The evolution of self-fertility in *Crepis tectorum* (Asteraceae)

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**Abstract:** The extent of self-fertility was examined in 16 populations of *Crepis tectorum*. A hypothesis that a weedy habit favours autogamy was only partly supported. Low levels of self-fertility characterized non-weedy populations from calcareous grasslands (“alvars”) on the Baltic island in Öland. By contrast, plants in nearly all weed populations studied were more or less self-fertile. However, the trend towards autogamy may have occurred independently of the trend towards a weedy habit, as shown by moderately to high levels of self-fertility in alvar populations from two other Baltic islands. In the weed group, there was a tendency for plants from two field populations to be more autogamous than plants from more “ruderal” habitats. There was an association between self-fertility and small, inconspicuous heads in the alvar group but the association was weaker when weed populations were also considered. The relatively wide heads characterizing the ruderal weed populations may, at least partly, be an indirect effect of increases in overall plant size and/or in the size of the fruit associated with each flower.

Colonizing and weedy plants frequently occur in situations where only few individuals are present, e.g., following long-distance dispersal or weed-clearing operations. Autogamous individuals capable of producing seeds without being cross-pollinated are thus favoured (Baker 1955, 1974). The autogamy in these cases is sufficiently strong to outweigh (Richards 1986) or even reduce (Lande & Schemske 1985) the negative effects of inbreeding depression when present. Empirical data support the view that colonizing and weedy species are predominantly autogamous (Baker 1965, 1967; Mulligan & Findlay 1970) but fewer cases are known where weedy and non-weedy conspecific populations differ in autogamy (Solbrig 1967, Lefebvre 1970, Baker 1974, Thomas & Murray 1981). Autogamous taxa usually differ from their outbreeding relatives by having less attractive flowers which facilitates self-pollination and/or increases the amount of resources available for seed production (Lloyd 1965, Moore & Lewis 1965, Ornduff 1969, Strid 1970, Gibbs & al. 1975, Rick & al. 1979, Thomas & Murray 1981, Wyatt 1984). However, the relationship between flower size and breeding system is sometimes weak (Horovitz & Harding 1972, Schoen 1982). A possible reason for this is that floral parts may evolve as a correlated response to selection on other
traits (Primack 1987). For example, the size of a reproductive structure may reflect the overall size of the plant rather than the breeding system (Giles & Bengtsson 1988).

The present study was designed to examine the relationship between weedy and autogamy in the annual Crepis tectorum. The main objective was to test the prediction that plants in weedy populations are more autogamous and thus less dependent on insect-pollination than plants in populations from a more natural habitat (see below). The second purpose was to examine whether corresponding changes had taken place in the size of the attractive structures. I tested the hypothesis that at least some of the variation in the inflorescence size was affected by variation in traits other than the size and number of the individual flowers, e.g., the overall size of the plant or the size of the fruit associated with each flower. Extensive adaptive variation among populations in plant and fruit size (Andersson, unpubl.) suggested that the expected association between autogamy and small inflorescences could be obscured.

Crepis tectorum L. (Asteraceae) is a widespread annual diploid (2n = 8) plant native to Eurasia and introduced in N. America (Babcock 1947). At least two distinct groups of intraspecific taxa (hereafter “ecotypes”) occur in northern Europe, one confined to dry and shallow soil on calcareous grasslands (“alvars”) on Baltic islands and one occurring as a weed throughout the area (fields, road sides, waste ground). The wide distribution and the great colonizing ability of the weed ecotype contrast with the highly distinct habitat of the alvar taxa (Sterner 1938, Pettersson 1958, Bengtsson & al. 1988). Earlier experiments have shown that plants in weed populations are characterized by a taller stem, larger fruits (= seeds) and flowering later in the summer than plants in alvar populations. Extensive population divergence in other traits has taken place within both ecotypes (Babcock 1947, Andersson 1989).

The flowering pattern of Crepis is determinate, i.e., inflorescences (hereafter “heads”) flower in a more or less fixed sequence on the plant, starting with the head terminating the main shoot and ending with heads on the lowermost branches. Each head consists of a large number of epigynous, hermaphroditic, ligulate flowers. Flowering of the head is centripetal, starting at the periphery and proceeding towards the centre. Individual flowers are protandrous but pollen from a flower may be deposited on exposed stigmas in adjacent flowers in the same head. Fertilized flowers develop into one-seeded fruits (achenes). The most common insect visitors are flies and bees which visit Crepis mainly for pollen (pers. obs.).

Material and methods

Information on the plant material used is given in Table 1. Six alvar populations (nos. 1–6) and one weed population (no. 9) are from Baltic islands along the east coast of Sweden while the weed populations nos 7, 8, 10, and 11 are from various localities on the mainland of S. Sweden (see Andersson 1989 for more information on these populations). Additional seed material of the weed ecotype (populations nos 12–16) was obtained from various botanical gardens outside Sweden. Detailed habitat data were not available for these populations but observations on cultivated plants show that these populations are of the “ruderal” type (subsp. tectorum) and not of the “field” type (var. segetalis). Voucher specimens are deposited at the Botanical Museum of Lund (LD), Sweden.

15 to 20 plants from each of the 16 populations were grown to maturity in an unheated