



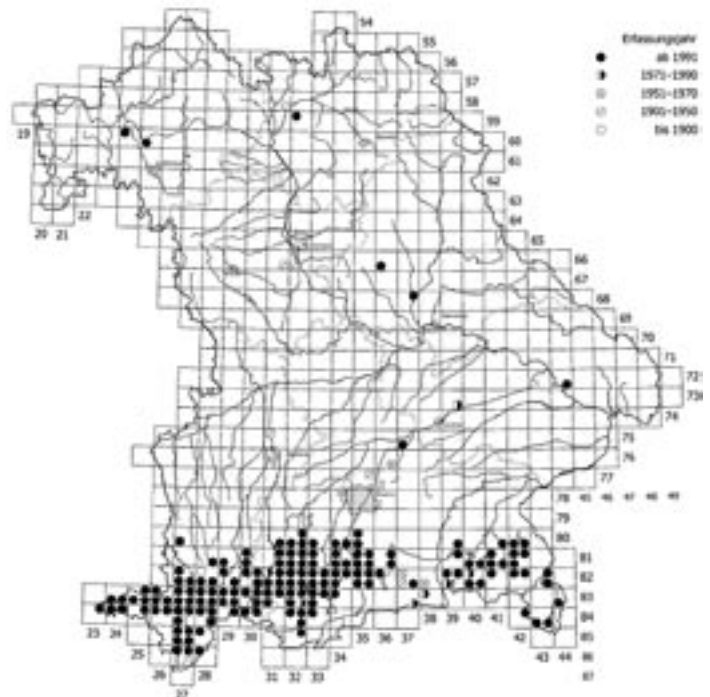
The Alcon Blue (*Maculinea alcon*) has a light-grey underside, with two series of black-grey marked spots. The upperside of the male is blue and lacks black spots, in contrast to the very similar *M. teleius*. The Bavarian centre of distribution is the pre-alpine region, where the species inhabits predominantly litter meadows and occasionally fens and wet grasslands. It is a highly endangered species in Bavaria and many populations show alarming signs of decrease. Due to its complex habitat requirements the Alcon Blue is an important indicator species of pre-alpine, wet grasslands.

One flew into the cuckoo's nest

Females of *M. alcon* needs late flowering gentians for oviposition. In Bavaria *Gentiana pneumonanthe* and *G. asclepiadea* are both used as host plants. Until the third instar the larvae live inside the buds and feed mainly on the developing seeds. The fourth larval instar leaves the plant and eventually will be adopted by host ants and lives for the rest of its life within ant nests. *M. alcon* is a highly adapted host parasite. Its caterpillars are able to imitate acoustic signals, which are used by the host ants for communication. The caterpillars are also fed directly by the host ants. Thus *M. alcon* sometimes is labelled as a "cuckoo species" in contrast to other, more primitive "predator species", such as *M. arion*. "Cuckoo species" use the resource "host ant" much more effectively than "predator species", which results in a higher carrying capacity of larvae in the host ants nests.

My home is my litter meadow

In our intensively used landscape *M. alcon* can only survive, if there is a sufficient amount of extensively used, flower-rich wet grassland. In the pre-alpine area, traditional litter meadows are of very high value for *M. alcon*. In former times these litter meadows could not be used for making hay, because they were mostly too wet to be cut during summer. Thus they were cut late in autumn, when the grass was already dry, and then used as litter in the stables. Nowadays many of these meadows are cut much earlier, which causes serious problems for the long-term survival of *M. alcon*. Early mowing kills the majority of the caterpillars, which are still in the gentian flower-heads and not ready to be adopted by the host ants.



Distribution of the Alcon Blue in Bavaria (Source: Artenschutzkartierung Bayern und Datenbank der ABE, Date: 05.2007)

Research for the Alcon Blue

When and how often mowing should take place? To find answers for this most important management question, we started a research project at the Bavarian Academy for Nature Conservation and Landscape Management (ANL). From 2002-2006 this was integrated in the EU research project "MacMan" (EVK2-CT-2001-00126).

Host ants or host plants – Where is the bottleneck?

In order to test the impact of different mowing frequencies on *M. alcon*, we investigated 73 research areas in Bavaria and Austria. Baiting with sugar cubes was used to test the adoption probability by host ants. Our results showed that in Bavaria *Myrmica scabrinodis* seems to be the only host ant species for *M. alcon*. The type and structure of vegetation and egg densities on the host plants were also assessed. Since 2003, specific management experiments have been conducted, with a wide variety of parameters recorded.

Our findings suggest, that in contrast to *M. teleius* and *M. nausithous*, host ant density is not a bottleneck for *M. alcon*. The crucial factor is the supply of a sufficient amount of host plants that are large enough to provide good access for oviposition and adequate food resources for the developing larvae.

For *M. alcon* populations living on *G. pneumonanthe* the optimal management seems to be by mowing every year. In habitats that are very poor in nutrients where *G. asclepiadea* is the main host plant, mowing should not take place every year, thereby ensuring a sufficient amount of vigorous host plants.

Early mowing – The threat depends on the host plant

To get an idea of the larval development within the buds, we collected over a longer time span 3441 buds for detailed investigations in the lab. The results showed, that in years with unfavourable weather, the usual mowing at the beginning of September can cause a high loss of larvae.

Populations which live on the comparatively early flowering *G. pneumonanthe* can cope with this loss in most cases. In contrast this mowing date is a serious threat for populations which live on *G. asclepiadea*, as it can lead



Bud of *G. pneumonanthe* with eggs, larva and “flight holes” of caterpillars, which left the bud

to an almost total destruction of caterpillars in the buds of this late flowering species.

Based on our findings we developed management guidelines for the different types of habitat and different host plants in Bavaria, which are displayed in the chart below. Further information and detailed results are provided in BRÄU et al. (2006), BRÄU et al. (in prep.) und STETTNER et al.(in prep.).

Type of vegetation	Frequency of mowing	Date of mowing
Litter meadow with low productivity (e.g. <i>Caricion davallianae</i>). Main host plant: <i>Gentiana pneumonanthe</i>	One cut every year	Around mid-September
Litter meadow with low productivity (e.g. <i>Caricion davallianae</i>). Main host plant: <i>Gentiana asclepiadea</i>	One cut every second or third year	At the beginning of October
Litter meadow with moderate productivity (e.g. <i>Molinion</i>). Main host plant: <i>Gentiana pneumonanthe</i>	One cut every year	Around mid-September
Litter meadow with moderate productivity (e.g. <i>Molinion</i>). Main host plant: <i>Gentiana asclepiadea</i>	One cut every year	At the beginning of October

Literary quotes:

BRÄU, M., GROS, P., NUNNER, A., STETTNER, C. & J. SETTELE (2006): Der verlustreiche Weg in die Sicherheit eines Wirtsameisen-Nestes – neue Daten zur Entwicklungsbiologie und zur Mortalität der Präimaginalstadien von *Maculinea alcon* sowie zum Einfluss der Mahd. – In: FARTMANN, T., HERMANN, G. (Hrsg.) (2006): Larvalökologie von Tagfaltern und Widderchen in Mitteleuropa. Abhandlungen aus dem Westfälischen Museum für Naturkunde. Heft 68 (3/4), 197-219.

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