Acta Bot. Neerl. (34 (4), November 1985, p. 425–438.

MEETINGS OF THE ROYAL BOTANICAL SOCIETY OF THE NETHERLANDS

MEETING OF THE SECTION FOR VEGETATION RESEARCH ON 4 APRIL 1984

P. A. BAKKER and H. PIEK (*Vereniging tot Behoud van Natuurmonumenten in Nederland, Noordereinde 60, 1243 JJ 's-Graveland*)

Vegetation research as applied to the management of nature reserves

Which are the intrinsic values in a certain nature reserve and how is it possible to conserve or to upgrade the actual and potential biological values? As a rule there are several alternatives for the management of a nature reserve. Before a decision is made as to the most desirable alternative, a floristic and phytosociological inventory of the area, including mapping of the vegetation, has to be made. After the choice has been made, e.g. between natural development or conservation of a semi-natural landscape, possibly with an accent on either botanical or zoological values, periodic floristical and phytosociological investigation of the area is indispensible to check whether the desired developments actually take place. A good reporting system of all measures carried out is indispensable; complementary data about changes in hydrology and fauna as well as a calculation of expenses over several years are necessary.

Sometimes it may be desirable to try alternative management methods on a small scale before applying them to large areas.

Examples of vegetation maps and species mapping in relation to management planning were demonstrated for a number of nature reserves in The Netherlands.

MEETING OF THE SECTION FOR VEGETATION RESEARCH ON 4 OCTOBER 1984

B. VAN GEEL, L. DE LANGE and J. WIEGERS (*Hugo de Vries laboratorium, Sarphatistraat 221, 1018 BX Amsterdam*)

Reconstruction and interpretation of a vegetational succession from Usselo (Lateglacial, Twente)

For fulla account see:
B. VAN GEEL, L. DE LANGE and J. WIEGERS (1984): Reconstruction and interpretation of the local vegetational succession of a Lateglacial deposit from Usselo (The Netherlands), based on the analysis of micro- and macrofossils. *Acta Bot. Neerl.* 33 (4): 535–546.

C. DEN HARTOG (*Laboratorium voor Aquatische Oecologie, Katholieke Universiteit, Toernooiveld, 6525 ED Nijmegen*)

Nymphaeid communities in The Netherlands

Nymphaeids are water plants which root in the bottom and have floating leaf-blades. They flower on or above the water surface. In The Netherlands communities dominated by the magno-nymphaeids (*Nymphaea alba, N. candida, Nuphar lutea* and *Nymphoides peltata*) are common; these have been classified lastly by WESTHOFF & DEN HELD (1969) in the alliance *Nymphaeion*.

In order to test the value of this classification as well as to investigate whether regional differences in floristic composition could be traced, a data set consisting of 590 relevés (from 46 sources), in

which *Nymphaea alba, Nuphar lutea* or *Nymphoides peltata* occurred, was treated with the programme CLUSTAN-1C. The results were highly unsatisfactory; this may be ascribed for an important part to the heterogeneity of the data.

When quantitative aspects were considered the data set could be reduced to 238 relevés characterized by the dominance of nymphaeids. This set was structured with the programma TABORD, and resulted in the recognition of 4 groups:

(1) Monodominance of *Nymphoides peltata*, with 3 subclusters.

(2) Monodominance of *Nymphaea alba*, with 3 subclusters.

(3) Monodominance of *Nuphar lutea*, with 9 subclusters.

(4) Codominance of *Nymphaea alba* and *Nuphar lutea*, with 7 subclusters.

The first cluster clearly corresponds with the *Nymphoidetum peltati.*

The other three clusters show that the communities dominated by *Nymphaea alba* and *Nuphar lutea* show a high degree of variation, where the accompanying species are concerned. This was already known; WESTHOFF & DEN HELD (1969) record for the *Potameto-Nupharetum* 4 subassociations. Two of these can be recognized in the data set. To name the various subclusters, however, appears rather useless. Because of the heterogeneity of the material, and the total absence of relevant abiotic parameters, it is practically impossible to give a satisfactory interpretation of the various subclusters. For the time being the three clusters are considered to belong to one association, the *Nuphareto-Nymphaeetum albae*. The rejection of the names *Myriophylleto-Nupharetum* and *Potameto-Nupharetum* is based on the fact that there are no specific relations between the nymphaeids and their subgrowth. In fact a well-developed nymphaeid cover reduces or even excludes the possibility for the development of other species.

A third community, the *Nymphaeetum candidae* occurs as well, but as the species *Nymphaea candida* has only recently been discovered in The Netherlands (ROELOFS & VAN DER VELDE, 1977), it was not represented in the data set studied.

Nymphaea alba and *Nuphar lutea* are perennial plants, which have up to 70% of their biomass in the substratum; they can survive for many years (up to more than a century!) and thus form a stable element in the aquatic environment. They represent in fact a climax of the hydroseries. As they have established themselves they appear to be quite insensitive to environmental fluctuations and changes, because nutrients can be obtained from the bottom and the water layer, and carbon dioxide can be obtained by the floating leaves from the air. *Nymphoides peltata* is shorter-lived and behaves more as a colonizer. It reacts rapidly and adequately to environmental fluctuations, but if such fluctuations become too frequent, it becomes soon exhausted, and disappears (BROCK et al., 1985). The species of the subgrowth exploit the environment in a totally different way; they are generally annual, hibernating as seeds or turions, and consequently are highly sensitive to changes in the water quality (trophic status, carbon metabolism, light). The whole subgrowth can change or disappear, without any change in the nymphaeid composition.

Although the nymphaeid-dominated communities can be classified for the time being within the alliance *Nymphaeion*, it is clear that this alliance is not homogeneous. It contains the stable climax-type communities of *Nymphaea* and *Nuphar*, and the colonizing type communities with *Nymphoides*. Further research over a larger area is necessary before a more definitive classification can be proposed. DEN HARTOG (1984) has already given a number of arguments to remove the *Nymphaeion* from the *Potametea* to a separate class *Nymphaeetea*. Apart from the structural and stability characteristics, there is a great similarity in the floristic structure of the nymphaeid communities all over the world. Moreover the "floating-leaves environment" (VAN DER VELDE, 1980) is characterized by a large number of faithful organisms (mainly insects, but also fungi).

BROCK, TH, C. M., G. VAN DER VELDE & H. M. VAN DE STEEG (1985): The effects of extreme water level fluctuations on the wetland vegetation of a nymphaeid-dominated oxbow lake in The Netherlands. *Arch. Hydrobiol.* (in press).

DEN HARTOG, C. (1984): *Synecological classification of aquatic plant communities. Colloques Phytosociol. 10 Végétations aquatiques*, Lille, 1981, pp. 171–182.

ROELOFS, J. G. M. & G. VAN DER VELDE (1977): *Nymphaea candida* Presl, een waterlelie nieuw voor Nederland. *De Levende Natuur* **80**: 170–186.

VAN DER VELDE, G. (1980): *Studies on nymphaeid-dominated systems with special emphasis on those*

dominated by Nymphoides peltata *(Gmel.) O. Kuntze (Menyanthaceae)*. Thesis Nijmegen. 163 pp.
WESTHOFF, V. & A. J. DEN HELD (1969): *Plantengemeenschappen in Nederland.* Thieme, Zutphen. 324 pp.

J. SCHAMINÉE and S. HENNEKENS *(Botanisch Laboratorium, Katholieke Universiteit, Toernooiveld, 6525 ED Nijmegen)*

Soil and vegetation of the Wylré-fields (south Limburg): the development of chalk grassland on derelict arable land

Since 1980, phytosociological and pedological investigations have been done on some recently abandoned fields situated within the woodlands of Wylré. A detailed analysis of the successional status of these fields and a comparison with the chalk grasslands within the region (Wrakelberg, Gerendalsweide and Berghofweide) have been carried out. Moreover, an attempt has been made to evaluate this succession from the viewpoint of nature conservation.

The soil of the Wylré-fields varies as to its structure and composition. On the western part of the slope, the present cretaceous rock is covered by a solifluction layer consisting of clay with flints and of loess. In the eastern part, a rendzina soil is exposed, while the footslope consists of a deep colluvial sediment of mainly anthropogenic origin. In spite of this variation, fertilization by addition of chalk lumps in the past has turned the lime-deficient solifluction soils into calcareous ones and the tilth got an edaphically uniform character all over the slope. This was affirmed by chemical and physical analyses. Moreover, an interesting conclusion of these soil analyses was that in chemical and physical respect the soil of the Wylré-fields is hardly at variance with those of the well-developed chalk grasslands in the region.

The vegatation of the Wylré-fields has been studied by 180 relevés, which have been synthesized into tables. It appeared to be difficult to classify the resulting types as syntaxa, because each of them consists of several syntaxonomic species groups, due to the pioneer character of the vegetation. The course of succession of the Wylré-fields is discussed by dealing with these various syntaxonomic species groups consecutively: Chenopodietea and Secalietea, Dauco-Melilotion, Trifolio-Geranietea, Epilobietea and Sambuco-Salicion, Calystegietalia, Rhamno-Prunetea, Arrhenatherion and Mesobromion. A selection of the relevés of the Wylré-fields has been compared with relevés of the chalk grasslands in the region, to get an overall idea of the phytosociological position of the Wylré-fields.

Although the vegetation of the Wylré-fields certainly cannot be classified as a stable Mesobromion grassland, it can be concluded that derelict arable fields on chalk soil are able to develop, within a few decennia, into a rich semi-natural vegetation with a high species diversity. For the sake of nature conservation this is an encouraging perspective. If a further succession into a well-developed chalk grassland is considered to be desirable, it will be necessary to diminish the accumulation of litter. For this purpose, partial clearance of scrub is a prerequisite. For the future, the present mowing regime or extensive grazing by sheep might be considered adequate measures.

B. M. VAN DEN BERG, L. F. M. FRESCO and J. P. BAKKER *(Vakgroep Plantenoecologie, Postbus 14, 9750 AA Haren (Gn.))*

Vegetation succession approached with a non-Markovian transition model

Although frequently used to analyse and predict vegetation succession, Markov models reveal many disadvantages: – a large amount of data is needed; – constancy in time will be an exception rather than a rule; – spatial patterns are neglected; – the predictive value is small because of the uncertainty in the establishment of new species (USHER, 1981).

In this study a modified transition model has been used for the analysis of changes in grassland under grazing. The main characteristic of this model is the variation of transitions (relative frequencies) with time. Spatial patterns can be taken into account. A plot can be labeled with the name of one single unit of a local vegetation typology. Such a plot can be either a permanent plot or a grid quadrat of a map. In both cases the size of the plot is of importance: the smaller the plots the better the approximation of reality.

Transition frequencies from all types to all other types were assembled in yearly transition matrices based on permanent plots. However, not all transitions occurred homogeneously dispersed over the entire area. Some will take place mainly along borders between vegetation spots. This type of replacement of one type by another will occur when one or more important species propagate by means of stolons or rhizomes. When generative propagation is dominant, transitions will start in gaps in the middle of spots. Hence transition probabilities "along borders" and "within spots" should be estimated separately for each combination of vegetation types. To simulate the expansion and contractions of vegetation spots this is a necessity.

The described model had been applied to a study of vegetation dynamics in the Westerholt (Drenthe, The Netherlands, 11 ha). In 1972 a grazing experiment started, causing a rapid vegetation succession. In 1977 the majority of the study area was passed into another vegetation type (BAKKER c.s. 1983).

In this study a comparison was made between data from 80 permanent plots and from repeated mapping (1972, 1977, 1982). As a result the following conclusions could be drawn: 1. Permanent plots do not render the indispensable information on the relation between pattern and succession (see above); 2. The minimum number of permanent plots (2 × 2 m) needed for the estimation of the probability of the most frequently occurring transition would have been 248, hence for the purpose of quantitative estimation of vegetation changes in a dynamic habitat a yearly mapping (detailed maps in a rough typology) is preferable; 3. Discrimination between "along border" and "within spot" succession is necessary; 4. To estimate the probability of transition as a function of non-constant variable (e.g. climate) a long series of one-year relative frequencies has to be analysed.

BAKKER, J. P., S. DE BIE, J. H. DALLINGA, P. TJADEN & Y. DE VRIES (1983): Sheep grazing as a management tool for heathland conservation and regeneration in the Netherlands. *J. Appl. Ecol.* **20**: 541–560.

USHER, M. B. (1981): Modelling ecological succession with particular reference to Markovian models. *Vegetatio* **46**: 11-18.

J. H. WILLEMS *(Vakgroep Botanische Oecologie, Lange Nieuwstraat 106, 3512 PN Utrecht)*

A botanical view of the prairies of the Midwest of the U.S.A.

F. J. A. DANIËLS, R. BOBBINK, F. BRABER and R. SCHILD *(Vakgroep Botanische Oecologie, Lange Nieuwstraat 106, 3512 PN Utrecht)*

Heath – and grassland vegetation in the Vosges, France

As a part of the research program of the Dutch "Werkgroep Vogezen" (University of Utrecht) a phytosociological study was carried out in the heath and grassland vegetation in the montane (600–1000 m) and high montane (1000–1150 m) zone of the Chajoux and Moselotte valleys, east and northeast of La Bresse, Vosges. These vegetation types determine the landscape of the cultivated lower zones of these agrarian valleys; their phytosociology is very poorly known. Climate is cool to cold and moist; mean annual temperature is between 4 and 8 °C, mean annual precipitation between 1500 and 2000 mm. The bedrock is granite. The mineral rich granite des Crêtes is found in the Chajoux valley, while the poorer granite du Valtin occurs in the Moselotte valley. The valley floors are filled with fluvio-glacial and recent alluvial material; generally these deposits have a coarse texture. Soils are acid, mostly of the "sol brun acide' type.

The syntaxonomic typology is based on 215 relevés, sampled in the period 1973–1981. Sample size was 4 or 9 square meters. The grasslands on the upper parts of the slopes in the montane zone, which are grazed only extensively and irregularly by small herds of cattle and sheep belong to the Festuco-Genistetum sagittalis Issl. 27 (Violion caninae Schwick. 44); those of the high montane zone are Violo-Nardetum strictae (Issl. 27) Oberd. 57. Both associations belong to the Nardetalia Oberd. 49 (Nardo-Callunetea Prsg. 49) and are rich in dwarf shrubs (e.g. Vaccinium myrtillus). The meadows, which cover the lower slopes and the valley bottoms, belong to the Geranio-Trisetetum flavescentis Knapp 51 (Polygono-Trisetion Br.Br. et Tx. 43 ex Marsch. nom. inv. Tx. et Prsg. 51, Arrhenatheretalia Pawl. 28, Molinio-Arrhenatheretea Tx. em. Tx. et Prsg. 51). Two types are

distinguished. One type is slightly manured, mowed once or twice a year, and occurs on moist soils (polygonetosum bistortae Oberd. 57) and the other is not manured, mowed once a year (by hand) and occurs on steep and less moist soil (nardetosum strictae Oberd. 57). This latter type is the richest in species with 44 species per relevé of 4 square meters. On wet sites two associations occur: the Chaerophyllo-Ranunculetum aconitifolii Oberd. 52 (Calthion palustris Tx. 37, Molinietalia caeruleae Koch 26, Molinio-Arrhenatheretea Tx. 37 em. Tx. et Prsg. 51) is found in the grassland area along rivulets and small streams as well as other sites strongly influenced by streaming water. The Parnassio-Caricetum fuscae Oberd. 57 em. Görs 77 (Caricion fuscae Koch 26 em. Klika 34, Caricetalia fuscae Koch 26 em. Nordh. 37, Scheuchzerio-Caricetea fuscae (Nordh. 37) Tx. 37) is found locally on peaty sites with stagnant water. Finally Vaccinio-Callunetum Bk. 42 (Genistion Böch. 43, Vaccinio-Genistetalia Schubert 60, Nardo-Callunetea Prsg. 49) is locally found on shallow, dry soil over the poor granite du Valtin in the Moselotte valley.

Palaeobotanical research suggests the origin of these vegetation types at about 2225–2000 BP. Their main development started in the period between 900 and 500 BP. (Kalis 1984). The old small scaled agrarian way of life in these valleys, with a fair number of self-supporting farms on small holdings with meadows and grasslands is presently in a process of rapid and strong changes. Industrialization, forestry, building of houses and construction of roads, and increased tourism lead to direct and indirect decrease of the area covered with those vegetation types. Particularly the Festuco-Genistetum and Violo-Nardetum show successional trends to shrub- and woodland communities due to changes in management.

KALIS, A. J. (1984): *Forêt de La Bresse (Vogezen)*. Thesis, Utrecht.

MEETING OF THE SECTION FOR PLANT TAXONOMY AND PHYTOGEOGRAPHY ON 29 MARCH 1985

W. A. BRANDENBURG *(Vakgroep Plantentaxonomie, Gen. Foulkesweg 37, 6703 BL Wageningen)*

Cultivated plants and plant taxonomy

Cultivated plants have been derived from wild or weedy plants under the influence of domestication. Depending on where, when and how plants are domesticated, cultivated plants may resemble their relatives, or on the other hand may show such differences that only detailed studies may reveal their relationships. This fact has thus far hampered the classification of cultivated plants. To meet the demand for clear classifications of cultivated plants on which an unequivocal nomenclature system can be based, there is an apparent need for two starting-points:

- the (evolutionary) species between and within which biosystematic relationships can be expressed between cultivated plants and their wild or weedy relatives;
- the cultivar as basic entity of cultivated plants, on which an open classification system can be based, providing crop delimitations and defining cultivar groups.

Both Nomenclature Codes have to make clear, when one of them should be used in order to avoid discrepancies between nomenclature systems for similar classification situations in cultivated plants. This is especially urgent with regard to cultivated plants of hybrid origin. The rules of the ICNCP should be followed for these plants, as the Hybrid Appendix of the ICBN does not contain sufficient provisions to cover the hybrid plants of various nature raised by man.

P. HOVENKAMP *(Rijksherbarium, Postbus 9514, 2300 RA Leiden)*

Phylogeny and geography of the fern Pyrrosia (Polypodiaceae)

In the course of monographic studies in *Pyrrosia* an attempt was made to reconstruct the phylogeny of the genus. For approximately 20 characters transformations were proposed, the resulting apomorphic characters were used to construct a cladogram. For the construction of the transformation series several general notions about evolution (e.g., increasing complexity, gradualness) were used

as arguments as well as the more specific hypothesis that in *Pyrrosia* evolution had led to an increased specialization as epiphytes. This epiphytic specialization concerns:

1) Reproductive strategy (primitive: obligately sexual; derived: vegetative reproduction by way of long-creeping rhizomes with facultatively sexual reproduction).
2) Nutrition (primitive: dependent on accumulated litter; derived: ability to derive nutrition directly from host tree).
3) Drought resistance (increased drought resistance by way of succulent leaves with xeromorphic adaptations and CAM-metabolism).

Following this cladistic analysis the geography of *Pyrrosia* was analyzed using procedures developed from vicariance analysis. In the first stage of this analysis, the monophyletic groups present in *Pyrrosia* were scanned for concordant patterns of distribution. Three such groups were found, and the conclusion could be drawn that the similarities in distribution pattern in these groups were due to a common origin, not to chance dispersal. The three groups found all had predominantly allopatric distributions throughout the Malesian area. In two of the three groups, a basal fork in the cladogram for that group corresponded with a distinction between species on continental Asia and species occurring on the Malesian islands.

In all three groups, the second fork in the cladogram corresponded with a distinction between species from East Malesia and species occurring on the Sunda-shelf; the geographical boundary between the two closely following Wallace's line.

In two of the groups, a tird fork was present in the cladogram corresponding to a distinction between species from New Guinea and species from the Philippines.

The conclusion was drawn that these similarities were too strong to be possibly due to chance, and that the course of events in the phylogeny probably corresponds to a sequence of vicariance events in the geology of the area. In this view, Wallace's line should be explained at least for the species concerned, as a line of fracture rather than as one of contact.

H. J. HUIZING *(Laboratory for Pharmacognosy, Antonius Deusinglaan 2, 9713 AW Groningen)*
Chemosystematics: an aid in the study of interrelationships of Symphytum taxa

By means of several preparative isolation procedures followed by e.g. mass spectrometry and nuclear magnetic resonance techniques as well as by means of gas chromatography in combination with mass spectrometry, pyrrolizidine alkaloid patterns derived from *Symphytum asperum*, several cytotypes of *S. officinale* agg., the artifical hybrids of the former taxa, and *S. peregrinum* were compared. Lysopsamine, intermedine, acetyl-lycopsamine, acetyl-intermedine, symlandine, symphytine, echiumine and myoscorpine were found in all *S. officinale* cytotypes. Echimidine and symphytine (or an isomer) were detected in *S. asperum* and *S. peregrinum*. The interspecific hybrids contained all alkaloids mentioned.

Thin layer chromatography and gas chromatography also in conjuction with mass spectrometry indicated the presence of the triterpenoid isobauerenol in all cytotypes of *S. officinale* and the interspecific hybrids. These observations suggest that the cytotype 2n = 40 of *S. officinale* cannot be regarded as belonging to a hybrid-swarm *S. asperum* × *S. officinale*, but really is conspecific with *S. officinale*. *S. peregrinum* differs chemically (but also in other respects) from *S. officinale*, *S. asperum* and their hybrids. It has to be treated as a distinct taxon.

F. A. C. KOUWETS *(Hugo de Vrieslaboratorium, Plantage Middenlaan 2a, 1018 DD Amsterdam)*
Biosystematic studies on the genus Closterium (Conjugatophyceae)

The unicellular algae from the Class Conjugatophyceae, commonly indicated with the collective name desmids, possess a remarkable variability in their morphology. The fact that most species almost exclusively show vegetative reproduction gave rise to the recognition of a large number of microspecies, and their morphology in addition can be affected by environmental factors. In order to get some insight in the variability within a taxon, and the relations between closely resembling taxa, as well as in possible differences between populations showing either vegetative or sexual reproduction, we have started to study 3 suitable and interesting *Closterium* species, i.e. *C. ehrenbergii*

Ralfs, *C. moniliferum* Ralfs var. *moniliferum* and *C. moniliferum* var. *submoniliferum* (Voron.) W. Krieg. A central rôle is attributed to gel-electrophoresis of enzymes extracted from clonal cultures that are obtained from cells isolated from field samples. Our first results show that the relations between the three taxa under study are very complex. Phenotypic variation of five enzymes is determined for a random sample of 100 specimens from a *C. moniliferum* population collected in a slightly brackish ditch near Heiloo (province of North-Holland). On the basis of the multi-enzyme phenotypes two groups comprising 88 and 10 clones respectively, could clearly be distinguished. Both groups in addition showed small but marked differences in their morphology. Moreover, non random association of the phenotypes of the five enzymes studied resulted in a distribution of the multi-enzyme phenotypes that deviated significantly from the pattern expected for sexual reproduction, and only 7 out of 96 possible combinations were represented. The question now arises whether those types fall within the variation pattern from the species, the most common form possibly representing an ecologically more adapted form, or whether both different forms also show reproductive isolation, each form representing a true taxon. It is known from the literature that morphologically identical forms of *C. ehrenbergii* may show reproductive isolation. The taxonomical position of *C. moniliferum* var. *submoniliferum* is yet unclear. Further studies on populations and above all cross-breeding experiments are needed to elucidate the taxonomy of this species complex.

J. C. M. DEN NIJS *(Hugo de Vries-laboratorium, Plantage Middenlaan 2a, 1018 DD Amsterdam)*
On the relation between sexual and asexual reproduction in Taraxacum.

Diplosporic agamospermy concomitant with polyploidy (mostly at the 3x level) has been the supposedly wide-spread reproduction mechanism in the highly advanced dandelion section *Taraxacum*. The genetical isolation between the agamospermic lineages and morphological (micro-) differentiation have led to the description of hundreds of (micro-) species. Our cytogeographical studies revealed a large-scale incidence of sexual diploids in W. and S.W. Europe and also in C. (and conceivably S.E.) Europe. We are investigating now some regions in East and S.E. Europe. In the Netherlands diploids occur in a series of grasslands in the so-called "Grote Rivieren" district. Phytogeographically spoken this region forms part of the "Fluviatiel" district. A lot of relevant species is more or less thermophytic and shows close relationships with Central and Southern European taxa. In the diploid area most of the populations are "mixed" and contain both sexual and agamospermic individuals in all possible ratios. The main problems are: what decided, historically or recently, the distribution pattern and what is the basis of the apparent equilibriums between the two reproductive strategies? Crossing experiments showed that all diploids studied are interfertile, and that triploids may successfully fertilise diploid specimens, the ensuing F1 consisting of di- and triploids. Single diploid individuals planted within an all-triploid, natural stand of dandelions produced an F1 offspring consisting of 2x, 3x and 4x plants, sexual or asexual, respectively. Some of the conclusions to be reached are: – a diploid motherplant does not need a diploid pollen donor to produce an offspring; – a diploid may give rise to triploid individuals. Should the latter reproduce agamospermously (and many of the plants do indeed), the microspecies concept could be applied. In other words: a diploid sexual species A may produce one (or more) triploid agamospecies (B, C and so on). It is obvious that this mechanism not only functions in the experimental garden, but also in field populations. Fitness tests under natural conditions with these kinds of hybrids are in preparation. Facultative agamospermy most probably occurs in some triploids and accordingly there are genetical bridges between the different ploidy levels; we pose that there are triploid-diploid cycles of development in which the adaptive capacities of the respective reproductive strategies must occupy a key position. Also in the sections *Alpestria, Erythrosperma, Ceratophora* and *Mongolica* diploids are of wide-spread occurrence, which points to parallel developments. In areas where diploids of the genus occur, the possibility of mutual gene flow renders the applicability of microspecies taxonomy open to serious doubt.

M. C. ROOS *(Vakgroep Plantensystematiek en -geografie, Heidelberglaan 2, 3584 CS Utrecht)*

Phylogenetic systematics of the Drynarioideae (Polypodiaceae), prelimenary results

The subfamily Drynarioideae of the Polypodiaceae comprises 8 genera (COPELAND, 1947): *Drynaria* (16 spec.), *Aglaomorpha* (5 spec.), *Merinthosorus* (2 spec.), and 5 monotypic genera. Its holophyly is supported by quite a number of character states. Although the monotypic genera are defended as representing distinct stages of phylogenetic trends (PICHI SERMOLLI, 1977), the phylogenetic relations among the 29 species, and thus the transformation series, were unknown as yet. Therefore, it is questioned, whether this classification reflects the phylogeny. One of the main goals of the present study is to outline a methodology for systematic research of which the starting points and purposes are consistent with the covering law of evolution; evolution interpreted in its broadest sense, *i.e.* descent with modification. In this context, cladistics is presently generally regarded superior to other systematic schools. Moreover, cladistics will lead to a survey of (all) possible phylogenetic relationships which are unambiguously defined and which can be judged according to several kinds of *a priori* established criteria. A corollary of the application of an adequate methodology are results giving detailed insight in the phylogeny that may lead to taxonomic and thus nomenclatural changes. In the present study, a reconstruction of the phylogeny of the group is carried out using a method of cladistic analysis developed by ZANDEE (ITB, Univ. of Leiden). The data of the character analyses are transformed into a binary data matrix. From the latter, the partial monothetic sets are read off. These sets show inclusion or exclusion relations, or overlap. Within these sets, the largest cliques are searched for, cliques being sets of sets of taxa all mutually excluding or including each other. The maximum size for cliques is 2N–1. N is the number of terminal taxa, whereas N–1 is the maximum number of sets within sets. The largest cliques are transformed into trees. These trees (cladograms in the present context) are judged according to their reflection of the datamatrix, *i.e.* the amount of homoplasies (= contradiction) and fitting character states (= support). Those cladograms showing the smallest value of contradiction minus support, are judged according to biological criteria and weighting of the supporting characters. Transformation series are tested using local outgroup comparison. The preliminary results of the cladistic analysis, suggest a classification of the subfamily into two holophyletic groupings, the genera *Aglaomorpha* and *Drynaria*. This is contradictory to existing classifications, which after all, could not be confirmed by a phenetic analysis either.

COPELAND, E. B. (1947): *Genera Filicum*. Chronica Botanic Co.
PICHI SERMOLLI, R. E. G. (1977). Tentamen Pteridophytorum genera in taxonomicum ordinam redigendi. *Webbia* **31**: 313–512.

M. W. VAN SLAGEREN *(Vakgroep Plantensystematiek en -geografie, Heidelberglaan 2, 3584 CS Utrecht)*

Monographic research in the Lejeuneaceae subfam. Ptychanthoideae (Hepaticae)

The importance of the sporophyte generation has been underestimated in the evaluation of taxonomic relationships within the subfam. Ptychanthoideae of the large hepatic family of Lejeuneaceae. Two types of sporophytes are present in this subfamily: the "fenestrate-type" and the "nodular-type", which differ in a number of characters. Monographic research in the genus *Brachiolejeunea* revealed that both sporophyte types are present in the genus, each in one of the two recognized subgenera (VAN SLAGEREN, in prep.). This has lead to the study of the sporophyte generation in most genera of the Ptychanthoideae with the aid of both LM and SEM. The distinguished characters are: 1) the morphology of the outer and inner capsule valve layers, as well as the lateral valve margin; 2) the morphology and arrangement of the elaters; 3) the storage of the spores in a closed capsule; and 4) the outline and ornamentation of the individual spore. The name of the two sporophyte types is derived from the morphology of the inner layer of the valve. In the fenestrate type sporophyte a sheetlike thickening layer with several holes (or fenestrae) is present on the inner tangential wall whereas in the nodular-type sporophyte irregular nodules are present in the angles and on the radial

walls. The elaters are also different: with well developed spirals and arranged regularly over the apical part of the valve in the fenestrate-type; with weakly, oft incompletely developed spirals that are located marginal on the valves in the nodular-type sporophyte. Of 22 investigated genera of Ptychanthoideae the fenestrate-type sporophyte is present in 14 genera and the nodular-type in only 8. The fenestrate-type sporophyte is with some differences also present in taxa that are taxonomically allied to the Ptychanthoideae: the subfam. Bryopteroideae of the Lejeuneaceae and in the fam. Jubulaceae. Both taxa are considered more primitive due to a.o. their type of seta. The nodular-type sporophyte is present, with considerable variation, in the subfam. Lejeuneoideae of the Lejeuneaceae. This subfamily is considered more advanced than the Ptychanthoideae due to a.o. their seta type and their often specialized ecology. It thus appears that the Ptychanthoideae have very different evolutionary affinities, and the same holds for the subgenera of *Brachiolejeunea*. Future elevation of these subgenera to a generic level will therefore express these differences more adequately.

B. O. VAN ZANTEN *(Biologisch Centrum, afd. Bryologie, Postbus 14, 9750 AA Haren)*
Feasibility of Long-Distance Transport in Colombian Hepatics

The spores of 61 Colombian hepatics have been tested for their resistance to the circumstances they would encounter during aerial long-distance transport. Of the 61, mainly tropic-(sub)alpine species, 28 are transoceanic and 33 endemic to South America. The resistance to desiccation, wet-freezing and dry-freezing (both –30 °C) was tested in the laboratory, and a combination of desiccation, dry-freezing (c. –60 °C), low pressure, high ozon-concentration and high U.V.-radiation was tested in a divice mounted on the wing tips of a Boeing 747 of the Royal Dutch Airlines (KLM).

Results:
1. The percentages of species surviving 4 days of wet-freezing are 96 in transoceanic species and 88 in endemics;
2. For dry-freezing the percentages are 81 and 53 respectively;
3. The average number of days of resistance to desiccation is 46 in transoceanic species and 25 in endemics;
4. The percentages of species surviving desiccation periods of at least 5 days are 82 in transoceanic species and 73 in endemics. for periods of at least 10 days, 71 and 67 resp., for 20 days 64 and 52 resp., for 30 days 46 and 24 resp., for 40 days 46 and 12 resp. and finally for periods of at least 50 days 39 and 9 resp.;
5. The test on the wing tips of the aeroplane was lethal for all species, except one (*Marchantia chenopoda*).

Conclusions:
1. Effective aerial long-distance transport by wet air-currents (depressions, typhoons) at high altitudes, is a good possibility for most hepatics;
2. Effective aerial long-distance transport by dry air-currents at relatively low altitude is possible for some hepatics;
3. Effective aerial long-distance transport at jet-stream altitude is very unlikely for most hepatics.

MEETING OF THE SECTION FOR PLANT MORPHOLOGY AND -ANATOMY ON 12 APRIL 1985

M. VENTURELLI *(Univ. São Paulo, Brazil, temporarily Hugo de Vries-laboratorium, Plantage Middenlaan 2a, 1018 DD Amsterdam)*
Development of ovule and seed in Rapateaceae

The embryology and the development of the seed in the family Rapateaceae had till now not been

investigated. The purpose of the present study is to provide a detailed description of the development of ovule and seed in some genera and to contribute additional data regarding the taxonomic position and relationships of the family. The ovule is anatropous, bitegmic and crassinucellate. The subdermal archesporial cell cuts off a primary parietal cell which divides mainly anticlinally. The megaspore mother cell mostly forms a triad. The chalazal megaspore develops into a *Polygonum* type of embryo sac. The endosperm is initially nuclear to become cellular later. The inner integument is completely of dermal derivation and upon the whole 2-layered. The outer one is subdermally initiated and becomes 6–7 layers thick. The micropyle is formed by both integuments. The mechanical layers of the seed coat originate from the outer layer of the inner integument (the exotegmen and the inner layer of the outer integument (the endotesta). The exotegmen is puzzle-piece shaped. The thickening of the endotesta starts as in a collenchyma cell, but becomes U-shaped in the mature seed. In *Cephalostemon* the cells of the inner layer of the inner integument are tanniniferous, stretch radially and attain a length of up to 60 μm but they become compressed later. In the funicular region of the ovule a rim-like structure develops from both dermal and subdermal layers. The rim remains attached to the placental tissue after seed detachment. In the hilar region an abscission zone differentiates. This region is vascularized by tracheids connected with the vascular bundles. The endosperm is starchy, the outermost layer, which is proteinaceous, excepted. The mature embryo is small, lenticular and undifferentiated.

The Rapateaceae share many characters with the other families of the Commelinales. The presence of an endotesta is characteristic of the order. Apart from the Commelinales an endotesta is also found in Zingiberales.

H. J. WILMS *(Vakgroep Plantencytologie en -morfologie, Arboretumlaan 4, 6703 BD Wageningen)*
How to find the few plants with meiotic developed embryo sacs in obligate apomictic reproducing Kentucky bluegrass varieties

Kentucky bluegrass, *Poa pratensis* L., can produce seed in a meiotic way and/or in an apomictic way. Plant breeders utilize this phenomenon: the meiotic way is used when creating variability through intra-specific hybridization and then only those F. plants which deviate phenotypically from the female parent are selected for the assessment of turf performance and seed production; the apomictic way is used when maintaining varieties in an uniform and stable way. Up till now in *Poa pratensis* the degree of apomixis is determined afterwards in field experiments by counting the deviating plants, which is a time consuming procedure. Therefore plant breeders have asked for a method to determine the reproductive character as soon as possible, preferable with the help of the very first flowers. This reproductive character is determined by the way in which embryo sac development proceeds. Spikelets of the panicle were preserved in formaldehyde, acetic acid and aethanol. Single pistils were transferred to Herr clearing fluid (HERR 1971).

Dissected ovules were placed in clearing fluid on a slide and examined with a Nomarski light microscope. The meiotic embryo sac development follows the *Polygonum* type, while the apomictic embryo sac development follows the aposporous way as in *Hieracium*. Initiation of the aposporous cell occurs next to the chalazal part of the meiotic cell, at some stage of the development from megaspore to mature embryo sac. While developing, the aposporous cell enlarges in the direction of the micropyle. All aposporous cells develop into embryo sacs when they had been initiated in an early stage of the meiotic embryo sac development (one-nucleated to four nucleated meiotic cell; see ABELN et al. 1985). The result of observing different pistils in various spikelets of one panicle is that the uppermost spikelets have the most developed stages in the proces of embryogenesis. This indicates that it is possible to predict the reproductive character of *Poa pratensis* plants by observing their very first uppermost flowers when the embryo sac development has reached the four nucleated stage or shortly beforehand. If there is found an aposporous cell at these stages the plant will be aposporous. If there is not an aposporous cell the plant will, in all probability, produce meiotic embryo sacs, of which the egg cells need to be fertilized to produce an embryo.

ABELN, Y. S., H. J. WILMS & A. J. P. VAN WIJK (1985): Initiation of apomictic seed production in Kentucky bluegrass, Poa pratensis L. In: M. T. M. WILLEMSE & J. L. VAN WENT (eds.): *Sexual reproduction in seed plants, ferns and mosses*. Pudoc, Wageningen. pp. 160–164.

HERR, J. M. JR. (1971): A new clearing-squash technique for the study of ovule development in Angiosperms. *Am. J. Bot.* **58**: 785-790.

R. W. DEN OUTER *(Vakgroep Plantencytologie en -morfologie, Landbouwhogeschool, Arboretumlaan 4, 6703 BD Wageningen)*

Structure of the secondary phloem derived from a storied cambium

The anatomy of the secondary phloem of 49 species of woody dicotyledons from the Ivory Coast, West Africa, all with a storied structure, has been studied. They belong to the families Bixaceae (1 species), Bombacaceae (3 species), Caesalpiniaceae (4 species), Papilionaceae (18 species), Sterculiaceae (16 species) and Tiliaceae (17 species). In the Sterculiaceae usually only the axial system is storied. Storied structure is accompanied by other anatomical features; together they constitute the storied structure complex. These anatomical features are already given by others for the secondary xylem. In this study they are extended with those of the secondary phloem, viz.: sieve-tube members are never long, with very oblique sieve plates, with 10 or more sieve areas and small sieve pores; sieve areas in the side walls of the sieve-tube members are never abundant, well developed, equally spaced, approximately of the same size as those in the sieve plates; companion cells are never much shorter than the sieve-tube elements, occurring single; in the conducting secondary phloem, parenchyma strands are always composed of at the most four cells; true phloem fibres and crystal cells are always present, like multiseriate rays; an orderly sequence in four often occurs. Though storied structure itself is considered to be an advanced feature, the component elements of the secondary phloem itself are either specialized, intermediate or even primitive according to standards given by ZAHUR (1959). This is in contrast with the secondary xylem with a storied structure in which usually all the component elements are advanced. On the other hand it is also possible that the arrangement of secondary phloem characters determined by Zahur needs revision with regard to the axial-parenchyma and mechanical-tissue types.

A. K. VAN SETTEN *(Instituut voor Systematische Plantkunde, Heidelberglaan 2, 3584 CS Utrecht)*

Leaf anatomy of neotropical Annonaceae

A preliminary study of the leaf anatomy of the neotropical Annonaceae was done using the light microscope.

The purpose of this study was to find leaf anatomical characters which could be of taxonomical value for delimitation of genera or groups of genera. The material studied comprises all neotropical genera, except *Reedrollinsia* and *Pseudephedranthus*. Leaves were studied in transverse sections and in surface view. Whenever possible, leaves from different specimens and from different species of a genus were studied.

The results of this study indicate that the following leaf anatomical characters are of taxonomical value, in this order of importance:

1. Shape of vascular tissue in the midrib;
2. Type of crystals found in the epidermal cells;
3. Sclereids: whether present or not, and type;
4. Length of bundle sheath extensions;
5. Presence of silica bodies;
6. Presence of secretion-cells;
7. Presence of coloured oil;
8. Presence of a special type of papillose lower epidermis;
9. Presence of stomata on the adaxial side;
10. Type of palissade and/or spongy parenchyma.

The presence, and type, of striations might also be a character of taxonomical value, but this could not be verified with the light microscope only.

C. VAN DER SCHOOT *(Botanisch Laboratorium, Lange Nieuwstraat 106, 3512 PN Utrecht)*

Internodal xylem anatomy of tomato: description and implications for longitudinal and lateral transport

The xylem vessels are the translocation paths of most amino acids produced in tomato roots. The amino acids traverse to the phloem along the xylem channels in tomato. This xylem-to-phloem transfer is important for the nitrogen economy of the plant. Assuming that lateral displacement of nitrogenous compounds is dependent on the xylem organisation, more knowledge on the xylem structure and anatomy of the tomato stem is required. Analysis of xylem macerates revealed the presence of 5 types of elements with distinct top-frequency length: ray parenchyma cells (80 μm/axial), axial parenchyma cells (250 μm/fusiform, strands), vessel members (180/290 μm/respectively perfusion and tail-to-tail length), tracheids (350 μm), fibres (590 μm). The living elements are organized in an axial and radial symplast which are interconnected via numerous pits. Both symplasts are in contact with the vessels by means of contact cells with large contact pits. A sheath of axial parenchyma surrounds the vessels. Local windows in the sheath allow vessel ray contacts. Two principal vessel types are distinguished: (1) wide (50–160 μm), straight, long vessels, suited for rapid transfer of water and solutes, and (2) narrow (20–50 μm), short vessels. The three main bundles of the vascular ring contain vessels with diameters of 20–160 μm, while the three minor alternating bundles only contain vessels of 20–80 μm. The varying size of individual vessels gives use to different transport velocities of water and corresponding lateral escape sites of solutes along the channels. Anatomical evidence for two modes of lateral transfer is present: (1) Symplastic uptake from the vessels after solute passage through the contact pits of contact cells. The excessive metabolic activity in the ray cells and the high frequency of paired tangential pits point to the rays as the symplastic conduits for xylem-to-phloem transfer. (2) Apoplastic solute flow through radial intercellular channels in the rays. Many blind pits in the ray cell/ray channel interface may indicate intense exchange of materials.

R. BAKHUIZEN, P. C. VAN SPRONSEN, F. A. J. SLUIMAN-DEN HARTOG, C. J. VENVERLOO and L. GOOSEN-DE ROO *(Botanisch Laboratorium, Nonnensteeg 3, 2311 VJ Leiden)*

Nuclear envelope radiating microtubules in plant cells during interphase mitosis transition

To be published in *Protoplasma* (in press).

A. A. M. VAN LAMMEREN and M. T. M. WILLEMSE *(Vakgroep Plantencytologie en -morfologie, Landbouwhogeschool, Arboretumlaan 4, 6703 BD Wageningen)*

Structural and morphogenetic aspects of the microtubular cytoskeleton in developing pollen of Gasteria

During subsequent stages of microspore and pollen development microtubules (MTs) appear to be arranged in quite different configurations. In order to determine their orientation and function, the cytoskeleton was visualized immunocytochemically. Therefore anthers were fixed at different developmental stages. They were embedded in polyethylene glycol (PEG) and sectioned. Sections were sticked onto slides; the PEG was removed in buffer and the embeddment-free sections were then processed for immunolabeling. For quantitative measurements the fluorescence intensity was determined. In prophase and after microspore mitosis periods of intensive fluorescence indicate changes in MT concentrations. Configurations of MTs change radical during pollen development and so does the shape of the developing cells. In microspore mother cells, which are about isodiametric at interphase, microtubules preferentially appear in a criss-cross pattern.These MTs are likely to function as a flexible cytoskeleton which sustains the integrity of the cytoplasm. In young microspores, generative cells and during nuclear division bundles of MTs were observed. In the microspores the bundles appear when the cell shape changes dramatically; in generative cells bundles of MTs impose the spindle shape and during nuclear division bundles establish and maintain the spindle shape. After division and nuclear repulsion MTs radiate from nuclear membranes. Here

they appear to fix the position of the nucleus. A detailed report of these findings is in press (VAN LAMMEREN et al., 1985).

VAN LAMMEREN, A. A. M., C. J. KEIJZER, M. T. M. WILLEMSE & H. KIEFT (1985): Structure and function of microtubular cytoskeleton during pollen development in Gasteria verrucosa (Mill.) H. Duval. *Planta*, in press.

E. S. PIERSON, J. DERKSEN and J. A. TRAAS *(Botanisch Laboratorium, Katholieke Universiteit Nijmegen, Toernooiveld, 6525 ED Nijmegen)*

Microtubules and microfilament in pollen tubes of lily and tobacco

Strong evidence exists for a relationship between cytoskeleton elements and tip growth of pollen tubes. In this respect microtubules and microfilaments were studied in pollen tubes of *Nicotiana tabacum* cv. Samsun, *Lilium longiflorum* cv. White Europe – a self-incompatible clone – and of *Lilium longiflorum* cv. Mount Everest – a cultivar compatible with cv. White Europe. Pollen were grown *in vitro* or *in vivo*. Microtubules were visualized by immunofluorescence, with FITC anti-anti tubulin(WICK et al., 1981), and by dry cleaving (TRAAS, 1984). The distribution of microfilaments was studied using phalloidin-rhodamine, a marker for filamentous actine.

Tips of young lily and tobacco pollen tubes, cultured *in vitro*, displayed a bright FITC fluorescence, indicating the presence of tubulin. However, in older pollen tubes tips fluorescence had disappeared, but a fuzzy network of short microtubules was present just behind the tip. In the more proximal zone of the cell parallel bundles of cortical microtubules were clearly visible. In dry cleaving preparations similar observations were made. Also microtubules associated with the generative cell were observed with immunofluorescence.

In both species we were able to show microfilaments in pollen tubes cultured *in vitro*, their arrangement being similar to that of microtubules. In lily the microfilaments usually protruded into the outermost tip of the cell.

In lily pollen tubes obtained *in vivo*, the microfilaments appeared organized in very bright and distinct bundles, forming a extended network. Noticeable was the presence of very clear microfilaments in the extreme tip of these pollen tubes. In some pollen tubes remarkable star-shaped foci of microfilaments were seen; they may represent microfilament organizing centres. There were so far no differences in the distribution of microfilaments in pollen tubes from compatible and incompatible matings, 48 hours after pollination.

TRAAS, J. A. (1984): Visualization of the membrane bound cytoskeleton and coated pits of plant cells by means of dry cleaving. *Protoplasma* **119**: 212–218.

WICK, S. M., R. W. SEAGULL, M. OSBORN, K. WEBER & B. E. S. GUNNING (1981): Immunofluorescence microscopy of organized microtubule arrays in structurally stabilized meristematic plant cells. *J. Cell Biol.* **89**: 685–690.

F. D. BOESEWINKEL *(Hugo de Vries-laboratorium, Plantage Middenlaan 2a, 1018 DD Amsterdam)*

Development of ovule and seed-coat in Averrhoa (Oxalidaceae), with notes on some related genera.

Published in *Acta Bot. Neerl.* **34**, 413–424, 1985.

G. STARITSKY and C. J. BREURE *(Vakgroep Tropische Plantenteelt, Landbouwhogeschool, Postbus 341, 6700 AH Wageningen)*

The morphogenesis of the inflorescence of the oil palm in relation to yield components

The growth of the oil palm is mono-axial. The single apical growing point is surrounded by 40–60 primordial leaves in sequential stages of development. The most developed young leaf extends

upright in the centre of the whorl of unfolded mature leaves. Because of its likeness this leaf is called the 'spear' and is given reference number 0. To the outside of the whorl the leaves are given the numbers +1, +2, +3, ... +60, and to the interior, the heart of the palm the developing leaves are given the numbers −1, −2, −3, ... −60. Full-grown palms produce about two new leaves each month and shed the same number of old leaves, which results in a rather constant number of leaves in the crown.

In the axil of the leaf primordia inflorescences are initiated. Differentiation into male and female inflorescences takes place during further development. Normally a series of inflorescences of the same sex is followed by a series of the other sex. So there is a tendency to dioecism and cross pollination is ensured. The mechanism of determination and differentiation is not exactly known and the process is extended over a long period. For instance, the developmental stages from inflorescence initiation via sex differentiation, abortion, development of flowers and fruits to harvesting of the fruit bunch take more than three years. The determination and development of these stages are not only affected by genetical factors but also by environmental conditions and internal competition for assimilates. All these factors together may result in unwanted fluctuations in economic yield. To study cause and effect of these factors was the objective of long term research by the Oil Palm Research Association in Papua New Guinea. This was carried out in a density experiment, containing 56, 110, 148 and 186 palms.ha^{-1} plots, planted in 1970. After thinning of half of the 186 palms.ha^{-1} plots in 1981, material became available for a study of the early development of the palm inflorescence.

Inflorescence buds were given the number of the leaf axil of their origin at the moment of collection. By light microscopic observations of sectioned buds a series of inflorescence developmental stages could be distinguished. From the most distinct stages scanning electron micrographs were prepared for illustration. The relation between developmental stage of the inflorescence, leaf number and growth condition of the palm will be treated in a more detailed publication.

This microscopical study is part of the dissertation research of the second author. The investigations are carried out in collaboration with the Rijksherbarium, Leiden and the Oil Palm Research Association, Papua New Guinea.