

An ESS model for the mixed production of cleistogamous and chasmogamous flowers in a facultative cleistogamous plant

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ABSTRACT

We have developed resource allocation models for the evolution of a mixed production of cleistogamous and chasmogamous flowers. The basic model takes into account the features associated with cleistogamous self-pollination (e.g. the greater economy and assurance of cleistogamous fertilization) and the inability of cleistogamous flowers to contribute to the outcrossed pollen pool. The basic model predicts that only one of each strategy (i.e. chasmogamy or cleistogamy) is favoured. However, when seasonal fluctuation of the fruit-to-flower ratio of chasmogamous flowers is considered, an evolutionarily stable strategy favours either cleistogamous or chasmogamous flower production. This fluctuation in fertility may explain the seasonally discrete production of dimorphic flowers in natural populations of some facultative cleistogamous plants. The simultaneous production of both of the dimorphic flowers is explained only when the effect of geitonogamous selfing of chasmogamous flowers is included in the model.

Keywords: chasmogamy, evolutionarily stable strategy, facultative cleistogamy, geitonogamy, resource allocation model, seasonal variation.

INTRODUCTION

Cleistogamy is a structurally modified mode of autogamy, in that the flowers never open and self-pollination occurs in a bud. Cleistogamous flowers have no nectar and no odour, their petals are either rudimentary or completely missing, and their stamens are often reduced in both number and size. In addition, cleistogamous flowers possess few pollen grains and the pistil is reduced in size (Darwin, 1877; Goebel, 1904; Ritzerow, 1908; Campbell *et al.*, 1983; Ellstrand *et al.*, 1984; Ruiz de Clavijo and Jimenez, 1993). This mode of reproduction is quite widespread and has been reported in 287 species from 56 angiosperm families (Lord, 1981).

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