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MITTEILUNGEN DER SCHWEIZERISCHEN ENTOMOLOGISCHEN GESELLSCHAFT
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On a collection of drosophilids (Diptera) at the Edersee (Germany)

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A collection of Drosophilidae made at Nieder-Werbe near the Edersee (Germany) yielded more than 21 000 flies out of 19 species (Table 1). The species composition was not very different from most comparable collections, but the species frequencies showed a high dominance of the mushroom breeder species, especially of *D. phalerata*. In addition to faunistical results some ecological data are given.

In the early fifties the distribution of species of the genus *Drosophila* was intensively studied in wide areas of Switzerland (BURLA, 1951), southwestern Europe (HADORN *et al.*, 1952), Scotland (BASDEN, 1954), the Netherlands (SOBELS *et al.*, 1954), Denmark (FRYDENBERG, 1955) and Finland (HACKMAN, 1955). In the course of these investigations HERTING (1955) reported on the fauna and ecology of *Drosophila* species of the Münsterland (Westphalia). A somewhat restricted study on the fauna of Erlangen (Bavaria) was published by NASWATY (1959). Whereas in the following years the study of the European *Drosophila* fauna was intensified and also extended to additional countries (e.g. Czechoslovakia, Hungary, Portugal, Yugoslavia) our knowledge of the German fauna is still scanty, based on a few old records made by different authors and perhaps lacking correct identifications. In order to improve this situation, we undertook a collecting trip to Nieder-Werbe, situated at the eastern border of the Edersee (Hesse).

METHODS

Collections were made at the following six sites eastwards of Nieder-Werbe:
Site 1: Shrubs and deciduous woodland along a small river, bordered by grassland; 20 baits.
Site 2: Shrubs along a small river, bordered by grassland; 20 baits.
Site 3: Deciduous and mixed woodland on a northwards exposed slope of a hill; 60 baits.
Site 4: Mixed woodland and shrubs on a southwards exposed slope of a hill; 20 baits.
Site 5: Deciduous woodland on the top of a hill; 40 baits.
Site 6: Deciduous woodland on the top of a hill; 60 baits.

Collections were made by net-sweeping every morning and evening from August 12th (evening) to August 17th (morning), except of sites 5 and 6, where collecting

[5] We thank the German Research Fund (DFG) and the University of Giessen for financial support for the collecting trip.

started in the evening of August 13th. During the collecting period the weather was mainly warm and dry, with occasional rainfall and thunderstorms.

For baiting we used mashed and fermenting bananas and potatoes as well as malt. Sites and baits were selected and combined in order to cover a wide range of habitats and attractants. It is noteworthy that we found the bait prepared with potatoes as effective as the banana one.

Indexes of diversity and equitability as well as niche width, niche overlap and niche components are calculated according to the methods compiled by Bächli (1979).

Table 1: Number and frequency of species collected at Nieder-Werbe.

Species	Flies collected	Frequency (%)
D. confusa	105	0.5
D. deflexa	59	0.3
D. fenestrarum	7	
D. immigrans	5	
D. kuntzei	1236	5.8
D. limbata	6	
D. littoralis	1	
D. obscura	3184	14.8
D. phalerata	13760	64.1
D. subobscura	1540	7.2
D. subsilvestris	794	3.7
D. testacea	162	0.8
D. transversa	66	0.3
D. tristis	3	
D. unimaculata	6	
A. variegata	1	
S. flava	4	
S. pallida	525	2.4
S. coleoptrata	2	
Total flies	21466	
Number of species	19	
Index of diversity	0.54	
Equitability	0.42	

RESULTS

The species collected are listed in Table 1. We recorded 15 species of *Drosophila* and the four species *Amiota variegata, Scaptomyza flava, Scaptomyza pallida* and *Stegana coleoptrata.* The number of species seems to be low with regard to the large collection, but compared with the results of Burla (1951) or Bächli (1972) we missed mainly domestic species. The indexes of diversity and equitability calculated from the data are found to be somewhat smaller than in comparable collections, for instance Bächli (1972) or Bächli & Nigro (1981), mainly due to the strong dominance of *D. phalerata.*

The collections made in the mornings yielded generally more flies than those of the evenings, especially of *D. phalerata* and *D. testacea.* Most species showed more or less the same frequency morning or evening, except for *D. obscura* and *D. subobscura* which were more abundant in the evenings. During the five days of collecting we did not observe constant changes of frequencies, except for *D. subsilvestris* and *D. transversa* which showed increasing frequencies.

BÄCHLI (1979) presented some quantitative methods for the analysis of this kind of collection. In our data the relative niche width was found to be especially low for *S. pallida,* due to the fact that this species was mainly collected at one site only. Niche overlap was calculated for the ten most abundant species. Clustering of this index by the UPGMA method (Figure 1) yielded two groups of species, one containing the fruit breeder species *D. subobscura, D. obscura* and *D. subsilvestris,* and including also the mushroom breeder species *D. transversa.* The last one would fit better into the second group formed by the mushroom breeder species *D. phalerata, D. kuntzei* and *D. testacea.* The species *D. deflexa, D. confusa* and *S. pallida* do not fit in with any group.

In order to divide up the index of diversity into distinct dimensions the data were arranged according to morning/evening, date and sites. The results are listed in Table 2. The main influence on the diversity was found in the different collecting sites, whereas the two components of time showed low values. This is in accordance with the impression we got during collecting and determining.

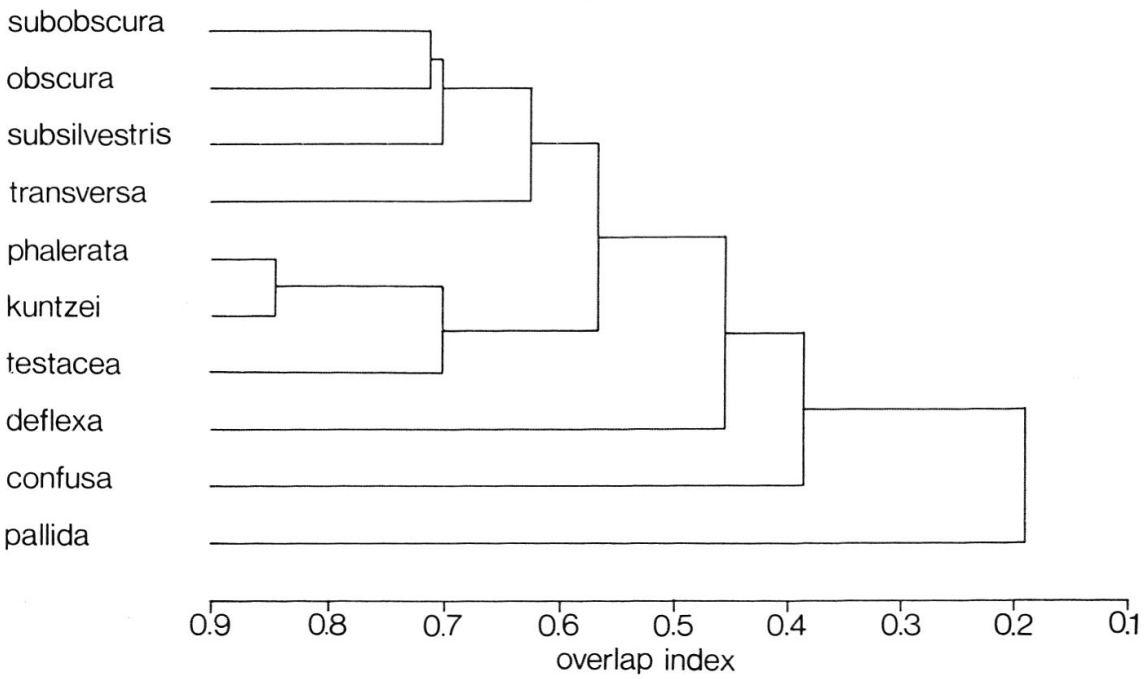

Figure 1: Dendrogram showing 10 abundant species according to their niche overlap (Renkonen index). Clustering by UPGMA.

Table 2: Niche dimensions.

Niche component	Items	Relative contribution
morning/evening	2	2.10 %
date	4	1.78 %
sites	6	14.29 %
combination	48	22.06 %
interaction		3.89 %

DISCUSSION

Our results are mainly to be compared with that of HERTING (1955), who collected in a comparable habitat but with different methods and during a period of two years. With the exception of *D. confusa*, all our *Drosophila* species have already been found by HERTING, who recorded, in addition, *D. helvetica, D. rufifrons, D. histrio, D. cameraria, D. andalusiaca* and five domestic species, all of them, except for *D. helvetica*, in very low numbers. He did not mention any species outside of the genus *Drosophila*.

The number of flies collected by us was considerably high and the frequencies we found differ considerably from HERTING's data. Our main yield is that of the mushroom breeders *D. confusa, D. kuntzei, D. limbata, D. phalerata, D. testacea* and *D. transversa*, which came to 71.4% of the total, compared with HERTING's 23%. On the other hand the *obscura* group species *D. obscura, D. subobscura, D. subsilvestris* and *D. tristis*, mostly considered as fruit and sap breeders, represented 25.7%, whereas HERTING's result was 61.9%. We conclude that our collection differs mainly by the strong dominance of the mushroom breeder species, especially *D. phalerata*. Such results are extraordinary, but BURLA (1951) and BÄCHLI & NIGRO (1981) gave examples of comparable cases.

We observed many mushrooms in the woodland, and occasional collections made around them yielded many drosophilids. From this we draw the conclusion that either the density of these flies was very high, or the expected competition between the mushrooms as natural resources and the artificial baits was obviously not exclusive.

In spite of the fact that some of the collection sites were situated in open areas or partly on the borders of woodlands the frequency of *D. subobscura* compared with that of *D. obscura* was very low, in contrast to the findings of BURLA (1951) and many other authors. Furthermore *D. helvetica* was completely lacking, whereas it was a dominant species in some collections made in July and August 1984 in Switzerland and Yugoslavia (BÄCHLI, personal note).

We have already mentioned that the collecting sites were selected in order to represent some differences in local habitats. These differences were indeed found in the frequencies of the flies collected at the different sites. At site 1 all the flies of *D. fenestrarum, D. limbata* and *S. flava* that we collected were recorded, as well as frequencies higher than in the average of *D. deflexa, D. obscura, D. transversa* and, especially, of *S. pallida*. At site 2 the species *D. confusa, D. subobscura* and *D. unimaculata* were collected more abundantly than is average and in this place we got the single specimen of *D. littoralis*. The site 3 was characterized by higher abundance of *D. kuntzei*, site 4 of *D. phalerata*, and site 5 of *D. subsilvestris* and *D. testacea*.

This collection was extraordinary with regard to the high number of flies collected as well as of the ecologically interesting dominance of the mushroom breeder species.

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