

Scorpion fly *Panorpa communis* – a fierce predator of orchid visitors

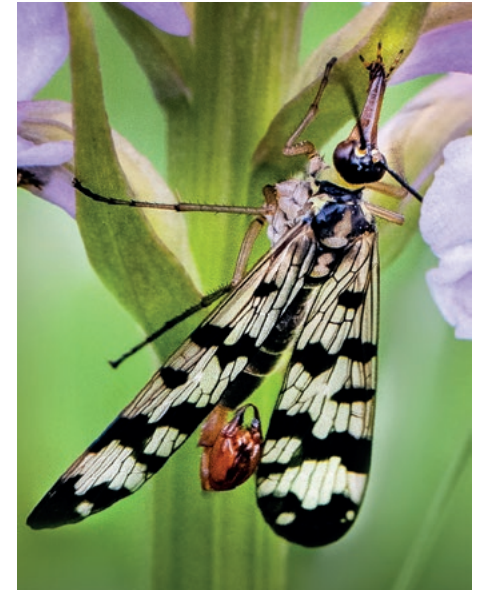
Nora De Angelli discusses a surprising, if rather gruesome, benefactor of orchids
Photos by Nora De Angelli

Scorpion flies, of the order Mecoptera (a compound word originating from the Greek, meaning with long wings), are carnivorous insects which usually feed on dead (rarely live) insects and aphids. These large mecopterans have slender black and yellow bodies, four long, membranous, transparent, dark-spotted wings, large compound eyes and an elongated, beak-like rostrum or mouthparts.

The rostrum has long and strong mandibles capable of piercing any invertebrate's soft, dead body, ultimately devouring or sucking up its internal organs. Always in search of food, *Panorpa* flies may also feed on decaying vegetation, plant sap or nectar (Dunford, 2008). The larger species are also known to be attracted by the foul smell of decaying flesh (carrion) over a long distance.

The males have an even more threatening appearance, given by their upcurved abdomens, which end with a large, reddish pair of claspers. These closely resemble the tail of a dangerous scorpion with an upward sting, hence their vernacular name, scorpion flies (Hoell et al., 1998). Despite the sinister, scary reputation of these insects, the claspers at the end of their tail do not sting, as is commonly believed. They are, in fact, the males' genitalia, used to hold females during mating (Gullan & Cranston, 2014).

In Central Europe, the large *Panorpa* flies are often seen hunting for orchid visitors or pollinators. They are usually found in



Panorpa communis on *Dactylorhiza maculata*, chewing the leftovers of a marsh fly



Detail of the head. At the tip of the mandibles, there are two pairs of strong fleshy appendages, known as pedipalps

humid meadows, heathlands, swampy areas, and sub-alpine regions. In many circumstances, during my long days of field research in Transylvania, while trying to study various *Dactylorhiza* populations and their specific pollinators found in those areas, I often encountered *Panorpa* flies landing on large orchid inflorescences, in their constant food-foraging habit. [Ed: three species of scorpion fly are known from Britain, of which *Panorpa communis* is the commonest.]

Dactylorhiza orchids are robust, imposing plants with dense, very floriferous inflorescences. The flowers are medium-sized, with colours varying from pure white to dark purple.

The lips are three-lobed, presenting various patterns of pink to purple stripes, dots, or loops, characteristic of each species. These patterns are known as false nectar guides (honey guides) that point the visiting insects towards the centre of the flower, where the anther and stigma are placed. The stigma shows a darker lining, which acts as a supplementary honey guide (Claessens & Kleynen, 2011).

At the base of the lip, just under the stigma, lies a long, conical or cylindrical spur which, with no exception, is devoid of nectar. All *Dactylorhiza* (I do not consider the genus to include *Coeloglossum*) are non-rewarding species with nectarless flowers that do not offer any recompense to pollinating insects. Despite lacking a reward, *Dactylorhiza* are allogamous (they do not self- or auto-pollinate) and depend entirely on insects for their cross-pollination and seed production. As a result, their pollination is exclusively based on deceit and mimicry (De Angelli & Anghelescu, 2020).



Dactylorhiza incarnata flower structure



The floriferous inflorescence of *Dact. maculata*

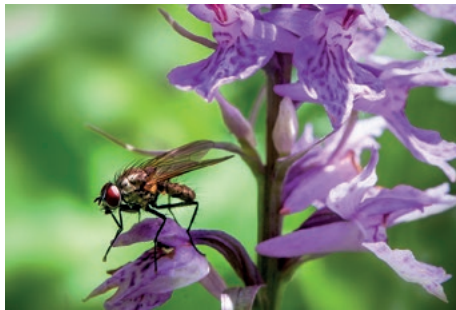
Dactylorhiza maculata plants in their natural habitat

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Common flies of the family Anthomyiidae foraging for nectar on various *Dactylorhiza* species



Dactylorhiza maculata



Dactylorhiza maculata subsp. *saccifera*



Dactylorhiza maculata subsp. *fuchsii*

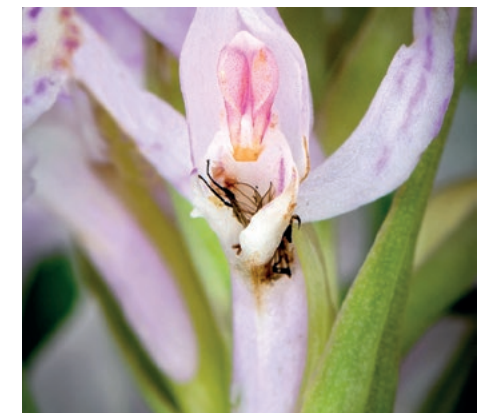
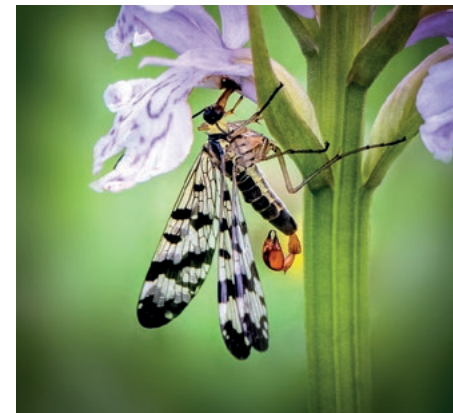
On a few occasions, I noticed male scorpion flies aggressively piercing the spurs of *Dact. maculata* subsp. *fuchsii* and *Dact. maculata*. From a distance, I could not understand why they were so keen on breaking through the spur walls – after all, the spurs contain no nectar. However, after getting closer, I finally managed to get a clear idea of their strange behaviour.

Dactylorhiza flowers are characterised by a sticky stigmatic surface that usually helps retain the pollen during the pollination process. This viscous substance, composed of amino acids and sugars, constitutes an important food source, which is regularly consumed by a variety of insects, increasing pollination success. However, on hot summer days, when the outside temperature is quite high, up to 35–40°C, the enzymes present in this stigmatic excretion can promote fermentation and produce fair amounts of alcohol. For small dipterans that frequently visit *Dactylorhiza* species, these small amounts are enough to cause drowsiness (Delforge, 2006). Quite frequently, due to their intoxication, the drunken flies either get stuck on the viscous stigmatic surface or fall inside the spur of the flower, where they get trapped and die.

Fierce scavengers, *Panorpa* flies take advantage of this. Using their long mandibles, they easily pierce the thin walls of the spurs and reach the dead (or dying) bodies stuck inside. At the tip of the mandibles, there are two pairs of strong fleshy appendages, known as pedipalps. The function of the pedipalps is to hold and penetrate the carcass and then, suck out the juices from the flies' bodies.

On one occasion, I witnessed a male scorpion fly devouring, through a hole made in the spur of a *Dact. maculata*

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Panorpa communis male feeding on a dead fly trapped inside the spur

flower, the body of a trapped marsh fly. During the whole process, which lasted almost 12 minutes, neither my presence nor the gradually approaching camera lens scared it in any way. Moreover, noticing the larger intruder (myself) it turned its back to me and started buzzing its wings to scare me away, to guard and protect its delicious meal.

These cunning, intelligent scorpion flies can also be considered second-level predators, as they often explore and patrol their surroundings, searching for spider webs, from which they steal the trapped insects. Rarely, lacking a better meal, these aggressive carnivores may also attack and feed on the spiders themselves. However, in most cases, regardless of their size, I noticed that the spiders remained hidden, away from the web, waiting patiently for the hungry, dangerous robbers to



Various common marsh flies visiting *Dactylorhiza* flowers

leave. On hot summer days, when the temperatures rise, *Panorpa* flies are also encountered robbing the abundant and nutritious nectar from various orchids such as *Anacamptis coriophora* or *Epipactis helleborine*.

Anacamptis coriophora is the only species of the genus with rewarding flowers. The flowers have a thick, conical, downward-pointing spur that secretes large amounts of nectar. To add to the attraction, the flowers emit an unpleasant, heavy, carrion scent, which resembles that of some species of bug, a fact suggested by their common name of bug orchid and also by their specific epithet *coriophora*. The latter is a compound term derived from ancient Greek meaning smelling like a bug. The pungent carrion scent makes bug orchids irresistible to the scorpion flies, which tend to spend significant amounts of time



Dagger flies of the family Empididae getting trapped in the viscous stigmatic exudate, blocking the spur entrance with their dead bodies

on the inflorescences, probing several flowers with their long beaks and drinking the sweet nectar to satiation.

Epipactis species are also known for secreting generous amounts of nectar, in the nectar cup (hypochile) found at the base of the labellum. However, their nectar has toxic or hallucinogenic properties, affecting the behaviour of many pollinators and visitors alike (De Angelli & Anghelescu, OSGBJ 71(3): 193–197). It contains ethanol and narcotic substances, such as derivatives of indole, morphinans (oxycodone), and derivatives of phenol (Müller, 1988; Ehlers and Olsen, 1996). The intoxicating effect, though, does not seem to scare away the omnivorous visitors. On the contrary, it was shown that the alcoholic, narcotic nectar is highly addictive and attractive to large insects, such as wasps – very efficient *Epipactis* pollinators (De Angelli 2022) – and scorpion flies – very efficient nectar robbers.

In humid areas, the inflorescences of various species of orchids often host large colonies of black aphids. Aphids are parasites on orchid flowers and feed on the nutrient-rich phloem sap of the young blooms, thus suppressing floral budding. This phenomenon is especially encountered in young *Epipactis* plants, in which the parasitic aphids drain the sap out of the buds, ultimately destroying the whole inflorescence and thus preventing the seasonal flowering altogether. Aphids, however, are food for many predatory insects, among which are parasitic wasps, predatory beetles, and scorpion flies.

Consequently, despite the occasional nectar-robbing habit, the scary-looking *Panorpa* flies may be regarded as beneficial to orchids, since they tend to protect various species from parasitic invasions.



Dactylorhiza maculata inflorescence hosting female orb-weaving spider, *Aculepeira ceropegia*. Its web is heavily loaded with small marsh flies



Aculepeira ceropegia female trying to catch/ambush an Anthomyiidae fly, which just landed on one of the flowers

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Male scorpion fly robbing nectar from the broad-leaved helleborine, *Epipactis helleborine*

Female scorpion fly robbing nectar from *Anacamptis coriophora* flower; the inflorescence harbours a large black aphid colony

