

SPECIES PACKING, COMMUNITY STRUCTURE, AND
RESOURCES: RELATIONS IN MIDDLE
EUROPEAN MEADOW-COLONIZING AUCHENORRHYNCHA GUILDS¹

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ABSTRACT

Meadow systems represent important resources for Auchenorrhyncha in Middle Europe where about 57 % of species are associated with herbaceous plants. Today, the whole European flora is subject to intense changes by intensifying of land uses, and the plant species diversity of meadow communities diminishes by bringing in nitrogenous fertilizers. Community structures and morphological characteristics of meadows are related to certain habitat characteristics as nitrogen and basic content of soils. The structure of investigated associated Auchenorrhyncha communities was determined mainly by quantities, qualities, and diversity of plant resources offered by the meadows. Some morphological characteristics of studied Auchenorrhyncha guilds were related to physical structures of the meadows. Species-area curves of meadow-colonizing Auchenorrhyncha were influenced by different factors, e.g. the plant diversity of the meadows.

KEY WORDS

Auchenorrhyncha, community structure, resources, meadows, herbaceous plants, plant architecture, species diversity, fertilization, SHANNON-WEAVER index, evenness, species-area curves.

INTRODUCTION

The Middle European biotas which would be covered naturally apart from special habitats by closed leafy woods were changed intensively after the Ice Ages by human influence. Cutted woods were substituted by several plant associations of different grades of naturalness (DIERSCHKE 1984). Meadow lands extensively used through centuries sheltered a great variety of herbaceous plant formations in Middle Europe. During recent times, the uses of most of these systems were considerably intensified, and by influences of fertilizing, the whole flora of Middle Europe is subject to intense changes today (ELLENBERG jun. 1985).

Some parts of European landscapes were for different reasons protected against intensifying of land usings. In some of these

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Middle European wildlife refuges in Bavaria, and in other meadow communities in Northern Germany, the author started some years ago investigations on the associated Auchenorrhyncha faunas. The study with a wide range of questions was designed for some more years. Here, it is intended to present some aspects resulting from the work having been done so far.

HERBACEOUS PLANTS AS A RESOURCE FOR AUCHENORRHYNCHA

The recent flora of Middle Europe consists mainly of herbaceous life form species. The greater part of associated Auchenorrhyncha species, as recorded, colonizes also herbaceous plants (fig. 1). But the relation shows not that great difference as the distribution of the plant species to life form types given in the figure.

In Fennoscandia and Denmark, the percentage of colonizers of non-herbaceous plants is somewhat decreased and is about 37.5 % (SERGEL, in press; data after several authors). For this region, the about percentage of colonizers of herbaceous plant associations which are sheltered only by extensive land usings was calculated counting available data and is about 39 %.

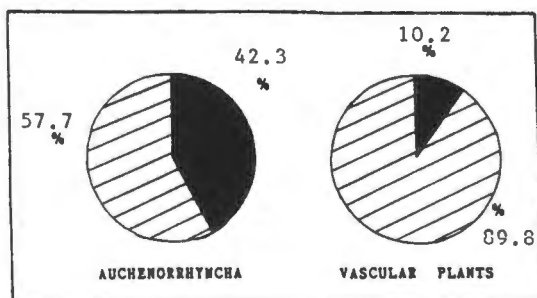


Fig. 1 - Distribution of the species of the recent vascular plant flora of Middle Europe to life form types (right; hatched: herbaceous, black: non-herbaceous; data after ELLENBERG sen.) and relation of associated Auchenorrhyncha colonizers (left; data after several authors).

MEADOWS: STRUCTURE AND HABITAT

Vascular plant species numbers in samples of meadows of different habitat characteristics were counted. The samples covered a gradient of nitrogen and basic contents of the habitat soils. The vascular plant species numbers of the investigated meadow communities were related to both of those nitrogen and basic contents. They can be plotted into a X-Y-Z-system (fig. 2).

Also some relative diversity parameters as the SHANNON-WEAVER index are related to these parameters.

Mostly, the more plant species the meadows contain the more they tend to show a diverse structure. The SHANNON index could be plotted as a function of the plant species numbers. The evenness index which counts the actual diversity in relation to the possible maximum diversity could be shown as related to the

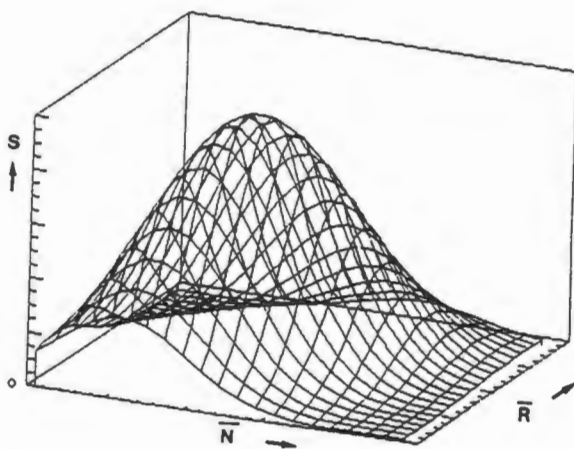
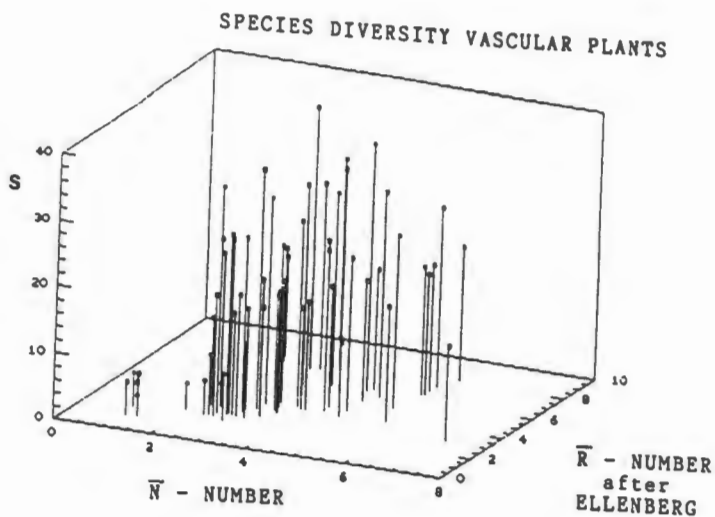


Fig. 2 - Species diversity (S) of vascular plants in samples of Middle European meadow communities as function of the nitrogen and basic characteristic of their habitats (measured in mean \bar{N} - and \bar{R} - indicator numbers of the communities calculated after the ELLENBERG system; for detailed explanation see SERGEL, in press).

Above: numerical plot; below: functional computer plot.

SHANNON index.

The differences in the community structure of the plant associations can be shown clearly by plotting their species-diversity-curves. The method can be used for bioindicational purpose (STÖCKER et al. 1977). An example for some herbaceous plant communities is given in fig. 3. Meadow types of mean nitrogen and higher basic cha-

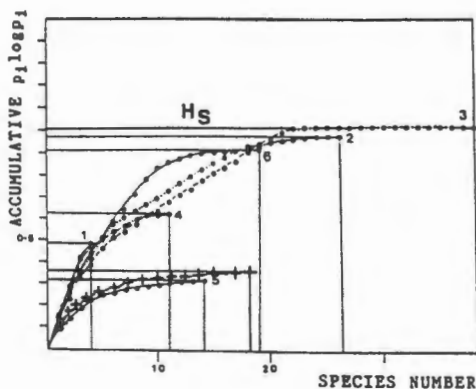


Fig. 3 - Dominance-species-diversity-curves of 7 herbaceous plant community samples in W. Germany. Points: 1) peat-bog association 2) Nardetum strictae (richer) 3) Mesobrometum 4) Deschampsia caespitosa stand 5) Epilobietum angustifolii 6) Trisetetum flavescens (all different parts of Bavaria). Crosses: intensified agricultural North German meadow.

racteristics showed the highest diversity values.

For studying physical structures of meadow types, different parameters were calculated (for examples see fig. 4: leaf area index, height of stand, mean number of structural units). Very small structural units as characterize e.g. Nardus / Avenella grasslands change also with the plant species to bigger ones in habitats with higher nitrogen content.

SOME CHARACTERISTICS OF ASSOCIATED AUCHENORRHYNCHA GUILDS

The Auchenorrhyncha faunas of different meadows were investigated by different methods (e.g. pitfall- and sticky traps, sweeping nets). Methodological comparisons of the results are dealt with in detail at other place. Results on field experimental studies on associated parasitoids and studies on spider predators will also be published in separate contributions.

The species packing of Auchenorrhyncha was related to plant species numbers of the meadow types. Species packing can be considered after CORNELL 1984 as local species richness. Moreover, there was some relation to the SHANNON-WEAVER index calculated for the meadow samples. Also the SHANNON index of the Auchenorrhyncha guilds was found to be related to the diversity of the plant communities.

Species-area-curves of Auchenorrhyncha/meadow systems were influenced by different factors, e.g. the plant species diversity of the meadows (compare fig. 5), structural characteristics of the meadows, their grade of isolation, etc.

Concerning some morphological characteristics of Auchenorrhyncha, there was found a general relation of increasing average body sizes in the Auchenorrhyncha guilds with with increasing average leaf sizes of the plants constituting the meadows, though not all species in the samples followed that pattern.

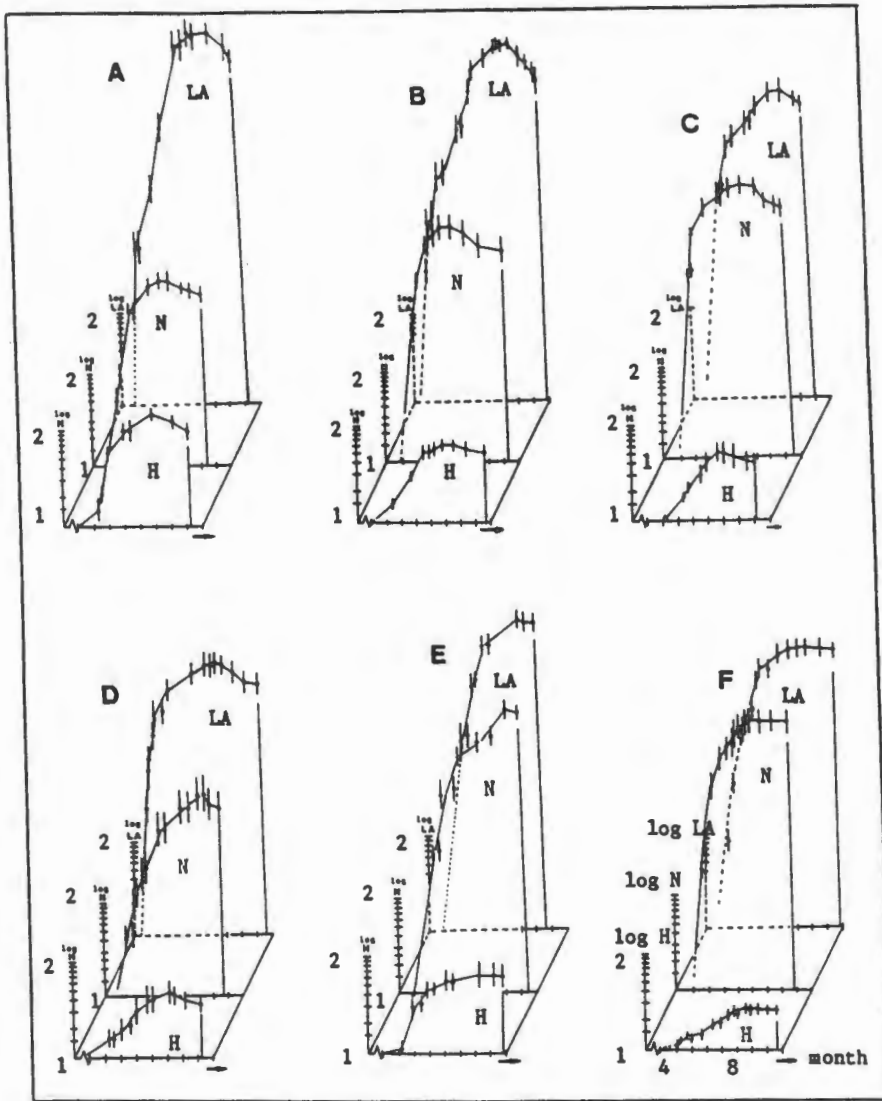


Fig. 4 - Physical structure characteristics of some meadow types during the growing period. LA: leaf area index (cm^2/m^2), N: number (mean) of structural units per m^2 , H: height of stand (cm). a) Scirpetum sylvatici b) Geranietum sylvatici c) Caricetum nigrae d) Mesobrometum e) Nardetum strictae (richer) f) Nardetum strictae (poorer). Values for samples in Bavaria 1985.

Plant communities of hierarchical structure, i.e. being to greater extent dominated by one or very few species, which are e.g. very fertilized ones, showed Auchenorrhyncha guilds similarly struc-

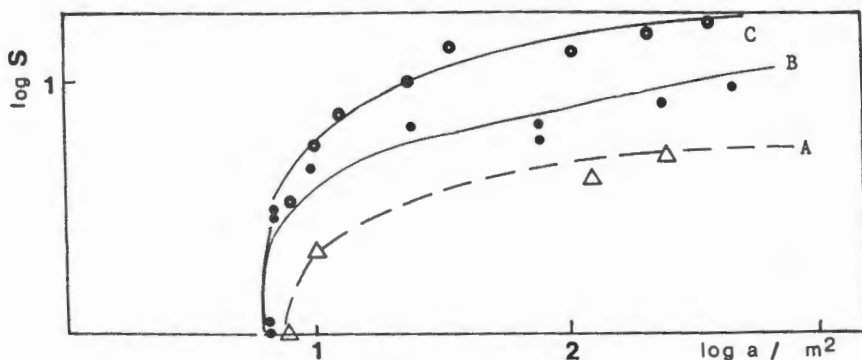


Fig. 5 - Species-area-curves for some Auchenorrhyncha/meadow systems resulting from standardized sweep net samples taken July-August 1985 in Bavaria. A) Deschampsia caespitosa stand B) Filipenduletum ulmariae C) Geranietum sylvatici. More diverse plant communities shelter a higher curve level.

tured, i.e. also dominated by one or very few species.

BRIEF CONCLUSIONS AND OUTLOOK

Meadows composed of herbaceous plants represent important resources for Middle European Auchenorrhyncha. The data given for plant life form types and associated Auchenorrhyncha could also indicate some influence of plant architecture on Auchenorrhynchous species richness, which pattern is generally known for phytophagous insects (e.g. LAWTON 1983, LAWTON & SCHRÖDER 1977). The decreased percentage of colonizers of non-herbaceous plants in Fennoscandia and Denmark is probably related with an also changed relation in the distribution of the plant species to life form types in more Northern latitudes.

The community structure of the investigated Auchenorrhyncha guilds was determined, apart from some other, e.g. climatic factors, mainly by resource quantities, qualities, and diversities offered by the host meadows. Generally, it could be considered to follow the scheme after PRICE 1984, predicting at low quantity and high quality range of resources many species with lower populations, and at high quantity and low quality range of resources fewer species with higher populations. The detailed data will be discussed more extensively in separate publications.

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