The Flower Biology of *Cephalanthera longifolia* (Orchidaceae)—Pollen Imitation and Facultative Floral Mimicry

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(Received November 30, 1979)

Key Words: Angiosperms; Orchidaceae, Cephalanthera longifolia, Cistaceae, *Cistus salviifolius*. Hymenoptera, Halictus.—Flower biology and ecology, pollination, pollen imitation, floral mimicry.

Abstract: Solitary bees (*Halictus* sp.) were found to be the effective pollinators of *Cephalanthera longifolia*. In the same foraging flight the bees also visit flowers of *Cistus salviifolius* which has a similar colour pattern. *Cephalanthera* offers no reward to its pollinators, but orange papillae on its labellum successfully imitate pollen of *Cistus*. As *Cephalanthera* also attracts pollinators in the absence of *Cistus*, this is regarded as “facultative floral mimicry”.

*Cephalanthera longifolia* (L.) FRITSCH [= *C. ensifolia* (Sw.) RICH.] is an Euro-Siberian + Mediterranean species (Gruenberg-Fertig 1966) whose distribution extends throughout Europe to Northwest Africa, and eastwards to western Siberia, the Himalaya, China, Korea, and Japan (Summerhayes 1968, Renz 1978). In Israel, *C. longifolia* is rather rare and occurs in the oak and pine forest communities throughout the Mediterranean territory (Dafni 1979).

The literature concerning the pollination of the genus *Cephalanthera* is very sparse. Van der Pijl & Dodson (1966, p. 36-37) classified this genus as wasp pollinated, based on the data of Godfrey (1931, 1933) who reported finding a sawfly (*Dolerus*), other wasps and *Halictus* sp. on *C. longifolia*. Similarly, Summerhayes (1968, p. 124) noted that *Halictus* and *Andrena* are pollinators of the same species. *C. damasonium* (Mill.) Druece is autogamous, and Proctor & Yeo (1973, p. 287) remark that “self-pollination among the Helleborines (Cephalanthera and Epipactis) is probably related to a more general shortage of pollinators in the dark and rather bare woods which they frequent”.

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Cephalanthera longifolia is known to have no food reward, nectar or edible pollen, so the question remains as to what attracts the pollinators to the flowers. The mechanism of the pollinia removal is well known and is described in detail by Summerhayes (1968, p. 124). In preliminary observations it was found that C. longifolia shares pollinators with Cistus salvifolius. Since both species have the same coloration, the possibility of floral mimicry had to be checked. Since the relevant literature is very scarce and most of the reports are not detailed enough (cf. Ducke 1901, Macior 1971, Yeo 1972, Lack 1976), special attention was paid to morphological, ecological, and evolutionary aspects.

Materials and Methods

The field observations were carried out during April 1978 and April 1979 at five localities: Mt. Carmel-Haifa University’s sparse Quercus calliprinos grove, Isfiya, Ya’ar Haya’aranim in a Pinus halepensis wood, Mt. Meron and Kfar Shamay (Upper Galilee) in a Quercus calliprinos grove. In each locality there were at least a few hundreds Cephalanthera longifolia flowering plants.

The field observations of the pollinators were made mainly between 10 am and 2 pm; at other times the insects were found to be relatively inactive. Some pollinators carrying pollinia of C. longifolia were caught in the field and transferred after several minutes to a well illuminated glass cage (30 x 40 x 30 cm) in the laboratory (50-60 % RH, 22-26 °C). This procedure was carried out on eight separate occasions. Ten to fifteen bees were caught and observed in each replicate.

To determine whether spontaneous autogamy occurred, 21 plants were covered with fine netting before the flowering so as to exclude any insect visits.

Twenty plants, at Haifa University grove, were marked and observed daily for phenological records in 1978 and 1979. Flowering duration and the capsule production rate (found by counting the number of swelling ovaries) were recorded in 60 flowers (30 in sunny patches and 30 in the shade).

In order to examine possible U.V. reflection, the flowers were photographed using U.V. sensitive film (plus-x-pan) and a suitable filter (Kodak Wratten Filter 18 A).

Results

Floral Morphology. The plants are 20 to 50 cm in height, the dense spikes containing 5 to 25 pure white flowers. The lanceolate sepals are 15–18 mm, the blunt petals 12–15 mm long. The labellum (15–19 mm in length) consist of two parts. The inner (hypochile) is concave and its side lobes clasp the column; it is white with an orange patch at the bottom. The kidney shaped outer part (epichile) has 4-6 yellow-orange parallel ridges covered with papillae (50 µm). The flower does not secrete any fluid or reducing sugars (checked by Fehlings reagent), but it has a sweet fragrance.