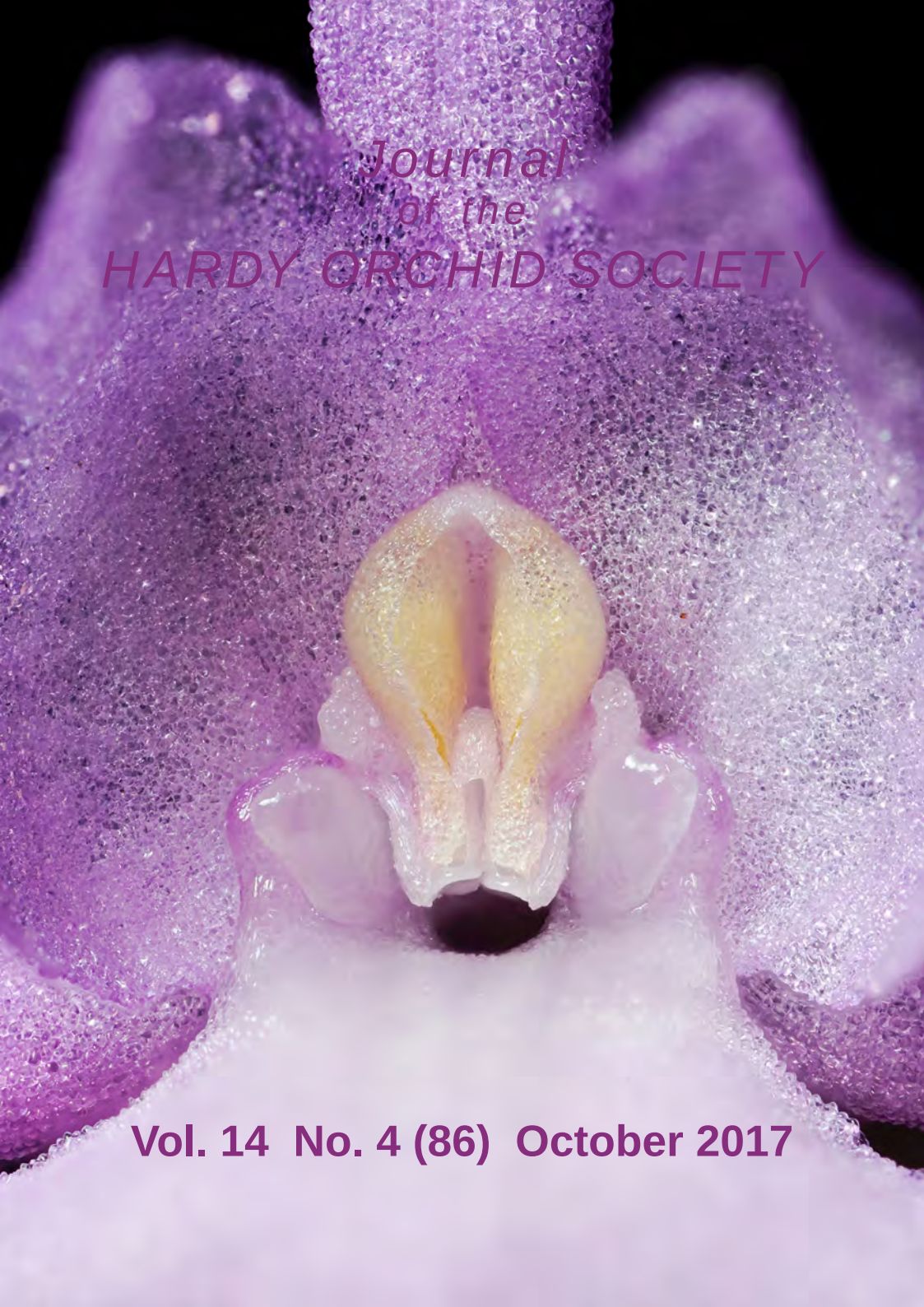


Journal of the HARDY ORCHID SOCIETY

Vol. 14 No. 4 (86) October 2017

Cover Photographs

Front Cover: *Gymnadenia conopsea* close-up showing the column and the two stigmatic lobes left and right of the spur entrance.
Back Cover: *Neottia ovata*, flower.

(See pollination article on page 130)

Photos by Jean Claessens & Jacques Kleynen.

The Pollination of European Orchids Part 6: Nectar As Attractant: *Gymnadenia conopsea* and *Neottia ovata*

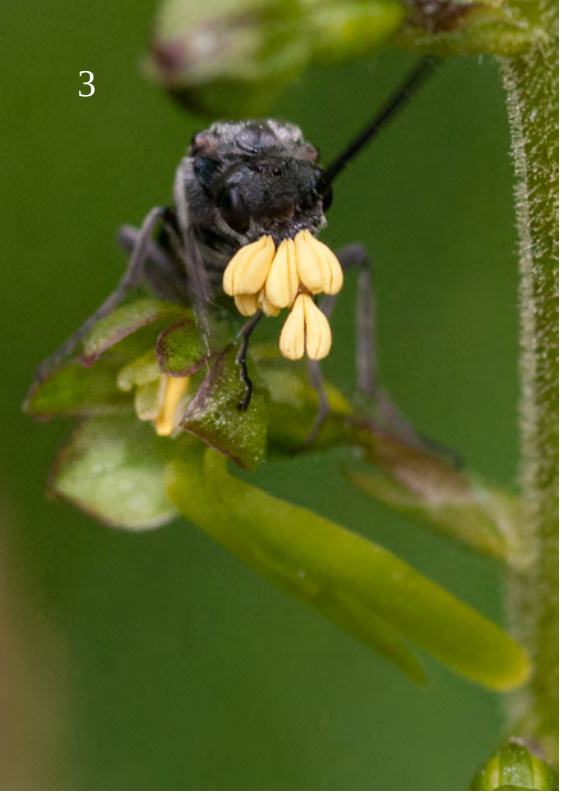
Jean Claessens & Jacques Kleynen

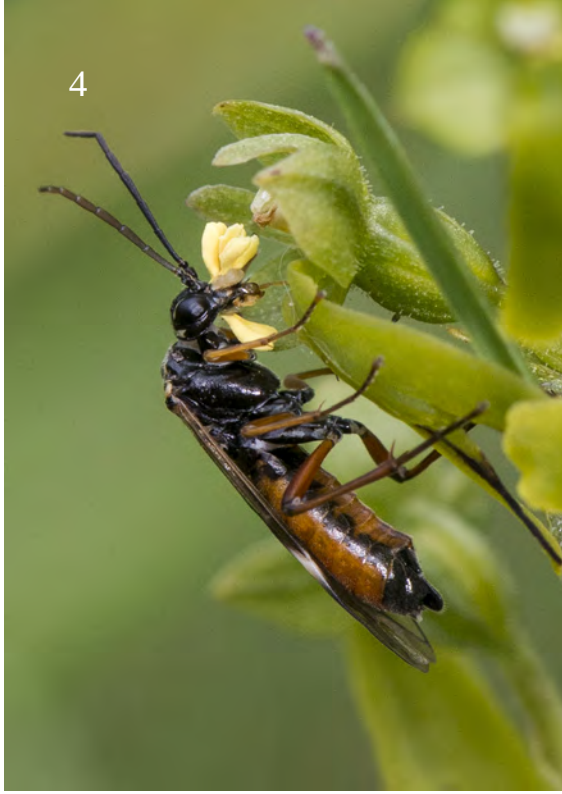
Attracting potential pollinators is vital for orchids, for most rely on insects for the transport of the genetic material, the pollinia or pollinaria. Nectar is an important attractant that serves as a food reward for the visiting insects. In this part of our series we will discuss two quite different ways of offering nectar to the visitors, illustrated in *Gymnadenia conopsea* and *Neottia ovata*. We will also discuss how this effects the potential visitor spectrum.

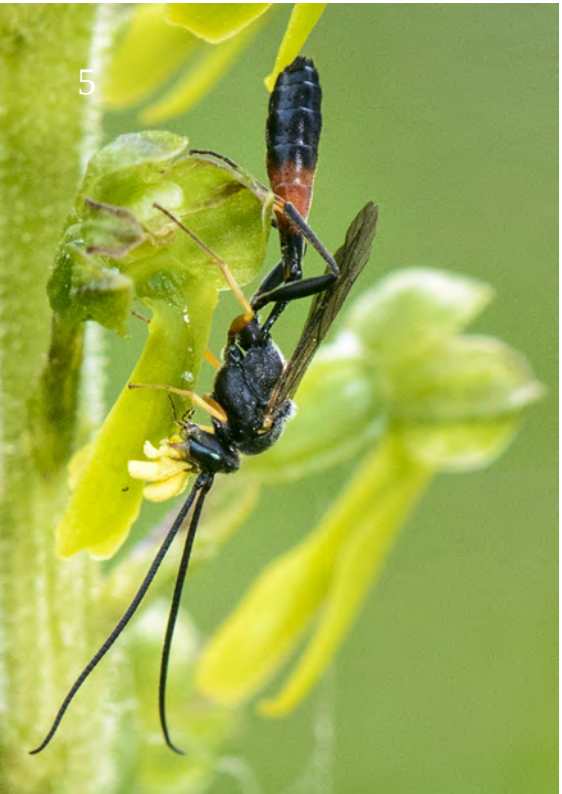
***Neottia ovata*, the Common Twayblade**

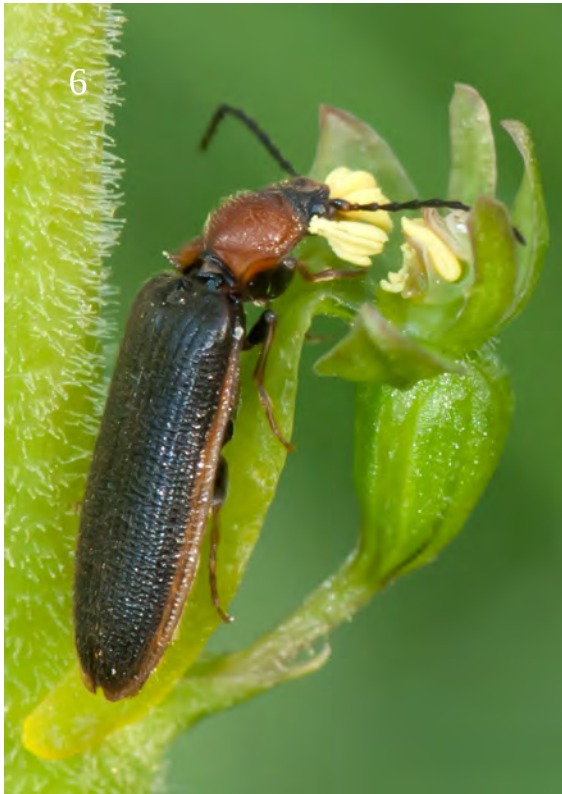
Although this common orchid can grow up to 60 cm, it is quite inconspicuous, because all flower parts are uniformly green. Characteristic are the two basal, egg-shaped leaves opposite to each other. It has a long flower spike with many flowers.

Fig. 1: *Neottia ovata*, flower detail; the stigma is already covered with pollen fragments.
Fig. 2: *Neottia ovata*, column; the pollinia are extracted with the help of a needle.
Fig. 3: *Dolerus aeneus* carrying several pollinia of *N. ovata.*
Fig. 4: *Tenthredopsis* sp. with various pollinia attached to its head.
Fig. 5: Ichneumon wasp, licking the lip for nectar.
Fig. 6: *Cantharis rustica* pollinating *N. ovata.*
Photos by Jean Claessens & Jacques Kleynen


3


4


5


6

The perianth segments form a very loose hood; the lip is yellow-green, strap-shaped and sharply bent down and backwards near the lip base. A slightly raised, linear, nectar-secreting zone runs down the centre of the lip. The lip base is slightly hollow, this is a second zone where a fair amount of nectar is produced. Both nectar sources are freely accessible to a wide range of insects.

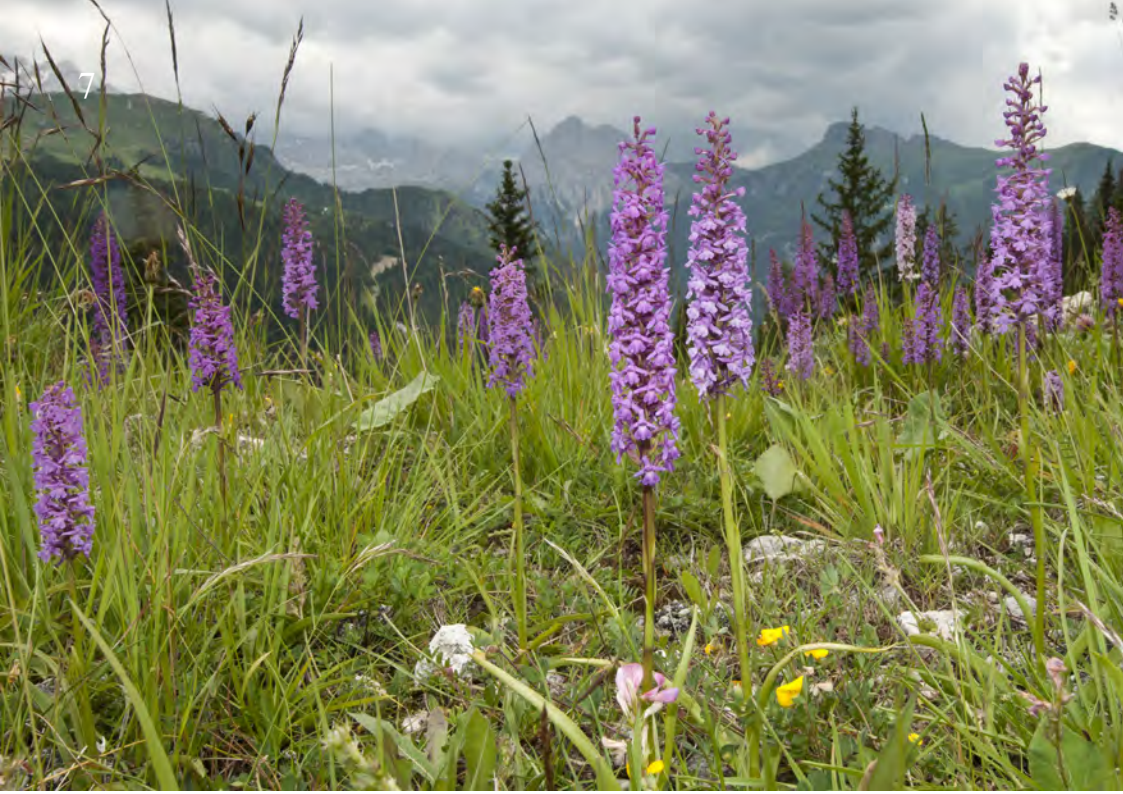
The column is quite special and characteristic for the genus. The pollinia are not connected to a caudicle or a viscidium, as in most orchids, but lie free in a gutter-shaped white structure, the rostellum. The rostellum consists of very long cells, filled with a viscid fluid. On top of the rostellum is a very sensitive, protruding tip. Under the rostellum lies the trapezoidal stigma, glistening with stigmatic fluid. Insects that land on the lip or the flower, start licking the nectar that is secreted on the lip. They can enter the flower upright or upside down, but they all follow the nectar trail and eventually turn towards the lip base, where the extra nectar supply is exposed. While licking, they touch the extremely sensitive tip of the rostellum, and in a split second the viscid fluid is expelled, taking the pollinia with it and adhering to the visitor's body. We filmed this fascinating strategy, a video is on Youtube: "Orchid pollination 11: Pollinia removal in *Neottia ovata"*. Depending on the size of the insect, the pollinia can stick to various parts of the body, but usually they are fixed on the head. If the insects react immediately, they can remove the load, but the viscid fluid hardens within seconds. After this the pollinia can no longer be removed, even when grooming intensely.

N. ovata is most visited by ichneumonids, sawflies and beetles (Youtube: Orchid pollination 6: Pollination of *Neottia ovata* by various insects), but the list of other pollinators is long. This orchid attracts a wide range of insects, due to its freely accessible nectar and unspecialised pollination mechanism: any insect that touches the rostellum can act as pollinator. This is in contrast with the specific relationship that exists in other genera, where only specific insects can act as pollinator, e.g. the adaptation of *Cypripedium calceolus* or *Cephalanthera* flowers to certain bees (Claessens and Kleynen 2013).

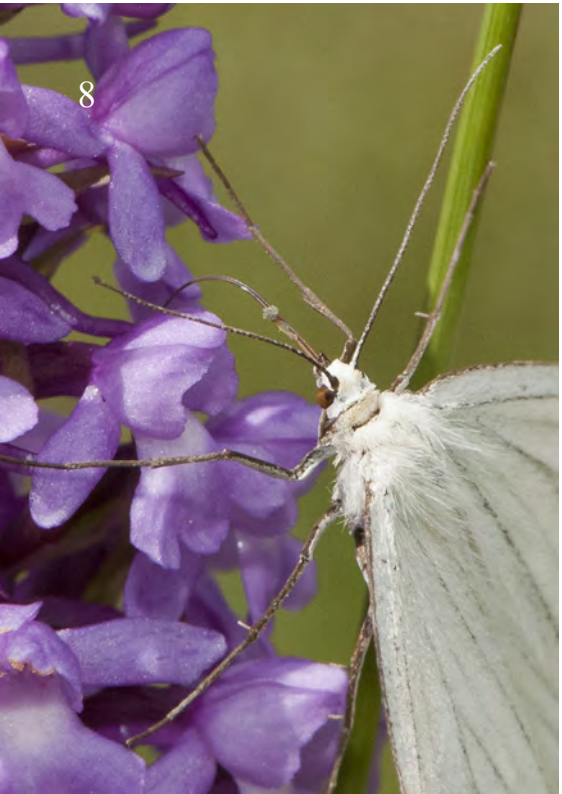
***Gymnadenia conopsea*, the Common Fragrant Orchid**

G. conopsea is also a large orchid, growing up to 60 cm tall. It has long, narrow, lanceolate leaves in two facing rows. The inflorescence is rather long and dense with up to 50 flowers. The flowers vary from rosy to reddish pink and pink-purple. Upper

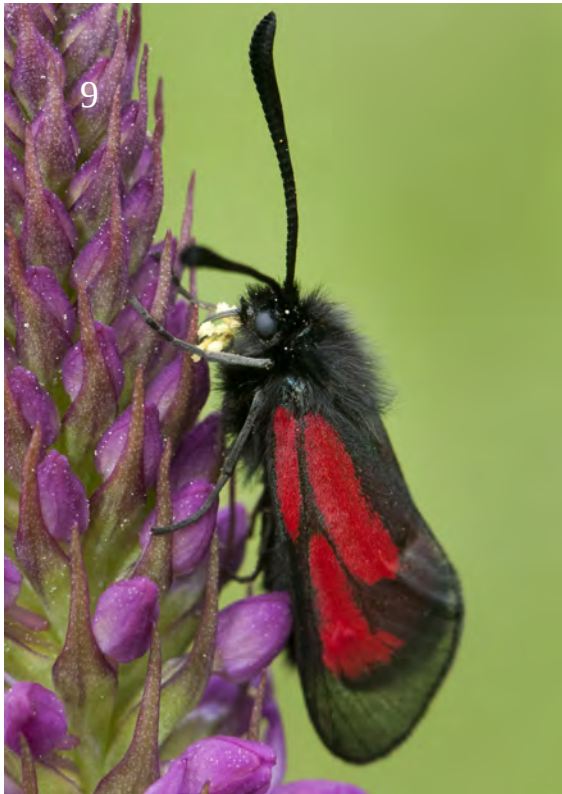
Front Cover: *Gymnadenia conopsea*, close-up showing the column and the two stigmatic lobes left and right of the spur entrance.
Fig. 7: *Gymnadenia conopsea* in its biotope, Dolomites (Italy).
Fig. 8: *Siona lineata*, Black-veined Moth pollinating *Gymnadenia conopsea*
Fig. 9: *Zygaena purpuralis* with pollinaria of *Gymnadenia conopsea.*
Photos by Jean Claessens & Jacques Kleynen



7



8



9

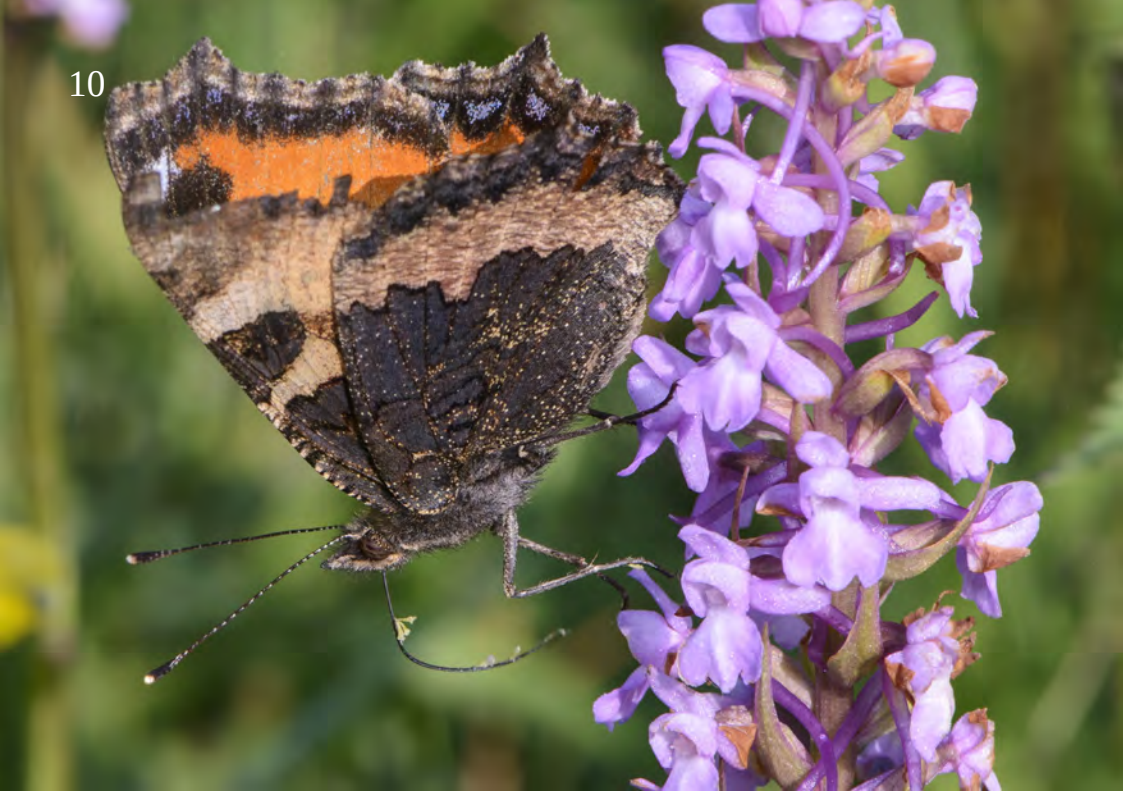
sepal and petals form a hood over the column, the lateral sepals are spreading. The lip is three-lobed, usually broader than long and ends in a long, slender, downward pointing spur, partly filled with nectar. The column is erect and has an anther with two pollinia connected to a caudicle and a naked viscidium, that is the viscidium is not covered by a bursicle or a membrane. The two viscidia are placed in the spur entrance at its upper side. The stigma is not under the anther, but instead forms two large stigmatic lobes left and right of the anther and a small third lobe in the spur entrance.

The flower morphology is well adapted to its main pollinators: Lepidoptera like the Silver Y (*Autographa gamma*), the Painted Lady (*Vanessa cardui*) or the Hummingbird Hawk Moth (*Macroglossum stellatarum*). The long, slender spur is only accessible for butterflies or moths who can reach the nectar with their long proboscis. The viscidia are in such a position that the proboscis of a visiting butterfly will touch them when probing the spur for nectar. The viscidia are long and narrow, well designed to adhere on the proboscis. When withdrawn from the anther, the pollinaria make a forward and sideward bending movement. This explains why the stigmatic lobes are placed left and right of the column. The butterflies are attracted by means of scent (the flowers produce eugenol which is quite attractive to the butterflies) and are rewarded by large quantities of nectar. A pollination video is on Youtube: "Orchid pollination 14: Pollination of *Gymnadenia odoratissima* by *Zygaena lonicera*". *G. conopsea* attracts diurnal as well as nocturnal pollinators, a strategy positively influencing the pollination rate.

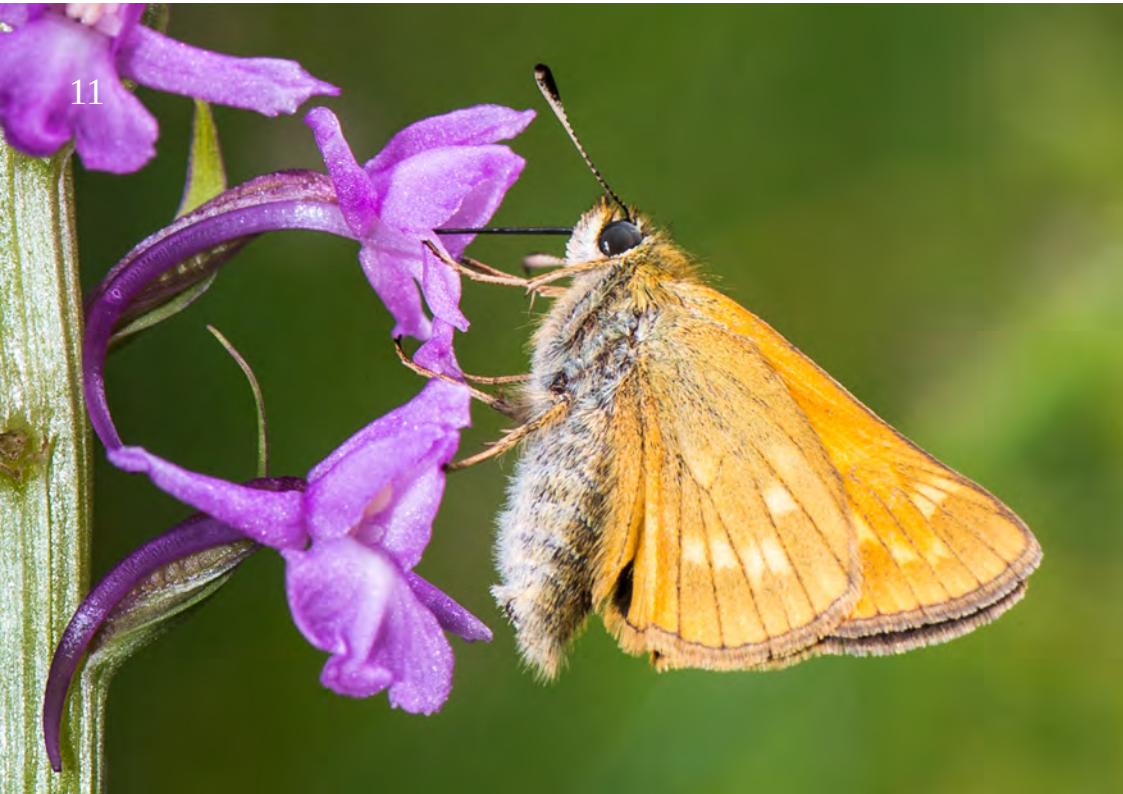
In special conditions there can be a shift towards other pollinators: we observed in one season that bumblebees were the main pollinators of a population of *G. conopsea* in the Netherlands (Claessens et al., 2014). Due to the shortage of other pollinators the nectar level in the spur was so high, that bumblebees could reach the normally inaccessible nectar. Normally the flower structure selects a specific group of pollinators, a contrast with *N. ovata*, in which flower structure allowed a large and heterogenous group of insects to reach the nectar and serve as pollen transporter. Despite the different pollination strategy both species attract a large number of pollinators and show a high fruit set.

Acknowledements
We would like to thank Mike Gasson for improving the manuscript. Also thanks to Nick Owens and Tony Irwin for their help with the identification.

Fig. 10: *Aglais urticae*, the small tortoiseshell pollinating *Gymnadenia conopsea*
Fig. 11: *Ochlodes sylvanus* pollinating *Gymnadenia conopsea*
Photos by Jean Claessens & Jacques Kleynen



10



11

References

Claessens, J. & J. Kleynen (2014) Bijzondere bestuivers bij orchideeën deel 2: Bijen als bestuivers van de Grote keverorchis (*Neottia ovata*). *Natuurhistorisch maandblad* **103**: 140-142.

Claessens, J. & J. Kleynen (2011) *The flower of the European orchid - Form and function*. Geulle: Jean Claessens & Jacques Kleynen, 440 pp.

Claessens, J. & J. Kleynen (2013) The Pollination of European Orchids: Part 2: *Cypripedium* and *Cephalanthera*. *Journal of the Hardy Orchid Society* **10**: 114-120.

Claessens, J. , J. Kleynen & B. Gravendeel (2014) Bijzondere bestuivers bij orchideeën Deel 1: Hommels als bestuivers van de Grote muggenorchis. *Natuurhistorisch maandblad* **103**: 30-32.

Harrap, A. & S. Harrap (2005) *Orchids of Britain and Ireland*. A&C Black, 480 pp.

Kotilínek, M. , T. Těšitelová & J. Jersáková (2015) Biological Flora of the British Isles: *Neottia ovata*. *Journal of Ecology* **103**: 1354-1366.

Nilsson, L. A. (1981) The pollination ecology of *Listera ovata* (Orchidaceae). *Nordic Journal of Botany* **1**: 461-480.

Sprengel, C. K. (1793) *Das entdeckte Geheimnis der Natur im Bau und in der Befruchtung der Pflanzen*. Berlin: Friedrich Vieweg dem aeltern, 258 pp.