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BAMBOO AND RATTAN RESOURCES IN SABAH: CONSERVATION STATUS, BIODIVERSITY BASE AND ITS STRATEGIC PROGRAMME

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ABSTRACT. *Bamboo and rattan have been termed as non-wood resources. These resources are the most important after timber in terms of economic importance. In Sabah, the bamboo industry and rattan industry have gained prominence among government and private agencies and have received attention by the scientific community. Scientists at Forest Research Centre, Sandakan and Luasong Forest Center, Tawau have researched on the species from nursery techniques through to silvicultural trials.*

There are several important commercial bamboo and rattan species found in Sabah and mostly being used by the ethnic groups either as furniture, flooring, walls, frames, shingles doors and in other parts of the house. Some of the species can even be found cultivated around their houses and valleys in the village surroundings.

Bamboos are found mainly on hill slopes and along rivers and are commonly found to grow best on slopes at forest margins. Some agencies in Sabah have started to plant them on small scale for their own consumption. Agencies like FELDA usually used them as poles to harvest their oil palm fruits and so on. In the case for rattans, Innoprise Corporation of Yayasan Sabah has planted more than 10000 ha of rattan in their forest area in Luasong. There are other agencies that have planted rattan in the state.

This paper highlights the current status of bamboo and rattan resources in particular its conservation status, complexity of biodiversity base and development of its strategic programmes in Sabah, Malaysia.

KEYWORDS. Rattan, bamboo, plantation, industry, conservation status

INTRODUCTION

Bamboo and rattan resources have been termed as non-wood resources. These resources are the most important commercially after timber in terms of economic importance. Thus, these resources have gained popularity among government and private sectors in the country and have received attention by the researchers around the region as well. In Sabah, researchers at Forest Research Center, Sepilok in Sandakan and at Luasong Forest Center in Tawau have planted and conducted research on the species from nursery techniques through to silviculture trials.

Bamboo has often been termed as the poor man's timber or friend. It has been used in natural occurring areas for construction and other uses such as flooring, walls, frames, shingles, doors and in other parts of the houses. In modern living, bamboo is found as curtains, paneling, picture frames and in a host of other uses. Bamboo shoots are eaten daily in many Asian countries. There are about 1100 bamboo based industries of various sizes in the country. All the industries require supply of raw material obtained from the wild.

Research on rattan has started in late 1970's and to date there are numerous publications, the most prominent being the book 'A guide to the cultivation of rattan'. However, there are still areas that need attention especially on the species that are not being utilized by the industries. There are about 640 mills in the country that utilize rattan from the wild (Aminuddin & Salleh, 1994). As the supply from the wild is getting scarce, steps to plant them on large scale have been started by government and private agencies. Innoprise Corporation of Yayasan Sabah as such for example, has planted more than 11000 ha of rattan in Luasong area in Tawau (David,1999)

This paper highlights the distribution pattern of this resource and its conservation status with particular reference to commercial species in Sabah.

BAMBOO

Bamboos are giant arborescent grasses belonging to the Graminae family and form the tribe Bambuseae of the subfamily Bambusoideae and are found naturally in all continents except Europe. In Peninsular Malaysia, there are about 50 species in 10 genera but only 13 species are being utilized by the industries (Aminuddin, 1995). In Sabah, there are 35 bamboo species in nine genera (Dransfield 1992). All are native or naturalised except *Thyrsostachys* which is introduced from Thailand. They are all well described botanically in Dransfield (1992). Most of the species are found in logged-over forests and along riverine areas fringing the forests. There has never been an inventory resources in Malaysia but in Peninsular Malaysia, it has been estimated to cover a region of about 320000 ha. (Aminuddin & Abd. Latif 1992).

In Sabah, there are several important bamboo species that are widely used viz *Gigantochloa levis* or poring (Wong 1992), *Schizostachyum brachycladum* or wuluh/wuhuh, *S. pilosum* or lampaki. *S. lima* or sumbiling and *Bambusa vulgaris* or tamahang/tamalang (Julius and Christopher 1994). Among these bamboos, poring is very popular and widely cultivated in the valley. Poring is commonly found planted on hill slopes, sometimes side by side with wuluh/wuhuh. The former seems to grow best on slopes at forest margins. Sumbiling/sumbihing and tamalang/tamahang are commonly found growing on river banks.

RATTAN

Rattans are spiny climbing palms that belong to the palm family of the 600 species of rattan found in the world, a total of 194 species of rattans can be found in Malaysia (Dransfield and Manokaran 1994). The taxonomic work of Malaysian rattans are refined and published in three manuals for Peninsular Malaysia, Sabah and Sarawak (Dransfield 1979, 1984, 1992a, 1992b). There are 107 species of rattan found in Peninsular Malaysia, 85 species in Sabah and about 105 species found in Sarawak. Out of these only about 20 species are being used in the industry for making furniture and other byproducts. Rattan has received attention by the researchers in the region. The big diameter cane such as *Calamus manan* in Peninsular Malaysia and *C. subinermis* in Sabah are the primier cane commonly used for making furniture frames. Studies on some of the commercial species started in early 1980's looking into *inter alia* germination, taxonomy and silviculture aspects.

Knowledge on genetic diversity

Very little is known on the genetic diversity of bamboo in Peninsular Malaysia, Sabah and Sarawak. Studies by researchers looking at distribution of some of the *Gigantochloa scortechinii* seems abundant, silvicultural treatment are being imposed so that the stand can be managed on a plantation basis. No work , however, has been done on the genetic diversity and relationships to ploidy levels.

Diminishing forest cover and uncontrolled exploitation have seriously depleted wild populations of rattan flora throughout South-east Asia to a point that some species can be categorized as endangered which means under threat of extinction. Kiew and Dransfield (1987) and Dransfield (1989) have published, based on taxonomic account of Dransfield (1979), list of species under threat and also those of Sabah and Sarawak. This list should give cause for concern as about 35% of the rattan species recorded for Peninsular Malaysia, about 25% of those recorded for Sabah and about 30% of those recorded for Sarawak are thought to be under threat.

Rattan research started to gain momentum in the early 1980's looking mainly at the silvicultural aspects of the most commercially important rattan species. The last two National Forest Inventories conducted by the Forest Department of Malaysia have included the presence or absence of rattan in the cluster sampling plots. This has given us some understanding of the distribution of the commercial rattan species, namely *Calamus Manan, C. caesius, C.scipionum, C.ornatus* and *Korthalsia spp.* (Aminuddin 1990)

Other aspects of study include looking at variation between five seed sources of *C.manan* using nine enzyme systems. There seems to be some variation between the sources (Wickneswari, pers.comm).

Ex-situ conservation

Suitable bamboo species that can be used either for shoot and culm production should be identified and promoted. In Peninsular Malaysia, there were four bamboo species planted in about 20 ha by small holders to propagate shoot production. Besides that, there were some important bamboo species planted in ex-mining areas with intensive management.

Most of the work done has mainly been on the planting of *Calamus manan* either in the forest or in rubber plantation in the country (Aminuddin & Supardi 1991). The Forest Department is planting the species at the rate of 1000 ha per annum in forest or logged-over areas. To date, there are over 15000 ha of rattan planted throughout the country. In the rubber plantation sector, private companies like Guthrie and Syarikat Kurnia Setia have taken the lead in planting large hectarages of rubber areas with *C. manan*. In Sabah, conservation efforts have started with *C.manan* and *C.subinermis.*

In-situ conservation

Work has been started to manage the wild bamboo stand in Chebar Forrest Reserve in Kedah as a plantation. Studies have shown that it is possible to leave behind about 20 culms/clump to about 200 clumps/ha *G. scortechinii* and maintain the number so that the production is continuous. There were about 2500 ha of area that is covered by the species. The State Forest Department has ventured into the project by providing manpower and other logistic supply.

In-situ conservation measures can only be conducted in areas where there are abundant rattan species. This step can be made through various virgin jungle reserves that are found in the country. Planting in such areas like the Sungei Puyu Forest Reserve in Kuala Lipis is one example of *in-situ* conservation method done by FRIM with the assistance of the Forest Department.

Knowledge on hybridization

No studies on bamboo and rattan have been reported on this subject.

Understanding pattern of variation

Very little is known on the reproductive behaviour of bamboo as most sympodial bamboo species have long flowering cycles, i.e 40-60 years. As seed is scarce, regeneration using material from seed is very limited. Variations between and within species also exist. Wickneswari *et al* .(1994) have examined the intra-and inter-clump electrophoretic variation in *G. scortechinii* and found that there is some inter-clump variation using three enzymes (alcohol dehydrogenase, glucose phosphate isomerase and uridine diphosphogliconate). Inter- and intra-clump variations were observed in malic enzyme.

In order to conserve *G. scortechinii*, improved planting material is needed. Generally, seed derived from bamboo populations after gregarious flowering possess a good deal of genetic variation as a result of out crossing segregation and recombination (Wickneswari *et al.* 1994). Therefore, genetic improvement through selection must be carried out. The occurrence of somatic mutations can provide material for selection and genetic improvement of the species. More suitable sampling strategies should be designed for future selection of the material.

Reproductive behaviour of the important rattan species is being studied. It takes about eight month from flowering to fruiting for *C. manan.* Other species have yet to be studied in detail. Only *C. subinermis* in Sabah have been studied but no details were given. Regeneration is mainly through seed. Variation within population exists in *C. manan* and *C. subinermis* and this is cause for concern as there seems to be variation in the genetic diversity (Bon *et al.* 1994). Further work on the selection of the genetic material should be conducted so that a much improved material could be obtained. From the studies by Bon *et al* . (1994), it is interesting to note that the genetic distances among populations of *C. subinermis* are higher than they are between population of *C. manan* . This observation is localized and cannot be generalized as the whole natural range of *C. manan* has not yet been surveyed.

Selection

The criteria used in tree breeding program should be used and modified to suit the selection in bamboo. The growth performance of the species in a particular area should be one of the factors considered. For example in Tapah, Perak, *Bambusa vulgaris*, which is widely found and commonly used for making vegetable baskets should be evaluated and described as suitable to the area.

Most of the planting materials produced come from vegetative propagation by means of culm and branch cutting and rhizome. Some can be marcotted using culms nodes (Azmy 1992). Before these materials are produced, selection of the parent material must be conducted to ensure a good planting stock. Hence, vegetative propagation techniques can help in mass production of materials for plantation establishment. Selection at seedling stage is therefore least done.

Selection in tissue culture is a possible solution in order to overcome the short supply of good planting material . Several studies as quoted by Aziah and Darus (1994) show that it can be done using the shoot proliferation method. Nodal segments were used as initial explants.

Provenance trials on some ' elite' species with specific uses should be carried out. For example, *Dendrocalamus asper* should be propagated as the shoot can be consumed as vegetable.

As mentioned above, the criteria used in tree breeding program should be used and modified to suit the selection in rattan. The growth performance of the species (in terms of stem elongation and diameter growth) in a particular area should be one of the factors considered. As the male to female ratio of rattan species is very high (about 4:1), selection must consider having the same number of ratios with good growth rate. Selection at seedling stage is therefore not done.

Selection in tissue culture is a possible solution to overcome the shortage in supply of good planting material. Several studies have shown that tissue culture techniques can produce a large amount of plantlets. Aziah(1993) showed that it can be done using somatic embryogenesis via callus formation using embryo as initial explants, somatic embryogenesis using young leaf of field grown material, adventitious shoot formation using collar region of *in vitro* germinated seedling as original plants and adventitious shoots formation using apex of field-grown material. Provenance trials on some 'elite' species should also be carried out.

Strategies for development of "cultivars"

Explants from juvenile material such as from embryos or seedlings are more responsive and produce larger number of plantlets in comparison with explants from mature trees. This therefore should be one of the strategies. Another production method is to use somatic embryos. Studies by Rao *et al.* (1988) showed that *Dendrocalamus strictus* and *Bambusa arundinacea* can be produced from zygotic embryos and seedling materials. Further work needs to be carried out so as to induce callus formation in nodal segments from mature plants. These can be further induced to form somatic embryos which will eventually produce plantlets.

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The fact that most of the studied populations of *C.manan* have been collected in plantations and not in natural forests may for explain their high level of breeding. Therefore, more population with larger sample size have to be studied before a complete picture of genetic diversity of any species of rattan can be given.

CONCLUSION

From the above discussion, there are still a lot of work needs to be done especially on the genetic diversity and its relationships to ploidy levels, ex-situ and in-situ conservation work and to understand the pattern of variation in bamboo and rattans in Sabah.

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