



Botanical
Survey
of India

ENVIS
(Environment Information Systems)

NEWS LETTER

EDITORIAL

The ENVIS Newsletter is now ready with its second issue. In every issue there will be 2 sections, one dealing with the wetlands and other with rare and endangered plants.

A general account of wetlands in our country has already been given in the previous issue. Like any other natural resource, wetlands today are fast diminishing due to constant encroachment of human activities. However, only a few people are aware of the usefulness of various plants of Wetlands. All such plants of economic importance will be dealt in the ENVIS Newsletter. In the present issue, information on Shola (Wood of *Aeschynomene aspera*), Makhana (seed of *Euryale ferox*) and wild rice is given.

In the section dealing with rare and endangered plants, three plants which have become rare due to extensive trade and one which has become endangered and is on the verge of extinction have been reviewed. The ENVIS Centre of B.S.I. is recently engaged in data base on endangered plant species, coastal plant diversity, mangrove vegetation and industrial utilisation of common aquatic plants. It has recently installed Local Area Network (LAN) system in the Windows environment for multiple search operation of the data base which will make it easy to retrieve specific information needed. The abstracted information in the form of computer printouts or in computer diskettes in "word star" format for easy retrieval through P.C. may be available in the centre.

I wish all success to this project.

(P. K. Hajra)

Place : Calcutta Director
Date : Sept., 1995 Botanical Survey of India



Release of Flora of Madhya Pradesh by his Excellency Moh. Shafi Qureshi, Governor of M.P. at Raj Bhawan, Bhopal. Shri B.P. Singh, Additional Secretary, Ministry of Environment & Forests, Govt. of India is seen on the left.

The Shola or Pith Plant

L.K. Banerjee, S.K. Basu and D. Ghosh
Botanical Survey of India

The 'Shola' plant *Aeschynomene aspera* L. is well-known in India. The pith is very light, spotlessly white, extremely flexible and long lasting with excellent insulating property. These qualities of 'Shola' pith have been thoroughly exploited and it is being used to make fishing floats, sun hats, toys and other handicrafts since long. In West Bengal, a separate community - 'The Malakar' are professionally collecting 'Shola' pith and preparing attractive jewellery out of it. This is

used for decorating idols of Goddess Durga and other Gods and Goddesses.

The genus *Aeschynomene* belonging to the family Fabaceae comprises about 150 species in tropical regions of both the hemispheres. In India, it is represented by 3 species namely *A. aspera* L. ('Phul Shola') *A. indica* L. ('Kat Shola') and *A. americana* L. ('Dhani Shola'). The three species can be distinguished from each other with the help of following characters given in the table :

NAME	CHARACTERS			
	STEM	LEAFLETS	STIPULES	PODS
<i>A. aspera</i> (Phul Shola')	glabrous to moderately hispid; pith soft	1-nerved, 1-1.5 mm wide; linear-oblong	25 mm long	8-10 cm long; straight; echinulate
<i>A. indica</i> (Kat Shola')	glabrous to moderately hispid; pith hard	1-nerved 2-2.5 mm wide; elliptic, oblong	up to 15 mm long	2.5-4.5 cm long; straight or slightly curved
<i>A. americana</i> (Dhani Shola')	glandular hispid; pith moderately soft	2-5 nerved falcate	10-25 mm long	2-2.5 cm long; falcate, hispidulous

Among these 3 species most significant commercial value of 'Pith Shola' is obtained from *A. aspera* L. which is distributed in

Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, Maharashtra, Karnataka, Tamilnadu and Kerala. In West Bengal, it is largely

aquatic shrub, 2-3 m in height, erect or sometimes suffrutescent; stem glabrous, stout, full of white light pith; stipules appendiculate, about 2.5 cm long; leaves 8-17 cm long, sensitive, 60-100 foliolates, petiole and rachis sparsely hispidulous, leaflets linear-oblong, 5-10 mm long, subequal, apiculate at apex. Flowers yellowish, arranged in 2-4 flowered axillary corymbose racemes; peduncles and pedicels hispid; bracts 2.5-3 mm long, ovate, acute; bracteoles 2, broadly ovate, acute; calyx bilabiate, hispid; petals yellow, partly pubescent; standard broadly spathulate, the keel petals 1.5-2 cm long, hairy outside. Pods woody, 8-10 x 0.5 - 0.9 cm, nearly straight, jointed, often indented on both sutures, joints 4-8, echinulate or smooth; seeds reniform, black, about 7 mm long. Flowers and fruits from August to November.



Harvesting of *Aeschynomene aspera* from natural habitat

India, Bangladesh, Sri Lanka, Myanmar, Malaysia and Indonesia. In India, it is found along the margins of fresh water swamps, rice fields, tanks, jheels, bils and lakes in the greater parts of West Bengal, Assam, Bihar, Orissa,

distributed in South and North 24-Parganas, Howrah, Hooghly, Midnapur and Bankura Districts.

Aeschynomene aspera L. was described by Linnaeus based on a collection of P. Hermann. In Sri Lanka it is a perennial

There is no systematic method of cultivation of this species. The swollen and robust stems are collected during the

months of September to December. These are cut into bits of about 1 metre and dried, the unused upper portion of the stems along with the ripening pods are usually thrown in the same water

plant is used to adorn the hindu bride and bridegroom's heads in the form of intricate design. Other ornamented articles are being made for use in the marriage and other religious ceremo-

extensively used for making different types of toys, artificial flowers, ear tops etc. Fisherman uses the light cork like stems to make floats for their nets as well as small rafts to stand upon while casting nets in deep water. Sometimes, thin fibres are obtained from yellowish grey bark. In Assam, it is even woven into sleeping mats, locally known as 'Kats'. It is also used for making bottle corks, swimming jackets, lifebelts and paper. Due to high moisture absorbing property, pith is used as a substitute for surgical lint, specially in dilating the narrow opening of sinuses and abscesses. The Pith absorbs the moisture of ulcerated tissues, swells up and enlarges the opening. In West Bengal, about 10,000 people are engaged in making sola craft which have a great demand in foreign markets.



Marketin_g of 'Shola sticks'

body where they float until the seeds are self-sown. The seeds germinate during dry season when the lands are not submerged under water. Sometimes, new shoots also develop from the cutstumps.

Chemically, the pith is composed of lignocellulose devoid of free aldehyde groups which shows a close resemblance to the cellulose by colour reaction. In air dry condition, the 'Shola' retains 8.6% moisture. The minerals like Calcium, Phosphorous, some free Nitrogen along with crude protein and crude fibre are the main constituent of the plant. The seeds contain yellow brown oil and some fatty acids.

nies, common in West Bengal. In each and every religious and ceremonial function, the white pith is used for making different types of ornamental and decorating materials. It is also utilized as the lining to the more highly ornate 'Tazeyas' during Mohurram, a Muslim festival. The pith is

Socio-economic aspect of 'Shola Plant' in West Bengal

Natural habitats of 'Shola Plant' spread over mostly in North 24-Paraganas, Barasat, Basirhat, Hashnabad, Potuakhali, Bongaon etc. and some parts of South 24-Paraganas, Midnapur, Howrah

Due to high insulating property of very light and spongy pith, it is largely used in the manufacture of sun hats for protection against the tropical sun. The pure white pith of 'Shola'



A Craftsman at work with 'Shola'

and Hooghly Districts. It grows well in sandy, loamy soils submerged or inundated regularly by

from each piece, the thin bark is removed and very thin white 'Shola' crape sheets are taken

tion of 'Shola' crape sheet, the basic material of 'Shola' industry.

It is estimated that a 'Shola' crape sheet costing about 5-6 rupees may produce the finished decorating material which costs about Rs.200/- to Rs.300/-. In West Bengal, it is estimated that near about 10,000 people are making different types of 'Shola' materials throughout the season and 100 people take just one month to make different decorating materials from one truck load (1200-1400 bundles) of 'Shola'. Therefore to involve 10,000 people in 'Shola' industry, the raw materials will be needed 100 truck load of 'Shola' (1,40,000 bundles). However, at present, the demand of the raw material is not sufficient for 10,000 'Shola' workers of West Bengal due to acute shortage of 'Shola' plant. The collected data from Calcutta market reveal that yearly 4 to 5



Decorative articles made from 'Shola'

fresh water. Commercially, good quality 'Shola' is obtained from the plants which remain submerged up to 3 metres depth in water. It is found that the luxuriant growth of 'Shola' depends upon the quality of the water and grows well in eutrophicated waterbodies. The 'Shola' collectors from the above mentioned districts bring the raw materials in bundles for selling on Mondays and Fridays at Salt Lake Market, Calcutta. The sellers make bundles of shola consisting of 15-20 stems. Each bundle is sold for 5-6 rupees. 'Shola' buyers from different parts of West Bengal mainly from Maheshpur, Pukuri, Gokulnagar, Mandir Bazar, Banshberia, Moufali, Ballavpur, Atpara, Kalikapur, Dhananjoypur, Jagadishpur, Ramnathpur, Chaitanyapur, Ratneshwarpur of Diamond Harbour subdivision purchase them during September to November. A truck load consisting of 1200-1400 bundles costs about Rs.6000/-. About a metre long 'Shola' stems are cut into 12-15cm long pieces and then

out with the help of a special knife. The thinness and polish of the 'Shola' crape sheet depends on individual skill. 20 'Shola' crape sheets are again packed into a



Decorative articles made from 'Shola'.

bundle. Each bundle costs about Rs. 100/- to Rs.-150/-. The village Maheshpur is the lone supplier of this important 'Shola' crape sheet throughout India. Out of 1,050 people, 1,000 people of this village are involved in the produc-

crores of foreign exchange is earned through shola crafts.

Considering the economic value of 'Shola', craft and large scale degradation of natural wetlands through reclamation due to population pressures, the Govt.

of West Bengal should take some urgent conservation measures for protection of 'Shola' fields in different parts of West Bengal. It is already observed that due to constrained habitat factors and excessive pisciculture practices 'Shola' population in West Bengal is reduced from 60% to 15% in original wetland area of West

Bengal. Since it is one of the most essential raw materials for cottage industry, urgent steps are to be taken for conservation and management of native population of 'Shola' plant.

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Euryale ferox Salisbury - the prickly Waterlily of the East

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It is a stemless, rhizomatous, annual aquatic herb belonging to Waterlily family, Nymphaeaceae. The whole plant including leaf, petiole, peduncle, flower and fruit, is densely prickly. The flowers which open by day and remain partially submerged, are about 5 cm in diameter, pinkish violet in colour and ripens into 8 - 20 seeded globular berry 4 - 10 cm across. The juvenile leaves may be submerged or floating, membranous and highly polymorphic and are quite different in appearance from mature leaves. The mature leaves are thick, orbicular and centrally peltate, bullet-papillate and dark green above, purple beneath, float upon water surface and often reach a diameter of 1 metre or more. These leaves are supported beneath by dichotomously branched, radiating (from petiole base) spongy, interlacing ribs which are structurally more akin to rafters and reminiscent of Gothic architecture.

Because of the enormity of leaf size, this curious looking plant was once considered as the

Asiatic representative of the Giant Waterlily of Amazon, the *Victoria amazonica* (Poepp.) Sowerby from which it, however, differs primarily in having all the stamens fertile (in *Victoria* the leaves are conspicuously upturned along margin, the flowers are much bigger and without prickles, and



Euryale ferox in the Indian Botanic Garden, Shibpur, Howrah

the inner stamens are sterile).

Salisbury, the British Botanist first provided the description of the plant in modern botany and named it *Euryale ferox* (in Koenig & Sims ed. *Annals of Botany* 2:73, 1805), the type of which has been conserved in Banks Herbarium in British Museum (BM). The generic name was

taken from *Euryale*, the second of the three Greek mythological Gorgons - the monster sisters, daughters of the Sea God, Phorcys. The specific epithet 'ferox' means ferocious.

It thus appears that both the generic name and specific epithet were coined in allusion to the terrifying look of the plant especially when it is with the partially unfolded fiercely spinous leaves. The plant has been very nicely depicted in Curtis' *Botanical Magazine* 35: t. 1447. 1812 and Roxburgh's *plants of the Coast of Coro-mandal* 3: t. 244. 1815. There is also a good place of the plant under the replaced name,

Annesia spinosa Roxburgh ex Andrews in *Botanist's Repository* 10: t. 618. 1811.

Euryale ferox, the only species of the genus occurs in fresh water tanks, wheels, beels and lakes in India, Bangladesh, Japan, Taiwan, China and Ussuri in Russia. Its fossils were reported from Pliocene and later deposits

in Europe. In many of these countries the plant is also cultivated for the starchy edible seeds which are considered wholesome. The history of its cultivation ap-

delicacy especially in North India. The seeds contain 76.9% of carbohydrates and 9.7% of protein besides other minor elements.



Cultivation of *Euryale ferox* in Saharsha District, Bihar

pears to be very old and perhaps dated back to prehistoric era. In Chinese literature, it has been claimed to be known there in cultivation even before 1000 B.C. In India it is known from Rajasthan, Kashmir, Uttar Pradesh, Bihar, Orissa, West Bengal, Assam, Meghalaya, Manipore and Tripura. It is however, in Brahmaputra and Barak Vallies and the adjoining regions of Assam, the plant grows more freely and luxuriantly in a truly wild state. The growth is so dense in some of these places that at times, it becomes difficult to force even small boats through it.

The plant, more precisely the edible seeds are known as Makhana in Assam, Bengal, Bihar and Uttar Pradesh and as Jubar or Jewar in Kashmir and Punjab. The seeds are made into flour or popped by roasting in sand and then used for making sweer dishes or even taken as snacks on frying and all these preparations are considered a

Makhana is usually sold in market in edible popped form. The main supply of this highly priced commodity comes from Darbhanga district of North Bihar. It is extensively cultivated in age old perennial shallow water bodies having a thick layer of silt. In fact, cultivation of Makhana is the main source of income of the fisherman community who in addition earn a little more from the sale of fishes after the crop is harvested. Of late, integrated aquaculture of Makhana with air breathing fishes have been recommended to derive more income from the crop.

Makhan is practically a self-sown seasonal crop. Fruits mature and bursts open between September and December and seeds drop to the pond bed. The plants are then uprooted and removed as far as possible to facilitate collection of seeds from the pond bed. With the onset of winter, remaining plants also die away. From February onwards, the seeds left over on the pond

bed (and those broadcasted subsequently) start germinating. *Nymphula crisonalis* larva, which attacks only juvenile leaves during early stages of growth appears to be the only pest of this crop. With the gradual appearance of thick and strongly venose mature leaves in about one and half months time the pest, however, disappears from the plant. As in this method of cultivation, practically no inputs are involved, the cost of production is meagre and limited to labour expenses involved in thinning out of overgrowth, transplanting into sparse areas and harvesting of sparsed seeds. According to a report published in 1972, 5 - 6 quintals seeds are usually collected from one acre cultivation which after processing into edible form amount to one third of the produce. With the then price of edible popped seeds being around Rs. 10 per kg., the sale of the produce would exceed Rs. 1500 per acre.

On an average 200 quintals of edible Makhana seeds are annually transported from the area after meeting the local demand. Processing of Makhana in to edible form, which is the primary occupation of the womanfolk of the area, has now become a cottage industry and is thus intricately linked with its rural economy.

Therefore, conservation of genetic variability in this wetland species, its improvement and introduction to newer areas need further attention.

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Rice is one among the most important cultivated crops of the world belonging to the grass genus *Oryza* L. It has two cultivated species namely *Oryza sativa* L. and *Oryza glaberrima* Steud. The former is the most common one whereas the latter is grown only in Africa, that too on a very small scale. Both these have originated directly from their wild ancestors. There is a lot of conjecture on the centre where and the time when the domestication of wild rice took place. Some authors believe that this process started independently in Africa, South and Southeast Asia and China (Duistermaat 1987). Archaeological evidence suggests that rice used to be cultivated in India even more than 3500 y B.P., whereas in South China it was known to be cultivated around 5000 y. B.P. The presence of the large number of wild rice species in India indicates that our country is one of the important primary centres of origin of cultivated rice from its wild progenitors.

Taxonomy of wild rice is a bewildering subject. There seems to be no unanimity of opinion among the various specialists in this regard. One of the reasons for this confusion is the polymorphic nature of the cultivated rice. More than 7000 different indigenous cultivars of it are known from India itself. These show all conceivable types of variations. This alongwith the fact that different cultigens of rice at time are found as escapes of naturalized populations, makes it

extremely difficult to assign proper taxonomic status to their closely related wild species. Thus Duistermaat (1987) considers *Oryza nivara* Sharma & Shastry, a very important wild rice discovered from Madhy Pradesh, to be only a naturalized form of *Oryza sativa* L. Another Indian species *Oryza malampuzhaensis* Krishnasw. & Chandras. is variously treated as a species, or a subspecies or tetraploid form of *O. officinalis* Wall. ex Watt by various authors. Even the recently described *O. indandamanica* Ellis is at times treated as a known variety of *O. meyeriana* (Zoll. & Mor.) Baill. Ellis [in J. Econ. Tax. Bot. 18(1): 245-246. 1994] after examining the type material of the latter gives additional differences between the two to substantiate his claim to a distinct status for this species. The rice genus *Oryza* L. according to one estimate has about 20 species in the world of which about 6 to 7 are known to occur in our country.

Oryza rufipogon Griff. found in swampy places along the sides of rice fields and other similar wet places is the most common wild rice of India. It is also widely distributed throughout the tropics and subtropics of Asia, America and Northern Australia. This species is very similar to the cultivated rice and can be separated from it with some difficulty mainly by the deciduous nature of its grains and also by the stout reddish awns. Cultivated rice hybridizes freely with

it. Some authors think that the red coloured rices of India might have evolved from this.

Grains of *Oryza rufipogon* Griff. are harvested in Madhya Pradesh and used as food during fasting days. *Oryza coarctata* Roxb. (Tateoka, 1965 treats it under a new genus *Porteresia*) grains are said to be edible. Grains of *Oryza meyeriana* (Zoll. & Mor.) Baill. var. *granulata* (Watt) Duistermaat, has a very good flavour. Most of these wild rices form very good fodder for cattle. The most important economic use of them, however, is their potential utility in breeding programmes. Recent works and ongoing efforts are progressing in this direction in most of the leading rice research institutes of the World. Attention in these lines has assumed more importance these days because almost full utilization of the variability within the cultivated rices for improvement work has already been undertaken. Detection of appropriate genes from the wild rices and incorporation of them into the high yielding varieties have already proved successful in some cases. Thus genes from a strain of *Oryza nivara* Sharma & Shastry collected from the eastern Uttar Pradesh during 1963 were successfully incorporated into the cultivated rices by the international Rice Research Institute, Philippines and created new cultivars that provided resistance to the deadly grassy stunt virus and blast diseases. This all important discovery has saved the rice

crops of more than 11 million hectares in Southeast Asia from total destruction. Similarly *Oryza officinalis* Wall. ex Watt contains genes producing characters making it resistant to insects like Brown plant hopper, White plant hopper and Green leaf hopper. The Central Rice Research Institute, Cuttack has identified a strain of *Oryza longistaminata* that is immune to bacterial blight (Devadath, 1983). *Oryza rufipogon* Griff. may contribute genes for adaptation to the stagnant flooding and resistance to bacterial blight. Wild species have also provided a source of CMS lines for hybrid rice production in China (Lin & Yuen, 1980).

Many of the wild rices are under great environmental stresses. Most of these species occur in some of the densely

populated areas and are thus highly exposed to anthropogenic disturbances. Habitats of these species are being converted to cultivated fields, building sites etc. Sharma (1983) points out that as the cultivation of rice is becoming more and more proximal to the habitats of the wild ones, these species are gradually losing their genetic identity due to the swamping of genes from *Oryza sativa* L. Species of *Oryza malampuzhaensis* Krishnasw. & Chandras. Occurring in moist shaded areas of forest fringes are also endangered due to habitat destruction. Conservation of these plants and their habitats and the collection and maintenance of the gene diversity of various wild rices for future crop improvement work are urgent necessities that cannot be delayed.

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Notes on *Aquilaria malaccensis*, *Pterocarpus santalinus* and *Taxus wallichiana* of Appendix II of CITES

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India, by virtue of a wide spectrum of diverse favourable factors is blessed with immense plant genetic resources and as such designated as one of the megabiodiversity countries of the World. But this valuable wealth is now on the threshold of degradation. Out of 15,000 + flowering plants so far recorded from this country, about 10% is estimated to belong under the rare, endangered or threatened category. There are several factors that affect the biodiversity of a country and now-a-days increasing national and international attention is being

paid to protect or minimise the loss of this valuable wealth. One of the factors relating to the massive decline of population of many species in the wild is the unregulated use and/or trade of valuable and potential resources. The convention on international trade in endangered species of wild fauna and flora - CITES, an international treaty, regulates the export, re-export and import of live and dead animals and plants and parts and derivatives thereof. The convention signed on 3rd March 1973 at Washington (U.S.A.) and entered into force after the tenth ratification on 1st

July 1975 while date of accession of India is 18th October 1976. At present, there are 128 member countries (parties) under the CITES.

Three appendices are framed by the convention which include the list of animals and plants subject to different degree of regulations. Appendix I includes species threatened with extinction and for which trade must be subject to strict regulation (authorised only in exceptional circumstances). Appendix II includes species which are not necessarily now threatened with

extinction but may become so unless trade is strictly regulated. Appendix III includes species subject to regulation within the jurisdiction of the party.

Plant species from India which have been already included in the Appendix I of CITES :

<i>Cycas beddomei</i> Dyer	(Beddome cycad)
<i>Nepenthes khasiana</i> Hook.f.	(Pitcher plant)
<i>Paphiopedilum</i> spp.	(Lady's slipper orchids)
<i>Renanthera imschootiana</i> Rolfe	(Red Vanda)
<i>Saussurea costus</i> (Falc.) Lipschitz	(Kut or Kuth)
<i>Vanda coerulea</i> Griff.	(Blue Vanda)

In the Ninth Meeting of the Conference of Parties, held in Fort Lauderdale(U.S.A.), 7-18 November, 1994, the following three important Indian plants have been approved for inclusion in Appendix II of CITES :

Aquilaria malaccensis Lamk. (*Aquilania agallocha* Roxb.) of the family Thymelaeaceae, known as 'Agar-Wood or Eagle Wood' has got high potential trade impact for its fungal infested wood found deep within the trunk producing an oleoresin, from which the valuable commercial incense 'Agar, Agarú or Agru' is obtained. It is a slow growing species distributed in India, Bangladesh and Malesia. In India, it occurs mostly in evergreen forests along the foot hills of north-eastern region(ca.1,000 m).

The quantity and quality of oleoresin depend on the age of the plant and the degree of infection. But, unfortunately, indiscriminate felling of trees sometimes the young and even uninfested ones makes this species vulnerable in the wild. In the year 1990-91, an amount of ca.4,32,370 Kg of 'Agar-Wood' valued at Rs.62,23,447 was exported from India to different countries all over the world. The infested part usually remain to a very very smaller part of the trunk and as such, the destruction frequency of the plant in wild can be easily assessed by this huge amount of 'Agar-Wood' collection from exploitation of infested trees, where chances of felling of more number of young and uninfested member of the population can not be ignored.

The fungal infested heart wood is hard, strong, heavy and

odoriferous while the normal uninfested wood is soft, elastic, light, white or yellowish white in colour, non-odoriferous and can be split easily. The fungal infested heart wood is again graded into 4 categories : Grade I known as 'Black or true Agar' in trade, the colour of which resembles black stone; Grade II known as 'batang' in trade and the colour of wood is brown to deep brown; Grade III has characteristic light brown in colour with yellow streaks and is known as 'Bhuta or Phuta' in trade and the Grade IV, the lowest grade is light and mild odoriferous known as 'Dhun' in trade. The Wood extract commonly known as 'Agar oil' also directly influenced by the intensity of infection and possesses characteristic golden-brown to yellowish-brown colour, balsamic odour and pleasant aroma.

They are large evergreen trees, about 18-25(-40) m high and 1.5-2.5 m in girth, usually straight and often fluted, younger parts silky. Leaves 5-10 m long and 2-5 cm broad. Flowers are white, silky hairy outside and densely villous inside. Fruits (capsules) are 3.5-5 cm long and densely hairy.

Ding Hou (Blumea 12:286. 1964) did not recognise *Aquilaria agallocha*



Aquilaria malaccensis

Roxb. distributed in North-eastern India as a separate species and merge it to *A. malaccensis* Lamk. Examination of Indian as well as Malesian specimens housed at the Central National Herbarium (CAL) reveal that the Indian material identified as *A. agallocha* Roxb. are taxonomically different (leaves, texture, shape & size of fruits and indumentum) from those of the Malesian specimens identified as *A. malaccensis* Lamk. The critical study may establish them as two distinct species and not one and the same as proposed by Ding Hou(1964).

***Pterocarpus santalinus* Linn.** f.(Fabaceae) - The red sanders, commonly known as 'Rakta-chandan' has high potential market for its timber. They are very strong, durable and takes a good polish. They are mainly used for the high prized furniture, musical instruments, etc. The wood contain a colouring matter 'Santalin' used in pharmaceutical, food and dye industry. The species is distributed in the dry hills or rocky areas of the Peninsular India, mainly in Andhra Pradesh, Karnataka and Tamil Nadu and sporadically in other states at altitudes 150—900 m.

The level of export had increased significantly since 1976 and its over-exploitation caused a sudden decline of the wild population of this slow growing species. In spite of some prohibitory measures for export, large quantities of red sandar wood chips (1988/89 : 135.4 tonnes; 1989/90 : 144.576 tonnes; 1990/91 : 23.7 tonnes; 1991/92 : 36.191 tonnes; 1992/93 : 56.8 tonnes) & powder (1990/91 : 56.41 tonnes; 1992/93 : 56.8 tonnes) have been exported from

India for extraction of dye, medicines and cosmetics.

The trees attain a height of 10-11 m and a girth of ca.1.5 m with blackish brown bark flaking into rectangular plates. Leaves imparipinnate, leaflets 3-5. Flowers yellow. Fruits (pods) ca. 5 cm in diameter including wing. Seeds reddish brown, smooth, leathery.

The sapwood is white. Heart-wood claret-purple, purplish black to almost black in colour, interlocked grained, fine textured, extremely hard and heavy (sp. gr.1.109; Wt.1.105 kg/cu-m). The colouring matter 'Santalin' imparts

Andaman and also cultivated in different parts of mainland India also possesses the red pigment in wood (Santalin) as those of *Pterocarpus santalinus*. The heart wood of 'Padauk' are light yellowish pink to reddish with dark lines and are used for big and heavy ornamental and decorative carpentry such as, billiard tables, piano cases, etc. because of its large size of logs which often attain a girth of ca.5.5 meter.

***Taxus wallichiana* Zucc.** (Taxaceae) - The 'Himalayan Yew' found in the evergreen and coniferous forests of India, Nepal,

Bhutan, Myanmar, Afghanistan and Pakistan. In India, it grows along the Himalayas and mostly found in the North-eastern region of the country (1500-3000 m). The young shoot and leaves of the plant had been medicinally used since long. But in recent times with the isolation of 'taxol' - a potential drug shown to be



Taxus wallichiana

a blood-red colour with alcohol, yellow with ether, violet with ammonia and other alkalis and is insoluble in water. The 'Andaman red wood - padauk' (*Pterocarpus dalbergioides*) sparingly found in

highly effective for the treatment of ovarian and breast cancer from the bark of the Pacific Yew tree found in N. America, there has been large scale demand for the plant and to meet this greater

demand, the global trade has been shifted towards the Himalayan Yew. Moreover, 'Dabur'- the Indian Pharmaceutical Company also marketed 'taxol' mainly extracted from leaves. Because of this unprecedented demand of the Himalayan Yew as a raw material for the production of the wonder drug 'taxol' and for related cancerous research in the laboratory, there has been large scale destruction of the *Taxus wallichiana* forest in the Himalayas and as a result, the species is now at a greater risk. In the year 1992, more than 48,375 kg of Birmi leaves have been exported from India. A recent report says during the period 13.4.94 to 13.5.94 (only one month), ca.170,710 kg of Birmi leaves have been transported to Tezpur town through forest check post at Charduar. Considering the over-exploitation, the Indian delegation called for the immediate protection and proposed its inclusion in Appendix II of CITES for regulation of the international trade. The proposal has been accepted excluding the export of drug and derivatives.

They are large, evergreen trees attaining ca. 30 m high and 1.5-1.8 m in girth with spreading branches. Leaves distichous, falcate (sickle shaped) with recurved margin, shining green above and paler beneath. Flowers usually dioecious; strobile stalked, globose, arise from the axil of leaves. Seeds borne in a scarlet fleshy cup.

Taxus wallichiana Zucc. was formerly recorded in old Indian Floras as *T. baccata* L. Though both the species are taxonomically very close, but *T. wallichiana* can be easily distinguished by their narrow leaves and larger cones.

Cypripedium tibeticum King ex Rolf. from valley of flowers, Garhwal Himalayas: A hope against hope for conservationists

M.S. Mondal

Botanical Survey of India

Cypripedium tibeticum King ex Rolf. a rare and endangered orchid was so far reported in India from Sikkim Himalayas only at the altitude of 3300m until and unless Mahapatra and others reported it from a pocket in the Valley of Flowers in the year 1992.

bear huge tiny seeds. World distribution of *Cypripedium tibeticum* King ex Rolf., is restricted to India (Sikkim), Bhutan and S.E. Tibet and China. Kataki (1984) designated this orchid as threatened for it's drastic depletion due to habitat destructions. It is apparent that the species being an anemochory,



Cypripedium tibeticum - A lady's slipper orchid

A very good population (ca.150 plants) of this orchid was found in the spot covering @15 sq. meter area with the association at *Viola*, *Potentilla*, *Fritillaria*, *Anemone* and *Caltha* etc. Another orchid species though not found in that particular pocket but common in the surrounding area was *Dactylorhiza hatagirea* (D. Don) Soo.

An analysis over the fact :

The Orchidaceae belong to the group 'Microspermae' meaning

the seeds from Tibet, the nearest habitat, reached the Valley by wind. The seeds got the favourable microclimate in that particular pocket with undisturbed virgin land and plant associations, germinated and multiply by seeds as well as by fleshy rhizomes.

Uniqueness within the plant itself :

Orchids, we know generally have pollinia i.e. pollen grains carried together within a membranous sac but this plant

attains uniqueness in the process of natural selection that it produces free pollen grains having very much chances of fertilization and seed formation ultimately securing its existence in the earth.

Conservation-the only way:

From the above fact it can be concluded that the plants have a capacity of its natural selection and multiplication - the only thing they require is the undisturbed natural habitat. Habitat fragmentation is an important cause for the wipe-out of numerous gene pools leading to the loss of genetic diversity. Habitat erosion

is directly proportionate to the erosion in the plant diversity and the loss is basically irreversible.

The only way to avert a mass extinction and to save genetic diversity is the 'CONSERVATION' - our evolutionary responsibility.

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Mahapatra, Sandhya, A. Ghorai and M.S. Mondal. *Cypripedium tibeticum* King ex Rolf. A new distributional record from Valley of Flowers (Garhwal Himalayas). *J.Econ. Tax. Bot.* 16(3) 575-567. 1992.

Wadhwa, B.M., R.R. Rao and P.K. Hajra. Botany of the Valley of Flowers, National Park and its environs. *Bull. Bot. Surv. India*. 1987.

Kumar, Satish and K.S. Manilal. A Catalogue of Indian Orchids, 1994, Bishen Singh & Mahendra Pal Singh, Dehradun.

Recent Prime Activities

Establishment of Environmental Park in Bhutan :

Director, B.S.I. and Additional Director, MOEF, were deputed to Bhutan, in connection with the setting up of an Environmental Park, as a part of technical co-operation programme. Both of them visited Bhutan from 12th to 22nd Sept., 1994 and prepared a project document and submitted to the MOEF, for further necessary action.

Workshop on Project Elephant:

Director, B.S.I. deputed Deputy Director, I.S.I.M. to attend the Eastern Regional Workshop on Project Elephant held at Kharagpur from 6th to 7th Oct., 1994.

Convention on International Trade in Endangered Species of Wild Flora and Fauna:

Director, B.S.I. participated in the 9th Conference of Parties Meeting held at Fort Lauderdale, Florida, U.S.A. from 4th to 22nd Oct., 1994.

AICRP on Ethnobiology:

Financial assistance for the above mentioned project was sanctioned by the MOEF, for a period of two years in Dec., 1994.

Inauguration of the Office-cum-Herbarium Building of Eastern Circle, Botanical Survey of India, Shillong:

Director, Additional Director and Joint Director visited the Eastern Circle, B.S.I. and attended the inaugural function from 21st to 23rd Dec., 1994.

Workshop on CITES Implementation:

Director, B.S.I. deputed Shri G.S. Giri, Botanical Survey of India to participate in the CITES Implementation Workshop held at Vigyan Bhawan Annex from 20th to 24th February, 1995.

Agri-Horticultural Society of India, Calcutta - 175th Foundation Ceremony:

Director, B.S.I. is a member of the Advisory Committee of this Society. He chaired a session and gave popular talk on wild plants of horticultural potential in the National Seminar on Ornamental Horticulture and Environment organised by the Society in February, 1995. Scientists from Circle Offices and Headquarters also participated in this Seminar.

Flora of Madhya Pradesh:

The Governor of Madhya Pradesh, His Excellency Moh. Shafi Qureshi, released Flora of Madhya Pradesh, Vol.I at Bhopal on Monday the 27th March, 1995. Shri B.P. Singh, Additional Secretary, MOEF, Additional Director and Joint Directors, B.S.I. also attended the function.

General Elections to Legislative Assemblies, Bihar:

Dr. P.K. Hajra, Director, Dr. D.M. Verma, Addl. Director and Dr. R.K. Chakraverty, Addl. Director of B.S.I. were appointed as special observers for the Assembly Election, Bihar in March, 1995.

2nd International Workshop-cum-Seminar on Legumes of South Asia:

Dr. M. Sanjappa, Scientist 'SE', B.S.I. was deputed to attend this workshop-cum-seminar held in 2 parts at Lucknow and Kathmandu (Nepal) from 27th to 29th April, 1995 and 3rd to 5th May, 1995 respectively. Dr. Sanjappa chaired a session in Kathmandu, part of conference and also presented a paper entitled "Chromosome numbers in Legumes of India".

National Committee and Scientific Advisory Committee of Biosphere Reserves:

Director, B.S.I. participated in a meeting of the National Committee on Biosphere Reserve on 2nd June, 1995.

Training Abroad:

Drs. P.K. Sarkar and J. Bhattacharyya, Scientist 'SD', B.S.I. were deputed to Bradford University, Bradford, United Kingdom under Colombo plan to undergo training in Biodiversity and Environmental Impact Assessment respectively from January to March, 1995.

Dr. M.N. Aziz, Jr. Scientific Assistant, B.S.I. was deputed to British Museum (Natural History), London, U.K. to undergo training on Biodiversity (lower groups of plants) for 40 days during May-June, 1995.



Dr. P.K. Hajra, Director, Botanical Survey of India in the CITES 6th Plant Committee Meeting at Tenerife, Spain is seen on the left

6th Plant Committee of CITES:

Director, B.S.I. participated in the 6th Plant Committee Meeting of the CITES held at Tenerife, Canary Islands Spain from 18th to 25th June, 1995.

Environmental Impact Assessment :

Director, B.S.I. deputed Dr. D.M. Verma, Additional Director, for EIA Studies of Rowghat, Bastar, which is proposed to be taken up for iron-ore mining by the Steel Authority of India Limited.

Work Measurement Studies :

W.M.C. studies were conducted by a committee comprising Director and other Officers of B.S.I. and Shri R.S. Hasija, Ministry of Finance, Govt. of India in Circle Offices of B.S.I. at Dehra Dun, Port Blair, Jodhpur and Coimbatore.

National Committee on Wetland, Mangroves and Coral Reefs :

Director, B.S.I. participated in the meeting on 4th July, 1995 in the MOEF.

Regional Plant Resource Centre, Bhubaneshwar, Orissa :

Director, B.S.I. participated in Scientific Advisory Committee Meeting on 17th July, 1995.

Birbal Sahni Institute of Palaeobotany, Lucknow, U.P. :

Director, B.S.I. attended the meeting of the governing body of the Birbal Sahni Institute of Palaeobotany on 8th August, 1995 in the Department of Science and Technology, New Delhi.



Survey of Wetlands in Palghat District, Kerala

List of some recent Publications

1. **Flora of Rajasthan** : Edited by B.V.Shetty & V.Singh
 Vol.1 (pp.1-451 & 16 colour + 20 b/w photos) 1987 : Rs. 400.00 or \$ 80.00
 Vol.2 (pp.453-860) 1991: Rs.144.00 or \$ 42.00
 Vol.3 (pp.861-1246 & 12 colour photos + 37 line drawings) 1993: Rs. 168.00 or \$ 52.00
2. **Flora of Madhya Pradesh Vol. 1** : Edited by D. M. Verma, N. P. Balakrishnan & R. D. Dixit (pp. 1-668 & 16 colour + 4 b/w photos) 1994: Rs. 324.00 or \$ 64.00
3. **Flora of Palghat District** (including Silent Valley National Park, Kerala) : By E. Vajravelu (pp. 1-646 & 15 b/w photos)1990 :Rs. 276.00 or \$ 56.00
4. **Flora of Mahabaleshwar and Adjoinings, Maharashtra** : By Sandhya Deshpande, B.D. Sharma & M. P. Nayar
 Vol. 1. (pp.1-431 & 7 colour photos + line drawings) 1993: Rs. 228.00 or \$ 48.00
 Vol. 2: 1995 Rs 196.00 or \$ 40.00
5. **Flora of Thiruvananthapuram, Kerala** : By M. Mohanan and A.N.Henry (pp. 1-625 & 6 colour + 3 b/w photos) 1994 : Rs. 332.00 or \$ 64.00
6. **Bharat Ki Vanaspati**- Hindi Publication : (pp.1-179) 1984 : Rs. 35.00
7. **Bibliography of Ethobotany** : By S.K.Jain, V. Mudgal, D. K.Banerjee, A. Guha, D.C.Pal & D. Das (pp.1-157)1984 : Rs.60.00 or \$ 20.00
8. **Red Data Book of Indian Plants** : Edited by M. P. Nayar & A.R.K. Sastry
 Vol. 1 (pp. 1-383 & 8 photos) 1987: Rs.160.00 or \$ 48.00
 Vol. 2 (pp.1-273 & 6 photos) 1988: Rs. 132.00 or \$ 40.00
9. **Mangroves in India— Identification Manual** : By L. K. Banerjee, A. R. K. Sastry & M.P. Nayar (pp. 1-113 & 30 photos) 1989: Rs.168.00 or \$ 52.00.
 The book deals with the mangroves in different parts of India, keys to the families, genera and species with short taxonomic descriptions, ecology, distribution and economic aspects. Illustrated with colour and black & white photos and 22 line drawings.
10. **A Manual for Herbarium Collections** : by R.R. Rao & B.D. Sharma (pp.1-20+1) 1990 Rs. 8.00
11. **Flora of Agra District** : By A.K. Sharma and J.S. Dhakne 1995 Rs. 236.00 or \$ 52.00
12. **Bladderworts of India** : By M.K. Janarthanam & A.N. Henry (p.1-144 & 3 colour plates)1992: Rs. 72.00 or \$ 24.00
13. **Seagrasses of Coromandel Coast of India** : By K. Ramamurthy, N.P. Balakrishnan, K. Ravikumar & R. Ganesan (pp.1- 80 & 34 colour plates) 1992 : Rs.140.00 or \$ 44.00
14. **Plant Resources of Jaldapara Rhino Sanctuary**: By L. K. Banerjee (pp.1-93+7 b/w & colour plates) : 1993 Rs. 84.00 or \$ 26.00
 All the above publications are available for sale with the Director, Botanical Survey of India, P-8, Brabourne Road, Calcutta-700 001, India. No publication is sent by V.P.P. Actual cost by Money Order is to be sent to the Editor of Publications, Botanical Survey of India in advance stating clearly the name and address of the sender.

Drafts are to be drawn in favour of "Accounts Officer, P. A. O. (BSI & ZSI), Calcutta," and to be sent to the Publication Officer at the above address.

Publications in Press

1. **Bulletin of B. S. I.** Vol. 34:1992
2. **Flora of Bilaspur District**, Vol. 2 by G. Panigrahi
3. **Flora of India-Introductory** Volume Part-1: Vols. 4 & 5
4. **Flora of Maharashtra**, Vol-1
5. **Plant Diversity in the Tehri Dam Submersible Area** by B. P. Uniyal, Surendra Singh & D.K. Singh
6. **Flora of Kasargod District-Kerala** by R. Ansari & V. J. Nair
7. **Ethnobotany of Eastern Ghat** by N. Rama Rao & A. N. Henry
8. **Flora of West Bengal** : Vol-1
9. **Flora of Mahanadi Delta, Orissa** by L. K. Banerjee & T. A. Rao
10. **Hymenochaetaceae of India** by J.R. Sharma

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