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Gelechiidae collected during 13 years of regular light trapping near a farm in southern Denmark (Lepidoptera)

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Summary

A mercury vapour light trap placed near a farm in southern Denmark was operated for 13 years. During 641 nights 12,879 specimens of Gelechiidae were captured, identified and counted. Three quarters of these belonged to two common species. The remaining specimens represented 68 species. The trap thus captured some 40% of the 164 Gelechiidae recorded from Denmark, and almost two-thirds of the species found in the faunistic district of South Zealand. Some species of special faunistic interest are discussed. It is concluded that automatic light trapping provides a relatively good picture of the composition of the night-flying Lepidoptera fauna in a given area, and it also provides data on abundance and fluctuation of the more common species. No evidence of long-term changes in population size of the species due to the light trapping was found.

Introduction

From 1973 to 1985 I collected moths regularly using a light trap in southern Denmark. The trap was operated throughout the season over periods when I had the time to deal with the material. As it was impossible for me to register every specimen of all species, I decided to do this only for members of the family Gelechiidae. This was because : 1) Most gelechiids are active by night and are attracted to light, 2) their distribution and abundance are insufficiently known, and 3) many species of Gelechiidae are difficult to identify, and most other investigations on moths from light traps have therefore excluded them. Indeed the present study is probably unique in giving special attention to the family Gelechiidae. The few other investigations on microlepidoptera from light traps, which include gelechiids, are based on a much smaller material. Kuchlein & Munsters (1988), for instance, found only 261 specimens of Gelechiidae during 14 years of light trapping).

The light trap was placed in a garden of a small farm opposite to Skibinge church near Præstø in South Zealand (Fig. 1). The garden was surrounded by fields, which were all intensively cultivated. Each field was, however, rather small, and most of them were separated by hedges. The garden was not especially well kept, and when the study was initiated, and throughout the project period, half of the garden was left uncultivated. The nearest "natural" area is Bellevue Skov, which like most other woods in that region is intensively managed, and is mostly composed of beech and spruce. Within a radius of 3 to 4 km there are several wetlands, of which especially Even has an interesting flora (Gravesen, 1976). Along the coasts of Præstø Fjord (more than 3 km away) there are small salt marshes. Of drier biotopes there are only a few small gravel pits in the immediate surroundings. Most species associated with dry biotopes probably came from Feddet (about 7 km) or even further away.

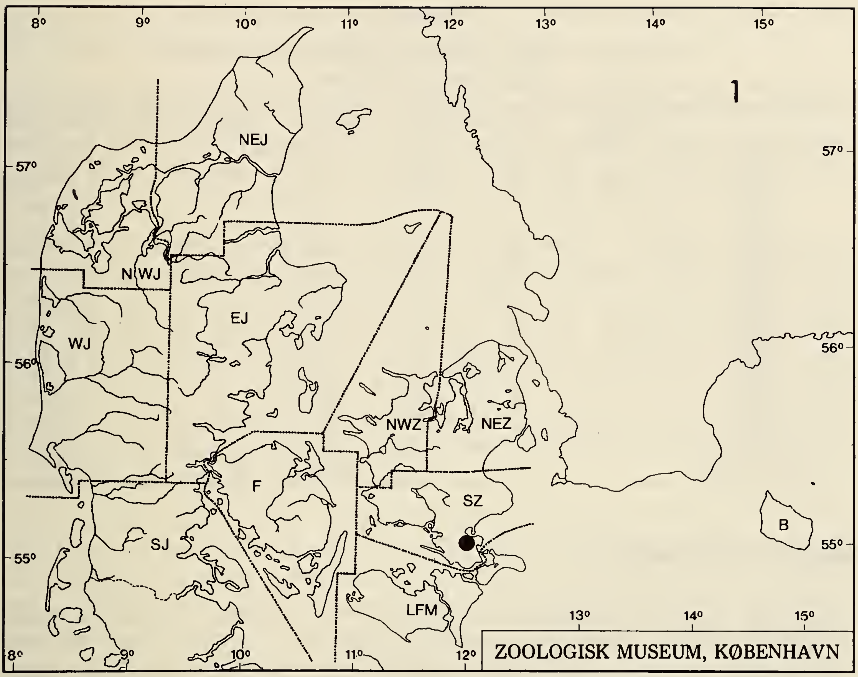
The purpose of running a light trap was to learn about the moth fauna in the area, and to be able to follow the annual changes in occurrence and abundance of the species. The aim of this project was not to study the effect of different types of light traps and their placement, as an extensive literature on this subject already exists. However, I constantly tried to improve the light trap, hoping it would result in an increase and/or changes in captures.

Methods

I ended up with using a modified Robinson trap (Robinson & Robinson, 1950) (Fig. 2) as described below. The source of light was a 250 watt mercury vapour bulb, which hung half way down in the funnel of the trap. A photoelectric cell connected with the cable automatically switched the bulb on at nightfall and off again in the morning. The collecting box was a large plastic bucket, which was dug down into the earth to prevent the captured moths from dessicating. Tetrachloroethane was used as killing agent, and to limit the use of this it is important that the trap is as enclosed as possible and that the opening of the funnel is not too big. It would have been impossible to make this investigation without using a killing agent in the trap.

The light trap was operated on most nights from spring to autumn, although most Danish gelechiids fly from mid-June to the end of August. I have counted here only nights on which the trap caught gelechiids (Table 1). This figure has been corrected for the fact that the trap periodically, especially at the beginning and end of the collecting season, worked on more than one night before examination of the capture.

At every examination of the capture, all specimens of Gelechiidae were sorted out and identified, usually under a stereo-microscope. When the identity of a specimen could not be ascertained from external characters, I later examined its genitalia. The specimens were generally in good condition, and during the last years of the investigation it was necessary to study the genitalia of only a few specimens.



Figs. 1-2. 1. Map of Denmark showing faunistic provinces with abbreviations used for these areas. The trapping site is marked with a dot. It is placed in the U.T.M. 10 km^2 square 33U UB11. 2. The light trap with the collecting box dug down into the earth. Diameter of the top of the funnel is 65 cm.

Table 1

Number of nights on which gelechiids were collected during the investigation

	May	June	July	Aug.	Sept.	Oct.	total
1973	1	4	23	14	3		45
1974	2	6	10	26	4		48
1975		7	8	22	7		44
1976		1	8	23	5		37
1977		9	10	16	8		43
1978	5	7	4	12	2		30
1979	3	3	4	18	4	1	33
1980	5	17	13	18	7		60
1981	5	4	11	27	1		48
1982	6	5	14	22	3		50
1983	1	9	28	30	3		71
1984	4	9	31	30	5		79
1985	5	8	9	27	4		53
1973-1985	37	89	173	285	56	1	641

Results and discussion

Altogether 12,879 specimens of Gelechiidae were collected during 641 nights of capture during the 13-year period (Table 2, 3). Half of these (51.4%) belonged to only one species, *Brachmia rufescens*, and an additional quarter (24.3%) of the specimens were of *Isophrictis striatella*. Both of these common species had vigorous populations in the part of the garden which was left uncultivated. The remaining 68 species constituted the last quarter of the collected specimens. Of these, 8 species were caught in numbers between 100 and 500 specimens, while no less than 20 species were found only in 1-2 specimens.

Table 2

Number of species of Gelechiidae caught during the 13 years of collecting

1973	74	75	76	77	78	79	80	81	82	83	84	85	total
37	31	31	31	34	25	22	30	29	29	40	42	31	70

From my knowledge of the fauna of Gelechiidae in the area in question, I estimate that no more than 30 species live within a radius of half a kilometre from the trap, which means in the garden, in the churchyard and in the fields or hedges between them. Some of the specimens of these species, however, may well have come from further away, as was the case with the rest of the captured species. Among these the species associated with salt marshes form an easily recognised group. Such species are *Monochroa tetragonella, M. elongella, Scrobipalpa stangei, S. samadensis*, and (at least in part) *S. nitentella*, and apparently some of these regularly fly far away from their breeding localities. The light from the trap is probably only able to attract moths which fly within a radius of a few metres from the trap.

In a small gravel pit about 1 km away *Bryotropha affinis* occurs, but it was not caught in the trap. *Gelechia cuneatella*, which I now catch regularly in the light trap in the garden of my new house in Præstø, 3 km away, never turned up in Skibinge. If I had continued to run the trap in Skibinge I would probably one day have caught stray specimens of these species there.

Over the 13 years of investigation some information on changes in abundance of the species dealt with were obtained. Only 9 species were caught in all 13 years, and all of these were species resident in or near the garden and each collected in more than 100 specimens. Sixteen species (all species only caught in 1-2 specimens) were only caught in one year. Among these, 6 were caught in 1973 (a year with many warm nights), whereas 8 of the rest were caught in 1982-84 (in these years the trap worked for most nights during July (Table 1)). The greatest diversity was observed in 1984 with 42 species whereas only 22 species were recorded in 1979.

Chrysoesthia drurella and *C. sexguttella* were caught only in the years 1973-76. The larvae of both mine leaves of *Atriplex* and *Chenopodium*, and apparently they disappeared together with their host plants, when the latter were succeeded by perennial herbs. *Gelechia sororculella, Caryocolum fraternella*, and *Brachmia rufescens* showed a notable increase in abundance during the period. *Dichomeris marginella* was not caught in the years 1978-81, but afterwards it became as frequent as before.

Species currently expanding their range in Denmark include *Monochroa niphognatha* and *Pexicopia malvella*, of which a few specimens were caught in the trap ; these records were the first from the faunistic province SZ. The capture of a single specimen of *Scrobipalpa proclivella* in the trap in 1979 may well fit into this group, but this species is excluded from the records since it cannot be ruled out that the specimen escaped from my breeding of the species.

Further species of special interest from a faunistic point of view are *Monochroa hornigi, Ptocheuusa inopella* and *Teleiodes flavimaculella*. The captures of these species also represent the first records from SZ, and in the case of the two first-mentioned species they are still the only records from this faunistic district.

Very surprising was the capture of 2 specimens of *Caryocolum pullatella* in 1982. This species, which has a northern and eastern distribution in Europe, is only known from one other specimen in Denmark (Bornholm), and the two specimens from Skibinge were most probably blown down from Scandinavia.

In the warmer parts of the world the family Gelechiidae comprises some of the most serious pest species among Lepidoptera. This is not the case in Denmark, and even though this investigation was undertaken in an agricultural area, hardly any of the collected gelechiids could be called pest species.

Table 3

Yearly and total captures of Gelechiidae during the project period divided into species

	1973	74	75	76	77	78	79	80	81	82	83	84	85	total
Metzneria lappella (L.)	9	2	2		8	1	1	1	1		1	2	8	36
Metzneria metzneriella (Stt.)			1		3	1		5			3	3		16
Isophrictis striatella (D.& S.)	59	82	217	297	168	365	239	134	124	357	403	353	336	3134
Eulamprotes wilkella (L.)						2			1		1			4
Eulamprotes atrella (D.& S.)	7	8	4	4	1	3	2	2	10	29	54	28	3	155
Argolamprotes micella (D.& S.)	17	2	1	1	2			1	5		3		1	33
Paltodora cytisella (Curt.)				1										1
Monochroa tenebrella (Hb.)	1													1
Monochroa tetragonella (Stt.)													1	1
Monochroa elongella (Hein.)	2			1										3
Monochroa lutulentella (Zell.)	9	11	5	9	11	8	1	2	1	4	8	5		74
Monochroa lucidella (Stph.)	7		1		3			1			10	6	1	29
Monochroa palustrella (Dgl.)	2	1			1					3	1	5		13
Monochroa hornigi (Stgr.)					1									1
Monochroa niphognatha (Gozm.)								1			1	3		5
Chrysoesthia drurella (F.)	2	85	13	2										102
Chrysoesthia sexguttella (Thbg.)		3	1											4
Ptocheuusa inopella (Zell.)	1													1
Aristotelia brizella (Tr.)	1		1	3	1	1	3			1	1			12
Parachronistis albiceps (Zell.)											1			1
Exoteleia dodecella (L.)	1													1
Teleiodes vulgella (D.& S.)	1		1								3	7	1	13
Teleiodes paripunctella (Thbg.)					2					1				3
Teleiodes proximella (Hb.)						1						1	1	3
Teleiodes saltuum (Zell.)												1		1
Teleiodes alburnella (Zell.)	1													1
Teleiodes fugitivella (Zell.)	34	41	24	5	13	1		1	1		1	2	1	124
Teleiodes flavimaculella (H.-S.)	1													1
Teleiopsis diffinis (Haw.)				1		1	1	2						5
Athrips mouffetella (L.)					1				1			5	1	8
Bryotropha similis (Stt.)	25	1	9	2	2				5	12		8	4	68
Bryotropha senectella (Zell.)	4	11	28	34	20	25	2		4	16	24	26	1	195
Bryotropha terrella (D.& S.)	1	12	6	20	12	9		8	1	8	8	12		97

Chionodes electella (Zell.)		1									1		1	3
Chionodes fumatella (Dgl.)		1				1								2
Chionodes distinctella (Zell.)					4				1		1	1		7
Aroga velocella (Zell.)		1		1					1			2		5
Neofriseria peliella (Tr.)		1				1	1	1	2		1	1		8
Mirificarma mulinella (Zell.)	6	19	53	30	18	18	15	13	11	7	16	12		218
Gelechia rhombella (D.& S.)	3		2	1	1			2	2	3	6	2		22
Gelechia scotinella H.-S.					1	2	2	3	3		3	5	2	21
Gelechia sabinella Zell.			1					1		1	3			6
Gelechia sororculella (Hb.)		1					3		1	3	4	7	1	20
Gelechia muscosella Zell.	2							1				2		5
Gelechia hippophaella (Schrk.)										1				1
Gelechia nigra (Haw.)										2				2
Scrobipalpula psilella (H.-S.)		1										1		2
Scrobipalpa acuminatella (Sirc.)	5	21	16	35	23	23	16	13	9	15	38	33	10	257
Scrobipalpa stangei (E. Her.)	4			2	1		1	22		1	27	19	2	79
Scrobipalpa samadensis (Pfaff.)		6	1	9			6	2	3	5	10	3	2	47
Scrobipalpa nitentella (Fuchs)	15		6	8	13	3		1		1	25	61	1	134
Scrobipalpa obsoletella (F.v.R.)	7	5	17	17	5	9	21	17	5	2	34	14	16	169
Scrobipalpa atriplicella (F.v.R.)	25	60	52	55	28	13	17	36	32	33	36	30	19	436
Caryocolum tricolorella (Haw.)		1											1	2
Caryocolum blandella (Dgl.)		2		5			1	1	1	4	4		2	20
Caryocolum fraternella (Dgl.)	1	1	5	2	2	10	10	2	26	68	75	56	22	280
Caryocolum pullatella (Tgstr.)										2				2
Reuttia subocellea (Stph.)	1													1
Aproaerema anthyllidella (Hb.)	2	1	15	57	60	8	9	5	5	7	11	1	1	182
Syncopacma cinctella (Cl.)											1			1
Acompsia cinerella (Cl.)	1	1	7	7	1	7	2		3	5	6	6	3	49
Anacampsis populella (Cl.)	1	1	4		1			2		1			3	13
Pexicopia malvella (Hb.)	1			1	1			1	1			2		7
Hypatima rhomboidella (L.)			2				2	5				1	1	11
Dichomeris marginella (F.)	18	4	5	5	1					4	10	8	11	66
Dichomeris juniperella (L.)											1			1
Brachmia blandella (F.)	1		1	1	15	1					3	1		23
Brachmia inornatella (Dgl.)					1							1		2
Brachmia lutatella (H.-S.)				1					1		6	4	1	13
Brachmia rufescens (Haw.)	202	244	79	171	253	95	129	203	459	849	2152	1547	233	6616
Total	480	631	580	788	678	609	484	489	720	1445	2997	2287	691	12879

Seventy species of Gelechiidae were collected from the trap. This is 42.7% of the species recorded from Denmark up to 1985 (Karsholt in Schnack, 1985). Two thirds (64.8%) of the 108 gelechiids recorded from the faunistic district of South Zealand (SZ) (Fig. 1) found their way into my light trap. This is quite a high percentage when one considers that there is very little "nature" in the vicinity of the collecting site, and that moreover, the moths probably have to fly rather close to the light to be attracted to it.

Conclusions

Regular collecting with mercury vapour light traps gives a pretty good picture of the fauna of night-flying microlepidoptera in the vicinity of the collecting site. Over a period of several years a number of species living in more distant areas will turn up in the trap. The light trap also provides data about changes in abundance of night-flying microlepidoptera (Table 3). Even though the trap was operated for 13 years, and that the captures show considerable variation in number of species and their abundance, the data given in Tables 2 and 3 prove that there have not been any serious effects on the populations of Gelechiidae around the trapping site. This is in accordance with nearly all other studies on the long term effects of light traps (e.g. Williams, 1952). The differences and changes shown by the present data are — apart from changes in the construction of the trap — more probably due to changes in weather conditions (warm and cold summers), and changes in the surrounding area (drainage of wetland, new developments, and decline in numbers of small biotopes). In comparison to such factors the effect of one single light trap must be minimal.

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