

Actes du 18^e congrès
m o n d i a l
et exposition
d'orchidées
11-20 MARS 2005



Proceedings of the 18th World
O r c h i d
Conference
MARCH 11-20, 2005

DIJON – FRANCE

Sous la direction de
Edited by

et
and

avec le concours de
with the assistance of

Aline RAYNAL-ROQUES

Albert ROGUENANT

Daniel PRAT

France
Orchidées

Orchids' pollinators discovered in insect collections

Pollinisateurs d'Orchidées découverts dans des collections d'insectes

1. Dr. Vladimir Nazarov
Isarweg 37
D- 84028 Landshut, Germany
nazarov@gmx.net

2. Ulf Buchsbaum, Dr. Axel Hausmann
Zoologische Staatssammlung München
Muenchhausenstr. 21
D-81247 München, Germany.
UlfBuchsbaum.Lepidoptera@
zsm.mwn.de
Axel.Hausmann@zsm.mwn.de



Dr V. Nazarov¹, U. Buchsbaum² and Dr A. Hausmann²

Abstract

*Orchid pollinaria can be detected easily on insect pollen-vectors in the field as well as in collections. On the poster, the results from the analysis of pollinarium charge on various families of Lepidoptera (Zygaenidae, Noctuidae) are presented. Out of the material of the ZSM and the Museum Witt about 61,000 specimens have been examined from 15 countries. 421 vectors could be found for *Anacamptis pyramidalis*, 63 for *Platanthera chlorantha* and 17 for *Gymnadenia* spp. The identification of pollinaria of these orchid species was not complicate because its unique morphology. Additionally each orchid species shows a characteristic pattern of localization of the pollinarium on different head parts of the insects.*

Résumé

Les pollinies d'orchidées sont facilement observées sur les insectes sur le terrain comme dans les collections. Les charges en pollinies de divers lépidoptères sont présentées. Les échantillons du ZSM et du Museum Witt (63 000 spécimens observés) provenant de 15 pays différents montrent qu'il y a 421 vecteurs de pollen d'*Anacamptis pyramidalis*, 63 pour *Platanthera chlorantha* et 17 pour *Gymnadenia* sp. L'identification des pollinies de ces espèces reste difficile en raison de leur morphologie unique. Chaque espèce d'orchidée présente une répartition caractéristique des pollinies sur la tête de l'insecte.

It is well-known that pollination in most orchid species can rarely be observed. But pollen aggregates of orchid – pollinia are easy to detect on the pollinators. Morphology of pollinia or pollinaria is unique in some species, facilitating rapid assessment of orchid pollen vectors by examination and analysis of insects in collections.

Materials and methods

The Lepidoptera material of the Zoologische Staatssammlung München and the Museum Witt has been examined for orchid pollinaria.

Results

We were examine of about 63,000 specimens of Lepidoptera and found 480 insects with orchid pollinaria. Most pollinaria belong to 3 orchids: *Anacamptis pyramidalis* (L.) L.C.M. Richard, *Platanthera chlorantha* (Custer) Reichenb. and *Gymnadenia conopsea* (L.) R. Br. Species of the genus *Zygaena* Fabricius, 1775 (Lepidoptera, Zygaenidae) have been identified as pollinaria vector of *Anacamptis pyramidalis*. 421 specimens of 15 species are carried by 826 pollinaria on its proboscises. We found 132 specimens with 296 pollinaria (132 / 296)

for *Zygaena lavandulae* (Esper, 1783), 100 / 231 for *Z. purpuralis* (Brünnich, 1763), 78 / 110 for *Z. loti* (Denis & Schiffermüller, 1775), 46 / 74 for *Z. filipendulae* (Linnaeus, 1758). *Zygaena* specimens with pollinaria of *Anacamptis pyramidalis* have been captured in more than 90 localities from 12 European countries, Caucasus and Morocco (Fig. 1).



Different species of *Autographa* Hübner, 1821, *Macdunnoughia confusa* (Stephens, 1850) and *Plusia putnami gracilis* Lempke, 1966 (Noctuidae, Lepidoptera) were detected with hemipollinaria of *Platanthera chlorantha* and *Gymnadenia* spp. On the eyes of 63 specimens of 4 species were found hemipollinaria *Platanthera chlorantha*. The hemipollinaria *Gymnadenia conopsea* were detected on proboscises of 17 specimens, which belong to 5 species. All hemipollinaria vectors were collected in the 9 localities of Bavaria (Germany) between 1895 and 1981 (Fig. 1). *P. chlorantha* hemipollinaria have been found on collection specimens of Geometrid moths by Hausmann (2004), this moth family needs more extensive study to investigate their importance as orchid pollinators.

Fig. 1 – The distribution of orchids pollen vectors:

- *Zygaena* specimens with load of *Anacamptis pyramidalis* pollinaria;
- Noctuid moths with load of *Platanthera chlorantha* and *Gymnadenia* spp

Discussion

All orchid pollinaria in this research were identified on the base of their unique morphology. Identification of the pollinaria of *Anacamptis pyramidalis* was easy. Both caudicles of pollinaria of this orchid are joined in one viscidium. This morphological particularity is very rarely observed in European Orchids. Additionally the viscidium of *A. pyramidalis* has a unique “saddle-shaped” form, which was successfully used by Charles Darwin (1862) to assign the pollinaria of this orchid on 23 species of Lepidoptera.

Pollinaria of *Platanthera* as well as those of most European orchid species are subdivided into two parts. Each caudicle has got a separate viscidium, which can

be separately removed by pollinators. So we have designated this structure as *hemipollinarium* according to Dressler (1981) to stress its difference from the pollinarium. We have identified hemipollinaria of *Platanthera* species on the base of their characteristic pattern of localization on the head parts of the moth and the morphology of viscidia and caudicle. The eye-attached hemipollinaria of *P. chlorantha* (Cust.) Reichb. have circle-shaped viscidia and its caudicle is longer than the pollinium. In contrast to that there are the tongue-attached hemipollinaria of *Platanthera bifolia* (L.) L. C. Rich. with elliptical viscidia and a caudicle shorter than the pollinium (Nilsson 1983; Maad and Nilsson 2004). It is well-known that in localities with sympatric occurrence of *P. chlorantha* and *P. bifolia*, there are my hybrids with an intermediate form of hemipollinaria (Nilsson 1983, 1985). However, all hemipollinaria we have discovered were typical for *P. chlorantha*. They were localized on the eyes of the moths. In hemipollinaria vectors the distance between the distal margins of both eyes varied from 2.75 to 3.40 mm. This corresponds to the distance between both viscidia of *P. chlorantha* (Nilsson 1978).

Another sympatric species pair, *Gymnadenia conopsea* (L.) R. Br. and *G. odoratissima* (L.) Rich., differs from each other in morphology of hemipollinarium, but less apparently than *Platanthera* spp. However, to a very certain extent we can state that hemipollinaria of *G. conopsea* differed from those of *G. odoratissima* in length/width ratio of caudicle (Nazarov and Buchsbaum 2004). On this base we have identified hemipollinaria *G. conopsea* on 9 Noctuidae specimens. Other moths with hemipollinaria *Gymnadenia* need destruction of proboscises for sure identification of orchids.

We are sure, that a successful identification of pollinaria/hemipollinaria on the collected insect is possible also for the polymorphic genera of European orchids. Accurate morphometrical information with measurements of their caudicle, viscidia and pollinia are needed. To facilitate a large-scale data collecting we have already implemented a Pollinia Data Base on the RBO web portal (<http://www.orchidsrepiol.de/> and <http://www.r-b-o.ue/>).

Acknowledgements

The authors thank Thomas Witt (München) for his contributions to this project and Tanja Kothe (München) for her help with SEM.

References

- Darwin, C. 1862. *On the various contrivances by which British and foreign orchids are fertilized by insects*. Jon Murray, London. 300 p.
- Dressler, R. L. 1981. *The orchids: natural history and classification*. Cambridge, 332 p.
- Hausmann, A. 2004. *The Geometrid Moths of Europe 2. Sterrhinae*. Apollo Books, Stenstrup, 600 p.
- Maad, J., and L. A. Nilsson. 2004. "On the mechanism of floral shifts in speciation: gained pollination efficiency from tongue- to eye-attachment of pollinia in *Platanthera* (Orchidaceae)." *Biol. J. Linn. Soc.* 83: 481-495.
- Nazarov, V., and U. Buchsbaum. 2004. "Widderchen als Bestäuber von Orchideen in Thüringen (Insecta: Lepidoptera, Zygaenidae)." *Entomofauna.* 25: 365-372.
- Nilsson L. A. 1978. "Pollination ecology and adaptation in *Platanthera chlorantha* (Orchidaceae)." *Bot. Notiser.* 131:35-51.
- 1983. "Processes of isolation and introgressive interplay between *Platanthera bifolia* (L.) Rich. and *P. chlorantha* (Custer) Reichb. (Orchidaceae)." *Bot. J. Linn. Soc.* 87: 325-350.
- 1985. "Characteristics and distribution of intermediates between *Platanthera bifolia* and *P. chlorantha* (Orchidaceae)." *Nord. J. Bot.* 5: 407-419.