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Potential for Parthenogenesis of Females in a Bisexual Population of the Geographically Parthenogenetic Mayfly *Ephoron shigae* (Ephemeroptera: Polymitarcyidae)*

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The burrowing polymitarcyid mayfly *Ephoron shigae* (Takahashi) is distributed widely in Japan. Some populations are bisexual, and others are unisexual (solely females), so that *E. shigae* is a geographically parthenogenetic mayfly (Watanabe and Ishiwata, 1997; Tojo *et al*., 2006; Sekiné and Tojo, 2007). In general, parthenogenetic populations are often found under that hard environments such as at high latitudes and altitudes, in xeric as opposed to mesic conditions (*e. g*., Suomalainen *et al*., 1987), in isolated habitats such as islands and island-like areas, and at the periphery of distribution (Cuellar, 1977). In *E. shigae*, however, the distributions of the bisexual and unisexual populations overlap broadly in their respective geographic ranges. *E. shigae* therefore, provides a good model to study the differentiation of unisexual and bisexual populations, the establishment of parthenogenesis, and the dispersal of parthenogenetic individuals.

In the previous study on *E. shigae*, obligatory parthenogenesis (parthenogenesis is the normal mode of reproduction) appears in unisexual populations (Tojo *et al*., 2006). Furthermore, it is revealed that all individuals reproduced by parthenogenesis are diploid females (2n = 12), indicating the occurrence of thelytokous parthenogenesis (Sekiné and Tojo, 2007). However, the parthenogenetic ability of females in the bisexual populations has not been clearly understood. Although it was reported that twenty of the females examined in the Asahi-gawa River population (bisexual population) showed no parthenogenetic ability (Tojo *et al*., 2006), it is still controversial as to whether this ability is peculiar to the unisexual populations or not.

Here, we examined the parthenogenetic ability of virgin females in the bisexual populations. The Hino-yosui flume (irrigation canal, Hino City, the Tokyo Metropolice) population was studied as a representative of the bisexual populations. Final instar nymphs were collected and incubated individually in the laboratory to emerge to adults. Unfertilized eggs were collected from ten virgin females. As a control, fertilized eggs were obtained from six females mated with males in the same bisexual population. These fertilized and unfertilized eggs were incubated separately in batches at 20 ± 0.5℃. About three months after incubation, developmental rates of fertilized and unfertilized eggs were examined for each egg batch. Upon the nymphs hatching, nymphs were sacrificed for chromosome preparations and the numbers of chromosomes were counted.

The developmental rate of fertilized egg batches was 98.1 ± 1.9% (99.9% at the highest, and 94.9% at the lowest; in six batches). Whereas the developmental rate of unfertilized egg batches was 14.1 ± 13.5% (34.7% at the highest, and 0.3% at the lowest in 10 batches). Nymphs hatched from fertilized eggs had either eleven (2n = 11, ♂) or twelve (2n = 12, ♀) mitotic metaphase chromosomes representing males and females respectively. On the other hand, nymphs hatched from unfertilized eggs had twelve chromosomes (2n = 12, ♀).

We conclude that females of the Hino-yosui population (bisexual population) have parthenogenetic ability, although it is lower than that of females in the unisexual populations : 89.0 ± 4.59% in the Chikuma-gawa population, 84.2 ± 1.96% in the Sakura-gawa population, 78.5 ± 5.95% in the Shonai-gawa population (Tojo *et al*., 2006). The mode of parthenogenesis in this bisexual population is the type as found in the unisexual populations so far examined.

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