Flora Malesiana 1991-2001

What has been achieved: revitalisation, momentum? What next?

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Abstract

M.C. Roos (National Herbarium of the Netherlands, Leiden University branch, P.O. Box 9514, 2300 RA Leiden, The Netherlands; e-mail: roos@nhn.leidenuniv.nl) 2003. Flora Malesiana 1991-2001. Telopea *10(1): 1–10.* An overview is presented of the development of Flora Malesiana since 1991, compared to the progress over the first 40 or so years (from 1948 to 1990). The many things that have been achieved are discussed. Also, the many things that have not been achieved are discussed. The overall picture emerging is a mixture of optimism and pessimism. Some concluding suggestions are presented for ways out of this status quo and to hook on to recent scientific developments for which funding seems a lesser problem.

Introduction

In 1948 the first instalment of Flora Malesiana was published. This implies that the Flora Malesiana project is now a little over a half a century on its way. It is a little over 10 years ago that this series of International Flora Malesiana Symposia started (1989), at the time with heated discussions on the future and prospects of Flora Malesiana. As a result of these discussions, at the Botanical Congress in Yokohama in 1993, Flora Malesiana was called a revitalised flora project. On the occasion of the Fifth International Flora Malesiana Symposium, these seem to me enough reasons to evaluate the present state of affairs and compare that with the situation a decade ago to see whether we really have gained momentum.In 1989 my predecessor in Leiden, the late Rob Geesink, evaluated the progress in Flora Malesiana (Geesink 1990) and he came to the conclusion that the completion of Flora Malesiana would take another 160 years. He regarded that as rather unattainable, and that a considerable increase in funding and efficiency, and a simplified format were necessary for completion within a reasonable time. Otherwise, according to him, Flora Malesiana would loose its credibility. In the following I will discuss what has been achieved since then, and, maybe even more importantly, what has not been achieved, and express some thoughts for future strategies.

What has been achieved

Many things have, of course, been undertaken in the last decade and I will not aim to make an exhaustive list at the risk of leaving things out. I will restrict myself to a few examples which may illustrate the progress made on the various fronts.

- **EU-HCM network — treatment of c. 350 species**

In 1993 the EU approved an application by a network of nine institutes in Britain, the Netherlands, Germany, France, Ireland and Denmark. The grant for three years was one of the largest awarded at the time and four Post-doctoral fellows and five PhD-students could be appointed. In the end, the research funded by this grant yielded the treatment of c. 350 species in families which are still under revision.

• **MSc programs**

Various MSc programs have been launched. It is fortunate that MSc programs in plant systematics were instituted in the region itself. The efforts made in Malaysia and Indonesia especially deserve mentioning (e.g. University of Bangsi, Malaysia; IPB Bogor, Indonesia). Other programs worth mentioning are those of Reading and Leiden.

• **Data bases / checklists (geographic & taxonomic)**

The computerisation of taxonomic information has developed enormously in the 1990's. Various databases, either taxon-based or specimen-based, have been developed as special projects or in the course of research projects. To mention just a few: the specimen data base of Euphorbiaceae, the data base on distribution patterns of taxa treated in the FM instalments so far, PROSEA data bases, etc.

• **Specimens on Internet**

At the risk of a Leiden bias, I first mention the web site on type specimens present in the Dutch herbaria. Many more examples are available (Table 1).

Table 1. Some examples of URLs where collection databases can be consulted.

Http://www.huh.harvard.edu/databases/cms/specimen_index.html (GH/AA)

Http://rathbun.si.edu/botany/types/ (US)

Http://www.bgbm.fu-berlin.de/biodivinf/projects/digitalisierung/default.htm (B)

Http://biodiversity.ukm.my/menu_db.html (Biodiversity Malaysia)

Http://www.botany.net/IDB/botany.html (general Botany Net)

Http://www.nhm.ac.uk/botany/databases/index.html (BM)

Http://nhncml.leidenuniv.nl/rhb/#types (L/U/WAG/AMD)

Http://www.nybg.org/bsci/herbarium_imaging/ (NY)

Http://linnaeus.nrm.se/botany/fbo/welcome.html.en (S-LINN)

• **Molecular markers & identification tools**

Molecular data are often not regarded as important for flora treatments. However, molecular studies have a great impact on classifications, and consequently on family delimitation (e.g. Apocynaceae, Verbenaceae). Also, molecular information is used to develop identification tools to species or even populations, and this may be of importance for the control of trade (e.g. the screening of products for seriously endangered species, including determination of the area of origin). Furthermore, DNA sequence data will be used increasingly to illuminate the delimitation of species, especially of species complexes.

• **CD-ROMs**

Increasingly, systematic information is presented on CD-ROM. This is not just another way of presenting the same information published as hard copy, but also aims at using the increased possibilities of an electronic format over the traditional printed presentation, i.e. the inclusion of all kinds of illustrations, user-friendly interactive and pictorial keys, and geographical information on the distribution of species and mapping. A number are mentioned in Table 2.

Table 2. Some examples of CD-ROM's and other electronic identification tools.

Bakker, M.E. (2000) Annonaceae – genera worldwide.

Jarvie, J.K., & Ermayanti. (2001) Trees and shrubs of Borneo.

Newman, M.F., Burgess, P.F., & Whitmore, T.C. (1995-1998) Manual of Dipterocarps for foresters.

Nooteboom, H.P. (2000) Davalliaceae – a family of Old World (sub-)tropical ferns.

Ridder-Numan, J.W.E. & Kort, I. de. (1999) Flora Malesiana: Leguminosae – Mimosoideae of South-East Asia.

Schuiteman, A. & Vogel, E.F. de. (2001) Orchids of New Guinea – Vol. I. Illustrated Checklist and Genera.

• Increased production

Over the past 11 years (1991–2001) 10 instalments have been published, with treatments of over 2 200 species (Table 3). Only in 1999 did no instalment appear (due to practical problems). This is a substantial increase in production, compared to the production of species treatments in the past.

Table 3. List of instalments published between 1991 and 2001.

Year, series	Family	No. species	Accumulated
To 1989			**TOTAL 5761**
1991, II	Tectaria-group	217	217
1992, I	Mimosaceae	158	375
1993, I	Rosaceae + 5	157	532
1994, I	Sapindaceae	235	767
1995, I	Meliaceae	223	990
1996, I	Caesalpiniaceae + 3	264	1254
1997, I	Rafflesiaceae/Loranthaceae + 5	345	1599
1998, II	Polypodiaceae + 6	230	1827
2000, I	Myristicaceae	335	2162
2001, I	Nepenthaceae	83	2247
2001			**TOTAL 8008**

Table 4 gives an overview of the production of treatments according to regions of employment of the authors: figures represent the number of different contributing authors, the number of family treatments they have contributed and the number of species they include per period.

In the first 43 years, the treatment of 5 761 species in total have been published, i.e. 134 species per year on average. The total number of species treated per period and the average number per year per period are presented in Figure 1. It is clear that the 1990's are outstanding in terms of species treated; the average number of species treated per year rose to 204. This is a clear indication that Flora Malesiana can really be regarded as a revitalised project with increased momentum.

Table 4. Overview of the contribution per region and per period in terms of different authors, and families and species treated. NL = Netherlands, EU = other European countries, AUS = Australia, MAL = Malesian countries, ASIA = other Asiatic countries.

Origin	Categories	1948–60	1961–70	1971–80	1981–90	1991–2001
NL	different authors	25	2	14	4	8
	families	82	9	22	12	11
	species	1286	1001	997	251	1038
EU	different authors	7		5	5	6
	families	10	1	6	6	7
	species	254	205	155	594	926
AUS	different authors	1	1	2		1
	families	1	1	2	2	2
	species	4	4	148	89	218
MAL	different authors			2		
	families			3		
	species			285		
ASIA	different authors			1		4
	families			1		6
	species			10		43
USA	different authors			1	2	3
	families			1	5	5
	species			14	465	22

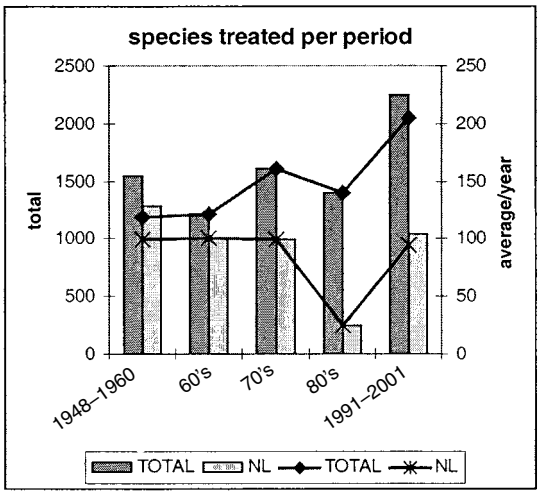

Fig. 1. Number of species treated per period, showing the contribution of Dutch collaborators in relation to the total production: **bars**: total number of species treated in the respective periods, **lines**: average number of species treated per year for each respective period.

Table 5. Species treated by authors according to origin, before and after 1991; in total numbers and percentages.

	No. of species			
	<1990	**1991–2001**	**<1990 %**	**1991–2001 %**
NL	3535	1038	61	46
EU	1208	926	21	41
AUS	245	218	4	10
MAL	285		5	
ASIA	10	43	0.2	2
USA	479	22	8	1
total	**5761**	**2246**	**100**	**100**

Table 6. Number of different contributing authors and their average contribution.

	No. of contributing authors		Species/author	
	<1990	**1991–2001**	**<1990**	**1991–2001**
NL	45	8	79	130
Rest EU	17	6	71	154
AUS	4	1	61	218
USA	3	3	143	
MAL	2		10	11
Rest ASIA	1	4	160	7
Total	**72**	**22**	**80**	**102**

Table 7. Contribution per region in absolute numbers and as percentages.

	Total numbers			Percentages		
	Authors	**Families**	**Species**	**Authors**	**Families**	**Species**
NL	53	135	4572	56	70	57
rest EU	23	29	2134	24	15	27
AUS	5	8	463	5	4	6
USA	6	11	501	6	6	6
MAL	2	3	285	2	2	4
rest ASIA	5	7	53	5	4	1
Total	**94**	**193**	**8008**	**100**	**100**	**100**

• Increased internationalisation

Another conclusion that can be drawn from Figure 1 is that except for a real dip in the 1980's, the contribution by Dutch authors has been remarkably constant (c. 100 species/year). Actually, the number of different Dutch authors has dropped in the 1990's relative to the first four periods together (Table 6: 8 in 11years vs. 45 in 43 years), but their average contribution in terms of species has risen by over 60% (Table 4: 130 vs.79). The latter figure, however, should be interpreted with care, as it does not tell how long it has taken to finish the treatment. The increase in production, therefore, comes from a considerable enlargement of the network of cooperating authors outside the Netherlands. This is mainly the result of a substantial increase in the number of contributing authors from other European countries, who also on average contributed double the number of species compared to their colleagues in the first four periods (Table 6: 154 vs. 71); their relative contribution, therefore, has almost doubled in the 1990's (Table 5: 41% vs. 21%). This is a very positive development.

Table 7 gives the total and relative number of species treated by authors arranged by region. Firstly, the Netherlands have made the majority of the contributions, both in terms of authors, families, as well as species. European botanists contributed 80-85% of the treatments. Not surprisingly, there is an obvious correspondence between the number of authors and the number of species treated (compare the percentages in the columns of authors and of species). However, Dutch authors treated relatively small-sized families, whereas authors from elsewhere in Europe contributed larger sized families.

• Many other relevant publications and treatments

Many other relevant publications appeared over the past 11 years. It is not feasible to mention them all, but only to highlight a few: the family portraits by van Balgooy, the Tree Flora of Sabah and Sarawak, the Checklist of Brunei, local language guides, the PROSEA series, etc., not to speak of the many electronic formats in development.

What has not been achieved

• Acceleration towards completion within a few decades

Table 8 clearly shows, in terms of coverage of the estimated total species richness, that in 2001 we are still at about the same level as in 1990, i.e. c. one quarter of the total flora (leaving the orchids out, following the decision not to include treatments of orchid taxa in series I; they will be covered in a series of CD ROMs – e.g. Schuitemen & De Vogel 2001). It may seem that we are running just to keep up, let alone progress. However, it is, of course, the result of much higher estimations of the numbers of vascular plant species occurring in Malesia (Roos 1993), and taking this into account, we really have made good progress.Still we have to face the rather awkward conclusion: the 1990's have seen a substantial increase in production, nevertheless this does not lead to an accelerated completion of the flora. Figure 2 shows the graph of the production so far, the production needed for completion of Flora Malesiana in 2020 and 2050 respectively (the over-ambitious and 'feasible' — ambitious goals in the action plan as set by the Board), and an extrapolation of the average production of species treatments since 1991 (i.e. 200 species/year). The latter indicates that at the present rate of progress, completion of Flora Malesiana will not be achieved before 2135, which is similar to Geesink's conclusion over a decade ago which prompted the discussion on the format and progress of Flora Malesiana at that time (Geesink 1990, p. 13: 'another 160 years from now'; in Polhill 1990, table 1: 2135).

Table 8. Status of Flora Malesiana for 1990 and 2001.
*** Van Steenis (1948); ** Roos (1993)**

		Taxa treated	Estimated species richness of the flora (*excl. Orchidaceae*)	Coverage (%)
1990	Species	5771	25000*	23
	Families	163	301	54
2001	Species	8008	35000**	23
	Families	193301 (*disregarding new classifications – no new families have been collected*)		64

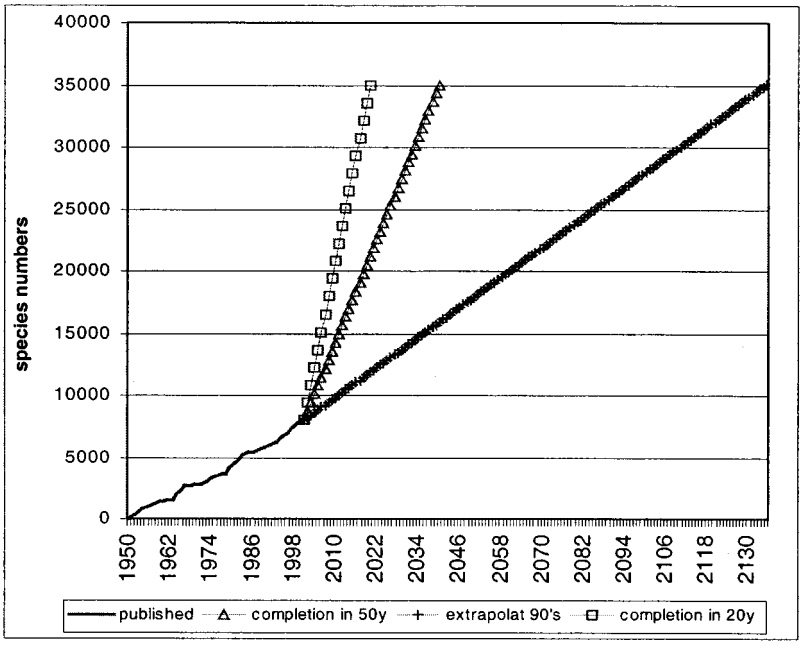

Fig. 2. Graph of 1) the progress in Flora Malesiana so far, in terms of species published, 2) the progress needed for completion in 20 years, 3) completion in 50 years, and 4) extrapolation of the progress of the nineties of last century.

• Allotment of all large-sized families

Large-sized taxa remain a problem, the largest family treatment published in the past decade has been the Myristicaceae, comprising 335 species. This is a major contribution, but still only one of the 18 families with over 500 species has been published so far (Table 9), and the *Tectaria*-group (revised by the late Prof. Holttum) belongs to the list of largest genera (Table 10).

Table 9. Families with >500 species.

	No. of species	Status
Orchidaceae	6500	CD-ROM team
Rubiaceae	2000	p.p. allotted
Euphorbiaceae	1000	working team
Melastomataceae	1000	p.p. allotted
Arecaceae	975	working team
Gesneriaceae	900	
Annonaceae	875	working team
Poaceae	850	p.p. in prep.
Ericaceae	750	1967
Araceae	725	p.p. in press
Myrtaceae	725	working team
Dryopteridaceae	700	
Lauraceae	700	
Zingiberaceae	700	working team
Acanthaceae	625	
Araliaceae	600	
Papilionaceae	575	working team
Moraceae	575	under revision
TOTAL	**20775**	
Cyperaceae	400	1974, 1979
Dipterocarpaceae	390	1982
Myristicaceae	335	2000

Table 10. Genera with >200 species.

	No. of species	Status
Bulbophyllum (Orch.)	1000	1993 p.p.
Dendrobium (Orch.)	700	
Selaginella	500	
Syzygium (Myrt.)	500	allotted
Schefflera (Aral.)	490	checklist
Ficus (Mor.)	475	allotted
Asplenium	400	allotted
Cyrtandra (Gesn.)	400	
Pandanus (Pandan.)	400	
Diplazium (Dryopt.)	300	
Grammitis	300	allotted
Rhododendron (Eric.)	290	1967
Calamus (Arec.)	280	allotted
Diospyros (Eben.)	250	
Eria (Orch.)	250	
Memecylon (Melast.)	250	allotted
Vaccinium (Eric.)	240	1967
Ardisia (Myrs.)	220	allotted
Tectaria (Aspid.)	215	1991
TOTAL	**7460**	
Myristica (Myrist.)	152	2000

• **Substantial overall funding**

A few attempts have been made to raise funds, but in vain. The main funding still comes from the core-funding of participating institutes and project-based funding from national science foundations.

• **Increase in contributions from the Malesian region itself**

The total number of contributions from the Malesian region itself is unfortunately low, much lower than e.g. the contributions from Thai botanists to their (national) Flora of Thailand (Table 5; see for further discussion also Middleton, this volume). It is rather disappointing that in the 1990's no treatments from Malesian authors came out, even though a couple of family treatments in the hands of Malesian colleagues were on the verge of completion already early that decade.

• **Deforestation**

There are no data that the rate of deforestation has decreased significantly. The huge forest fires in Borneo in the second half of the1990's have added their share to the area affected by logging and agriculture. To fulfil one of our main arguments for completing FM, i.e. to provide primary scientific data for better sustainable use and conservation of the plant diversity in the region, more efforts on knowledge transfer and information dissemination is urgently needed, apart from progress towards a complete Flora.

What next?

What can we conclude for the future of Flora Malesiana? Ten years ago the discussion to accelerate the production of instalments essentially focussed on format, efficiency and funding to increase the number of collaborators. What can we add to that discussion? The following are just a few suggestions and thoughts.

• **Format**

Regarding the format, the question still is whether we should hold to voluminous instalments being the sole products of Flora Malesiana, or whether other formats of information on Malesian plant diversity also can be recognised as fitting the goals of Flora Malesiana. After all, the prime goal is a complete survey of the species diversity of vascular plants in the Malesian region, by means of critical revisions of existing knowledge and collections, and including the production of identification tools, and to make this primary scientific information generally accessible. This may allow for a much broader interpretation of the way of presenting the information.

However, the semi-monographic format will most probably remain the ultimate goal of Flora Malesiana as it is highly appreciated as a source of multiple-purpose information by workers in the region. After all, as Geesink (1990), I would like to quote Van Steenis: 'A flora is only useful after it is completed'.

• **Efficiency**

I do not think that we can expect much of a further increase of efficiency in the revision work. The contribution per author seems higher than before, but it needs to be another three times higher, as only when we are able to produce treatments for 600 species per year, will completion in 50 years be in sight. So how can we substantially increase the workforce? Maybe each participant in the network could spend a few percent of his/her time more on flora writing, but everybody is usually over-committed and has to find a compromise between various duties. Moreover, local and special purpose floras depend on the same pool of botanists. I fully understand the national incentives to develop local projects, but in my view, the largest increase in efficiency can be achieved when the research is carried out within regional treatments.

• **Funding**

Table 11 gives some general societal research priorities that may be of relevance for Flora Malesiana and related research in obtaining additional funding. For each of them some suggestions for objectives are given which may be eligible under the respective funding schemes.

Table 11. Some general societal research priorities and possible systematic activities that may fit for grant applications

Societial research priorities	Funding possibilities?
bio-informatics	collection databases sequence databases pattern analysis (old) literature
genomics	infra-specific diversity identification phylogeny and evolution
global change	geographic patterns collection information
biodiversity convention	national monitoring and inventory GIS and geographic scale
increase scientific network	more contributions from the region other scientific disciplines and relevant networks

If there are any possibilities for general funding, e.g. under one or another scheme related to the Biodiversity Convention, the Board will do its best to submit a proposal. Participants in the network are called upon to look for possibilities to submit proposals whenever possible, with a revision component, either as a core activity or as a corollary of the main objectives.

Conclusion

A major point in my eyes is to strengthen the participation of Malesian botanists in the Flora Malesiana network to increase their number of contributions. The largest and most important potential for further accelerating the Flora Malesiana project lies in the region itself. This means that funding of training programs should have high priority. Also, a major drawback for institutes in the region is the low availability of (old) literature. A program to make this information electronically available (e.g. on CD-ROM) will be an important step in enhancing taxonomic work in the region. For a better understanding of the phytodiversity in the region, it will be worthwhile to look for other relevant networks, e.g. in the field of geology, conservation, and geography.

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