

# Progress on the Flora of Thailand

David J. Middleton

## Abstract

*David J. Middleton (Arnold Arboretum, Harvard University Herbaria, 22 Divinity Avenue, Cambridge, MA 02138, USA) 2003. Progress on the Flora of Thailand. Telopea 10(1): 33–42. The history, current status and prospects for the Flora of Thailand project are discussed. The need for further collecting in Thailand is highlighted, particularly in Peninsular Thailand, an area covered by both the Flora of Thailand and Flora Malesiana. The rôle that non-South-East Asian botanists have in the Flora of Thailand and Flora Malesiana is discussed and the need for collaboration between the Floras is emphasised.*

## Introduction

In this paper I want to discuss three topics: the history, progress and future of the Flora of Thailand project; the need for more field work in Thailand; and the rôle of the botanist from outside Asia in the Flora of Thailand and Flora Malesiana. As there is a slight overlap between the areas covered by the Flora of Thailand and Flora Malesiana, from the Isthmus of Kra southwards to the Malaysian border, I thought it would be of particular interest to look more closely at this area.

Thailand has a total population of almost 65 million people and population densities among the highest in South-East Asia. Over the past three decades Thailand has experienced rapid economic growth and a considerable improvement in indicators of social development (Santisuk et al. 1991). Much of this economic development has relied heavily on the utilisation of Thailand's natural resources, including timber, minerals, agriculture, fisheries, and more recently tourism (Arbhabhira 1987). Thailand has therefore experienced one of the fastest rates of deforestation in the tropics, with significant environmental and economic impacts (Santisuk et al. 1991). Forest cover has declined from over 50% of the total land area in the 1950's to approximately 25% in 2000 (Table 1).

Despite the heavy reliance on natural resources for development, and the rapid rate of ecosystem loss, Thailand's biological diversity and natural ecosystems remain relatively poorly studied. Since 1973 the Thai government has pursued a policy to actively protect as much remaining forest land as possible. Currently there are 115 National Parks and Wildlife Sanctuaries in Thailand which include 6.72 million hectares of land, c. 53% of the remaining forest area or 8% of the total land area of Thailand (Napompeth & Rodcharoen 1998). While the IUCN has listed numerous reptiles, birds and mammals as in danger of extinction in Thailand, little is known of the status of most plant species. According to the IUCN List of Threatened Plants (Walter & Gillett 1998), Thailand has 27 endangered (E), 21 vulnerable (V) and 33 rare (R) species but it is probable that these figures are greatly underestimated due to the lack of data on many plant groups. To quote from Boontawee et al. (1995) "There is an urgent need to explore, identify, protect, and manage the available forest biodiversity properly for future sustainable utilization."

Table 1. Forested areas in Thailand as detected by LANSAT-TM image (from Boontawee et al. 1995 (1976–1991) and the Royal Forest Department web site: [http://www.forest.go.th/Botany/Flora/Forest\\_type.htm](http://www.forest.go.th/Botany/Flora/Forest_type.htm) (2000)).

Year	Forest area km <sup>2</sup>	% Country area
1950	344 000	67
1976	198 417	38.67
1978	175 224	34.15
1982	156 000	30.52
1985	150 866	29.40
1988	143 803	28.03
1989	143 417	27.95
1991	136 693	26.64
2000	129 715	25.28

## The Flora of Thailand

### Historical Background

Scientific plant collecting began in Thailand in 1778 with the expedition of the Danish botanist J.G. Koenig and continued very sporadically thenceforth until the 20th century when collecting became more extensive. These early collections have been summarized by Kerr (1939). Kerr himself made systematic collections in various parts of Thailand from 1902 to 1932 and collected over 21 500 specimens. His collecting itinerary and other information about this remarkable botanist have been gathered into a review by Jacobs (1962). Early expeditions to Peninsular Thailand, in the area also covered by Flora Malesiana, included those of Curtis between 1889 and 1899. He collected along the Malaysian border and up to Phangnga, although the collections from Thailand are few and mostly from small offshore islands. Ridley collected more extensively in Peninsular Thailand and described many new taxa (Ridley 1920). When Kerr began his collecting in 1902 it is estimated that there were only 4 250 collections from the whole of Thailand. By the time he left Thailand in 1932 there were approximately 35 000 specimens, from his own collecting activities and those of his various colleagues and associates, including collecting trips in Peninsular Thailand on expeditions in 1923 and between 1926 and 1930 resulting in over 7 000 specimens. This increased the density index for Thailand to about 8–9 specimens per 100 km<sup>2</sup> (Jacobs 1962), albeit unevenly spread and with most of the country remaining poorly known. Numerous new taxa were described from these collections, mainly by Craib and by Kerr himself. After Kerr retired not much collecting was done until the Thai Royal Forest Department started new collecting initiatives in the 1950's under the direction of Tem Smitinand. Danish botanists also became involved in the late 1950s and remain active to the present day.

### The Flora of Thailand Project

The Flora of Thailand Project was initiated in 1963 under Thai–Danish collaboration and formally launched in 1967. The first part was published in 1970 and additional parts have been produced regularly since then, although not as fast as was at first hoped. To date 16 parts in seven volumes have been published (Smitinand & Larsen

1970, 1972, 1975, 1979, 1981, 1984, 1985a, 1985b, 1987, 1988, 1989, 1990, 1991, 1992, 1993; Larsen 1996; Santisuk & Larsen 1997, 1998, 1999, 2000). It remains a collaborative project with involvement of institutions from Thailand, Europe, Japan and the United States. The current co-editors are Thawatchai Santisuk and Kai Larsen. Submission of manuscripts has increased recently resulting in the hope that the Flora can be completed within 30 years (Parnell 2000), although Santisuk et al. (1991) have suggested that it may take as long as 100 years.

Table 2 gives the figures for the number of taxa that have already been published, or have been accepted for publication, for the Flora of Thailand. Given an estimated number of species for Thailand of 10 250 (my estimate; Parnell (2000) suggests a higher figure of 12 500) then this comprises about 30% of the total number of species. Currently one part is appearing each year. The largest family so far published is the Cyperaceae with 248 species (Simpson & Koyama 1998), followed a long way behind by the Apocynaceae *sensu stricto* (Middleton 1999) with 125 species. However, the account of the Euphorbiaceae is almost complete with c. 400 species. The largest family in the Flora is the Orchidaceae, revision of which is being coordinated by Henrik Pedersen in Copenhagen, building on the work of Gunnar Seidenfaden. Coordinators or authors have been found for nearly all the remaining families with the notable exceptions of the Vitaceae and several small families which might make good projects for Thai students.

In addition to the Flora accounts an extremely useful bibliography to South-East Asian taxonomic treatments has been produced by Alain Mauric and kept up-to-date by Rachun Pooma and Kanlaya Pattarahirankanok. This can be accessed at: <http://www.forest.go.th/Botany/BIBLIO/main.htm>. Information on the mosses of Thailand can be accessed at <http://www.mobot.org/MOBOT/Moss/Thailand/>.

One aspect of the Flora of Thailand which has not yet been sufficiently explored is to have web accessible multi-access keys and descriptions. This would be particularly useful for the large families and would be possible to do for many groups from already existing data. Since the Apocynaceae was published (Middleton 1999) two new species have been described (Middleton 2001; Middleton & Santisuk 2001). This is a fact of life for any plant family from an undercollected region like Thailand but need not render previous accounts outdated if the reader is also aware that new taxa and distributions will simply be added to multiaccess keys and descriptions on a web accessible floristic account. As with many aspects of botanical research, this would, of course, be contingent on raising necessary funds and, as yet, no families have been produced in this way. Thailand has a reasonable prospect of completing a written Flora within about 30 years but it may take longer to have it in a web accessible form.

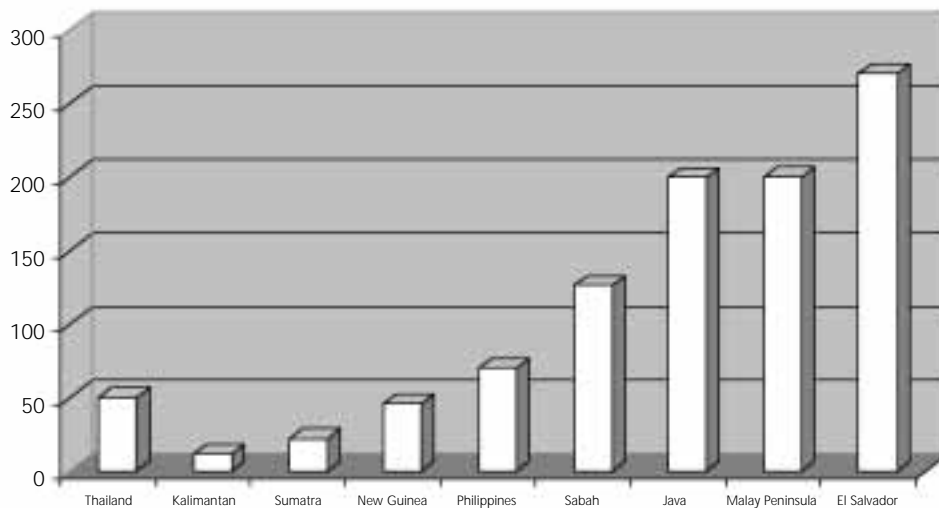
Table 2. Number of taxa published for Flora of Thailand: to volume 7, part 2, plus number of taxa in press or accepted for publication as of August 2001.

	Families	Species
Taxa published	130	2 300
Taxa accepted for publication	25	850
Total number expected	304	10 250

### Collecting in Thailand

Thailand remains poorly collected. In the United Kingdom, an average of 17.2 herbarium specimens per km<sup>2</sup> has been collected compared to 0.5 specimens per km<sup>2</sup> in Thailand (Parnell 2000). When one considers that the flora of the UK consists of only about 1500 native species and the flora of Thailand approximately 10250 species, the undercollection of the Thai flora is even worse than the stark figures would suggest. Although the U.K. is considered one of the world's best collected countries, the overall collection density is also low compared to some other parts of South-East Asia (Fig. 1). Collecting densities in all of South-East Asia compare unfavourably with parts of the New World tropics. Recent collecting suggests that the rate for Thailand may be increasing but is still one of the lowest in the tropics (see Parnell et al. in press). This collecting rate has risen to its current rate from one of the lowest in Asia for the period up to 1974 and effectively zero in the period 1974–1981 (Larsen 1979; Parnell et al. in press). Data from both Parnell (2000) and Middleton (1999) show that even in the better known plant groups in Thailand such as the genus *Syzygium* and the Apocynaceae the pattern of collecting within Thailand is extremely patchy. 20% of all collections made in Thailand have been made in a single province, Chiang Mai.

Parnell et al. (in press) also point out that even in those parts of Thailand considered to be reasonably well collected, such as Chiang Mai province, the collections made there are in fact extremely localised on just a few mountains (Doi Sutep and Doi Inthanon) and the surrounding foothills.



**Fig. 1.** Number of collections per 100km<sup>2</sup>; data from Johns (1995) and Parnell (2000) except Malay Peninsula very roughly estimated by extrapolation from 1972 figure in Johns (1995).

### Peninsular Thailand

There have been several recent expeditions to Peninsular Thailand. Shimizu et al. (1980), Phengkhilai and Niyomdham (1991), Larsen (1992), Simpson et al. (1995) and Dransfield (1996) all give accounts of collecting in Peninsular Thailand and have made valuable contributions toward furthering our understanding of this area. These collections are mostly housed in AAU, BK, BKF, K, KYO, PSU and TCD (abbreviations follow Holmgren et al. 1990). However, the area under consideration is large and the overall concentration of specimens from this area remains small.

If one examines the distribution of the Apocynaceae on each side of the border between Malaysia and Thailand it is clear that the Thai side of the border remains terribly undercollected. The majority of species of Apocynaceae are not local endemics so one would expect a reasonably even spread of taxa across the provinces within a region if there were an even spread of collecting. Ten species of Apocynaceae recorded from both Peninsular Thailand and Malaysia have never been collected in the four Thai provinces along the Thai–Malaysia border and yet four species recorded from these four provinces and also in Malaysia are not known anywhere else in Thailand. There are also 44 species of Apocynaceae known from Peninsular Malaysia which are not known in Thailand of which 26 are in at least one of the four Malaysian border states: Perlis, Kelantan, Perak, Kedah (data from Turner 1995; Middleton 1999). Peninsular Thailand includes the important biogeographic transition between Thai seasonal dry evergreen forest and the extremely diverse mixed dipterocarp forest (Van Steenis 1950; Whitmore 1984) characteristic of much of western Malesia. This transition has never been quantitatively described but it is clear that the Isthmus of Kra, the northern limit for Flora Malesiana accounts, is much further north than the edge of this forest type. However, there are areas of it in the southern Thai provinces right on the Malaysian border so one would expect many more of the Malaysian elements to be found in this area if they were better collected. This increased collecting would have two benefits: firstly that taxa found there could be incorporated into the ongoing Flora of Thailand, and secondly that biogeographic studies would have a more accurate pool of data to use in describing this transition zone. Evidence of this is that when more work has been done in Peninsular Thailand numerous papers have resulted, describing new taxa and new country records (e.g., Shimizu et al. 1980; Larsen & Larsen 1993, 1995; Mekanawakul 1996; Sookchaloem 1997; Sookchaloem & Murata 1997; Larsen & Mood 1998; Sawangchote et al. 1999; Triboun & Larsen 1999; J. Dransfield 2001; S. Dransfield 2001). In Larsen and Mood (1998) and S. Dransfield (2000) new genera are even described.

### International collaboration

To quote from Pooma (1999), a Thai national and staff member of the Royal Forest Department, “The amount of biological systematic information in *ex situ* collections, such as natural history museums, herbaria and botanic gardens, is very rich in countries poor in biodiversity, and vice versa”. He goes on to note the need for technology transfer and data repatriation back to the country of origin. This collaboration requires, of course, willing participants in both the country of origin and the country in which the material is housed. There have been some calls for repatriation of herbarium material back to the country of origin but again as Pooma

points out "Specimens are safer in well-maintained and curated major herbaria in developed countries due to the economic, technical, environmental and legal problems in developing countries". Whether this argument remains in years to come will have to be seen but at the moment having data on biological diversity in Thailand available mainly in herbaria outside Thailand poses a responsibility on those herbaria to return that information to Thailand. Pooma reiterates that the completion of a published Flora, including information on species distribution and habitats, and a classification of the vegetation types are necessary for a nation-wide policy and plan for sustainable use and conservation of Thailand's genetic resources. Engaging staff at herbaria in which major Thai collections are housed on a project like the Flora of Thailand does, in part, fulfil that requirement for the repatriation of data and information. Posting images of specimens on the Internet is also a valuable means of making data available worldwide.

### Flora of Thailand

Of the families completed for the Flora of Thailand to date (including manuscripts in press or accepted for publication) just under half the families and species have been completed by European botanists (Table 3). This compares well with Flora Malesiana where a very much higher proportion of the taxa have been completed by European botanists. 22% of the species have been revised by Thai botanists.

Table 3. Number of taxa published (or accepted for publication), in the Flora of Thailand, by location of author.

	Families	Genera	Species	% species published
Thai	34	156	680	22
European	75	406	1490	47
Non-Thai Asian	45	196	928	29
Australian	1	11	35	1
North American	6	9	17	<1
<b>Total</b>	<b>155</b>	<b>778</b>	<b>3150</b>	<b>100</b>

The dominance of European botanists in completing accounts for Flora Malesiana and, to a lesser extent, the Flora of Thailand is understandable given the concentration of collections in Europe, particularly type specimens, and the resources available for the training of taxonomists in Europe compared to South-East Asia. The important rôle of taxonomists in Europe in ensuring that accounts for the Flora of Thailand are completed is, however, beginning to change with many Thai students having recently been trained in universities in Thailand, Japan and Europe and taking on this rôle themselves. Also many European universities and institutions have changed their emphasis from traditional taxonomic practices to systematics based on molecular studies, or have abandoned systematics altogether. Therefore, the pool of available young European taxonomists to work on the Flora of Thailand has diminished at a time when the available pool of young talented Thai taxonomists is increasing.

One of the best ways forward with large families is to encourage collaboration between experienced taxonomists and students. The Euphorbiaceae with about 400 species has been a collaborative effort with contributors from Thailand and Europe. The larger and more complex genera have been completed by experienced Thai and European researchers whilst the smaller genera have mostly been revised by students as a tool for taxonomic training. This has proved an effective model for the completion

of large families that will be continued with the Lauraceae and possibly the Rutaceae. Similar cooperative ventures between experienced taxonomists and students are being conducted for Flora Malesiana, such as in the Apocynaceae and Cucurbitaceae. Students from Thailand or the Malesian countries studying for graduate degrees, within or outside their own countries, may also have the opportunity to work on taxa over wide ranges and in more depth and produce really outstanding work. Testament to this is Indonesian researcher Sidiyasa (1998), who revised the genus *Alstonia* in the Apocynaceae for his PhD at Leiden University, a work which won him the IAPT Silver Engler medal for 1998.

A number of families have been completed by the same authors for both Flora Malesiana and the Flora of Thailand, often in collaboration with other authors. The Sapindaceae (Adema, Leenhouts & van Welzen 1994; van Welzen 1999), Caesalpinoideae (Larsen, Larsen & Vidal 1984; Ding Hou, Larsen & Larsen 1996) and Mimosoideae (Nielsen 1985, 1992), amongst others, are already complete. Other families such as Apocynaceae (Middleton 1999) and Myrsinaceae (Larsen & Hu 1996) have been completed for the Flora of Thailand and are being worked on by the same authors, sometimes in collaboration with others, for Flora Malesiana. Yet others such as the Musaceae and Cucurbitaceae are being worked on simultaneously for both Floras. This cross fertilisation between Flora Malesiana and the Flora of Thailand has proved an extremely efficient way of contributing accounts of both large and small taxonomic groups for both Floras. However, the bulk of this work has been done by botanists from outside South-East Asia, and whereas approximately 65% of species found in Thailand are also found in Malesia the converse is not nearly as true. Malesia is a much larger and more diverse area and it would be a bigger commitment for authors concentrating on the Flora of Thailand to also take on Flora Malesiana. The Ericaceae and Meliaceae are perhaps the most notable examples of large families completed for Flora Malesiana but whose authors will not for various good reasons complete the Flora of Thailand account.

One of the advantages that the Flora of Thailand has over Flora Malesiana is that it is a Flora of a single nation state. Flora Malesiana covers six nations, seven if you include the portion of Thailand to the Isthmus of Kra (and eight if you include the newly independent East Timor). Botanists in Thailand can get national funding to work on their flora and complete accounts whereas resources are not often available within the countries that make up the Malesian region for botanists to work on projects that extend beyond their own national borders. It is highly understandable, although not ideal, that Malaysian botanists have concentrated their efforts of the Tree Flora of Malaya and now the Tree Flora of Sabah and Sarawak and that Philippine botanists have been concentrating on the Philippine Plant Inventory project. Of course collections made in these efforts, new taxa published and accounts produced, will be new sources of information for any future Flora Malesiana account. However, floristic accounts extracted from monographic and semi-monographic revisions, such as Flora Malesiana, invariably lead to more accurate generic and specific delimitation and this has to be weighed in when one is seeking a balance between the urgent need for these accounts and the desire for scientific purity (Roos 1997).

Santisuk et al. (1991), in an international report on the botanical research and conservation needs for Thailand, noted that "one cannot overemphasize the urgent need to inventory all remaining natural vegetation and to complete the Flora [of Thailand] ... ". The same is true for Malesia and, given the common needs and goals of the two Floras and the large overlap in taxa, the collaboration should be further enhanced and encouraged.

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