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Asajirella gelatinosa in Panama: a bryozoan range extension in the Western Hemisphere (Ectoprocta: Phylactolaemata)

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Abstract

Asajirella gelatinosa, a freshwater bryozoan known previously only from eastern Asia is now reported in the Republic of Panama. Colonies were collected during April 1992 in the broad reaches of the lower Río Chagres as it enters Gatun Lake, part of the Panama Canal system. A subsequent collection in 1998 included large colonies and numerous statoblasts from a region upstream of this site in the impounded Lago Alajuela (Madden Lake). Colonies and statoblasts resemble those from Japan in almost every detail. Human transport of statoblasts is a likely cause of this disjunct distribution.

Introduction

Species distribution among freshwater bryozoans includes a fair number of apparently disjunct populations. Although the discontinuous patterns may be exaggerated by sparse survey efforts, there is little doubt they are real. For example, *Fredericella indica* is common and widespread throughout North America (Wood & Backus, 1992), but has also been documented in a few sites on the Indian subcontinent (Annandale, 1909) and at a single site in Europe (Massard & Geimer, 1995). *Stephanella hina* is known from Japan and Korea, but it also occurs at several sites in Massachusetts (Smith, 1989, and pers. com.). *Plumatella reticulata*, a very abundant species in the American Midwest, has been reported nowhere else except two sites in Israel (Hastings, 1938; Massard et al., 1992). In some instances the expanding range is relatively recent and traceable to human activities. *Lophopodella carteri*, for example, is believed to have entered eastern North America on imported aquatic plants in the 1930s (Masters, 1940) and has been slowly spreading westward. *Pectinatella magnifica*, once confined to eastern North America, has spread westward with the development of new reservoirs (Neck & Fullington, 1983). In the 1970s it crossed the Pacific to Japan (Oda, 1974), and has now invaded North Korea (Dongsoo Kong, pers. com.).

The asexual production of encapsulated, dormant buds (statoblasts) enables freshwater bryozoans to be passively dispersed in a variety of ways. Brown (1933) demonstrated the survival of statoblasts emerging from the digestive tracts of ducks, frogs, salamanders and turtles. Statoblasts resistant to desiccation may be transported on feathers or fur of migrating animals. They are easily carried in water currents, either individually, on vegetation, or within detached fragments of bryozoan colonies. Such mechanisms might explain dispersal within natural drainage systems, along flyways of migratory waterfowl, or between nearby bodies of water. In other cases human assisted transport is suspected, especially where distribution is widely disjunct in east–west directions.

A curious addition to such disjunct freshwater bryozoan populations is *Asajirella gelatinosa*, a conspicuous and easily recognizable species previously known only from Japan, Taiwan and Korea, now discovered in the Río Chagres drainage, including the impounded Lago Alajuela and the lower Río Chagres as it enters Gatun Lake, Panama. Although initially collected in

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1992, the species may have been introduced to Panama at any time since shipping traffic commenced with the completion of the Panama Canal in the early 1900s. To our knowledge, no one before 1992 had ever looked for bryozoans in this region, nor until now has this species been reported from the western hemisphere.

Methods

Asajirella gelatinosa colonies containing statoblasts were first collected by one of us (BO) on 15 April, 1992 north of the bridge at the town of Gamboa in the broad reaches of the lower Río Chagres as it enters Gatun Lake (Figure 1). The lake is the 230 km^2 heart of the Panama Canal system created in the 1890s by damming the Río Chagres. The area of collection is therefore continuous with the much wider stretches of Gatun Lake to the southwest. In the region near Gamboa the aquatic macrophyte, *Hydrilla verticillata*, occurs alongshore in dense beds and also in association with the tops of drowned trees in deeper areas. Colonies of *A. gelatinosa* were found growing abundantly on leaves and stems of *H. verticillata* snagged on one of the drowned trees encountered. Returning to the region in February, 1998 we encountered large colonies upstream of the first site, on stumps and reeds in the shallow water of the Lago Alajuela impoundment just above Madden Dam (9° 14.74′ N, 79° 35.62′ W) (Figure 1). Colonies were narcotized with menthol and preserved in 70% ethyl alcohol. Many statoblasts were stored in water for later germination; some preserved statoblasts were eventually dried in Peldri II®, sputtered in palladium alloy, and examined with a Phillips scanning electron microscope.

Results

The Panamanian colonies are globular and ranging in diameter 6–60 mm, all containing statoblasts. They are much more soft and flimsy than similar sized colonies of *Pectinatella magnifica* or *Lophopodella carteri*. Deep clefts in the colony margin illustrated by Toriumi (1956) may be unique to *Asajirella gelatinosa* and are very evident in the Panamanian material. Zooids are radially arranged, their oral side facing outwards. The gut of retracted zooids remains straight, not bent or folded. The number of tentacles ranges from 65 to 78 (18 counts, mean = 72), somewhat less than those reported by Toriumi (1956).

In 1998 statoblasts trapped in the lake bottom bobbed immediately to the surface in large numbers whenever the sediments were disturbed by wading or hand stirring. The water level was already in seasonal decline, and since statoblasts of this species become buoyant only upon drying we assume they had been produced in a previous year. Stored in a dark plastic 35-mm film canister the statoblasts all germinated simultaneously about 6 days after collection.

The statoblasts are essentially circular, but their saddle shape makes them appear slightly quadrate (Figure 2). Small hooks project from the periphery. The diameter range is 1.25–1.37 mm (n=50). Scanning electron microscopy reveals a meshwork of raised reticulated lines over the entire statoblast surface, the area of enclosed spaces decreasing toward the center. Small nodules cling to this reticulum, especially in the central region of both valves (Figure 3). All these features agree very well with descriptions of Asian material by Toriumi (1956) and Oda & Mukai (1985).

Discussion

Statoblast morphology at both macro- and microstructural levels leaves little doubt that the Panama species is indeed *Asajirella gelatinosa*. The species was first described by Oka (1890) as *Pectinatella gelatinosa* from material obtained in Shinji Pond on the campus of the University of Tokyo. Histological aspects were studied by Mukai & Oda (1980a) and statoblast microstructure by Mukai & Oda (1980b) and Oda & Mukai (1985); genetic features were reported by Backus & Mukai (1987). The weight of these and other studies persuaded Oda & Mukai (1989) to move the species from Pectinatellidae to Lophopodidae in a unique genus, *Asajirella*.

Sporadically abundant but never common, *Asajirella gelatinosa* has been previously reported only from eastern Asia. This includes ten sites in central and southern Japan (Toriumi, 1941a), three in Korea (Toriumi, 1941b), and one site each in Taiwan (Toriumi, 1942), Burma (Annandale, 1908), Orissa District of India (Annandale, 1911), Ceylon (Annandale, 1911), and Indonesia (Vorstman, 1928). Annandale and Vorstman knew the species as *Pectinatella burmanica*, which was recognized as *Pectinatella gelatinosa* by Toriumi (1956) and Lacourt (1968). The aquatic macrophyte, *Hydrilla verticillata*, on which some of

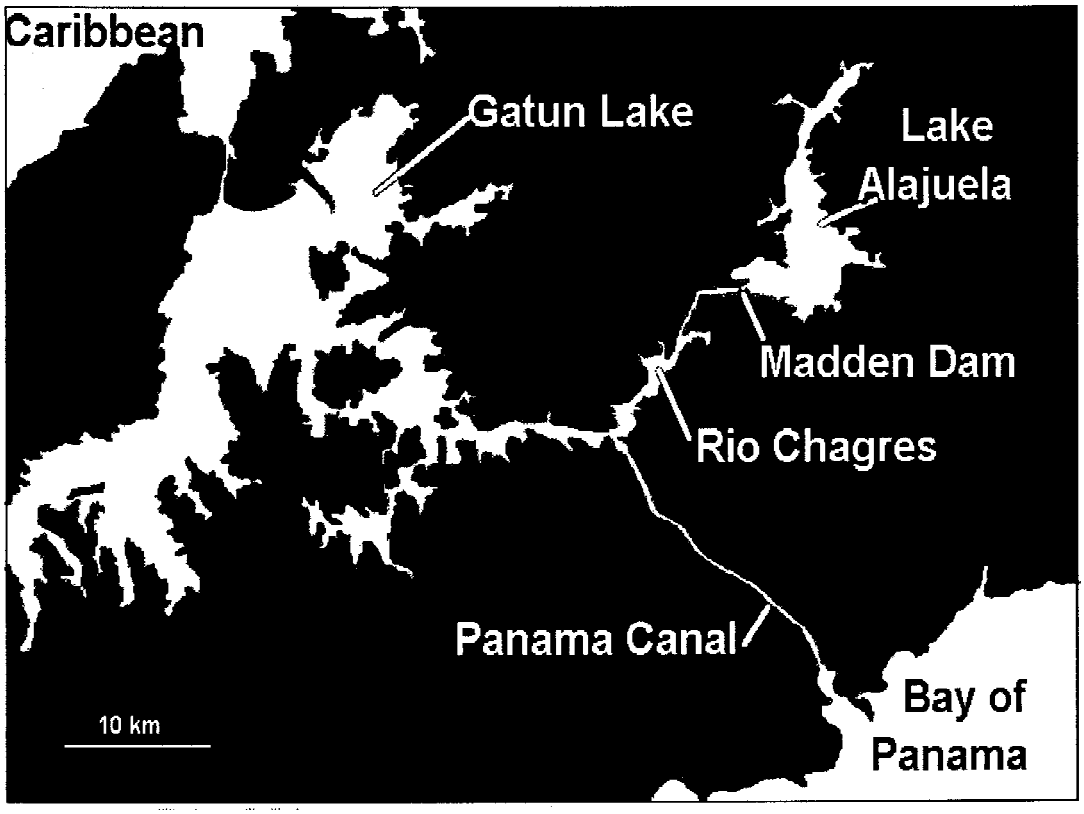

Figure 1. Map showing the major bodies of water associated with the Panama Canal.

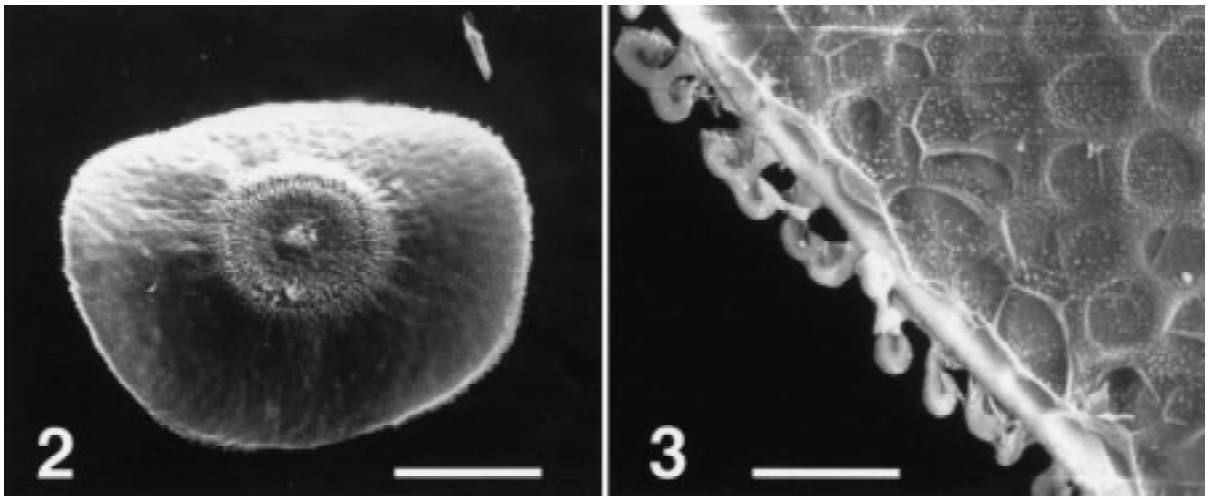

Figure 2. Statoblast of *Asagirella gelatinosa* from the Río Chagres at Gatun Lake near Gamboa, Panama. Scale bar=0.4 mm. *Figure 3.* Magnified portion of same statoblast showing the characteristic marginal hooks and surface reticulation with tiny nodules. Scale bar=0.025 mm.

the *A. gelatinosa* was growing in Panama, also shows an apparently disjunct distribution. *H. verticillata* is widely distributed in the Old World from southern and eastern Europe, Africa, Asia and Australia, but in the New World has only been found in the tropical moist forest region of the Canal Zone in Panama (Croat, 1978). The occurrence of both *A. gelatinosa* and *H. verticillata* in Panama suggests both have recently been introduced and that this may have occurred jointly with statoblasts adhering to plant material or as separate events.

The ecology of the *Asajirella gelatinosa* is best known from field and laboratory studies of Mukai et al. (1979). Colonies have been found mostly in shallow (3 m) ponds where they grow on wooden pier pilings, stems and leaves of reeds and pondweeds, and submerged logs and twigs. The fusion and growth of multiple colonies creates a massive growth with a clear, gelatinous matrix forming a single, thick base. Such compound colonies reach a size of 15 cm wide and more than 30 cm long. Small colonies are known to divide and move apart in the manner described for *Lophopodella carteri.* The polypides are the largest among all known freshwater bryozoan species. Statoblasts germinate around 25°C, and colonies grow well at temperatures of 27–33°C. Statoblasts are said to be released only upon disintegration of the colony which, if true, would be unlike continuous release by other lophopodid species. Undried statoblasts survive temperatures of −20°C for at least 60 days. Nothing has been reported on resistance of statoblasts to desiccation, but other lophopodid species are notorious for surviving prolonged dry periods (Wood & Marsh, 1995). The viability of apparently old statoblasts from the sediments of Lago Alajuela was therefore not surprising. Gametogenesis in *Asajirella* is not uncommon, but larvae have been reported only once (Oda & Nakamura, 1980).

Freshwater bryozoans share a similar niche with freshwater sponges, and their ecologies show many parallels. In a limited survey of sponges in and around Gatun Lake, Poirrier (1990) encountered three species, all known from elsewhere but none previously reported from Central or South America. One species, *Eunapius carteri,* grew thickly on rocks along the lake shoreline at Gamboa near to where *Asajirella gelatinosa* colonies were found in this study. Like *A. gelatinosa*, this represented the first known occurrence of *E. carteri* in the New World.

Knowledge of sponge and bryozoan distribution in tropical fresh waters is far too limited for any general patterns to emerge. In 1998 we conducted a quick (1 week) bryozoan survey of lakes and streams in central Panama, and although several species were encountered, *Asajirella gelatinosa* was found only in the Río Chagres area adjoining Gatun Lake. It is tempting to link its presence with the active shipping traffic in the lake from vessels using the Panama Canal. More intensive and continued surveillance of this area is needed to document other bryozoan species in Gatun Lake and to detect any spread of *Asajirella gelatinosa* to other freshwater sites in the region.

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