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Morphological traits of gynodioecious *Persicaria amphibia* (Polygonaceae)

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Abstract

Gynodioecy, as intermediate sexual system, involves modifications of floral structure from hermaphrodites to dioecy. We here present the morphological differences in the sexual type of flowers concerning the terrestrial *Persicaria amphibia* as a gynodioecious species. Hermaphroditic flowers are relatively larger than female ones, and they produce viable pollen grains, while female flowers produce no viable pollen as male-sterility but increase female fitness by exerted pistil. Although female flowers had aborted stamens, the anther development at the early stage was normal until the late stage which the anther locule of female flowers was collapsed without forming pollen-like structures. The pilate-glandular trichomes could be diagnostic characteristic of female individuals since this type of trichome occurs only in leaves, stems, and pedicels of female plants. Excepting for the trichome type, the variance of microstructures was not significant between hermaphroditic and female plants.

Keywords: floral dimorphism, *Persicaria amphibia*, Polygonaceae, sexual system

Introduction

Flowering plants are predominantly hermaphroditic, containing both androecium and gynoecium for each flower (see e.g., Barrett 2002). Although the hermaphrodite is a successful reproduction system, opportunities for self-fertilization exist. The lower fitness of inbred offspring was general assumption in comparison with outbred one, the inbreeding depression mainly forced the evolution of plant mating strategies (Charlesworth & Charlesworth 1987). To guarantee the outbred, some flowering plants (< 10%) have unisexual flowers as dicliny, that is associated with a wide spectrum of gender strategies that involve various combinations of female, male, and hermaphrodite flowers at the plant and population levels (Lloyd 1975, Barrett 2002). Gynodioecy is the most common type within the gender dimorphic sexual systems that coexists hermaphroditic individuals and female individuals (= male sterile) in populations. As an intermediate sexual system toward dioecy from hermaphrodite, the evolution of gynodioecy involves specialization for male or female function which could associate with changes in floral structure so that hermaphroditic and female flowers display significant dimorphism (Delph 1996). Since hermaphroditic flowers are the only source of pollen in gynodioecious species, hermaphrodites function primarily as "males" within populations (Lloyd 1975). Hermaphroditic flowers have usually larger flowers than female flowers because of enclosing male reproductive organ and increasing male fitness (Sutherland & Delph 1984, Stanton *et al.* 1986). In contrast, female fitness is less affected by floral display, thus female plants tend to have smaller flowers relative to hermaphrodite (Bell 1985). However, the floral size dimorphism may be affected by various factors such as pollination mechanism, abiotic concern, or hormonal signal produced by pollen (Baker 1948, Plack 1957, Delph 1996). In addition, the maintenance of females in populations has been suggested as an important factor but, the frequency of females in populations widely varies among populations (Byers *et al.* 2005, Caruso & Case 2007). Since the floral dimorphism in gynodioecious species could indicate the transition level to complete dioecy (Ashman *et al.* 2000), the measurement of the morphological differences between genders can be useful to trace evolutionary pathway of gyonodioecy. However, the studies focused on morphological differences and functional structures of reproductive organ in gynodioecious species are rather limited (e.g., Sun & Ganders 1987, Hong & Moon 2003).

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