

Meetings of the Royal Botanical Society of The Netherlands

MEETING OF THE SECTION FOR VEGETATION RESEARCH ON
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MYRICA GALE AN IMPORTANT ELEMENT IN SUB-FOSSIL VEGETATIONS

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This lecture describes the occurrence of *Myrica* remains in sub-fossil pollen and macrorecords from the western Netherlands. The information used is derived from published and unpublished data from the author and others.

The identification of *Myrica* pollen is rather difficult and the pollen grains can be confused with those from *Corylus*. This is the main reason that in the interpretation of sub-fossil pollen spectra, *Myrica* is somewhat obscured. Macro remains (seeds, leaves, rhizomas) are often recorded in peat cuttings, and in combined pollen- and macroanalysis.

The results show that *Myrica* has been an important element in sub-fossil vegetations in the western Netherlands from 3000 BP onwards. It occurs as a dominant species in oligotrophic vegetations together with, e.g. *Erica tetralix*, *Molinia caerulea* and *Sphagna*, where horizontal and lateral watermovements prevail. When *Myrica* is a local element, the pollen spectra show high values up to more than 1000%. A strong decrease in or disappearance of *Myrica* pollen indicates important changes in the vegetation cover, for example due to changes in hydrology. *Myrica* disappears from the vegetation when the groundwater table is lower than 35 cm below the surface, but also after repeated burning and high grazing activities.

THE INFLUENCE OF GRAZING ON THE POLLEN PRODUCTION OF GRASSES

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The aim of this project is to study whether cattle grazed in prehistoric times on the pleistocene sandy soils of The Netherlands. Because cattle mainly feed on grasses, the question is whether the woods in prehistoric times were grassy enough to allow grazing. Can pollen analysis of old surface samples underneath burial mounds or from settlement sites (in-context samples) provide evidence? Therefore, in successive years samples were taken from litter and moss polsters in an area extensively grazed by Scottish Highland cattle (grazing experiment in De Imbos). Data were available for changes in grazing pressure and vegetation during the years of the experiment (1982–1987). Pollen analysis revealed changes in pollen percentages between sample series from two successive years (1986 and 1987). The preliminary results point to an increase in pollen production of grasses in the woods with a low grazing pressure, and a decrease in pollen production in woods with a heavy grazing pressure. The decrease in pollen production is correlated with the decrease in the standing crop of *Deschampsia flexuosa*. Pollen concentrations decline with increasing grazing pressure.

NATURE MANAGEMENT AND ARCHAEOBIOLOGY

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Nature management in The Netherlands, for example in the Northern Pleistocene sandy area, particularly concerns the management of anthropogene landscape. The aim of the management is mainly directed towards the preservation of nineteenth century heathland larded with prehistoric elements, such as Celtic fields, megaliths, burial mounds, more recent estates and forest remnants. After decades of neglect some herds of primitive heath sheep were re-established to prevent the growth of birches and to remove purple moor grass. In addition, grazing with cattle or horses was introduced to various forms of forest. One argument for the introduction of these animals suggests the reconstruction of a natural situation of large herbivores to create the type of landscape that would have existed. However, the exact date was never defined.

Palynological evidence suggests that the Preboreal/Boreal forest in The Netherlands was still of an open character and that it rapidly closed at the beginning of the Atlantic (*c.* 7500 BP). Information on the amount of light in present-day natural or disturbed forests in Europe and the Near East, up to the Zagros Mountains in Iran, was gathered by the author through the study of the pollen content of so-called surface samples.

The faunal assemblage, which was thought to prevent the natural mesic forest from closing in, was assumed to include wild horse and European bison. There is, however, no proof that wild horses existed in Northwestern Europe during the Holocene. Scarce late-Holocene finds must be connected with early-Neolithic farmers. European bison bones from the Holocene were not found west of the line Berlin-Dortmund, and there is no reason to suggest that this species was a faunal element native to The Netherlands. Earlier finds concern the larger steppe bison.

For the Atlantic period, the time of dense deciduous forests of lime, elm, ash and oak, the presence of large herbivores could only be demonstrated in dynamic situations, such as lake edges, along rivers, and in coastal estuaries. At the beginning of this time, Mesolithic hunters had moved from the Pleistocene plateau of Drenthe and Veluwe towards such places. Postulated natural forest development during the Neolithic, such as the appearance and spreading of beech, seems to have an anthropogenic cause, as concluded from the European pollen record. E. Weeda's suggestion (personal communication) that beech filled in the gaps that resulted from the destruction of lime seems to be very likely.

POLLEN RESEARCH OF COPROLITES AND RECENT FOX EXCREMENTS: POSSIBILITIES FOR SEASON DETERMINATION AND VEGETATION RECONSTRUCTION

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In the course of an archeo-botanical research, coprolites (fossilized excrements) of dogs were investigated, yielding pollen from various crops and many other plants. Pollen enter the donor in two ways: by air (sniffing) and through food and drink. Two questions arose. The first was whether the season of the excrement dropping could be determined from its pollen content. This could help to demonstrate a seasonal occupation by the people of the site. The second was whether a vegetation reconstruction of the environment was possible. To address these questions, comparative research

among recent foxes in the Amsterdamse Waterleiding Duinen was initiated. Excrements were collected for 1 year.

In order to deal with the question of seasonality, pollen numbers were compared with Spieksma's pollen calendar (Driessen, M.N.B.M. *et al.*, 1988. *Pollenatlas van de Nederlandse atmosfeer*. Onkenhout B.V., Hilversum). Attributing the excrements to a specific season turned out to be impossible as some species can occur in the excrements in large quantities both in the flowering- and the fruiting-period. They sometimes can be found throughout the year. Perhaps it will become possible, after more research, to point out certain character species.

With respect to the problem of vegetation reconstruction, a qualitative statement is certainly possible as every species encountered in the fox excrements did indeed occur in the environment.

A quantitative reconstruction was only possible to a certain extent. All dominant vegetation elements were indeed regularly dominant in the total amount of excrement, but once-only dominant species in the excrements were not dominant in the vegetation. Frequently occurring species in the excrements were also frequent in the vegetation, but not all the frequent vegetation elements were found in the excrement.

THE VEGETATION SINCE THE LAST GLACIATION IN THE SERRA DA ESTRELA, PORTUGAL

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In the frame-work of a long-term project of the Laboratory for Palaeobotany and Palynology (Utrecht), which aimed to study the vegetation development of four contrasting West European mountain ranges: the Serra da Estrêla in central east Portugal constitutes the most southern mountain range. The Serra da Estrêla is a granitic mountain range up to 1992 m high and is characterized by a definite Mediterranean mountain flora and climate. Peat deposits and lake sediments suitable for palynological and macro-palaeobotanical research are present in the central part of the mountain from 1400 m upwards. The vegetation history since the last glaciation is studied by means of palynological research from deposits in a series of sites along an altitudinal transect. The sites are all located within a relatively small area. It was found in other mountain areas (Vosges, Forez; France) that vegetational events in part of the area are reflected in deposits in other parts of that area. Pollen diagrams show a number of common trends. With the help of these trends, the pollen assemblages from different sites can be correlated in time and autochthonous and allochthonous elements in the pollen deposition can be separated. The interpretation in terms of past vegetation is enhanced by the study of patterns in the present-day pollen deposition and vegetation along with sub-fossil pollen in the deposits. Recent pollen deposition and vegetation are being studied in a 32-km long and *c.* 3-km wide transect over the mountain range and altitudinal vegetation zones are described. Palynological research on deposits of six sites at 1410 m, 1600 m, 1725 m, and 1850 m is now in progress or completed (Janssen & Woldringh 1981; Van den Brink & Janssen 1985; Bos 1986). The diagram from Charco da Candieira (1410 m) will serve as a standard diagram for the entire area, as it includes the late-Glacial up to the present day. These deposits will be studied in great detail, both for pollen and for macro-fossils. Some preliminary results are: (1) the original forest-limit was formed by *Quercus* at an altitude between 1600 and 1725 m; (2) there has been a stepwise destruction by man of the original forests during the last *c.* 5000 years, resulting

in soil erosion and in treeless shrub vegetation; (3) it appears that the changes in the areal distribution of *Betula* depend on altitude, namely, large fluctuations in the extent of birch at lower altitudes throughout the Holocene and shorter living and later populations towards higher altitudes.

WEEDS, A COMPARATIVE STUDY OF RECENT VEGETATION RELEVÉS AND ARCHAEOBOTANICAL INFORMATION

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Weeds from archaeological contexts are of special interest to archaeo-botanists because they enable the reconstruction of former field weed communities and, hence, the reconstruction of former agricultural techniques.

Two contexts are of particular importance: charred cereal grain deposits and cesspits. Samples of charred cereal grain are a good source of information because one might assume that the charred weeds in the samples were harvested together with the cereals from the same fields. One disadvantage, however, is that these deposits are seldom found, and thus make it difficult to form a picture through time. Besides the remains of foodplants, cesspits contain many arable weeds. In addition, cesspits are frequently found during archaeological excavations (in urban contexts). It is, however, the interpretation of the weeds recovered from cesspits that is regarded as very difficult. Character species of *Secalietea* communities are indicative of winter cereal cultivation, but the numerous other weed species in cesspits could (as is generally thought) come from such diverse habitats as summer and winter grain fields, gardens, dungheaps, roadsides etc. In order to contribute to a solution of the problem of the origin of the many weed species in cesspits, vegetation relevés from fieldweed reserves were studied. In addition cereal grain samples from the same fields were examined for weed diaspores, after which the relevance for archaeo-botanical research is discussed.

The presence of 76 weed species could be demonstrated in the recent samples of cereal grain. This suggests that by far the greatest number of weeds has a good chance of being harvested together with the cereals, turn up in bread or porridge and eventually in cesspits. This would imply that one is justified in using these indicator values to reconstruct former ecological conditions on the fields.

As expected, the relative abundance of the different ecological groups of weeds in the vegetation relevés depends on the agricultural system used. It is shown that the development of perennial weeds is not only favoured by a three-field rotation system (summer grain, winter grain, fallow), but also by a continuous winter grain (rye) cultivation. However, differences in species composition can be observed. In contrast to continuous rye cultivation, a three-field rotation system favours the development of *Artemisietea vulgaris* and *Lolio-Potentillion* communities.

Another remarkable observation is that the number of *Molinio-Arrhenatheretea* species can easily equal the number of *Chenopodietea* species. High numbers of *Molinio-Arrhenatheretea* species in cesspits were usually interpreted to have originated from roofing material, e.g. hay, etc.

It is also demonstrated that, although differences exist in the mean ecological indicator values of the separate synsystematical groups of weeds, this does not necessarily mean that they are derived from different fields.

BUCKWHEAT, WAR AND ACID RAIN: PALAEO-ECOLOGICAL AND HISTORICAL RESEARCH ON RECENT LANDSCAPE DEVELOPMENT IN THE SOUTHERN PEEL AREA (THE NETHERLANDS)

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Palaeo-ecological analysis of regeneration peat in former peasant peat pits enables a detailed reconstruction of the local and regional landscape development in the Peel, a largely cut-over bog area in the southern part of The Netherlands. Palynological data were compared with historical data concerning the economic history of the region in the past two centuries, particularly with respect to developments in agriculture and afforestation, enabling a precise dating of stratigraphic events.

Changes in local bog-vegetation, as revealed by micro- and macrofossil analysis, could be attributed to climatic changes and to the impact of human activities in the direct surroundings (buckwheat fire culture, canal digging, reclamations).

Preliminary magnetic measurements of the peat show a temporal pattern, consistent with historical data on the industrial sulphur emission in The Netherlands in the twentieth century.

The procedure of using two totally different sets of data may lead to the following.

An objective check of historical data.

A better insight into the (non-) completeness of both palaeo-ecological and historical data.

An identification of synchronous and hence possibly inter-related events.

A precise dating of recent peat horizons.

An extrapolation of relationships to periods and events for which no historical records are available.

Because data from natural (peat) and cultural archives are complementary, to a large extent, temporal landscape ecology will benefit by using both sources of information whenever possible.

MEETING OF THE SECTION FOR PLANT SYSTEMS AND GEOGRAPHY ON 15 APRIL 1988

DEVELOPMENT OF THE SPORE WALL IN POLYPODIACEAE (FILICALES)

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Spores in Polypodiaceae are monolete. Their mature spore wall consists of a tough inner layer, the exospore, and an outer layer, the perispore. The exospore surface may be smooth or show any of a large number of different patterns; the perispore varies from very thin and smooth to thick and lavishly sculptured.

In order to explain part of this variation, spore wall development in several species was studied with the aid of transmission (TEM) and freeze-fracture scanning (SEM) electron microscopy. The species studied most extensively so far are: *Drynaria sparsisora*, *Microgramma ciliata* and *Belvisia mucronata*.

Deposition of the first thin layer of exospore material is similar in all species studied. After that, each species shows a different succession of surface patterns caused by the deposition of several layers of exospore material. Deposition of the highly variable perispore is such a swift process that it has not yet been possible to find any differences in its methods of deposition.

The series of succeeding exospore surface patterns are similar within the genus *Belvisia*; their mature spores have only slightly different surface ornamentation. This indicates that the series of surface patterns during exospore formation is more similar in closely related species than in more distantly related species. Widely different mature spore surfaces result from quite different methods of deposition. Therefore, ontogenetic characters may be useful in interpreting relationships within this family of ferns.

Principally because of the lack of experimental studies on spore wall deposition in ferns it is hard to tell which factors govern the deposition of this large variety of patterns. A striking similarity has been observed between certain spontaneous condensation patterns on glass and the ornamentation of certain mature fern spores. This may indicate that at least part of the patterning is governed by simple physical processes.

THE REPRODUCTION OF THE WALCHACEAE, A FAMILY OF LATE PALAEOZOIC CONIFERS, WITH SPECIAL REFERENCE TO *WALCHIA HYPNOIDES*

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Studies on the pollination mechanism of recent conifers have demonstrated a high degree of efficiency in wind pollination, especially with regard to the morphology and position of the ovuliferous cones. It has long been known that modern conifers are characterized by a siphonogamous nature, while Late Palaeozoic conifers, with prepollen, appear to be zoogamous.

The present material originates from the Rotliegend (?Upper Carboniferous—Lower Permian) of west and central Europe. It includes classical specimens described and figured by Florin and recently collected material from the Saar-Nahe Basin (FRG).

A new interpretation of the morphology of the ovuliferous cone of *Walchia hypnoides* resulted in the establishment of a new, thus far monotypic, natural genus assignable to the family Walchiaceae.

A reconstruction of the pollination biology of *Walchia hypnoides* is made on the basis of this newly collected material. Prepollen of the genus *Potonieisporites* could be observed in the pollen/archegonial chamber of *Walchia hypnoides* ovules by means of fluorescence microscopy. A comparison of the size of *Potonieisporites* grains and the diameter of the salpinx suggests the existence of a pollination droplet mechanism.

A similar pollination strategy as for *W. hypnoides* is suggested for other Late Palaeozoic conifers (e.g. *Walchia*, *Ortiseia*). The morphology of Late Palaeozoic conifer prepollen was studied by light microscopy and with SEM and TEM. No distal sexual thinning was observed in Late Palaeozoic prepollen.

HETEROSTYLY IN CONNARACEAE

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In Connaraceae heterostyly is found in various forms. All the species of *Agelaea* and *Jollydora*, and most of the species of *Manotes* show heterotristyly. In *Jollydora duparquetiana* plants with

short-styled flowers do not set fruits, or they do so only rarely. In *Connarus* in Africa and Asia only medium styled and long-styled flower types have been found. *Burttia*, *Vismianthus*, *Rourea* and most of the *Cnestis* species show heterodistyly with 10 fertile stamens, while *Connarus* (partly), *Hemadradenia* and *Ellipanthus* have heterodistyly with only five fertile stamens. *Cnestis ferruginea* is almost homostylous and possibly self-compatible, and *Ellipanthus beccarii* is dioecious.

Heterostyly is considered to be primitive in Connaraceae. In the five-carpellate genera homostyly, and in the one-carpellate genera dioecy represent the most advanced conditions in the evolution of heterostyly.

These evolutionary trends are similar in other heterostylous families studied, e.g. Oxalidaceae and Lythraceae, and fit very well in the pathways by which distyly and tristyly may have evolved in other breeding systems, as suggested by Ganders, F.R. (1979). The biology of heterostyly. *N.Z.J. Bot.* 17: 607–635. The direction of evolution in other characters in Connaraceae is generally in accordance with heterostyly.

FIG ANATOMY AND REPRODUCTIVE BIOLOGY OF AFRICAN FIGS (*FICUS*, MORACEAE)

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The functional anatomy of representatives of three different subgenera of *Ficus* was studied. *F. ottoniifolia* (*Urostigma*, *Caulocarpae*) is a strangler with green cauliflorous figs. *F. sur* (*Sycomorus*) is a tree with special branches with red mature figs. *F. asperifolia* (*Sycidium*) is a gynodioecious species with the figs dispersed on leafy shoots. After wasp oviposition and/or pollination all female flowers show at least initial stages of a double fertilization. The wasp larva feeds on the plant endosperm. This indicates that the pollen transport by wasps achieves better nutrition for its offspring.

The monoecious species and the gynodioecious species each show a different type of organization of the heterostyly. In the monoecious species the figs are a space-stressed environment for flower development. The gynodioecious species lack the pressure of bracts on the developing flower primordia.

The differences encountered in the anatomy of the flowers, the build-up of the synstigma, and the syconial architecture can be related to differences in fenology.