

An important factor limiting the distribution of large branchiopods in Shiga Prefecture, Japan: moisture content of rice paddy soil in winter

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Rice fields are wetlands with alternate flooding and drying each year. Large branchiopod crustaceans are interesting animals that made good use of this artificial environment. A few days after water is put into rice fields, tadpole shrimps, fairy shrimps and clam shrimps start emerging. Depending on species, the size of the adult shrimps may be from 5-6 mm, all the way up to 30-40 mm, so they should be easy to spot; however, even farmers frequently do not notice them in the fields, perhaps because they are neither pests nor natural enemies. Throughout the world, large branchiopods like these inhabit ephemeral ponds, and in Japan, the most widespread ephemeral ponds are man-made, namely rice fields.

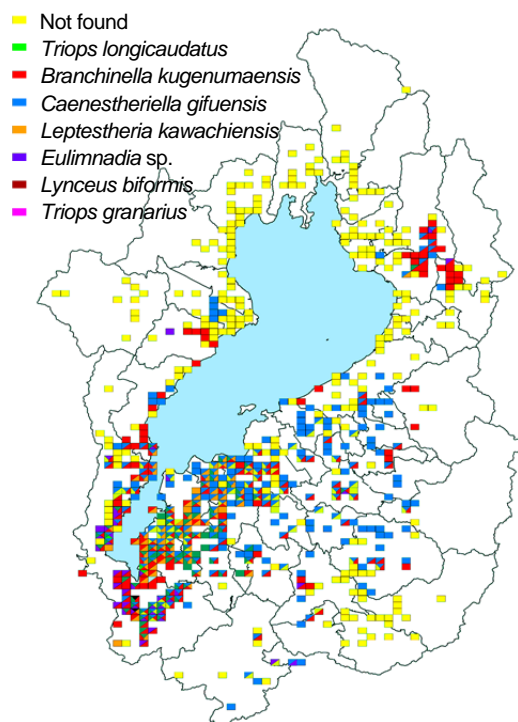


Fig. 1. Distribution of large large branchiopods of pddy fields in Shiga Prefecture



Fig. 2. *Caenestheriella gifuensis*, the most common large branchiopod crustacean in paddy fields in Shiga Prefecture (Photo: H. Akiyama)

So far, seven species of large branchiopod have been recorded from rice fields in Shiga Prefecture, including two species of tadpole shrimp, one kind of fairy shrimp, and four species of clam shrimp. It is interesting that their major area of distribution lies in the southern half of the prefecture, while in the northern part only five species occur, and only in limited areas (Fig. 1). To try to explain this pattern, a detailed survey of the distribution of large branchiopods and of factors thought possibly to be limiting their distribution was conducted in the central eastern part of Shiga, which is the boundary region of the ranges of some species. The likelihood of appearance as well as the absolute abundance of the most dominant species, the clam shrimp *Caenestheriella gifuensis*, increased with a decrease in the amount of moisture in the paddy soil in winter. No *C. gifuensis* were found in the relatively wet paddies found in the lowlands near Lake Biwa and at the feet of the mountains.

Shiga Prefecture is 100 km long north-to-south and 60 km wide, with Lake Biwa at its center. There is no basic difference in the extent of consolidation and modernization of the rice-growing land, nor of farming methods, in the northern and southern areas of Shiga. The major difference is climatic, inasmuch as three times more precipitation (especially snow)

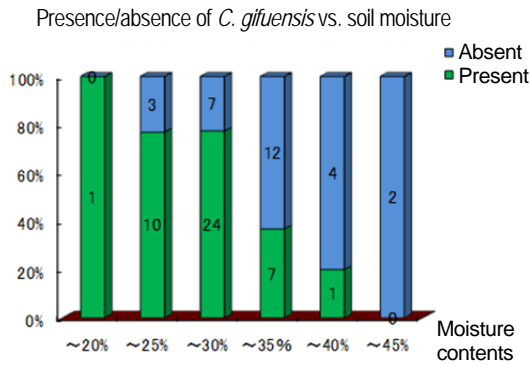


Fig. 3. *C. gifuensis* was usually found in paddy fields which were dry in winter.

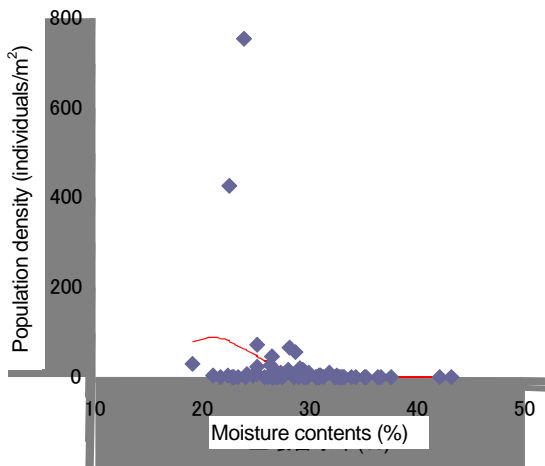


Fig. 4. The optimal soil moisture contents for *C. gifuensis* in winter was estimated as 21%.



Fig. 5. Upper: a dry paddy field with 28.4% of moisture contents. *C. gifuensis* and *B. kugenumaensis* were present in early summer. Lower: a wet one with 34.7% of moisture contents. No large Branchiopods occurred

falls in winter in the north than the south. The intermittent snow and rain in the north results in a high concentration of moisture in the paddy soil, which can be expected to affect the resting eggs of the branchiopods, thus limiting their distribution. The details remain to be investigated, however, and the moisture content of winter paddy soil is affected not only by precipitation, but also by the topography of the land, the nature of the soil, and the management of the land.