

The pollination of European orchids

Part 7: Autogamy: *Neotinea maculata* and *Corallorhiza trifida* by Jean Claessens and Jacques Kleynen

Introduction

In this last part of our pollination series we will discuss the way autogamy or self-pollination is achieved in two species. Autogamy is thought to be disadvantageous, resulting in less vigorous offspring. Estimates of occurrence of autogamy in orchids range from five to 20% (Tremblay *et al.*, 2004). In Europe we found autogamy in 19 genera (Claessens and Kleynen, 2011); the genus *Epipactis* is notorious for its many self-pollinating species, making identification difficult.

Neotinea maculata

The Dense-flowered Orchid is a rather inconspicuous orchid with two or three oval, spotted or unspotted leaves. The inflorescence is short with many small, densely packed, whitish or pink-tinged flowers. The species has a faint vanilla scent. Sepals and petals form a hood, with the three-lobed lip sticking out. Davies & Huxley (1983) described the flower as "... a tiny man with an oversized helmet". At the flower base is a short, conical spur which according to some authors contains nectar. However, we never found any free nectar when inspecting over 100 flowers. The column is broad and the anther cells open wide, even before anthesis. The pollinia are connected to the viscidium by very slender caudicles. The two stigmatic lobes do not lie under the viscidium, as is the rule in many orchids, but instead they are placed left and right of the anther base. When the anther opens, the pollinaria can easily fall out of the wide open anther and then onto the nearby stigmatic lobe. They will almost inevitably stick into the stigmatic fluid, after which the massulae are soaked with stigmatic fluid and the pollen tubes start growing towards the ovary. Our observations showed, that this species is almost invariably self-pollinating. However, this species has scent production, a feature for attracting insects. Sometimes a pollinarium is missing, indicating the activities of insects. Indeed, there are scarce reports of little bugs as

Figure 1: *Neotinea maculata* habitat.

Figure 2: *Neotinea maculata*, showing the characteristic dense-flowered inflorescence.

Figure 3: Column of *Neotinea maculata*. The stigmatic lobes (S) are left and right of the anther. One pollinarium has fallen out of the anther, an example of autogamous pollination.

Photos by Jean Claessens (Figs. 1 & 3) & Jacques Kleynen (Fig. 2)





pollinators (Berger, 2003; Wilcox, 2014). *N. maculata* is the only representative of the genus *Neotinea* which is autogamous, the other species of the genus, *N. ustulata*, *N. lactea* and *N. tridentata*, are allogamous and rely on pollinators for pollination. In *N. maculata* it is above all the wide opening of the anther and the very thin, flexible caudicle that enable a successful autogamous pollination.

Corallorhiza trifida

This small, whitish-green orchid has no leaves, just a few sheathing scales along the stem. The inflorescence is lax, carrying four to 12 pendant flowers. Median sepal and petals form a hood, the lateral sepals are spreading. The lip is white, marked red spots at the base. There is a spur-like prolongation of the lip, called the mentum, visible as a knob on the ovary; it contains no nectar. The flowers produce a faint musk scent. The column is erect and slender. The anther contains four superposed pollinia, that are connected by very thin caudicles to a knee-shaped outgrowth of the viscidium, called the hamulus. Although the viscidium is functional, the species is autogamous. The flowers attract various small insects, above all tiny Empid flies. We regularly saw them probing the flower for nectar. They were clearly attracted by the flowers. However, we never saw a removal of pollinaria by the Empid flies. In fact, removal is often impossible, because this orchid generally self-pollinates in an early stage of development, before the flower opens. The anther already opens while the flower is still in bud. As soon as the anther cap lifts, the pollinaria fall out of the anther. The caudicles prevent them from falling onto the ground, instead they guide them towards the stigma, which is right under the anther. The caudicles have exactly the right length, so that one or more pollinia invariably land onto the stigmatic surface (Claessens and Kleynen, 1998, 2012). In some rare cases we observed that one or more pollinaria were missing, but we couldn't find any traces of autogamous pollination. It is uncertain if the missing pollinaria were eaten or if they had just fallen onto the ground. The viscidium is functional, so there might be a chance that in some rare cases the pollinaria were removed by an insect, but that remains to be investigated. The very high fruit set is an indication of autogamy.

Figure 4: A single flower of *Neotinea maculata*.

Figure 5: *Spermophagus sericeus*, a rare pollinator of *Neotinea maculata*.

Figures 6 & 7: Autogamous species generally show a very high fruit set, like those fruiting specimens of *Neotinea maculata* show.

Photos by Jean Claessens (Figs. 4, 6 & 7) & Yves Wilcox (Fig. 5)

Autogamy seems to be a dead end, because there is no exchange of genetic material. Yet, this strategy can be beneficial, because it enables species to conquer or to live in an environment in which hardly any insects are found. The plant is no longer dependent on insects for its pollination. For more information please visit our website www.europeanorchids.com or consult our book “*The flower of the European orchid – Form and function*”.

References

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On the page opposite:

Figure 8: *Corallorhiza trifida*, habitat.

Figure 9: *Corallorhiza trifida*, inflorescence. In the two right flowers the pollinaria have already fallen out of the anther.

Figure 10: Small Empid flies inspecting the flowers of *Corallorhiza trifida*.

On the following page

Figure 11: *Corallorhiza trifida*, column. S=stigma, C=caudicle, V=viscidium. The pollinia are superposed, the caudicle is thread thin.

Figure 12: *Corallorhiza trifida*, column. The pollinaria have fallen out of the anther and are sticking onto the stigmatic surface.

Photos by Jean Claessens

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