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**First Report of a Freshwater Amphipod
(Gammaridea: Hyallellidae), *Hyalella
azteca* (Saussure), from Nonanchihaline
Waters of Bermuda**

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Abstract

The discovery of the freshwater amphipod *H. azteca* in Bermuda is reported. No freshwater amphipods have previously been recorded from open water pond habitats on this western Atlantic island. *H. azteca* in Bermuda presumably dispersed from nearby North American populations; several possible methods for dispersal are discussed. Distinctive morphological features of Bermuda *H. azteca* are compared with similar characters reported for other New World populations.

Key Words

Hyalella azteca, Amphipoda, Bermuda, introduced species, dispersal mechanism.

Introduction

During a collecting trip to Bermuda in 1987, the authors found a large population of the freshwater amphipod *Hyalella azteca*

(Saussure) (YPM 8432, Fig. 1). The amphipods were discovered in Seymour Pond, Southampton Parish, one of the few freshwater ponds in Bermuda. According to a survey taken in 1900 (the Savage map), this pond covered 0.7 acres; with subsequent partial fill by garbage tip its 1980 size had been reduced to 0.5 acres (Sterrer and Wingate 1981). The pond was purchased by the Bermuda Audubon Society after 1953 and is being maintained as a nature reserve (Altrusa Club 1972). Seymour Pond is rain-fed and has only a slight salt content, probably from wind-carried salt spray; there are no known subterranean fissures connecting the pond to the ocean (D. Wingate, personal communication).

The discovery of *H. azteca* represents the first recorded occurrence of a freshwater amphipod from an open pond habitat in Bermuda and a new distributional record for the species. Several amphipod species with freshwater affinities have been described recently from Bermuda (Stock et al. 1987), but these species are from the freshwater lenses of flooded caves or other anchihaline habitats. Freshwater open ponds are not abundant in Bermuda; some, such as Seymour Pond, occur naturally, whereas others have been constructed in the last few decades as golf course water traps or wildlife reserves (Wyers 1981). An investigation of ponds other than Seymour Pond may result in the discovery of additional populations of *H. azteca*. Open ponds that are brackish, however, such as Spittal Pond, have been investigated and lack populations of *H. azteca*. The distributional

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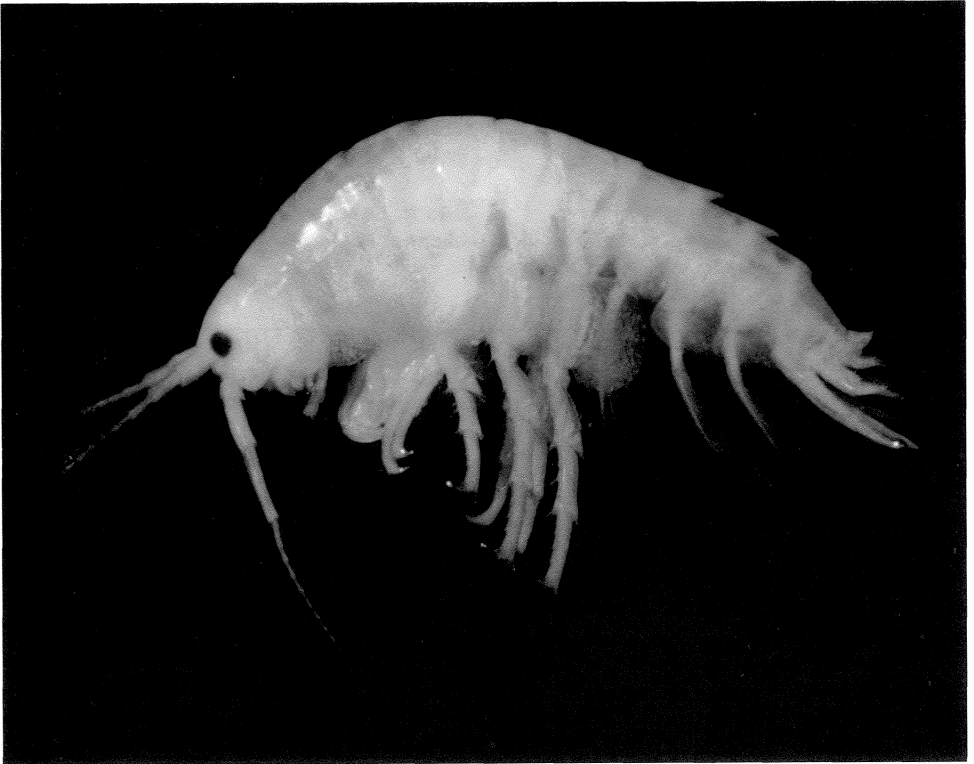


Fig. 1
YPM 8432. Male *Hyalella azteca* (Saussure); length,
6.4 mm; from Seymour Pond, Bermuda.

extension of *H. azteca* to Bermuda is interesting although not surprising; this freshwater amphipod is widespread throughout North America and South America and is known from other islands in the western Atlantic, for example, Dominica and Puerto Rico (Shoemaker 1933).

H. azteca presumably represents a species introduced to Bermuda; however, one can only speculate on its mode of introduction. One possibility is a natural one carried out by birds. Swanson (1984) proved that *H. azteca* can be readily transported for short distances between freshwater basins of North America within the feathers of migrating waterfowl. Although Bermuda is regularly visited by large numbers of migrating birds, this mode of dissemination is unlikely because of the

relatively large distance between Bermuda and the nearest mainland (1000 km). Small disseminules, attached to various parts of birds' bodies in mud, however, are a possible means of long-distance dispersal (Carlquist 1974). As Seymour Pond is regularly used by migratory herons, egrets, and waterfowl (Slaughter 1975), this mode would seem to have been a possible pathway of dispersal for *H. azteca*. Consequently, the amphipod could have been introduced at any time favorable geologic and biotic conditions existed. The Bermuda expeditions of A. E. Verrill, however, suggest otherwise.

A. E. Verrill of the Yale Peabody Museum made collecting forays to Bermuda in 1898 and 1901. Verrill had a keen interest in the animals and plants introduced to the island,

and wrote extensively on these alien organisms (Verrill 1903). An assiduous collector, he amassed specimens of the native and introduced biota from nearly every conceivable habitat. He discovered many inconspicuous animals, including ostracods from cisterns and several marine amphipod species that have yet to be recollected. Verrill even ascertained through gut content analysis that the principal food of the endemic skink, *Eumeces longirostris*, was at that time the amphipod beach hopper *Orchestia agilis* [= *Platorchestia ? platensis* (Kroyer)]. Verrill was obviously no stranger to amphipods. It seems most probable, then, that Verrill would have uncovered the presence of *H. azteca* if this species had been introduced to the islands by the time of his 1901 expedition. An argument for the natural introduction of the amphipod prior to this century, therefore, seems a weak one.

Two human-mediated accidental introductions of *H. azteca* in the twentieth century can be considered. First, freshwater was initially imported from North America to Bermuda in 1938 (Wyers 1981). The likelihood for the introduction of *H. azteca* in this manner is low, however, because of the necessary concurrence of many obvious variables. A second, and more probable, scenario would have been the coincidental introduction of *H. azteca* when the mosquito fish, *Gambusia affinis*, was imported. *G. affinis* was introduced to Bermuda for mosquito control in marshes, ponds, drainage ditches and individual cisterns (Sterrer 1986), presumably after 1933 (George 1971). Shipments of these fish in water from North America, particularly if bits of aquatic vegetation were present, would seem to have been the most likely means of introduction for *H. azteca*.

Morphological Considerations

Two distinctive morphological features from the Bermuda population of *H. azteca* should be mentioned. First, Bousfield (1973) stated that the number of dorsal teeth on the pleon varies from one to three and that they are

totally lacking in *H. azteca inermis*. Shoemaker (1933) reported that dorsal teeth vary from one to four in the dentate form, but he did not specify the location of the mucronations on the amphipods. The Seymour Pond specimens possess two dorsal mucronations, one each on the second and third segments of the pleon, prominent even on the smallest individuals.

Second, Stebbing (1903) described a nonmucronate species, *H. faxoni*, from Costa Rica, which he distinguished from *H. azteca inermis* by the possession of three distal plumose setae on maxilla 1, a feature to which he attached considerable significance. Weckel (1907), however, in discussing North American *H. azteca*, noted that the number of distal plumose setae on maxilla 1 is usually two but occasionally three; subsequently he synonymized Stebbing's *H. faxoni* with *H. azteca*. The setation of maxilla 1 on Seymour Pond specimens agrees in most respects with North American *H. azteca*; significantly, however, all the individuals examined have three distal plumose setae on the inner plate of the first maxilla, and some even possess four.

The maxillary characteristics of Bermuda *H. azteca* are noteworthy and add to the considerable variation described for this widely distributed species. A comparative analysis of known populations, especially of those outside North America, may lead to an evaluation of the assumed monospecific status of this amphipod.

Material Examined

YPM 8432. 12♂♂♀ Seymour Pond, Southampton Parish, Bermuda. E. A. Lazo-Wasem and A. J. Baldinger, collectors, 31 May 1987. From algae and submerged board.
YPM 8433. 17♂♂♀ Seymour Pond, Southampton Parish, Bermuda. M. F. Gable, collector, 31 May 1987. 0.5 mm net dippings.

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