon line (the boundary between Pennsylvania and Maryland) and the Ohio river through central Indiana and Illinois, only 61 species of Diplopoda occur to the north (based on entries in Hoffman (1999a), 20 of which are known or suspected to be native European species that were introduced into North America through human agency. Forty-six of the 61 species, including all 20 aliens, inhabit formerly glaciated territory, so only 26 indigenous millipeds have invaded this area from refugia to the south (Shelley 2002a). Only one species, *Conotyia fischeri* Cook and Collins, 1895 (Chordeumatida: Conotylidae), appears to be endemic to glaciated regions, as it is known only from northern and western New York, where it ranges from Lake Ontario and the St. Lawrence River to the Adirondacks and the Finger Lakes area (Shear 1971, Shelley 1988, Hoffman 1999a).

Our knowledge of milliped distributions in North America, even in an area as well collected as this glaciated northeastern region, is still incomplete. However, no new taxa have been discovered there since the description of *Okeanobates americanus* Enghoff, 1979 (Julida: Okeanobatidae). Prior to this, the last ones were *Aniulus paludicolens* Causey, 1967, *Uroblaniulus stolidus* Causey, 1953, and *U. jerseyi* (Causey, 1950), all representatives of the Parajulidae (Julida). Shelley (2001) considered *A. paludicolens* to be a valid species, but the last two are of dubious validity and await a generic revision. Therefore, the discovery of an unreported, indigenous milliped from the northeast is of considerable interest.

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While examining the milliped collection from the Peabody Museum of Natural History, Yale University, New Haven, Connecticut (PMNH), one of us (RMS) discovered samples of a species of *Cleidogona* (Chordeumatida, Cleidogonidae) from Connecticut and Rhode Island. Initially, we thought the specimens represented an undescribed, endemic species because they did not conform to the two most northern representatives along the Atlantic Coast, *C. caesioannulata* (Wood, 1865) and *C. major* (Cook & Collins, 1895). Some of these specimens were mentioned by Hoffman (1999a, b), who suggested that they were *C. major*; but the northernmost locality of this species is Washington, DC (Shear 1972), some 300 mi (480 km) southeast of the Connecticut sites. *Cleidogona caesioannulata* has been collected as far north as Stroudsburg, Monroe County, Pennsylvania (see Shear (1972:225, map 12), and would thus be the most plausible candidate among the established species to occur in New England. However, when the specimens were dissected and the gonopods and cyphopods compared to those of described species, the millipeds turned out to be *C. nantahala* Shear, 1972, which occurs some 700 mi (1,120 km) to the southwest in western North Carolina and potentially also north Georgia (Shear 1972, Shelley 2000a). The identity was established through side-by-side comparisons with authentic North Carolina specimens. We present here the New England records, illustrations of the gonopods (figs. 1-3) and cyphopods (fig. 4) to facilitate future identifications of this species in the Northeast, remarks on northern representatives of *Cleidogona*, and a likely explanation of how *C. nantahala* reached this area.

### *Cleidogona nantahala* Shear, 1972

(Figs. 1-4)

*Cleidogona nantahala* Shear 1972:227. Hoffman, 1999a:221. Shelley, 2000a:187.

**Diagnosis:** Gonopods apically divided, with narrow, curvilinear, apically sub-acuminate inner branch (ib) extending beyond distal extremity of laminate outer branch (ob); colpocoxite (c) apically divided (Figs. 1-3). Cyphopods with post-genital plate (pgp) distally expanded (Fig. 4).

**New England Records** (All specimens housed at the PMNH): CONNECTICUT: *New Haven Co.*, West Rock, ♂, ♀, March 22, 1964, B. Vogel. *Middlesex Co.*, Hurd State Park, beside Connecticut River, ♂, March 26, 1961, C. L. Remington. RHODE ISLAND: *Washington Co.*, Wood River crossing, Nooseneck Hill Road, under log, ♀, June 2, 2003, J. E. O'Donnell, R. J. Papedis.

**Remarks:** *Cleidogona nantahala* belongs to the "Major species group" which ranges from Georgia to Washington, DC, but there is a considerable gap between the northernmost record, *C. major* at Washington, DC, and the New England localities. The northernmost generic record along the east coast is the aforementioned one of *C. caesioannulata* (a member of the "Caesioannulata species group") from Stroudsburg, Pennsylvania, some 110 mi (176 km) southwest of the New England localities. We believe this site represents the northern generic range limit along the east coast because no *Cleidogona* has been found

to the north despite years of reasonably thorough diplopod sampling. *Cleidogona caesioannulata* has the widest distribution of any species, ranging from Stroudsburg westward and northward through Wayne County, Ohio, to Mason County, Michigan, on Lake Michigan about 2/3 of the distance northward on the Lower Peninsula at the level of the "thumb," and southward to North Carolina, where it occurs in all physiographic provinces and spans the state from the Coastal Plain (Beaufort County) to the Blue Ridge Mountains (Mt. Mitchell, Yancey County)<sup>4</sup> (Johnson 1954; Shear 1972; Shelley 1978, 2000a; Kevan 1983; Snider 1991). It is plausible that *C. caesioannulata* adapted to colder climatic conditions during glacial maxima and spread northward following glacial retreat; it may also have occurred farther north between glacial advances, such that the present distribution represents a truncation of a once wider and more northerly one. Whatever the explanation, species of *Cleidogona* are almost always associated with deciduous forest and probably could not have survived in periglacial tundra or taiga. It is germane to note here that unidentifiable females and juveniles of *Cleidogona* have been found in Middlesex and Essex counties, Ontario, the latter being the southernmost county in Canada and directly across the Detroit River from Detroit (Judd 1967; Kevan 1983; Shelley 1988, 2002a). Kevan (1983) and Shelley (1988, 2002a) believed that the individuals represent an undescribed species, as the postgenital plate of a female from Essex County, which is divided into two long, broad, apically truncated arms (see Shelley 1988, fig. 24), is unlike that of any species Shear (1972) reported, particularly *C. caesioannulata* or another "northern" species in the United States. Snider (1991) reported *C. caesioannulata* from 11 counties in Michigan, including St. Clair, so this species should be expected around Sarnia, Lambton County, Ontario, which is directly across the St. Clair River. Consequently, *Cleidogona* can be reasonably expected in Ontario from the latitudes of Sarnia and London southward (in Lambton, Middlesex, Elgin, Kent, and Essex counties), and two species can be anticipated, *C. caesioannulata* and the potential new one with the divided postgenital plate in females.

The New England specimens of *C. nantahala* are the third record of *Cleidogona* from formerly glaciated territory, the others being the aforemen-

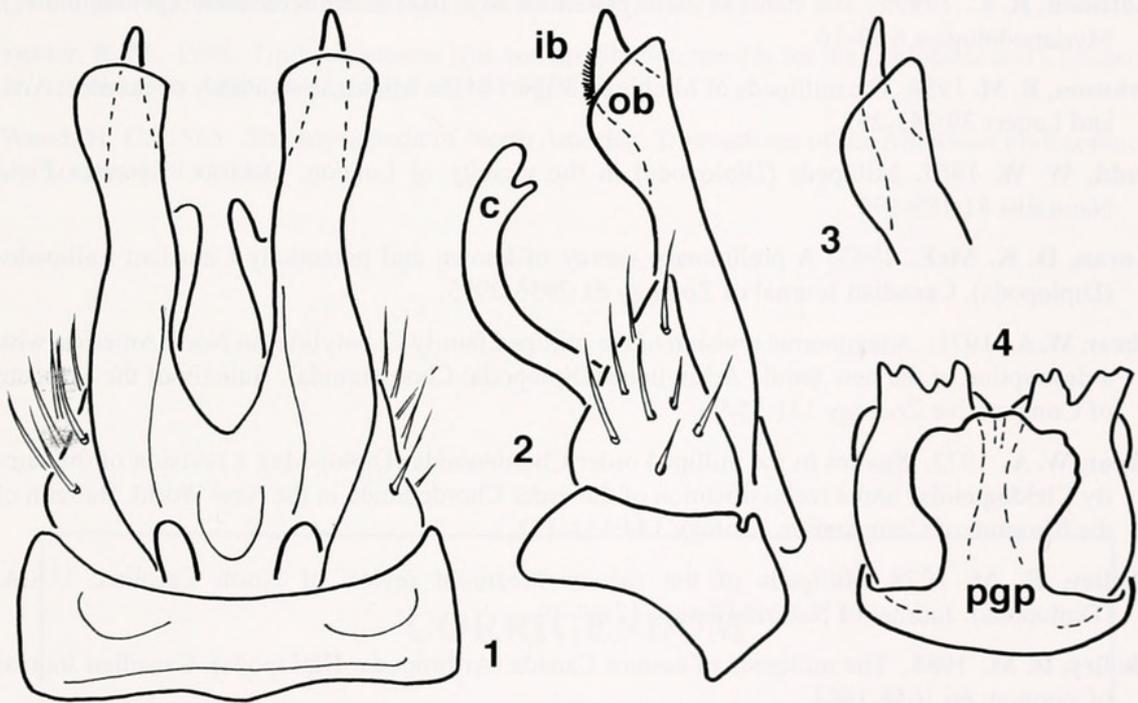
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<sup>4</sup>Hoffman (1999b) suggested that *Julus punctatus* Say 1821, under the replacement name and new combination *Cleidogona sayanum* (Bollman, 1893), is a senior synonym of either *C. caesioannulata* or *C. major*. The types of *J. punctatus* no longer exist, and Say did not provide any locality information in his description; however, circumstantial evidence adduced by Hoffman suggests that the specimen(s) were most likely collected around Philadelphia, in eastern Pennsylvania. Hoffman (1999b) had no specimens, but if *C. caesioannulata* is discovered near this city and a specimen is designated as the neotype of *J. punctatus*, *C. caesioannulata* will fall as a junior synonym of *C. sayanum* despite the fact that the latter name has not been used in the primary literature since its proposal in 1893. We are not prepared to accept this action and discourage others from doing so as it would replace the oldest current name in the genus (though not the type species) and, because of its wide distribution, the one most likely to be cited by researchers who are not systematists. For geographical reasons, it is unlikely that *C. major* is a synonym of *C. sayanum* because it is unknown north of Washington, DC, and such a synonymy would be equally disruptive because *C. major* is the type species of *Cleidogona*.

tioned ones of *C. caesioannulata* from Michigan and north central Ohio (Johnson 1954, Shear 1972, Kevan 1983, Snider 1991) and the potential new species from southern Ontario. They are so disjunct from *C. nantahala*'s home range, in western North Carolina from Mitchell to Macon counties and, based on females, probably extending to Pickens County, Georgia (Shear 1972, Shelley 2000a), that the only plausible explanation for their New England occurrences is human introduction. For over 200 years, New England nurserymen have imported plants from the southern Appalachians, where a thriving cottage industry in the collection of native plants still exists; it thus seems likely that individuals of *C. nantahala* were transported to New England in soil of rhododendrons or other native plants. The time of the introduction is unknown, but southern New England is perhaps the best-known region of the continent as far as its total fauna is concerned because it has been a center for natural historians since colonial days. However, the earliest collection of *C. nantahala* was only 43 years ago, in 1961, by C. L. Remington, an assiduous arthropod collector who was actively sampling in southern New England for many prior years. Beatrice Vogel, who collected the species in 1964, was a Yale graduate student studying wolf spider systematics who also sampled frequently in the area. As no specimens are available earlier than this, it is reasonable to conclude that the introduction probably occurred after 1950. We do not know the circumstances of either find, but the 1961 collection was in a state park, suggesting that it was not disturbed habitat or a place where southern Appalachian plants had been cultivated. The Rhode Island collection also was not from a cultivated spot, and the distance from the Connecticut sites, ca. 50 mi (80 km), suggests that more than one introduction may be involved.

To our knowledge, *Cleidogona nantahala* is the first native North American millipede to be successfully introduced to another region of the continent, and we also believe it to be the first one introduced anywhere. Since the late 1980s, three North American scorpions – *Centruroides vittatus* (Say), *C. hentzi* (Banks), and *Vaejovis carolinianus* (Beauvois) – have been encountered with increasing frequencies in southeastern states well outside their normal ranges (Shelley 1994a, b; Shelley and Sissom 1995), and while there is no definite evidence that reproducing populations have become established, the increasing frequency with which individuals are being encountered in homes, office buildings, yards, and casually wandering along city sidewalks suggests that this is just a matter of time. However, as often as plants and soil have been transported from one region of the country to another, no native millipeds have ever been encountered outside their home areas until this discovery of *C. nantahala*. According to the list of species in Hoffman (1999a) and recent references (Shelley and Golovatch 2001; Shelley and Edwards 2001, 2002; Shelley 2004), 35 exogenous millipeds of European, Asian, Australian, and Neotropical origins have been introduced into North America and are now established here, primarily in urban environments; this figure does not include species intercepted during quarantines at ports. Asian

and European millipeds have been widely introduced into islands throughout the world, but this has not happened with any North America species, not even in Hawaii, where the North American centipede, *Scolopendra polymorpha* Wood, occurring from the Central Plains westward (Shelley 2002b), was recorded from a pineapple field in Oahu by Shelley (2000b). The question therefore arises as to why this particular milliped species has been able to establish itself in New England and, once there, perhaps gradually spread and increase its range. Over a half-dozen species of *Cleidogona* also occur in western North Carolina; some of which are partly sympatric with *C. nantahala* and could potentially be introduced along with the latter, but this has not happened. Apparently there is an aspect of the ecophysiology of *C. nantahala* that makes it unique among cleidogonids as a colonizer.



Figs. 1-4 *Cleidogona nantahala*. 1, gonopods of male from Hurd State Park, Connecticut, anterior view. 2, left gonopod of the same, lateral view. 3, tip of left gonopod of male from West Rock, lateral view. 4, cyphopods of female from West Rock, posterior view. c, colpocoxite; ib, inner branch; ob, outer branch; pgp, postgenital plate.

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## CORRIGENDUM

On a recently published paper [Brailovsky, *Entomological News* 115(1)], the name Heteroptera was misspelled as Heteroptyera on the cover.



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