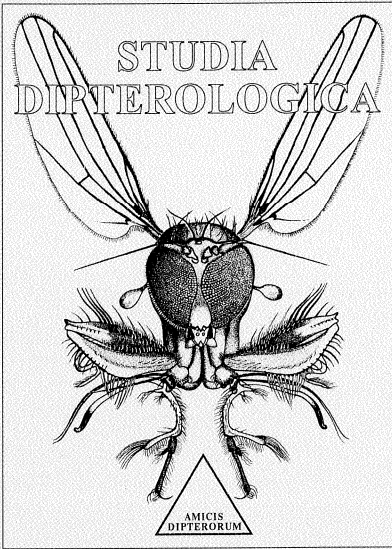




STUDIA DIPTEROLOGICA Supplement

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Räuberische Fliegen der Gattung *Coenosia* MEIGEN, 1826
(Diptera: Muscidae)
und die Möglichkeit
ihres Einsatzes
bei der
biologischen
Schädlings-
bekämpfung



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wurde überwiegend positiv bewertet. 1997 wurde unter Praxisbedingungen die Art *C. humilis* eingesetzt. Die Versuche wurden insgesamt ungünstiger bewertet.

Der gezielte Einsatz von *Coenosia*-Fliegen im System der biologischen Schädlingsbekämpfung als ergänzende und prophylaktische Maßnahme wird für die Zukunft als erfolgversprechend angesehen. Die Praxisversuche verdeutlichten, dass überall dort, wo eine Etablierung von *Coenosia* im Bestand erfolgreich ist, Schädlinge, insbesondere Trauermücken, Sumpffliegen und teilweise auch die Weiße Fliege, reduziert werden. Voraussetzung für eine Etablierung ist u. a. ein für die Eiablage und Larvenentwicklung günstiges Bodensubstrat, wobei die gesamten Rahmenbedingungen für einen erfolgreichen Einsatz noch nicht abschließend geklärt werden konnten. Es wird vermutet, dass selbst der Einsatz von nützlingsschonenden Pflanzenschutzmitteln die *Coenosia*-Fliegen aufgrund ihres Jagdverhaltens als Anreizjäger in besonderem Maße gefährdet.

Abschließend bleibt festzustellen, dass die Verbesserung der biologischen Schädlingsbekämpfung tierischer Schaderreger unter Glas in Zukunft nur durch einen Komplex sich ergänzender Maßnahmen ermöglicht werden kann. Dabei hat die Vorsorge mit den sogenannten „Offenen Zuchtverfahren“ einen besonderen Stellenwert, der in Zukunft weiter entwickelt und verbessert werden muss.

Neue polyphage Nützlinge wie z. B. die räuberischen *Coenosia*-Fliegen unterstützen und ergänzen den Einsatz von weiteren Spezialisten, die das Ende der Kette von Maßnahmen zur biologischen Schädlingsregulierung bilden.

6 Summary

Greenhouses where a biological and integrated mode of husbandry is practised can be colonised by two predaceous fly communities that differ significantly in their life cycle and behaviour. One of these comprises dance flies of the family Hybotidae (Empidoidea) whilst the other comprises true flies (Muscidae) of the predaceous genus *Coenosia* MEIGEN, 1826.

Studies on emergence abundance have shown that both groups of predators do not simply colonise greenhouses from the outside for short periods but that they can complete their developmental cycle in the greenhouse soil and can become established there for a long period of time.

The prey spectrum of the dance flies that have been found in greenhouses includes important pests such as leaf-mining flies (Agromyzidae), black fungus gnats (Sciaridae) and white flies (Aleurodidae). *Platypalpus articulatus* MACQUART, 1827, and *Platypalpus kirtlingensis* GROOTAERT, 1986, catch thrips (Thysanoptera), whilst *Stilpon nubilus* COLLIN, 1926, preys on the nymphs of thrips and plant-hoppers. Unlike the dance flies, which catch their prey whilst on foot, species of *Coenosia* wait in ambush until a potential prey flies close by, then seize it in mid-air and usually return to their original position where they suck it dry.

The species *Coenosia atra* MEIGEN, 1830, *Coenosia attenuata* STEIN, 1902, *Coenosia humilis* MEIGEN, 1826, *Coenosia strigipes* STEIN, 1916, *Coenosia tigrina* FABRICIUS, 1775, and *Coenosia testacea* ROBINEAU-DESVOIDY, 1830 (*tricolor* ZETTERSTEDT, 1845) are members of the greenhouse predator community. *C. attenuata* is indigenous to the Palaetropical region. Their prey spectrum also includes white flies, black fungus gnats and leaf-mining flies.

Studies on the natural occurrence of these predaceous flies in greenhouses led to a recognition of the significance of this complex of beneficials for the control of important greenhouse pests. The species of *Coenosia* play a pre-eminent role in this. They can build up

effective populations under greenhouse conditions, and as non-specific predators can feed on a variety of pest groups and on innocuous species. As they are the primary antagonists of the adult stages of black fungus gnats, white flies, and leaf-mining flies, they were selected from the complex of predaceous flies to be introduced as new beneficials into the practice of biological pest control.

A three-stage method for rearing *Coenosia*-species was developed, using black fungus gnats (Sciaridae) as food. This led to the mass-rearing of the black fungus gnat, *Bradysia paupera* TUOMIKOSKI, 1960, for the first time, using the fungus (*Fusarium spec.*) as food in a substrate of wood-fibre. Because of the cost of this rearing method, the scavenger midge *Scatopse transversalis* LOEW, 1836, was used as an alternative food source, reared only using porridge oats on a wood-fibre substrate. In addition to reducing the time needed to supervise the cultures, this also avoided the danger of accidentally including pest species when mailing the *Coenosia*-puparia. Then followed studies on the biology and morphology of the pre-imaginal and imaginal stages of the *Coenosia*-species. Using *C. attenuata* as an exemplar species, the immature stages which in principal are of identical structure were described using scanning electron microscope photographs. In the course of this, comparison of the posterior spiracles of ovarian larvae and mature larvae of *C. strigipes* showed that the larva hatches from the egg in the third instar and that no moult takes place prior to pupation. The cephalopharyngeal skeletons of the various *Coenosia* larvae are identical in structure and are adapted to the predaceous way of life.

The length of development hardly varies among the species *C. attenuata*, *C. humilis* and *C. strigipes*. From egg laying to adult eclosion, it ranges between 40 and 43 days at 20 °C; and between 26 and 27 days at 25 °C. The results with *C. atra* were rather different, as development was completed after some 33 days at 20 °C, 10 days less than in the other species.

The performance of *Coenosia*-species as predators was studied comparatively by monitoring their consumption of vinegar flies (*Drosophila melanogaster* MEIGEN, 1830) and black fungus gnats (*B. paupera*) under various climatic conditions. Daily consumption depends upon the species of prey that is offered. Because of the smaller size of the black fungus gnats, their smaller body volume and weight in comparison with the vinegar flies, greater numbers of this prey species are consumed.

For *C. attenuata*, the average number of prey per fly/day was 1.5 *Drosophila* compared with 6.9 black fungus gnats, i.e. 4.6 times as many; for *C. strigipes* the same figures were 1.7 and 7.6, i.e. 4.5 times as many. The daily consumption of prey did not vary significantly between *C. attenuata*, *C. humilis* and *C. strigipes*. *C. atra* proved to be the weakest species. If one examines the total number of flies taken as prey throughout the entire adult life, then more than twice as many individuals are taken as prey by *C. strigipes* when compared with *C. attenuata* and *C. humilis*, because of its longer life-span. In an experiment with a climatic chamber, the maximum age reached by a female was 95 days, and in an experiment in the greenhouse it was 102 days. The daily consumption of prey did not diminish with the increasing age of the fly. The effectiveness of *Coenosia*-species in controlling a black fungus gnat population was demonstrated in a laboratory experiment.

In 1995, the method of rearing *Coenosia*-species in the laboratory was developed into commercial mass-rearing. In 1996, *C. attenuata* was brought into operation for the first time in various ornamental plant and vegetable cultures such as cucumbers and tomatoes, under the control of the State Plant Protection adviser. The effectiveness of this new beneficial was

evaluated as overwhelmingly positive. In 1997, the species *C. humilis* was introduced into practice but on the whole these experiments were less favourably evaluated.

The goal of introducing *Coenosia*-species into the system of biological pest control, as a complementary and prophylactic measure, promises to be successfully fulfilled in the future. Practical experiments have shown that wherever *Coenosia* is successfully established in a community, the pests are reduced in numbers, especially black fungus gnats, shore flies (Ephydriidae), and in part also white flies. The prerequisite for successful establishment is a ground substrate that is favourable for oviposition and larval development, but it has not yet been possible to clarify definitively all the conditions that are required for this. It is suggested that the use of plant protection methods that do not directly affect the beneficials may in fact particularly endanger the *Coenosia*-species, because of their hunting behaviour which is based on ambush from a waiting position.

In conclusion, it needs to be said that future improvements in the biological control of zoological pests in greenhouses will only be made with a complex of complementary measures. Provision with the so-called "banker plant system" will be of particular value for this, and must be further developed and improved in the future.

New polyphagous beneficials such as the predaceous *Coenosia*-species support and complete the introduction of additional specialists, which form the terminal links in a chain of measures for the biological control of pests.

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