# Convolvulus arvensis L. (Convolvulaceae)
# Orchard Morning-Glory, Field Bindweed

**Description**. Herbaceous perennial from persistent, vertical and horizontal rhizomes; rhizomes often spirally twisted, to 2 m or more in depth; stems 20- 100 cm long, prostrate, spreading, or twining, often forming tangled mats, angular, puberulent. Leaves alternate; petioles 0.5-3 cm long; blades 1-5(10) cm long, 1-3(4) cm wide, sagittate to hastate, puberulent, becoming glabrous, somewhat glaucous, margins entire, apices rounded. Flowers solitary, sometimes 2-3 per node; peduncles 0.5-6 cm long, often remotely bracted; bracts 2, 2-4 mm long, linear; sepals 3-5 mm long, oblong to obovate, margins minutely ciliate, apices obtuse; corolla 1.5-3 cm long, 1.5-2.5 cm wide, funnelform, white to pink, sometimes purplish near the margins; anthers 5, 2-3 mm long. Fruit a capsule, 5-8 mm long; seeds 3-4 mm long, ovoid to obovoid, dark brown. Flowering in California from May to October. (Abrams 1951, Austin 1986, Clapham et al. 1962; Dempster 1993, Fernald 1950, Holmgren 1984, Munz 1959, Stace 1972, Wagner et al. 1990, Webb et al. 1988).

**Geographic distribution**. A native of Mediterranean Europe, bindweed has been introduced throughout most temperate and dry subtropical climates, including northern Africa, Australia, Eurasia, India, New Zealand, Hawaii, Chile, and North America (Aneja and Srinivas 1990, Austin 1986, Carretero 1995, Chapman 1991, Clapham et al. 1962, Fernald 1950, Gleason and Cronquist 1991, Holm et al. 1977, Holmgren 1984, Leaden et al. 1994, Wagner et al. 1990, Webb et al. 1988).

The earliest reported record in California is from San Francisco (Bolander 1870). Collections cited by Jepson (1939) suggest that it had become widespread in California prior to 1900.Naturalized populations of bindweed in California occur on San Nicolas, Santa Catalina, Santa Cruz, and Santa Rosa islands (Junak et al. 1997) and throughout much of the mainland (Anonymous 1998).

**Ecological distribution**. In its native range, bindweed occurs in cultivated and fallow fields, along roadsides and railroad right-of-ways, and disturbed open sites (Clapham et al. 1962, Stace 1972) and occupies similar habitats where naturalized (Abrams 1951, Dempster 1993, Fernald 1950, Gleason and Cronquist 1991, Holm et al. 1977, Mitich and Kyser 1990, Munz 1959, Swan 1989).

**Reproductive and vegetative biology**. Field bindweed is self-incompatible and thus requires insect-pollination for seed set (Westwood et al. 1997a). In Europe the principal pollinators are small bees (Richards 1978). Dormant seeds retain high viability and germinability under field conditions, surviving for at least as long as 20 years (Conn 1990, Conn and Deck 1995, Frazier 1943b, Timmons 1949). Dispersal can be effected by birds (Proctor 1968), but are primarily dispersed in cultivated fields by irrigation and by vehicles (Holm et al. 1977).

Although initially dispersed by seeds to new sites, it also can reproduce successfully and vigorously by underground rhizomes (Brown and Porter 1942, Frazier 1943a, Dexter 1937, Kiltz 1930, Mitich 1991, Weaver and Riley 1982). Deep-set rhizomes also may persist for several years as a function of efficient use of carbohydrate reserves (Bailey and Davison 1984b, Bakke et al. 1944, Frazier 1943b). Fragmentation of rhizomes is one of the primary mechanisms by which it disperses and persists in cultivated fields (Buhler et al. 1994). Re-establishment by means of root or rhizome fragments, however, may be reduced by techniques that either minimize tilling or expose such fragments to desiccation and sun (Sherwood 1995).

Low light conditions, as experienced in agricultural fields and with denser plant cover, induces dormancy in field bindweed (Bakke and Gaessler 1945). Although field bindweed is a poor competitor under conditions of low light intensity and low water stress, its deep rhizomes provide an important dormancy mechanism for survival (Dall'Armelliana and Zimdahl 1988, 1989, Mashadi and Evans 1988). Bindweed root systems apparently do not utilize the same soil-water and nutrient resources as do those of most cultivated crops. Several studies showed that field bindweed does not apparently compete for water with most irrigated crops, primarily because root penetration and depth does not overlap between bindweed and preferred crops (Bakke 1939, Black et al. 1994, Blank 1987, Stahler 1948). However, under conditions of water stress, field bindweed can be a better competitor than most cultivated crops (Stahler 1948).

**Weed status**. Field bindweed is included among the world’s most undesirable agricultural weeds (Holm et al. 1977), including the United States (Lorenzi and Jeffery 1987, Phillps 1967). As early as 1939, Jepson considered it a “difficult weed to eradicate, the most troublesome orchard and garden pest yet naturalized in California”. In California, field bindweed is considered an important weed in cultivated fields and vineyards (Holt and Wright 1990, Mitich and Kyser 1990, Rosenthal 1985), but has not been listed as one of greatest ecological concern in California (Anonymous. 1996).

**Microbial pathogens**. Several fungal pathogens have been reported to infect bindweed, including *Alternaria*, *Fusarium*, *Phoma proboscis*, and *Phomus convolvulus* (Abbas et al. 1995, Aneja and Srinivas 1990, Ansari et al. 1990, Heiny 1990, Heiny and Templeton 1991, Morin et al. 1989, Ormeno-Nunez 1988a, 1988b, Sparace et al. 1991). *Phomus convolvulus* appears to be the most successful fungal biocontrol, but sporulates optimally only under conditions of high humidity (Morin et al 1989). *Phoma proboscis* was found to be resistant to herbicide treatment and may act synergistically in the control of bindweed growth (Heiny 1994). Like *Phomus*, however, it develops best under conditions of high humidity (Heiny and Templeton 1991).

**Insect pathogens.** Several phytophagous insects (i.e., Noctuid moths, whiteflies) and gall-forming mites (e.g., *Aceria*, *Epitrimerus*, *Aculus*) are reported to be destructive to bindweed (Boldt and Sobhian 1993, Chessman et al. 1997, Coudriet et al. 1986, Craemer 1995, Rosenthal 1985, 1996, Rosenthal and Buckingham 1982, Rosenthal, et al. 1988). Chessman et al. (1997) found that moth larvae fed on leaves and stems of several bindweed “biotypes”, but development to pre-pupal maturity was delayed relative to larvae feeding on other “biotypes”. Introduction and establishment of gall-forming mites (*Aceria malherbae*), which reduces productivity in field bindweed, was initially successful in Texas, but mite populations did not persist (Boldt and Sobhian 1993).

**Herbicide control.** Several kinds of herbicides (e.g., arsenicals, chlorates, dicamba, flouroxypyr, 2,4-D, glyphosates, imazapyr, metasulfuron) have been used primarily in cultivated fields, with varying results (Bakke 1941, Crafts 1937, Flint and Barrett 1989, Heering and Peeper 1988, Hulbert et al. 1930, Lynes 1935, MacDonald et al. 1993, 1994, Mashadi and Evans 1986, 1988, Packer and Krall 1989, Schoenhals et al. 1990, Tingey 1994, Wiese and Lavake 1986). Pandey and Singh (1994) reported that bindweed could not be controlled with sulphonyl urea herbicides, at least in wheat fields. Field conditions, including amount and time of cultivation, and soil moisture, appear to be critical factors determining effectiveness of some herbicides (Hulbert et al. 1930, Lynes 1935, MacDonald et al. 1994, Wiese et al. 1997a, 1997b). Use of surfactants (e.g., sodium carbonate) and soil nutrient (e.g., nitrates, phosphates) levels have been reported to reduce the effectiveness of certain herbicides (Nalewaja et al. 1990, Shaw et al. 1985). One or more different herbicides appear to be effective when combined with appropriate tillage conditions (Bailey and Davison 1984a, Lynes 1935, Matic and Black 1994).

Glyphosates appear to be among the more effective herbicides in cultivated fields (Ahrens and Pill 1985, Dall'Armellina and Zimdahl 1989, Packer and Krall 1989, Sherrick et al. 1986). Yerkes and Weller (1996) reported differing response to glyphosate, suggesting variation in susceptibility or resistance. Westwood et al. (1997b) reported various levels of susceptibility to glyphosates, which were related partly to differences in adsorption and translocation. Mixtures of glyphosates with other herbicides appear to be synergistic and may be more effective (Flint and Barrett 1989, Westra et al. 1992).

**Other control measures**. The use of dark polyethylene film to increase soil temperature has been shown to be effective than herbicides for small infestations (Elmore et al. 1993). Under some conditions, defoliation has reduced productivity and reduced infestation levels (Bailey and Davison 1984b, Timmons and Bruns 1951). Combinations of both herbicide treatments and mechanical removal methods also have been shown to be effective (Derscheid et al. 1970, Wiese et al. 1997a, 1997b).

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