Moth Pollination of Greater Butterfly-orchids

By Mike Gasson

My interest in butterflies and moths coincides with a long standing affection for wild orchids. I have included this small piece as we had space to fill in the newsletter and because it illustrates how these two interests can sometimes come together. I do a fair amount of voluntary work with Norfolk Wildlife Trust and for several years have done what I can to preserve a small and vulnerable population of Greater Butterfly-orchids in Foxley Wood. This year they featured in a corporate event and rather than have people just look at the flowers I tried to demonstrate something of the remarkable way that this orchid species exploits moths to achieve pollination. It proved to be a successful venture, providing an active pollinator specimen for the visitors and some decent photographs, a few of which are shared here.

The orchid flowers are white and become especially conspicuous as the light fades. This visual attractant is accompanied by the production of a scent that acts as a potent moth lure. Furthermore, the flowers feature a very long spur that contains a large amount of nectar, thereby providing a reward to visiting lepidoptera. The length of the spur with its nectar at the end restricts this reward to insects that are equipped with a suitable length of tongue/proboscis. The flower's lip provides a convenient support for the moth's body and it can hang on to the lateral sepals as if they were designed as handle bars!

Orchid pollen is unusual in that, whilst produced in great quantity, it is held together in the form of pollen bundles and incorporated in sophisticated structures known as pollinia. In the case of orchid species that are insect pollinated various mechanisms have evolved to attach the pollinia to a visiting insect. The Greater Butterfly-orchid has pollinia with sticky pads that are strategically placed on each side of the entrance to the nectar carrying spur. In order for these to become attached to a visiting insect they need to make contact such that they adhere and allow the pollinia to be taken away to pollinate another flower. In moth terms this is where it gets rather interesting.

Moths are almost completely covered in hairs or scales that would break off the insect rather than facilitate carriage of an attached orchid pollinia. For this reason the only places that the pollinia will effectively stick to a moth is on the eyes or the proboscis. The Greater Butterfly-orchid has evolved to target the former, whereas the related Lesser Butterfly-orchid targets the latter. One of the simplest ways of differentiating these very similar looking orchid species is to look at the distance between the two pollinia: they are close together when the proboscis is targeted (Lesser) and wider apart when aimed at the eyes (Greater).

In order to be effective as a pollinator the moth morphology needs to meet two criteria. First, the proboscis length needs to match the spur length. Too long and the moth gets the nectar whilst its eyes stay clear of the sticky pads! Second, the eyes need to be the right distance apart to make contact with the sticky pads.

This mechanism was first proposed by Charles Darwin but the most comprehensive practical work on moths as pollinators of Greater Butterfly-orchids was undertaken in Sweden during the 1970s by Andres Nilsson. One of my orchid friends, Roy Sexton, has done similar work in Scotland, trapping moths in a meadow habitat rich in Greater Butterfly-orchids and then looking to see what species had acquired pollinia. His work confirmed that Noctuids of the Plusiinae sub-group are especially effective orchid pollinators.

Going back to the Norfolk event, I ran some moth traps at the time the orchids were in flower and found several species of this group to be active in the habitat. Silver Y (*Autographa gamma*), Beautiful Golden Y (*Autographa pulchrina*) and Burnished Brass (*Diachrysitis chrysitis*) were all present. As you can see in the photographs opposite, I found that our local orchids were able to deliver pollinia to the Burnished Brass (lower image) and scored a bull's eye with the Beautiful Golden Y (top image).

One additional feature of this mechanism, also occurring in some other orchid species, is that once adhered to the moth the pollinia bend such that they protrude to be in line with the orchid stigma. This ensures that the insect presents the orchid pollen perfectly so as to pollinate another flower when it moves on. It is easy to use a pencil or similar object as an artificial pollinator – the pollinia stick on and you can watch them bend. What is even more sophisticated is the fact tthat the bend time tends to be matched to the time that an insect typically stays on an individual flower thereby promoting cross pollination.

Moths that are attracted to feed on the orchid nectar can pay a high price and may acquire large numbers of pollinia such that they are effectively blinded. Despite this the strong scent still provides them with a guide and they will continue to feed. Two of my other orchid friends, Jean Claessens and Jacques Kleynen, specialise in studying and photographing orchid pollination. The black and white image is derived from one of their photographs and if you are interested some articles and epic video clips can be accessed via the home page of the Hardy Orchid Society website:

www.hardyorchidsociety.org.uk