A PROPOSAL FOR THE REPATRIATION TO THAILAND OF BOTANICAL DATA FROM THE ROYAL BOTANIC GARDENS, KEW

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ABSTRACT. Article 17 of the Convention on Biological Diversity obliges its 175 Parties to facilitate the exchange of information, taking into account the special needs of developing countries, and "where feasible, include repatriation of information". Biological data are necessary for the development of policies directed towards the conservation and sustainable use of a country's genetic resources. It is generally accepted the most important historical data are safer if conserved in developed countries with technology transfer and in-kind assistance being preferable to the return of the original collections. An action plan, which would require additional financial support for its implementation, has been developed for the repatriation of taxonomic, historical, economic and conservation data, and a strengthening of collaboration between the Royal Botanic Gardens Kew and Thailand. Forest Herbarium (BKF) is suggested as the implementing agency and national herbarium in Thailand with collaboration from several biological institutions and Thai universities.

INTRODUCTION

The Convention on Biological Diversity entered into force in December 1993 and has been ratified by 174 countries and the European Union. Its objectives are broadly separated into the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to these resources, by transfer of relevant technologies.

The Preamble of the Convention states that "Information and knowledge of biological diversity and the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures are generally lacking". Thus the Convention recognises the importance of information and points out one of the obligations of developed countries to support developing countries in the provision of information (Article 17) including the establishment and maintenance of programmes for scientific and technical education and training for identification, conservation and sustainable use of biodiversity (Article 12).

However, the Convention is not the sole reason for seeking to exchange data on biodiversity. Even without the Convention, data are required to support the fundamental resource utilisation decisions that affect the economic prosperity and social well-being of all countries. Such data have been collected in one form or another. The Convention has encouraged programmes to collect scientifically sound data and facilities to effectively manage them (Crain & Reynolds, 1996).

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Thailand signed the Convention at the Earth Summit in Rio, June 1992, but has not yet ratified it. This is mainly due to the absence of laws governing the use of genetic resources. However, the government agreed in principle to ratify the Convention and the country has begun to adopt specific measures in accordance with the Convention.

Ashton (1989) suggested that the completion of a published Flora, including information on species distribution and habitats, and a classification of the vegetation types were necessary for a nation-wide policy and plan for sustainable use and conservation of Thailand's genetic resources. These would allow a better management of natural forests for sustainbility and conservation. This was supported by Sabhasri (1996) who noted that the Convention's Article 17 specifically dealt with the exchange of information, and called on the Contracting Parties to facilitate the exchange of information relevant to the conservation and sustainable use of biological diversity. He highlighted the special needs of developing countries and added that this information should include the results of technical, scientific and socio-economic research, data on training and surveying programmes, and indigenous knowledge. It should also, where feasible, include repatriation of the information. He further suggested that Thailand had to make fuller use of existing knowledge to practise integrated ecosystem management in various types of habitats, including taking full advantage of information on Thai biodiversity held by various institutions abroad.

Responding to the CBD and the policy considerations outlined above, a proposal was developed to deal with the repatriation to Thailand of botanical data from the Royal Botanic Gardens Kew, U.K. It also focuses on capacity building in taxonomy. Kew is a taxonomic organization that holds much important material for plant research, and has long experience of plant collecting in Thailand. Needs and supply assessments were carried out through communication with the various departments in Kew and with the Thai institutes concerned. The problems were analysed by correspondence with taxonomists in various institutions both in Thailand, and abroad. From this an action plan was developed. This papers summarises the main points from a more detailed unpublished report (Pooma, 1999).

NEEDS AND SUPPLY ASSESSMENT

The Convention

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. The Convention therefore defined that ex-situ conservation measures should be undertaken in the country of origin (Article 9). Living collections, seed banks, herbaria, and laboratories operated by botanic gardens are key facilities in this regard and it is now standard practice for botanic gardens collecting abroad to build collections in the country of origin by leaving full, duplicate sets of specimens with the local botanical institute or herbarium, and to build their capacity by technology transfer and engaging in joint research (UNEP/Convention/COP/3/Inf. 46). It is necessary to continue correcting this imbalance to help those developing countries implementing the Convention especially in accordance with Article 7, for the identification and monitoring of biodiversity.

The Convention's provisions on access and benefit-sharing are binding only on Contracting Parties, and only cover genetic resources acquired after the Convention's entry into force (ten Kate, 1996, as cited in UNEP/Convention/COP/3/Inf. 46). The document also categorises the benefits into monetary and non-monetary, and identifies non-monetary benefits as including provision of samples, access to other genetic resources in exchange, transfer of technologies or license to use them, information, training, joint research, and exclusive crop or product development rights. However, biological collections were mentioned in the second meeting of SBSTTA as being the basis of taxonomy and sources of genetic resources (Recommendation II/2). Benefits from the use of genetic resources must be shared.

In the field of systematic botany, the terms 'access' can mean an exchange of botanical information while 'benefit sharing' might be specified to mean a complete duplicate set of all specimens left in national institutions, a strengthening of institutional capacity for technology transfer, and access by nationals to all national specimens deposited in international *ex situ* collections. Glowka *et al.* (1994) further referred to the importance of the 'return' or 'repatriation' of original and unique information about species and ecosystems in developing countries held by museums and other research institutions in developed countries.

Systematic collections and the repatriation of specimens

Systematic collections provide the material or research guidance for biology, including medical science and biotechnology. They serve to raise public awareness of and interest in the living world (WCMC, 1994).

Information contained within biological collections (including information with reference to global change, in palaeontological collections) is a key resource for countries fulfilling their obligations under the Convention and other significant environment Conventions such as the Framework Convention on Climate Change, the Convention on Wetlands of International Importance, and CITES (Anon, 1998). This was supported by Boom (1996) who also stated that the voucher specimen is the most basic element in plant science research. No matter what the field of inquiry—ecology, genetics, systematics, physiology, ethnobotany, pathology, or biodiversity prospecting—if a plant specimen is not deposited permanently in a herbarium, there is no way to verify the identity of the organism involved. However, Chalmers (1996) realised that the items in these collections are most useful when they are accurate; that is when they are prepared so as to display to greatest effect their most distinctive characteristics, when they are protected against decay and damage, when they are stored in such a way that they can readily be located and examined, and when they are accompanied by documentary information.

The major museums and herbaria focus on taxonomic coverage, obtaining representatives of all described genera and higher taxa world-wide, not representative samples of biological diversity in any ecological or statistical sense (Gauld, 1996). Quicke (1993) stressed that local museums tend to concentrate on material collected in their region and act as important sources of information about current and past distribution of organisms. They also tend to be at the forefront when it comes to providing information about local land use and conservation issues.

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. The science of biodiversity is now at a critical point, as its needs are becoming more urgent with time but more importantly as there is a shortage of skilled professionals. Developing a consensus on what needs to be done, based on an agreement between global and regional herbaria, will be necessary.

Hoagland (1996) suggested that international scientific access to specimens and field sites can be predicated on returning equity to the host country in the form of technology transfer and in-kind assistance. Seminars, equipment, literature, co-authorship of publications, student and professional exchange, help with collection development and curation, exchange of scientific specimens, identification services and training, assistance in writing grants and finding research funding—all these lead to intellectual collaboration and the building of a mature scientific infrastructure. Each nation should develop its national collection and share it with other nations at the regional level, and co-ordinate with international collections in terms of access and exchange, especially in the priority areas of conservation and sustainable use. Regarding national legislation that restricts taxonomic study in several countries, Hoagland further asked "Who will want to help develop taxonomic infrastructure or provide knowledge in a country that restricts access, charges the scientist to do work, and then demands ownership of both specimens and scientists?".

Repatriation of data from Kew: the current situation

Floras are an influential and useful product of Kew's systematic research. Kew has a long and successful tradition of Flora writing that started in the 19th century with the Flora of British India and the Flora of Tropical Africa. More recently Kew has been working on floras in many areas, including Thailand. Therefore, Kew is currently repatriating data and information via these Floras. Data are also repatriated through monographs and revision published by Kew, and through access to various databases. The top set of all collections made by Kew staff are deposited in the leading institutions of the countries of origin while the duplicates are sent, when possible, to other institutions (P. Cribb, pers. comm. 1998). The Library and Archives repatriate data through photocopying by request, and exchange of publications. The Living Collections Department, Jodrell Laboratory and the Seed Bank, information is freely available in databases, some of it on the Internet. They are also involved in training programmes, and collaborative projects.

There is a close link between Kew and BKF which is maintained in several ways. As well as several staff working on Flora of Thailand accounts, and one staff member on the editorial board, Thai herbarium specimens are being directly utilised by foreign contributors who are studying the Thai flora. More importantly, it is necessary to add more in the areas promoting an analysis of biodiversity on a scientific basis. Kew, therefore, will be directly benefiting through the sharing of biological material, and will return the information retrieved from data collected from Thailand, including advanced knowledge in various fields.

Electronic data storage and retrieval

Scientists from several institutions, both in Thailand and abroad, agreed that it would be better to repatriate all data through on-line mechanisms, mostly on the Internet. However, the limited number of qualified personnel and the lack of funds are the major obstacles, especially considering the large number of specimens, many of which are unidentified or wrongly identified. In addition, the costs of using the Internet in a developing country such as Thailand are high when compared to the cost of living in the country. Furthermore, databases, photographs or images can be less useful than access to the actual specimens. Likewise, Anderson (1996) clarified that descriptions, databases, photographs, and scanned images are all helpful, but they pale in importance when compared to an opportunity to study the actual specimen that someone else has studied; and when that is not possible, studying a duplicate is the next best thing and still far superior to all the alternatives. He further stated that the reason why herbaria continue to collect and exchange duplicates is that they rely on such exchange to increase the strength of the collections with speed and efficiency. If researchers at an institution want to build up a good representative collection of a particular group or from a particular area, they cannot possibly do it all themselves, but through carefully targeted exchange of duplicates much can be accomplished in a few years.

The need for an implementing agency

The lack of a coordinated network among Thai institutions is the major barrier to taxonomic research in the country. It is important that all data should be freely and easily available to all scientists. In the past, Thailand has highlighted the need to share responsibility for collection, conservation and research related to plant genetic resources between the agricultural, forestry and health sectors (medicinal plants) and other governmental and non-governmental organisations and universities. Therefore, the existing biological data in the country are scattered around these institutions or with researchers within specific fields that develop their own independent resource bases. Presently all foreign natural scientists, including botanists, are required to register and receive permission from the National Research Council in Bangkok before conducting their work. The basic problems are that many foreign botanists have not sent duplicates or copies of their publication or research results back to their supporting institutions.

There is still no national institution that would strengthen the network between institutions and increase the exchange of biodiversity information in the country. The efforts of relevant institutions have yet to yield substantial and beneficial results because they have not been sufficiently supported either financially or institutionally. Moreover, their plans and policies on conservation of biodiversity have never, to any significant extent, been integrated into the policies and plans for the utilisation of natural resources. There are still many factors exacerbating the wasteful use of biodiversity while the condition and support for the conservation and sustainable utilisation of biodiversity are still insufficient (OEPP, 1995).

In Thailand the two largest herbaria (Bangkok herbarium (BK) and BKF) are both in Bangkok. Although BK is an older herbarium and contains many precious types, it has not developed to the extent of BKF. Neither herbarium actually teaches plant taxonomy

since this is undertaken by Thai universities. The basic problem, as elsewhere, is duplication of funding and lack of organized cooperation between BK, BKF, and various Thai universities with functional herbaria.

It would be highly desirable if Thailand had a central or national herbarium. This should preferably be developed at BKF and include BK. BKF is the official body in charge of plant systematic research and its responsibility includes botanical gardens and arboreta, and the Flora of Thailand project. It would have overall responsibility for acquisition and distribution of specimens collected by themselves and other herbaria in Thailand, dissemination of library material and database information, as well as organizing botanical research activities in Thailand.

Thai universities must continue to be able to properly train plant taxonomists. With support from BKF, taxonomic students would be able to do basic studies at their universities and then visit BKF for special needs, e.g. checking references, specimens, and professional assistance. The universities must agree to exchange specimens so that all herbaria would have adequate teaching as well as research material.

Queen Sirikit Botanic Garden (QBG) might be appropriate for advanced research in taxonomy and as a training centre in co-ordination with Biodiversity Rescarch & Training Program (BRT) and Thai universities. The Office of Environmental Policy and Planning (OEPP) should be developed as the co-ordinating agency for all biodiversity information and implementation of the Convention for Thailand. Finally, non-governmental organisations, private sector including companies could benefit from repatriated data and information by contacting those institutions in the country.

Nevertheless, repatriation should be concentrated in a single institution. Spreading repatriated collections all over the country is, in the end, counter-productive, because anyone wanting to get a general overview of, for example, a certain family, would then have to travel all over several institutions, or request loans. A basic problem with, for example Chiang Mai University Herbarium (CMU) and Prince of Songkla University (PSU), is that various families and genera found in the north are lacking in the south and vice versa, specimens from all regions should therefore be exchanged. On the other hand, there are some advantages in decentralisation. BKF must set an example to merit national herbarium status by coordinating botanical activities in Thailand. However, data on-line should be available in both research and educational institutions and should give free access to all information.

The concept of a national herbarium can only be realized if Thai and collaborating foreign botanists agree on priorities and develop solid cooperation programmes. The present system of neglect, competition, and personality clashes can only result in a sad continution of financial waste, substandard research, and botanical incompetence which has effectively prevented Thai botanists from developing an international reputation for botanical excellence.

SPECIFIC NEEDS OF THAILAND

A national policy and plan for the sustainable use and conservation of each country's genetic resources in accordance with the Convention requires the completion of a Flora for that country, including information on distribution of species and status in

in situ conditions. Each country has to make full use of existing knowledge to practise integrated ecosystem management in various types of habitat, including taking full advantage of information about the biodiversity held by various institutions abroad.

For Thailand, specific needs in the context of the Flora treatments were recommended as follows (Santisuk *et al.*, 1991): (a) a workshop to review management and production of the Flora of Thailand; (b) two additional PhD level staff in the RFD Botany Section; (c) manage a grant programme to enable Thai botanists from other institutions to work at BKF on the Flora of Thailand and (d) strengthen the library and infrastructure in BKF.

Recommendations covering botanical research and conservation were also made: (a) conduct comprehensive botanical inventories in priority areas of Thailand, including in major conservation units and threatened areas and (b) initiate a programme of *ex situ* conservation of rare and endangered plants in botanical gardens and arboreta.

The Flora of Thailand so far only covers 35% of the country's flora and it was recently estimated by the contributors at the 10th Flora of Thailand Meeting in 1996 that another 30 years would be necessary to conclude it. Completion of floristic and monographic studies, essential in identifying and monitoring biodiversity resources, are the keys to implementing the goal of the Convention. Specific needs to achieve this have been identified as follows:

Taxonomic data

All type specimens collected from Thailand; related type specimens to Thai species; regional and important publications related to the Thai flora.

Historical data

Prior to September 1920, with the establishment of BK by Kerr, no botanical collections from Thailand were kept in the country. These early collectors are listed by Kerr (1939). Some of the more important collectors include: Schmidt (1899–1900), Linhard (c. 1904), Hosseus (1904–1905), Ridley (1912–1919), and Kerr (1908–1914). All these specimens were sent to Europe especially at Aberdeen, Copenhagen, Berlin, and Kew. After 1920 Kerr's material was deposited in BK with duplicates sent to Craib at Arberdeen, as was done previously, for identification and distribution. In addition, 40 boxes of miscellaneous items relating to Kerr are found at Kew. These items are important not only for the history of botanical inventory in Thailand, but also for their geographical importance and significance for economic botany as well as their value for Thai local history and anthropology (P. Davis, pers. comm. 1998). At least one copy of the collections should be deposited in a Thai botanical institution or national museum.

It often happens that specimens which should normally be found in a herbarium are missing. Immediately after collecting, the top specimen should go to the implementing institution in the host country, one duplicate to the collecting institution, and the remaining ones to the main herbaria specialising in SE Asia, abroad. In Thailand, the absence of many duplicate specimens collected by foreign institutions may be due to the following reasons:

The collection of specimens in protected areas is under the control of the RFD, and a complete set should be deposited to the BKF, the central herbarium under the RFD. But in practice many foreign collectors have taken specimens back with them without leaving any duplicates at the BKF

Sometimes no duplicates were collected and therefore no specimen left in Thailand; in some cases, such as palms, photographs of living plants in their habitats are important but these photographs have seldom been left with duplicate specimens (J. Dransfield, pers. comm. 1998).

Many specimens in the main Thai herbaria are still not incorporated due to a lack of human and financial resources. Some specimens have been accidentally destroyed or lost.

Economic and conservation data

Thousands of plant species are found in S.E. Asia which provide food, fibres, pharmaceuticals, building materials and fuel, for personal use and for sale in local, regional or international markets. The Centre for Economic Botany at Kew (CEB), has been developing an "Economic Botany Bibliographic Database" which contains over 156,000 literature references including 334 records of useful plants from Thailand (as well 290 records of economic botany artefacts in the Museum). It would be useful to develop links between CEB staff and Thai scientists.

Living collections in botanic gardens are important for research, conservation, education and recreation. They can specialize in taxonomically isolated, rare or endangered species, economically important species, species required for restoration or rehabilitation of ecosystems, and keystone species (Heywood, 1991). Databases of the above (including such information as dates, plant descriptions, present status, uses, threatened species, propagation, etc.) should be created and made available to scientists from the countries of origin. The Living Collections Department at Kew has also large collections from around the world and information from these has been databased (including 594 records of Thai plants).

Infrastructure in taxonomy and relevant fields and strengthening collaboration

Hoagland (ASC, 1997) considered that the greatest need for institution-building in biodiversity is not databases, per se, but taxonomic training and research, improved stewardship of international, comparative collections, and the resultant new knowledge concerning as yet undescribed biodiversity and taxonomic relationships. Moreover, there is a need for more visits by specialists, rather than their relying on the specimens brought back by general collectors (Prance as cited in Stace, 1989). The Kew-BKF collaboration on the Flora of Thailand is, as mentioned before, on the following families: Araceae, Cyperaceae, Dioscoreaceae, Poaceae-Bambusoideae, Arecaceae, Nepenthaceae and Labiatae-Viticoideae. There should also be collaboration concerning the Annonaceae, a problematic family for which a database of Thai species has already been developed at Kew. Lauraceae, another complex family, has no contributor and Kew has no current authorities in SE Asia. Both Thailand and Kew would benefit from new expertise in this area. Orchidaceae would also benefit from Kew collaboration as it holds a large collection of SE Asian material.

The Flora of Thailand is a collaborative project, involving Thai and foreign botanists, especially from Europe and Japan. In the past, collaboration was based mainly on the production of the Flora with a little focus on scientific and capacity building programmes or the building of reference collections. Collaboration should be strengthened by establishing training programmes for young Thai botanists or technical staff through field work and foreign expertise. Exchange of information should include increasing collections both in Thailand and all in collaborative institutions; it should also include regional networking under scientific research agreements.

THE ACTION PLAN

Development Objective

The key objective of this proposal follows the Convention's objectives in requesting developed countries to help developing countries such as Thailand to implement the objectives of the Convention. This relates especially to Article 7, i.e. to identify and monitor Thailand's biodiversity through the exchange of information and biological reference material collected in this country and are held in major herbaria in Europe and America; this also includes data repatriation.

Objective 1: Making data on biological collections available to scientists in Thailand.

Action 1: Repatriation of historical, economic and conservation data

Scope: To target the requirements on taxonomic, historical, economic and conservation data. This will require:

Preparing a specimen checklist for Thai herbaria;

Reviewing all type specimens collected from Thailand, together with historical and missing specimens;

Selecting herbarium specimens at Kew for cibachroming and/or digital imaging;

Extracting economic and conservation data related to Thai plants at the Centre for Economic Botany and the Living Collections Department in Kew;

Developing and designing database needs;

Sending data back to Thailand.

Action 2: Repatriating type specimens of species related to Thai plants and original and important publications related to Thai flora

Scope: To target the requirement on type specimens and important publications. This will require:

Preparing specimens and literature requirements in Thailand for accounts of large and critical families for the Flora of Thailand;

Assessing related type specimens and taxonomically important specimens in Kew for cibachroming, and important literature at Kew library for photocopying;

Loaning type specimens from other herbaria to Kew for cibachroming;

Sending data back to Thailand.

Action: 3 Repatriation of Kerr's Archives

Scope: To target the requirement on Kerr's Archives. This will require:

Extracting data and information from Kerr's Archives (approx. 34,000 items and 4,200 black and white photographs) at herbarium, Kew for microfilming;

Sending data back to Thailand;

Funding Kew for the conservation of Kerr's Archives.

Objective 2: Developing infrastructure in taxonomy and other relevant fields including strengthening collaboration between Kew and RFD.

Action 4: Capacity building in advanced taxonomy

Scope: To target the requirements on the infrastructure in taxonomy. This will require:

Funding two postdoctoral posts to work on Thai Annonaceae and Lauraceae at Kew;

Funding two Thai students for PhD training in UK (at Kew) for Annonaceae and Lauraceae;

Funding a Thai PhD student in Kasetsart University to work on Labiatae-Viticoideae, with training at Kew;

Sending a Thai student to the U.K. for postgraduate studies in Ethnobotany;

Sending data on Thai Annonaceae, Labiatae-Viticoideae and Lauraceae gathered Kew back to Thailand.

Action 5: Capacity building for Thai botanical and herbaria staff

Scope: To target requirements for training courses. This will require:

Sending two Thai herbarium technicians for the Herbarium Techniques Course at Kew;

Sending two Thai botanical gardens staff for the Conservation Techniques Course at Kew;

Sending two Thai botanical gardens staff for the Botanic Gardens Education Course at Kew;

Sending two Thai botanical gardens staff for Botanic Garden Management Course at Kew.

Action 6: Strengthening collaboration

Scope: To target the requirements on strengthening collaboration. This will require:

Planning and conducting a Herbarium Techniques course in Thailand, with expertise from Kew staff members, for 20 young taxonomists from Vietnam, Laos, and Thailand;

Planning and conducting workshops in Thailand for young Thai taxonomists on Araceae, Arecaceae, Cyperaceae, Dioscoreaceae, Lamiaceae, Nepenthaceae, Poaceae-Bambusoideae, and Orchidaceae;

Designing field work programmes for Kew expertise to focus on particular areas including, surveying rare and endangered species for conservation and seed banking;

Preparing a research agreement between Kew and RFD.

IMPLEMENTATION

If such a project were to succeed, it would require joint coordination by RFD and Kew, and the institutions would need to find additional financial resources. The project would also require partnerships with other collaborating institutes such as Aarhus University Denmark, Rijksherbarium Leiden, Trinity College Dublin, QBG and Thai universities. The OEPP will assume responsibility for gathering repatriated data through the Biodiversity Data Management project which has been established as a clearing house mechanism for implementing the Convention for Thailand.

There is also a need for a research agreement designed as a Memorandum of Understanding between Kew and RFD due to RFD's new regulation on access to genetic resources especially in protected areas. An International Herbarium Techniques course in Thailand should be undertaken, that includes local botanists from the Indo-Chinese region. It will be a first step towards further collaboration and exchange of biological data among Laos, Vietnam, and Thailand which share similar ecosystems.

Funding for these activities will have to be sought from various sources.

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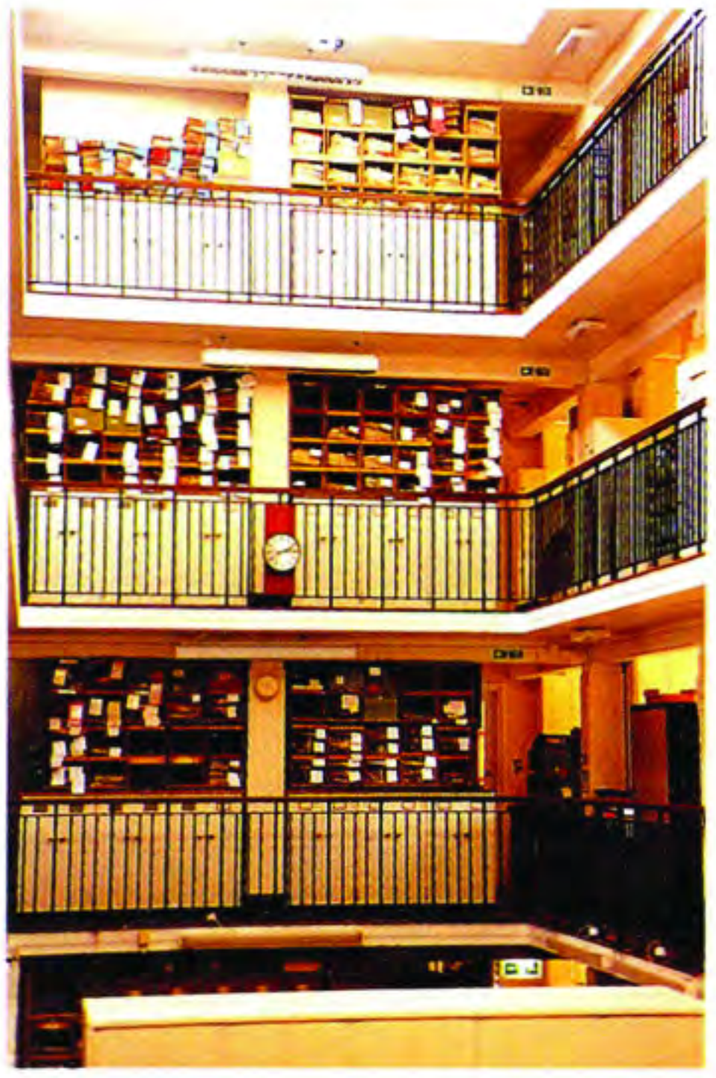
Figure 1. RBG, Kew: The living collections.

a



b

c

d

e

Figure 2. (a) Herbarium building, Kew; (b) Herbarium room, Kew; (c) Specimen cabinet, Kew; (d) Herbarium room, BM; (e) Herbarium building, BKF.

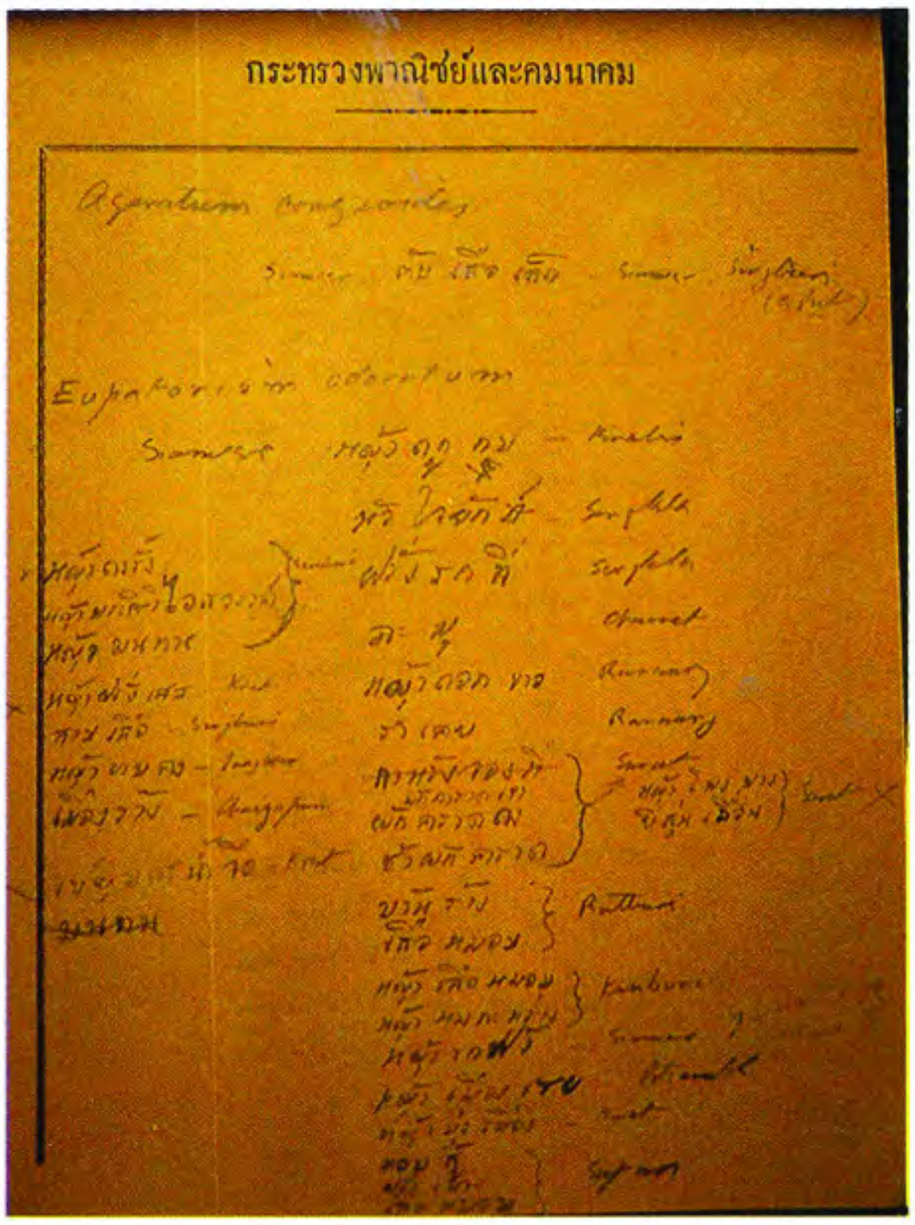


Figure 3. Kerr's Archives.