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International Organization of Plant Biosystematists

Newsletter

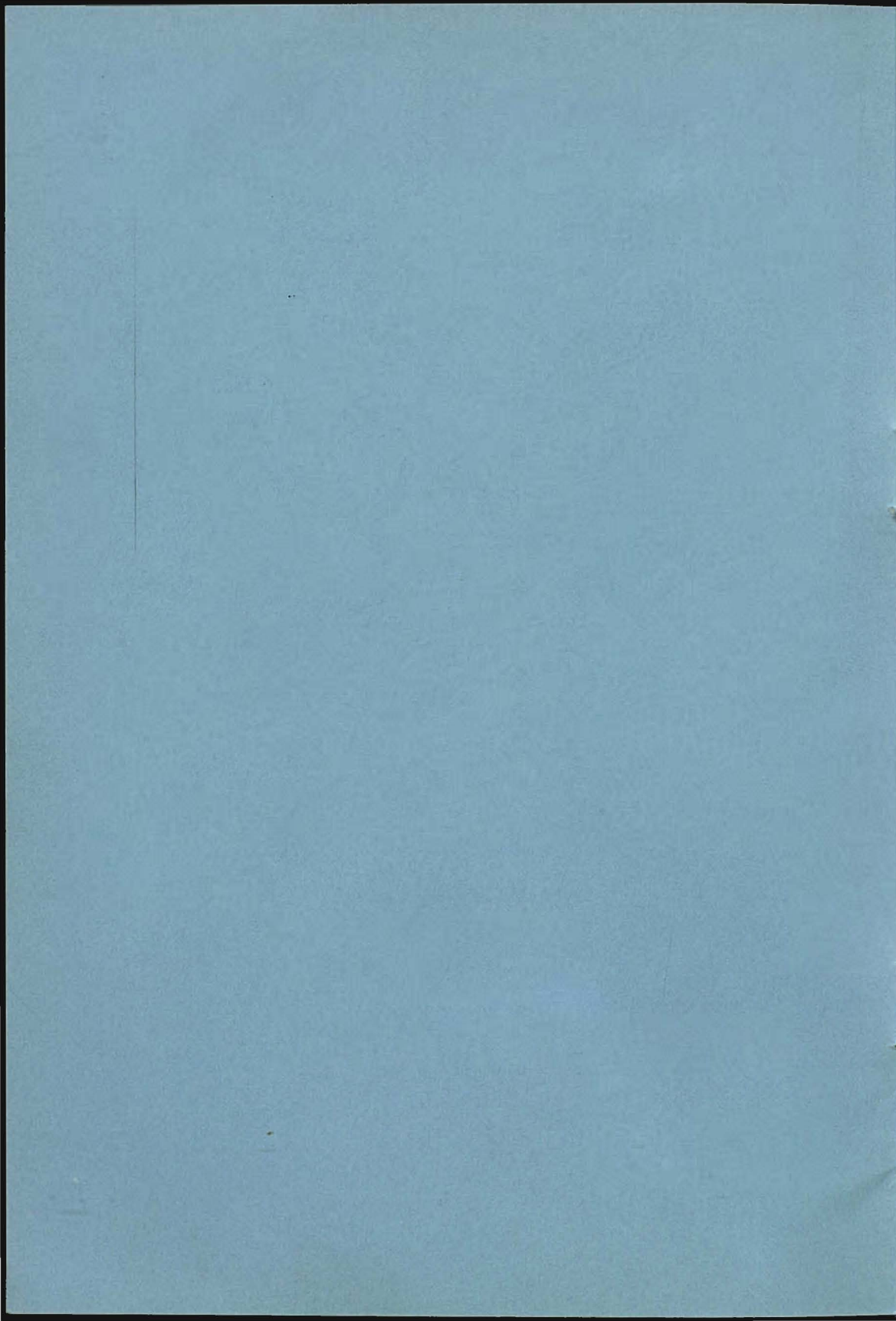
No. 11

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International Organization of Plant Biosystematists

Newsletter No. 11

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MATASELLOS: 18-1-89

Dear IOPB Members,

Our winter issue of the Newsletter is very varied and contents-rich. Best thanks to all contributors!

Dr. Elias Landolt from Swiss Fedral Institute of Technology is author of our current Lead Article on "Urban ecology and biosystematic research" (p. 3). Thank you Rocca, I am convinced that our Members will find new impulses in your interesting contribution.

Our column "Profile of a Scientist - Profile of a Lab" has as many as **three** entries this time (p. 5). Many thanks to the Executive and Council, I am waiting for other profiles. Please don't forget that a "Profile" from e.g. Zew Zealand (yes, I'm talking to you, Colin) takes a rather long time to land on my desk ...

Our "Chromosome Number Report" contributed by Dr. Albers presents numerous interesting data (p. 10). Speaking about chromosome counts: please look up the contribution of Dr. Jonsell (p. 12). Should you have any unpublished chromosome counts from the area included in the Flora Nordica project, please submit them to the Committee.

Good news: biosystematics in China is developing quite impressively (p. 13). Please note the very last part of the report sent in by Dr. Chen Jiakuan - perhaps there will be one day an IOPB Symposium held in his country ...

In the previous issue of the Newsletter you've been informed about the approaching IOPB elections. Now it is time to send your suggestions to your Past President Dr. Grant (p. 14). Think hard, it is **very important** that we have an active Executive and Council.

More good news, this time from Japan: The Organizing Committee is at a full work on the approaching IOPB Symposium (p. 14). Thank you for this information, Shoichi, we are looking forward to receiving the Second Circular, to be distributed soon.

Still more good news: We have got an offer for the IOPB Symposium 1992! It will be held in the St. Louis Botanical Garden, Missouri, USA (p. 14), as suggested by Dr. Peter Raven. Best thanks, Peter, the IOPB has gratefully accepted your kind proposal.

Another item of interest is a project of the IOPB Award (see p. 15). Please read carefully; if you **don't agree**, let me know, othetwise I'll consider it accepted. The First Award is planned to be granted during the Kyoto Symposium next year.

Things are happening in Scandinavia ... Look up the report on the meeting held in Uppsala (p. 15), and the announcement concerning the forthcoming meeting in Oslo (p. 17). I hope to publish a brief report on another meeting held at the Tromsø University in the next issue of the Newsletter.

Data for Newsletter No. 12 should arrive here before May 31, 1989.

Best seasonal greetings and good wishes for the New Year

The Editor

NOTE: Please write in capital letters or use typewriter while preparing your 'Research News' sheet for the Newsletter. You don't want to have some words misspelled in print, do you? Please only use the new form.

2. Lead Article

By Elias Landolt, Geobotanical Institute, Swiss Federal Institute of Technology Zurich, Zürichbergstrasse 38, CH-8044 Zurich.

Since World War II, a drastic change in agriculture has taken place in Europe. The rural landscape comprising numerous elements and ecological niches is increasingly being replaced by large areas of monocultures. Extensively managed dry meadows, reed meadows, swamps, open creeks, road embankments, hedges, orchards, fallow fields, and many other biotopes disappeared, with them numerous plant and animal species.

The increase in the human population size resulted in urbanization of large areas. At earlier times, when manual labour was still cheap, places and gardens in towns were meticulously maintained. Gardens and paths were properly weeded, roads, parking places and backyards asphalted, paved areas and walls cleanly sealed giving no possibilities for weeds to grow. Flower-beds, lawns as well as exotic trees and shrubs were regarded as the only vegetation worthy of a town; wild plants and weeds, considered signs of disorder, were not tolerated. Later on, when labour became more expensive, liberal amounts of herbicides were used to clean roads and places.

Today, the general attitude towards plants in urban areas has changed. The often negative effects of herbicide use led to much more cautious applications. Wild plants have nowadays more opportunities to grow within town limits, and are better tolerated than in old days. The urban climate favours the occurrence of many plant species. During summer time on clear days, the temperature within the areas built over may be up to 5°C higher than in open surroundings. Winters are often milder, too. Many archeophytes and garden plants growing wild in warmer regions which reach their distribution limits in our climate still find favourable conditions within town. Since many pioneer habitats, which cannot be found anymore in the rural landscape still occur in towns, many plants have been able to colonize successfully urban biotopes; on the other hand, their original habitats in the rural landscape have been destroyed so that some species have disappeared from the countryside.

All the above mentioned reasons considered, it is easy to understand that ecologists involved in nature conservancy became increasingly involved in urban ecology. Many papers dealing with the richness of the urban flora and many aspects of urban ecology have been published to date, especially in German-speaking countries and also in Eastern Europe, England, Italy and France (see e.g. SUKOPP et al. 1973, BORNKAMM et al. 1982, JANSSEN and BRANDES 1984, WITTIG et al. 1985, SCHULTE 1985, KUNICK 1987).

The importance of a city as a living space for endangered plant species can be exemplified here by the city of Zurich. Our urban area of about 100 km² contains about twice as many species of ferns and phanerogams (ca. 1000 taxa) as a purely agricultural area of the same size in the eastern part of the Swiss midlands. Of the 1600 species occurring there, 700 are endangered or vulnerable: 70 of these species form viable populations within the urban area, and the further 120 grow within the suburbs of Zurich. The city is well-suited for conservation of endangered species because, contrary to agricultural areas, it is not forced to get a maximal yield of the land,

and therefore can afford to support multifarious habitats.

Urban ecology is a fascinating subject, very helpful in getting knowledge about general ecology, progresses, competitive abilities, and life strategies of plants.

The Geobotanical Institute of SFIT is just beginning to investigate more closely the urban vegetation and flora of Zurich. The inventory of all species and vegetation types constitutes the first step in understanding the behaviour of species. Next comes the assessment of microclimatic and edaphic factors as well as the complexity of human influence. The aim of those studies is to find out correlations between environmental factors and the occurrence of various species. Further interesting aspects of our investigations are the observation of newcomers, their spreading to new sites, and also the analysis of various seral phases. It will be exceedingly interesting to detect the strategies of various colonizing species appearing within the area of Zurich and displacing established taxa in their sites.

Interface of urban ecology and biosystematics is particularly interesting. For instance, comparison of origin of a given species with its ecological requirements may lead to recognition of adaptations specific to the new habitat. Also, a better knowledge of different microspecies within critical species groups (e.g. *Polygonum aviculare* s.l., *Stellaria media* s.l., *Erophila verna* s.l., *Arenaria serpyllifolia* s.l., *Capsella bursa-pastoris* s.l.) will be much enhanced by data on their ecological behaviour in urban areas. Last but not least, it should be remembered that urban sites remaining under human influence may offer chances of establishment and further evolution to some newborn taxa e.g. allopolyploids (see. e.g. URBANSKA 1987). The main advantage of biosystematic research in urban areas are the great diversity in species and habitats, and also the increased possibilities of accelerated ecosystem dynamics due to changes in environmental conditions. The immediate vicinity of the study area and mostly easy access to the sites studied represents as well an important aspect. Urban ecology truly opens exciting perspectives to biosystematic research.

References

- BORNKAMM R., LEE J.A., DEAWARD M.R.D. (eds.), 1982: Urban ecology. Blackwell Sci. Publ. 370 pp.
- JANSSEN Ch. and BRANDES D., 1984: Struktur und Artenvielfalt von Randzonen der Grossstädte, dargestellt am Beispiel von Braunschweig. Braunschw. Naturk. Schr. 2, 57-97.
- KUNICK W., 1987: Verbreitungsmuster einzelner Pflanzenarten in westdeutschen Städten. In: SCHUBERT R. und HILBIG W. (eds), Erfassung und Bewertung anthropogener Vegetationsveränderungen 1. Martin-Luther-Univ., Halle. 101-119.
- SCHULTE W., 1985: Florenanalyse und Raumbewertung im Bochumer Stadtbereich. Materialien zur Raumordnung, Geogr. Inst. Bochum, 30, 394 pp.
- SUKOPP H., KUNICK W., RUNGE M. and ZACHARIAS F., 1973: Ökologische Charakteristik von Grossstädten, dargestellt am Beispiel Berlins. Verh. Ges. Ökol. 383-403.
- URBANSKA K.M., 1987: Disturbance, hybridization and hybrid speciation. In: VANANDEL et al. (eds.), Disturbance in grasslands. Junk, Dordrecht. 285-301.
- WITTIG R., DIESIG D. and GÖDDE M., 1985: Urbanophob- Urbanoneutral- Urbanophil. Das Verhalten der Arten gegenüber dem Lebensraum der Stadt. Flora 177, 265-282.

3. Profile of a Lab - Profile of a Scientist

Profile of a Lab, by M. Angels Cardona, IOPB Council Member, Cytotaxonomical Laboratory, Department of Plant Biology, School of Sciences, Universitat Autònoma of Barcelona, 08193 Bellaterra, Barcelona, Spain (received July 1988)

This is a small and young laboratory which was started in 1984. Except for its Director, the lab consists of students working on their Doctoral Dissertations. Its major field of research is cytotaxonomy of phanerogams, along with morphological, ecological, distributional and phylogenetic studies.

The interests of the group are focused on the following subjects:

- a) Endemic flora of the Balearic Islands: phylogenetic relationships and paleogeographic implications. This study is at advanced stage and the Director of the Laboratory has been working on it since 1973.
- b) Study of the Catalan taxa of the genus *Onobrychis* (a recently completed research).
- c) Revision of the mediterranean taxa of the genus *Rubia*. Western taxa are well-known and live material is available. On the other hand, only herbarium material is available from eastern taxa, which greatly influence such revisions.
- d) Characteristics of invading species: biogeographic, physiological and genetic studies on annual species of *Bromus*. A joint project developed with the Center of Functional and Evolutionary Ecology of the C.N.R.S. at Montpellier. The genetic study carried out by our Laboratory deals with the following aspects:
 - Determining the chromosome number of the different taxa, using numerous populations of each taxa.
 - Study of the different ploidy levels in the taxa from the mediterranean region (mainly Morocco, NE Spain, S France, Corsica and Turkey) and its correlation with their distribution.
 - Analysis of the meiosis.
 - Construction of the karyotypes for the different taxa, along with morphological, ecological and distributional studies to determine phylogenetic relationships and evolutionary trends.
 - Selfings vs. crossed pollination.
 - Reversal in male/female function.

Bad experience: After countless efforts it was arranged for a young student to start a study on "Isozyme characterization of *Pinus halepensis*, *P. brutia* and *P. ceciliae*", using the facilities of the Genetics Laboratory (*Drosophila*). Shortly after starting the research, a job offered made the student put aside both the project and the university. A lesson for the Director of the Laboratory to learn?

Selected publications:

CARDONA M.A., 1984: Caryosystématique et différenciation évolutive de quelques *Rubia* méditerranéennes. *Webbia* 38, 513-529.

CARDONA M.A., CONTANDRIOPOULOS P. and SIERRA E., 1986: Etude biosystématique d'An-

thyllis hystrix de Minorque et d'A. *hermanniae* de la Méditerranée orientale et centrale. Orsis 2, 5-25.

GARNATGE M.T and CARDONA M.A., 1988: Fitodermologia i cariologia d'*Onobrychis vicifolia*, *O. supina* i *O. saxatilis* a Catalunya. Orsis 3 (in press)

LLORET F. and CARDONA M.A., 1988: Cariologia i distribució a Catalunya dels taxons de la secció *Pniqma* del gènere *Bromus*. Orsis 3 (in press).

Profile of a Scientist, by William F. Grant, IOPB Past President

Dr. Grant is Professor at Department of Plant Science and Affiliate Member, Department of Biology, McGill University, as well as Adjunct Professor, Department of Biology, York University, Toronto. He carried out extensive biosystematic and cytogenetic studies in a number of plant studies (*Amaranthus*, *Avena*, *Betula*, *Celosia*, *Lotus*, *Impatiens*, *Manihot*) using cytological, cytophotometric, paper and thin-layer chromatographic and isoenzyme techniques. In 1973 he was asked to participate in a Nobel Symposium in Sweden where he spoke on "Chemosystematics in the Classification of Cultivars".

W.F. Grant and his students have made numerous significant discoveries in the cytogenetics of the genus *Lotus*. These include the development of amphidiploids for the transfer of genes from wild diploid species to the cultivated tetraploid forage species Birdsfoot Trefoil (*Lotus corniculatus*), the development of the chromatographic and isoenzyme techniques to show that *Lotus corniculatus* is an allotetraploid (previously considered to be an autotetraploid), the development of anther and ovule culture for the successful production of hybrids, the first production of trisomics in the genus, the use of Giemsa banding in caryotype of *L. uliginosus*, the finding that self-incompatibility (rather than self-sterility) is responsible for reduced seed set after self-pollination, the production of a tetraploid plant of *L. purchianus* for use in open range land in California, the successful crossing of wild indehiscent with dehiscent species for selection of the indehiscent character, the association of a biochemical character (HCN) with basic chromosome number ($x=6, 7$) and geographic distribution, and the determination of the chromosome numbers for all species in the genus. Also, the first reports in the genus of polytene chromosomes, B chromosomes, and cytomixis (the latter two phenomena found only in species hybrids).

W.F. Grant is also much involved in the field of testing and monitoring for mutagenic effects of environmental pollutants with use of higher plants. We mention here only some of his activities; for instance, he participates in the US in the Environmental Protection Agency Gene-Tox Program and is also Chairman of the *ad hoc* Steering Committee for the International Program on Chemical Safety Collaborative Study on Plant Systems of the WHO. He was partly instrumental in the founding of an "Environmental Contaminants Advisory Committee on Mutagenesis" to the Ministers of the Department of Health and Welfare and the Department of the Environment.

W.F. Grant is a nationally and internationally recognized scientist. He served as an Executive Member on various organizations and also was Editor of some scientific journals in Canada

and abroad or Member of Editorial Boards. In 1984 he published "Plant Biosystematics" (Acad. Press), the proceedings of IOPB Symposium held in Montreal. He has trained many students who hold teaching and research positions all over the world.

Profile of the biosystematic group at the Botanical Garden and Museum
by Liv Borgen, IOPB Secretary/Treasurer

At the time being the research work of the group is mainly directed towards 1) biosystematics and classical taxonomy of higher plants, 2) seed dispersal and embryology, 3) taxonomy of fungi and lichens, 4) vegetation ecology.

Dr. Liv Borgen is Curator and Director of the Botanical Garden and Museum. She and her students have worked on chromosome numbers and biosystematics of *Cruciferae* (e.g. *Lobularia*, *Sinapidendron*, *Brassica*, *Diplotaxis*) and *Compositae* (e.g. *Argyranthemum*, *Asteriscus* s.l.) of the Macaronesian flora. The studies including field observations, character analyses with numerical evaluation, karyological studies, crossing experiments, as well as fertility tests lead to taxonomic revisions and the understanding of evolutionary patterns and processes. A project on population genetics of *Lobularia* will be started next year.

Minor projects should contribute to a better knowledge of the Nordic flora. Current research includes chromosome studies in populations of *Dactylorhiza* and *Draba* (with Dr. B. Stedje, Oslo). A joint project with Professor K.M. Urbanska, Zurich, on population biology in some taxa of *Antennaria*, is in its incipient stage.

Two master students are about to finish their Thesis work: Halvorsen Brandrud works on *Viola epipsila*, *V. palustris* and their hybrid in SE Norway whereas A. Often studies the *Stellaria longipes* complex in Norway and Svalbard. A former master student, C. Brochmann, is now doing biosystematic work on arctic-alpine *Draba* for his Ph.D. Thesis; he will spend the winter and spring at Professor Soltis' Lab in USA to work with isoenzyme and DNA analyses. In cooperation with the ecology group (Elven, Økland), three master students have started research projects on autecology and population biology of two closely related species of *Draba* at the Dovre mountains in Central Norway.

In addition to her duties as Curator and Director of the Botanical Garden and Museum and the engagement in IOPB, Liv Borgen is a member of the group working with medical plants and spices under the Nordic Gene Bank, which currently register clones of *Humulus lupulus* in the Nordic countries. Also, she is involved actively in the Flora Nordica Project (committee on chromosome numbers).

Recent publications:

- BORGEN L., 1987a: *Lobularia* (*Cruciferae*). A biosystematic study with special reference to the Macaronesian region. *Opera Bot.* 91, 1-96.
BORGEN L., 1987b: Postglacial evolution in the Nordic flora - a review. *Blyttia* 45, 147-169.
BROCHMANN C., 1987: Evaluation of some methods for hybrid analysis, exemplified by hy-

- bridization in *Argyranthemum* (Asteraceae). Nord.J.Bot. 7, 609-630.
- BROCHMANN C. and RUSTAN Ø.H., 1987: Distributional and ecological patterns of the endemic vascular flora of the Cape Verde Islands. Cour.Forsch.-Inst.Sencenberg 95, 155-173.
- BROCHMANN C. and RUSTAN Ø.H., 1988: Additions to the vascular flora of Cabo Verde 2. Garcia de Orta, Sér.Bot. 8, 9-37.
- KILIAN N., BROCHMANN C. and RUSTAN Ø.H., 1987: *Launaea thalassica* (Asteraceae-Lactuceae), a new species from Cape Verde Islands, W Africa. Willdenowia 16, 491-496.
- RUSTAN, Ø.H. and BROCHMANN C., 1988: The genus *Kickxia* Dum. (Scrophulariaceae) in the Cape Verde Islands, W Africa. Cour. Forsch.-Inst.Sencenberg 83 (in press).

4. Research News

BIR S.S., Professor, Department of Botany, Punjab University, 147002 Patiala, India.
Projects completed: Cytological analysis of south Indian forests in Palni Hills; results published in series of papers. A book on "Vegetation characteristics of Indian Hills (Palni Hills), south India" by BIR and CHATHA has been published containing details of floristics of forests of Palni Hills.

Projects started: In the near future it is planned to take up chromosome analysis of forests of Kashmir Himalayas and Andaman and Nicobar Islands as soon as financial assistance is received from funding agencies in India.

Recent publications:

- BIR S.S. and CHATHA G.S., 1987: Meiotic analysis of woody elements of south Indian *Rubiaceae*. The Nucleus 30(3), 114-124.
- BIR S.S., SAHNI M., SWARAN K. and GILL B.S., 1987: Cytological investigations on some grasses from Punjab plain, North India. J.Cytol.Genet. 22, 23-47.
- BIR S.S. and SAHNI M., 1987: Chromosomal and morphological variations in grasses of Punjab. J.Cytol.Genet. 22, 12-22.
- CHATHA G.S. and BIR S.S., 1987: Population analysis of some woody species from Palni Hills, South India. J.Cytol.Genet. 22, 83-94.
- BIR S.S. and CHATHA G.S., 1988: Secondary association of chromosomes in *Pavetta breviflora* var. *subcoriaceae*. Cytologia 53, 291-296.
- BIR S.S. and SAHNI M. and SING C.P., 1988: Cytology of genus *Sporobolus* R.Br. from North India (Punjab Plain). Cytologia 53, 53-57.
- CHATHA G.S. and BIR S.S., 1988: Cytology and distribution pattern of woody species of *Verbenaceae* in Palni Hills. Proc.Indian Acad.Sci.(Pl.Sci.) 98(2), 138-148.

DOWNIE Stephen, Dr., NSERC Postdoctoral Fellow, Department of Biology, University of Michigan, Ann Arbor, MI 48109, USA.

Projects completed: Systematics of *Arnica* subgenus *Arctica* (Asteraceae)

Current projects: CpDNA rearrangement study of the *Asteridae*. Molecular systematics of the *Asteridae*.

Projects started: The *Euphrasia* of North America.

Recent publications:

- DOWNIE S.R., 1988: Morphological, cytological and flavonoid variability of the *Arnica angustifolia* aggregate (Asteraceae). Can.J.Bot. 66, 24-29.
- DOWNIE S.R., and McNEILL J., 1988: Description and distribution of *Euphrasia stricta* in North America. Rhodora 91 (in press)
- DOWNIE S.R., QUINTIN A. and McNEILL J., 1988: Le statu d'*Euphrasia borealis*, *E. nemorosa*

sa et *E. stricta* dans l'est de l'Amérique du Nord: une analyse numérique. Can.J.Bot. (in press).

GUANG XI Wang, Department of Biology, Wuhan University, Wuchang, Hubei, The People's Republic of China.

Projects started: Thecytotaxonomic studies on some species of aquatic vascular plants.

Recent publications: A Japanese-Chinese Dictionary of Botany.

HE Jingbiao, M.Sc., Lecturer, Department of Biology, Wuhan University, Wuchang, Hubei, The People's Republic of China.

Projects completed: Floristic studies on *Typhaceae*, *Sparganiaceae*, *Potamogetonaceae* and *Najadaceae* in southwestern Hubei.

Projects started: Biosystematic studies in Chinese *Orellia*. (Ph.D. Thesis)

Recent publications: On the relationships between the distribution of *Typhaceae*, *Sparganiaceae*, *Potamogetonaceae* and *Najadaceae* and their habitat.

HUI QIN Wang, Ass. Prof., Department of Biology, Wuhan University, Wuchang, Hubei, The People's Republic of China.

Personal news: Vice Director of Botanical Society of the province Hubei.

Projects completed: Flora of China. Vol. 10 (*Eragrostina*) and Vol. 8 (*Hydrocharitaceae*).

Projects started: Cytotaxonomic studies on the major aquatic plants.

RAVANKO Orvokki, Docent, Department of Biology, University of Turku, SF-20500 Turku 50, Finland.

Projects started: The annual and seasonal changes in the algal vegetation in Ruissalo, off Turku (hydrolittoral and upper sublittoral part). "Macroalgae" and epiphytic diatoms.

Recent publications:

1987: Preliminary studies on cells and chromosomes in *Polysiphonia violacea*. Mem.Soc. Fauna Flora Fenn. 63, 45-50.

1988: The chromosomes in three *Chara* species (Charophyta) in the SW archipelago of Finland. Ann.Bot.Fenn. 25, 85-88.

SIANG CHUNG Sun, Prof., Department of Biology, Wuhan University, Wuchang, Hubei, The People's Republic of China.

Personal news: Personal Member of the Standing Committee of the Botanical Society of China.

Projects completed: Notes on Chinese *Eragrostima* (to be published) in Flora of China, Vol. 10, and on Chinese *Pandales* and *Helobiae* in Flora of China, Vol. 8.

Projects started: Biosystematic studies of Chinese aquatic plants.

YOU Jun, N.Sc., Department of Biology, Wuhan University, Wuchang, Hubei, The People's Republic of China.

Projects completed: Cytotaxonomy of *Najas* L.

Projects started: Systematics of *Najas* L.

Herbarium, University of Wisconsin, Madison, WI 53706, USA.

Recent publications:

ILTIS H.H., 1987: Maize evolution and agricultural origins. In: SODERSTROM T.R., HILU K.W., CAMPBELL C.S. and BARKWORTH M.E. (eds.), Grass systematics and evolution Int.Grass Symp. 1986. Smithsonian Inst.Press, Washington, D.C. 195-213 (+ 7 pp. of references).

ILTIS H.H., 1987: Los bosques tropicales y la extinción de la vida en la tierra: haciendo las preguntas correctas. Biocenosis 3(3-4), 27-34.

RICHARDSON J.W., BURCH D. and COCHRANE T.S., 1987: The flora of Wisconsin. Preliminary report No., 69. *Euphorbiaceae* - the Spurge family. Wisconsin Acad. Sci., Arts and Letters. 97-129.

Contributions from the University of Wisconsin Herbarium No. 7., 1987: Sierra de Manantlán (Jalisco, Mexico), miscellanea. 70 pp.

5. Chromosome Number Report

by Albers F., Austmann M. and Meve U., Botanisches Institut, Westfälische-Wilhelms-Universität Münster, D-4400 Münster, West-Germany.

Asclepiadaceae

Caralluma europaea (Guss.) N.E. Brown. $2n=22$. Spanien: Almeria, Cabo de Gata. Albers 87-23-004-20.

Echidnopsis framesii White & Sloane. $2n=22$. South Africa: Cape Prov., 13 km N Nieuwoudtville ("Uithoek"). Meve UM255, UM256.

Huernia barbata (Mass.) Haw. $2n=22$. South Africa: Cape Prov., E Prince Albert, Farm Prutkraal. Meve UM318.

Huernia brevirostris agg. $2n=22$. South Africa: Cape Prov., 19 km SE Oudtshoorn. Meve UM408.

Huernia guttata (Mass.) R. Brown. $2n=22$. Namibia: 29 km E Aus, Farm Plateau. Meve & Struck UM180.

Huernia kennedyana Lavr. $2n=22$. South Africa: Cape Prov., 34 km W Cradock. Meve UM458.

Huernia loeseneriana Schlechter. $2n=22$. South Africa: Transvaal, Pretoria, Magaliesberg. Meve UM475.

Huernia primulina N.E. Brown. $2n=22$. South Africa: Cape Prov., W Pearston, "Cranemere". Meve UM437.

Ophionella arcuata var. *mirkinii* (Pill.) Bruyns. $2n=22$. South Africa: Cape Prov., 4 km S Pearston. Meve UM435.

Orbea namaquensis (N.E. Brown) Leach. $2n=22$. South Africa: Cape Prov., Richtersveld, 54 km N Lekkersing. Albers & Meve A&M15, A&M16. $2n=22$. South Africa: Cape Prov., 11 km N Concordia. Meve UM210.

Orbea variegata (L.) Haw. $2n=44$. South Africa, Cape Prov., Hermanus. Liede Hbg. 17431. $2n=44$. South Africa, Cape Prov., Brandfontein (Cape Agulhas). Liede Hbg. 173316. $2n=44$. South Africa, Cape Town, Signal Hill. Meve & Liede UM275, UM276, UM277.

Orbea verrucosa var. *verrucosa* (Mass.) Leach. $2n=22$. South Africa, Cape Prov., Graaff Reinet, St. Olives, western slopes of Ouberg. Meve UM342.

Pectinaria articulata subsp. *articulata* (Ait.) Haw. $2n=22$. South Africa, Cape Prov., Bo-Visrivier above Noudrift-Sutherland. Lavr. & Peh. 18851.

Pectinaria articulata subsp. *asperiflora* (N.E. Brown) Bruyns. $2n=22$. South Africa, Cape Prov., 20 km E Touwsrivier, "Witwaterspoort". Meve UM281. $2n=22$. South Africa, Cape Prov., 21 km N Matjiesfontein. Meve UM376.

Pectinaria articulata subsp. *borealis* Bruyns. $2n=22$. South Africa, Cape Prov., Richtersveld, Hellskloof. Albers & Meve A&M32.

Pectinaria articulata subsp. *namaquensis* (N.E. Brown) Bruyns. $2n=22$. South Africa, Cape Prov., 11 km N Concordia. Meve UM125. $2n=22$. South Africa, Cape Prov., 5 km N Concordia. Meve UM231.

- Pectinaria longipes* (N.E. Brown) Bruyns. 2n=22. South Africa, Cape Prov., 55 km N Matjiesfontein. Bruyns PVB101/76.
- Pectinaria maughanii* (R.A. Dyer) Bruyns. 2n=22. South Africa, Cape Prov., Nieuwoudtville, Bühr s.n.
- Quaqua acutiloba* N.E. Brown Bruyns. 2n=22. South Africa, Cape Prov., 20 km E Touwsrivier, "Witwaterspoort". Meve UM280. 2n=22. Namibia: 37 km N Rosh Pinah. Albers & Meve A&M98.
- Quaqua incarnata* (L.f.) Bruyns subsp. *incarnata* var. *incarnata*. 2n=22. South Africa, Cape Prov., 3 km E Kamieskroon. Meve UM159.
- Quaqua inversa* var. *cincta* (Luckhoff) Bruyns. 2n=22. South Africa, Cape Prov., 5 km N Concordia. Meve UM160.
- Quaqua marlothii* (N.E. Brown) Bruyns. 2n=22. South Africa, Cape Prov., 16 km E Prince Albert. Meve UM307.
- Stapelia acuminata* Mass. 2n=22. South Africa, Cape Prov., 22 km N Kamieskroon. Albers & Meve A&M113. 2n=22. South Africa, Cape Prov., 3 km E Kamieskroon. Meve UM156.
- Stapelia arenosa* Luckh. 2n=22. South Africa, Cape Prov., 5 km S Calvinia. Meve UM268.
- Stapelia flavopurpurea* Marloth. 2n=22. Namibia: 29 km E Aus, Farm Plateau. Meve & Struck UM183.
- Stapelia gariensis* Pill. 2n=44. South Africa, Cape Prov., Richtersveld, Grootderm. Jürgens Hbg. 22039.
- Stapelia gigantea* N.E. Brown. 2n=22. South Africa, Transvaal, Farm Brandraai, Blyde River Canyon (Odendaal Resert). Glen s.n.
- Stapelia macowanii* N.E. Brown var. *conformis*. 2n=22. South Africa, Cape Prov., Uitenhage towards Steytlerville. Albers et al. K1113.
- Stapelia olivacea* N.E. Brown. 2n=22. South Africa, Cape Prov., Beaufort West, SE part of Karoo National Park. Meve UM368. 2n=22. South Africa, Cape Prov., 11 km N of entrance of Mountain Cebra National Park. Meve UM456.
- Stapelia similis* N.E. Brown. 2n=22. Namibia: 16 km N Rosh Pinah. Albers & Meve A&M71.
- Stepeliopsis urniflora* N.E. Brown. 2n=22. South Africa, Cape Prov., near Witzpütz, Farm Aub. Lavr. & Peh. 21200.
- Trichocaulon flavum* N.E. Brown. 2n=22. South Africa, Cape Prov., 16 km E Prince Albert. Meve UM306.
- Trichocaulon officinale* N.E. Brown. 2n=22. Namibia: 18 km E Aus. Meve & Struck UM176.
- Tridentea jucunda* (N.E. Brown) Leach A&M91 var. *cincta* (Marl.) Leach. 2n=22. South Africa, Cape Prov., 5 km S Calvinia. Meve UM269.
- Tridentea jucunda* (N.E. Brown) Leach var. *dinteri* (Berger) Leach. 2n=22. Namibia: 32 km N Rosh Pinah. Albers & Meve A&M105. 2n=22. Namibia: N Aus. Albers & Meve A&M90, A&M91, A&M93.
- Tridentea jucunda* (N.E. Brown) Leach var. *jucunda*. 2n=22. South Africa, Cape Prov., between Kliprand and Loerisfontein. Meve UM243.
- Tridentea longipes* (Luckh.) Leach. 2n=22. Namibia: 16 km N Rosh Pinah. Albers & Meve A&M75.
- Tridentea marientalensis* subsp. *albipilosa* (Giess) Leach. 2n=22. Namibia: 29 E Aus, Farm Plateau. Meve & Struck UM179.
- Tridentea parvipuncta* var. *parvipuncta* (N.E. Brown) Leach. 2n=22. South Africa, Cape Prov., 15 km W Kromrivier. Meve UM 357.
- Tridentea pedunculata* (Mass.) Leach. 2n=22. v11 km N Concordia. Meve UM211, UM212.

Tromotriche thudichumii Pillans. 2n=22. South Africa, Cape Prov., 7 km SE Soutpan. Meve UM271.

6. Flora Nordica Calls for Chromosome Counts

by B.E. Jonsell, Bergius Botanic Garden, Box 50017, S-10405 Stockholm, Sweden,
Main Editor of Flora Nordica

Flora Nordica (see IOPB Newsletter No. 9, 1987) is a project aiming at a scientific Flora for vascular plants of the Nordic countries. Surprisingly enough, no really critical Flora has been completed for this area during the present century, but a number of national field Floras of high standard has appeared during later years. It may be repeated here that in March 1987 it was decided to take a step further and launch Flora Nordica as a joint project for Denmark, Finland, Iceland, Norway and Sweden. Since the area of the Flora is determined by the political boundaries of those countries, Spitsbergen, the Faeroes and Jan Mayen, but not Greenland, which is phytogeographically oriented towards America, are included.

The organization was given in detail in Newsletter No. 9. The committee for chromosome numbers was then not complete; it includes Liv Borgen (Norway), Ulla-Maj Hultgård (Sweden), Simon Laegaard (Denmark), Jóhann Pálsson (Iceland), Pertti Uotila (Finland). Two scientifically trained persons now employed for the Flora are Thomas Karlsson, Lund (for account writings, publishing items, etc.), and Magdalena Agestam, Stockholm (project secretary). Scientists, within or outside Scandinavia, with taxonomic knowledge of a group from that region are encouraged to write accounts for the Flora. For the first volume (of four), which will cover Pteridophytes, Conifers and Dicotyledons from *Salicaceae* to *Papaveraceae* (Flora Europaea sequence), about 50 contributors are now on work.

Since the nordic vascular flora is one of the best known in the world as to composition and distribution, much detailed information about intraspecific variation, hybridization, reproduction, frequency changes, etc. can be incorporated. However, lots of problems remain, many of them being of a great evolutionary and phytogeographical interest. In addition to the formal accounts discussions will take an important part; here states of knowledge may be summarized, problems pointed at. Hopefully this will stimulate to further biosystematic research in the northern areas.

Chromosome numbers are of particular biosystematic interest. They will be included in the Flora but critically evaluated. Only well documented counts from the Nordic countries will be included. When meeting in Oslo recently, the Committee for chromosome numbers realized fact that when a critical attitude is taken, the state of knowledge for a given area is very varying and largely much poorer than expected. More or less updated lists for Denmark, Finland and Norway (with Spitsbergen) reflect a quite rich evidence. On the other hand, the formation on Sweden is spread among various sources and surprisingly poor, except for certain specially studied taxa and the province of Scania, extensively studied by B. Lökvist in the 1950-ies and

60-ties. As far as Iceland and the Faeroes are concerned, documented counts exist for only few taxa, and the idea of a campaign to improve that state of affairs was put forward. A first task for the Chromosome Number Committee is therefore to make an inventory of unpublished documented counts from the Flora area and to try to get them published, of course after consent from the authors. Apart from sources to be traced in Scandinavia, there is probably a great number of counts made in Nordic material by scientists from other parts of the world (whether stray counts or counts made as parts of wide ranging readers who have documented counts from the Nordic area to make those known to Flora Nordica. Our plea comprises both unpublished counts (including non-widespread theses and reports) and counts published too recently to have been included into the compiles "Index to chromosome numbers". Your information should include the mentioning of a voucher specimen and where it is deposited. We would be grateful for your cooperation on this matter and would be glad to hear from you under the address: Flora Nordica, Bergius Foundation, Box 50017, S-10405 Stockholm, Sweden. For plant families to be included in Volume 1, we would appreciate your information before June 1st, 1989.

7. Biosystematics in China

by Chen Jiakuan, Department of Biology, Wuhan University, Wuchang, Hubei, Wuhan, The People's Republic of China, IOPB Council Member

Chinese Organization of Plant Biosystematics has been established in Chengdu, Sichuan, on October 22, 1988, during the 55th Anniversary of the Botanical Society of China (BSC). On that day I was invited to introduce the information on the IOPB to more than 100 members of BSC. Prof. Hong Deyuan reported the international developments of plant biosystematics. Then it was discussed how to promote the plant biosystematics in China. In conclusion, all the botanists present agreed in establishing an organizing committee of Chinese Organization of Plant Biosystematics (COPB). Prof. Hong Deyuan, Prof. Hsi Pinsheng and I, were nominated as members.

By now I have received many letters from all over China and sent application of membership of the IOPB to those persons who requested it. I think that the IOPB membership is steadily increasing in China.

I have written five short articles about the IOPB for Chinese journals, so that more and more botanists know the IOPB and plant biosystematics in China. Some younger botanists and post-graduate students began biosystematic studies of particular plant taxa. I hope to have a chance to hold IOPB Symposium in China before long.

8. IOPB Executive and Council Elections 1989: Call for Nominations

by W.F. Grant, Past President IOPB

A Nominating Committee consisting of the IOPB Council and Executive members has been established to solicit names for a mail ballot for Vice-President, Secretary-Treasurer, and ten Council members. No more than two persons may be elected from any one country. The Nominating Committee consists of the Council J.F. Bain, Canada, Maria A. Cardona, Spain, W. Hardy Eshbaugh, USA, J.R. Estes, USA, Chen Jiakuan, China, B.E. Jonsell, Sweden, J.C.M. Den Nijs, The Netherlands, Arne Rousi, Finland, C.J. Webb, New Zealand, Judy West, Australia, and the Executive, Krystyna M. Urbanska, Switzerland, Shoichi Kawano, Japan, Liv Borgen, Norway, and William F. Grant, Canada. Send suggestions of names to any member of the Nominating Committee. A ballot will be sent for voting to all members of IOPB and the names of the new Executive and Council members will be announced at the Business Meeting to be held during the IOPB 1989 Symposium, Kyoto, Japan, July 10 to 14, 1989.

Editor's Note: Please look up the addresses on p. 19. Remember that the Council Members are eligible for reelection (IOPB Constitution, Sect. 3, Art. 7).

9. IOPB Symposium 1989: News from the Organizing Committee

IOPB Symposium 1989, Kyoto, July 10-14

by Dr. S. Kawano, Chairman of the Organizing Committee

The Second Circular on the forthcoming IOPB Symposium will be printed by end of December 1988. The Advanced Registration Form mailed with the Second Circular and payment must be completed not later than April 1, 1989. At a later date, an additional fee will have to be required.

All correspondence should be addressed to Prof. S. Kawano, Department of Biology, Faculty of Science, Kyoto University, Kyoto 606, Japan. Phone: 075-753-4131, Telex: 6422302 SCIKYUJ, Fax: 075-751-6149

10. IOPB Symposium 1992

Dr. Peter A. Raven has offered to have IOPB Symposium 1992 held at the Missouri Botanical Garden, St. Louis, Missouri, USA. The IOPB has gratefully accepted the offer. More precise timing and general scope of the Symposium will be discussed at the Business Meeting to be held during the IOPB 1989 Symposium in Kyoto.

11. IOPB Award

During the Business Meeting held in Zurich, a suggestion was put forward concerning an IOPB Award (see Newsletter No. 7, p. 16). After having the matter carefully considered, I'd like to propose that the IOPB Award be granted in the form of IOPB Life Membership, for the first time during the IOPB Symposium 1989 in Kyoto. Further details would be discussed with the Executive and Council.

Should any Member of the IOPB not agree with my proposal, please let me know as soon as possible, at the latest by end of May 1989.

The President

12. Meetings, past and future

Sweden: Report on the Symposium "Variation and Evolution in Isolated Populations" held at Uppsala, September 5 to 7, 1988.

by Liv Borgen and Odd Stabbetorp

The Symposium took place on occasion of the 25th Anniversary of the Ecological Research Station in Øland. Four guest lecturers were invited: Prof. Arthur J. Cain, University of Liverpool, Prof. G. Ledyard Stebbins, University of California at Santa Barbara, and Prof. Donald A. Levin, University of Texas at Austin. The audience consisted of biologists from all the Nordic countries.

Dr. Cain gave two lectures about "Variation in populations of the snail *Cepaea*". He outlined the impact of a very strong and very local selection on the variation pattern and the importance of knowing the population biology in great detail.

Dr. Stebbins gave the lectures "The role of ecological islands for the evolution", "Reproductive vs. edaphic isolations as factors in the origin and maintenance of plant species", and "Isolation and reunion as a key factor in the origin of polyploid races and species". Stebbins emphasized the importance of adaptive shifts and the spatio-temporal shifting balance in plant populations as the basis for the evolution of species. He pointed out two important requisites for evolution to take place: Ecological opportunity and genetical diversity. He outlined the main difference between plants and animals with respect to 1) sexual selection and preferential mating, 2) the genetics of sex chromosomes, 3) degrees of fertility, and 4) generation turnover. He emphasized the considerable difference in population structure and biological strategy between woody perennials and weedy annuals. Stebbins claimed that in genera predominantly containing diploids, the polyploids tend to occur in the margins of the distribution area of the diploids, arising as a result of isolation and reunion of populations. He cited a considerable amount of examples from the plant kingdom on which he based this theory.

Dr. Endler's lectures were entitled "What is natural selection and how can it be demonstrated", "Natural and sexual selection in *Poecilia reticulata*", and "Sensory drive: a bias in the direction of evolution". He outlined the joint action of natural selection and genetic drift in the evolutionary process at the organismic level, resulting in change in fitness. He presented some very interesting and complicated examples from his own research on guppies.

Dr. Levin gave the lectures "The contribution of the dormant seed pool to rapid speciation in plants", "Consequences of stochastic elements in plant migration", and "The founder effect in plant evolution". He emphasized the well-known fact that some species have very long lived seeds and that seed banks are most prominent in annuals. Seed banks tend to buffer populations against change in genetic composition and to retard the rate of response to selection. Thus seed banks slow down directional selection. Studies on agricultural plants, however, have revealed that aged seeds have very high mutation rates. Levin postulated that these high mutation rates may explain the tendency in annuals to have a more rapid chromosomal evolution than perennials. This may also be the reason why sterility barriers are more common in annuals than in perennials. Phenotypic plasticity, on the other hand, may facilitate a shift from cross fertilization to selfing.

Levin also discussed the very local migration of pollen and seeds, and the impact of this on population divergence. The potential for genetic drift seems to be generally larger in plants than in animals due to random elements in the gene flow.

Levin claimed that the uniformity of plant populations within a species seems to be largely the result of range expansion, and that the populations are connected by descent. Accordingly, speciation in plants occurs in local or isolated populations. Levin admitted that a cline can develop during the migration process, and that local and random differentiation due to the founder effect may occur, but he stated that races are not necessarily the precursors of species. He therefore presented the following species concept: "Species are ecological distinctive groups of populations which differ substantially from other such groups in their genetic system and/or organization of their gene pool". This species concept presented by Levin, although wide and somewhat unprecise, may turn out as a useful working concept in plants. It should also satisfy the cladists.

In conclusion, this Symposium was an intellectually rewarding event in the amiable settings of the old Uppsala University.

Meetings 1989

- April 7-9: Species mapping and the biology of plant distribution. Exeter, U.K. Further details from Dr. P.J. Edwards, Meetings Secretary, British Ecological Society, Department of Biology, The University, Southampton, SO9 5NH, U.K.
- June 5-7 A Symposium "Evolution in higher plants: Patterns and processes" will take place in Oslo on occasion of the 175th Anniversary of the Botanical Garden. Speakers have been invited primarily from the Nordic countries but the working language will be English. On June 8th an excursion will be arranged in the Oslofjord area. For further information please write to Liv Borgen, University of Oslo, Botanical Garden and Museum, Trondheimsveien 23B, N-0562 Oslo 5, Norway.
- September 18-20. Variability within plant monocultures. U.K. Further details from Dr. P.J. Edwards, Meetings Secretary, British Ecological Society, Department of Biology, The University, Southampton, SO9 5NH, U.K.

13. Requests for Material and Information

CARDONA M. A., Prof. at the Department of Botany, School of Sciences, Universitat Autònoma of Barcelona, 08193 Bellaterra, Barcelona, Spain, would appreciate seeds, dried plants of *Rubia* and publications on the genus from all the mediterranean and macaronesian areas.

HE Jingbiao, M.Sc., Lecturer, Department of Biology, Wuhan University, Wuchang, Hubei, The People's Republic of China, would appreciate herbarium specimens of *Otelia alismoides* (L.) Pers. from India, Australia, Japan and Soviet Union.

RAVANKO Orvokki, Docent, Department of Biology, University of Turku, SF-20500 Turku 50, Finland, would appreciate *Monostroma* from the Lake Zurich, charophytes of Switzerland, information on research and literature.

SIANG CHUNG Sun, Prof., Department of Biology, Wuhan University, Wuchang, Hubei, The People's Republic of China, would appreciate herbarium specimens and fresh material of aquatic plants especially *Helobiae*.

12. Miscellaneous Notes

Change of address

DOWNIE Stephen, Dr., Department of Biology, University of Michigan, Ann Arbor, MI 48109, USA.

ELVEN Reidar, Dr., formerly at Tromsø University, moved to University of Oslo, Botanical Garden and Museum, Trondheimsveien 23B, N-0562 Oslo 5, Norway

New management of *Phytologia*

Beginning with the volume 66, management of *Phytologia* was assumed by Michael J. Warnock. The journal, which has been known for rapid publication of botanical research will continue in that capacity. However, some significant changes have been instituted that may appeal to a number of prospective authors. A review policy is now in place and manuscripts will be next formatted to allow consistency within the journal from article to article. For further information, contact: Dr. Michael J. Warnock, Managing Editor *Phytologia*, Department of Life Science, Sam Houston State University, 185 Westridge Drive, Huntsville, Texas 77340, USA.

IOPB logo

I think it is time to have a logo of IOPB. Who has a good idea? Please send suggestions to K.M. Urbanska rather soon. We may want to use the logo on the IOPB Award Certificate ...

The President

International Organization of Plant Biosystematists Executive and Council Members

- President:** **Krystyna M. Urbanska**
Geobotanisches Institut ETH
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- Member ex officio for 1989 Symposium:**
Ichiro Fukuda
Division of Biology
Tokyo Woman's Christian University Zempukuji, Suginami
Tokyo 167, Japan

Council:

- J.F. Bain**, Department of Plant Science, Macdonald College of McGill University, Ste. Anne de Bellevue, P.O.Box 4000, Quebec, Canada H9X 1C0
- Maria A. Cardona**, Depto. Botanica, Facultad de Ciencias, Univ. Autonoma de Barcelona, 08193 Bellaterra (Barcelona), Spain
- W. Hardy Eshbaugh**, Department of Botany, Miami University, 175 Upham Hall, Oxford, Ohio 45056, USA
- J.R. Estes**, Dept. of Botany and Microbiology, 770 Van Vleet Oval, University of Oklahoma, Norman, Oklahoma 73019, USA
- Chen Jiakuan**, Department of Biology, Wuhan University, Wuchang, Hubei, Wuhan, The People's Republic of China
- B.E. Jonsell**, Bergius Botanic Garden, Box 50017, S-10405 Stockholm, Sweden
- J.C.M. Den Nijs**, Hugo de Vries Laboratory, University of Amsterdam, Plantage Middenlaan 2a, NL-1018 DD Amsterdam, The Netherlands
- Arne Rousi**, Department of Botany, University of Turku, SF-20500 Turku 50, Finland
- C.J. Webb**, Botany Division, DSIR, Private Bag, Christchurch, New Zealand
- Judy West**, The National Herbarium of Australia, CSIRO, Division of Plant Industry, P.O.Box 1600, Canberra City, ATC 2601, Australia

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MEMORANDUM
TO: [Illegible]
FROM: [Illegible]
SUBJECT: [Illegible]

[Illegible text follows]

MEMBERSHIP APPLICATION FORM

International Organization of Plant Biosystematists

The International Organization of Plant Biosystematists (IOPB) was founded in 1960 to promote international cooperation in the study of biosystematics. The IOPB acts on several levels, from coordinating and publishing information on biosystematics to organizing conferences. The IOPB is open to all persons working or interested in biosystematics which is interpreted in a broad sense (see symposium volume "Plant Biosystematics", edited by W.F. Grant, 1984). The history and past activities of IOPB have been given in *Taxon* 31, 386-387, 1982.

An IOPB Newsletter is sent to all members. Such items as current research, requests for material and information, meeting reports, publications, etc. are reported. The Editor is Prof. Krystyna M. Urbanska, Geobotanisches Institut ETH, Zürichbergstrasse 38, CH-8044 Zürich, Switzerland.

At present, Membership is for the three year period between Symposia. The next Symposium will be held in Japan in 1989.

Membership fee 1987-1989: US\$ 20.00.

Make cheques or money orders payable to the International Organization of Plant Biosystematists (IOPB).

Send the form and/or payment to: Dr. Liv. Borgen, Secretary-Treasurer, IOPB Botanical Garden and Museum, Trondheimsveien 23B, N-0562 Oslo, Norway.

IOPB - Membership application for

Last name

First name (Mr., Mrs.)

Title

Address

Date

Signature

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY

REPORT OF THE COMMITTEE ON THE
PROGRESS OF THE DEPARTMENT OF CHEMISTRY
DURING THE YEAR 1954

The Department of Chemistry at the University of Chicago has
been fortunate in having a very able and energetic
Chairman, Professor [Name], who has led the
Department through a period of rapid growth and
development.

The Department has been particularly fortunate in
having received a large number of new appointments
during the year, and these appointments have
been of a high quality.

The Department has also been fortunate in
having received a large number of new appointments
during the year, and these appointments have
been of a high quality.

RESPECTFULLY,
[Name]

Research News

for the International Organization of Plant Biosystematists Newsletter
(IOPB Newsletter)

Typewritten or in capital letters

Last name	First name	Title
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Address:

Personal news (Promotions etc.)

Publications during thre year:

Current projects:

Projects completed:

Projects started:

Requests for research material and information:

Articles and reports should be attached

To be sent to Krystyna M. Urbanska, Geobotanisches Institut ETH, Stiftung Rübel,
Zürichbergstrasse 38, CH-8044 Zürich, Switzerland

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY
RESEARCH REPORT

BY
J. H. GOLDSTEIN
AND
R. F. W. WILSON

RECEIVED BY THE DEPARTMENT OF CHEMISTRY
ON

APRIL 15, 1954

RESEARCH REPORT NO. 100

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CHICAGO

CHICAGO, ILLINOIS

1954

