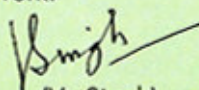


NEWS LETTER



EDITORIAL

India is endowed with rich biodiversity which provides all the medicaments to sustainable livelihood. ENVIS Centre on Plant Diversity in the Botanical Survey of India, Ministry of Environment & Forests is engaged to meet the task of disseminating information on plant diversity to a wide range of users through the data base system. This year, on the occasion of 50th Anniversary of India's Independence, ENVIS, Botanical Survey of India, has published a special issue on deltaic plant diversity, a book entitled, "Mangroves, Associates and Salt marshes of the Godavari-Krishna delta, Andhra Pradesh", which provides more information regarding plant diversity of a fragile ecosystem and the sustainable life support. Besides the information on some macrophytic plants and plants of rare and endangered categories, ENVIS Centre, Botanical Survey of India has also launched for collecting the field data of rural technology and techniques by which plant diversity are utilized for various trade purposes. These will definitely provide wonders for tomorrow by sharing knowledge and by increasing global information network.


(V. Singh)

Additional Director

In-charge

Place: Calcutta

Date: July, 1998 Botanical Survey of India



Peter H. Raven, Director, Missouri Botanical Garden during his recent visit to Indian Botanic Garden, BSI is expressing among the scientists under the Great Banyan Tree, "As the institution constitutionally organized to develop the understanding of plants of India, the role of Botanical Survey is unquestionably of the greatest importance."

THE HIMALAYAN "GINSENG" *Panax pseudo-ginseng* Wall.

Sandip Kumar Basak

Botanical Survey of India, Howrah - 711 103

The genus *Panax* L., Araliaceae, distributed in the Central and Eastern Himalaya, North-Eastern America, China, Korea, Vietnam and Japan. This genus includes the traditional and reputed medicinal plants such as *Panax ginseng* C.A. Mey., *P. notoginseng* (Burkill) Chen, *P. pseudoginseng* Wall., *P. quinquefolium* L. and *P. vietnamensis* Ha et Grushv.

In India the genus is known from Sikkim, West Bengal (Darjeeling district), Arunachal Pradesh (Tawang district) and Meghalaya (Khasia Mts.). It grows wild in the temperate forest and is represented by three species namely *P. assamicus* Banerji, *P.*

fruticosus L. and *P. pseudoginseng* Wall. with its two varieties. Only *P. pseudoginseng* (the Himalayan Ginseng) is known to have ginseng properties like other commercial ginseng species. Although about a century ago this species were frequent in the Eastern Himalaya but now their population is disappearing alarmingly mainly due to demographic pressure, deforestation and commercial exploitation. Therefore, some necessary informations about this species for helping administrative and scientific measure regarding conservation would be of immense importance for rescuing its security before extinction.

CLASSIFICATION OF "GINSENG"

SPECIES	TRADE NAME	DISTRIBUTION
<i>Panax ginseng</i> C.A. Mey	True Asiatic or Chinese Ginseng.	Eastern Asia (China, Korea & Japan)
<i>P. notoginseng</i> (Burkill) Chen	Sanchi Ginseng	China & Central Nepal
<i>P. pseudoginseng</i> Wall.	Himalayan Ginseng	Eastern Himalaya & one race in Japan
<i>P. quinquefolium</i> L.	American Ginseng	Eastern North America Canada, Japan, Korea & China.
<i>P. vietnamensis</i> Ha et Grushv.	Vietnamese Ginseng	Vietnam

Panax pseudoginseng Wall. is a perennial herb with long creeping rhizome. Rhizome with fascicles or incrassate nodes, bearing scars of preceeding aerial stems, hard dark brown to yellowish brown, faintly scented, sweetish bitter in taste, numerous adventitious roots rippling along the nodes. Stem upto 75 cm tall, erect, soft, slender, terete, glabrous, green, bearing a whorl of 3-6 or 7 palmate leaves; petioles 2.5-12 cm, slender, terete, glabrous; leaflets 3-6, sessile or petiolate, 2.5-12 [-15] cm long, 1-3 [-7] cm wide, ovate or lanceolate, acuminate, base rounded or cuneate, margin serrate or deeply incised-pinnatifid, membranaceous, sparsely hirsute along veins or both surfaces. Flowers greenish 1.5-2 mm long, many, arranged in simple or branched terminal umbels; bracts caducous. Calyx cupular, sepals 5, valvate, glabrous or more or less puberulous, margin obscurely dentate, ± 1 mm long caducous, petals 5, free, white or pale green, triangular, 1-5.2 mm long, glabrous. Ovary 2-3 celled, inferior, style 2-3, united at the base,



Panax pseudoginseng Wall. ssp. *himalaicus* Hara var. *bipinnatifidus* (Seem.) Li
Plant showing bipinnatifid leaves, flowers and fruits.

erect or curved, 2.3-2.5 mm. Fruit berries or drupe, 3-5 mm diam., globose or laterally flattened, 5-lobed, green or scarlet-bright red with blacktip when ripens.



Roots and rhizomes of the *Panax pseudoginseng* Wall. which are exported for valuable medicinal properties.

P. pseudoginseng Wall. represents three subsp. namely *P. pseudoginseng* Wall. subsp. *pseudoginseng* Hara, subsp. *japonicus* (Mey.) Hara and subsp. *himalaicus* Hara, of which the later is indigenous to the Eastern Himalaya. On the basis of variation of leaflets, this has been again divided into two varieties such as var.

bipinnatifidus (Seem.) L. and var. *angustifolius* (Burkill) L. distributed in Darjeeling, Sikkim, Bhutan and Arunachal Pradesh.

It grows in dense forests of high mountains with cold, rain and fog nearly throughout the year. It grows well at alt. of 2000-3000 m under the canopy of evergreen forests composed of broad - leaf (Oak - Birch, Hemlock - Acer - Silver Oak) and needle - leaf (Conifers) trees. As this plant is hygrophilous it generally grows in gregarious patches

along the shady sides of streams where the humidity of air and soil is very high. This plant thrives well in the humus rich blackish soil composed of shedded dried broad leaves of the forest. However, this plant also found to grow even on open grassy slopes along the margin of fertile stream with the association of *Iris clarkei* between Tonglu and Chitrey at alt. of 3000-3070 m.

Distribution

INDIA (Darjeeling & Sikkim Himalaya, Arunachal Pradesh - Tawang district, Meghalaya - Khasia Mts. : 1500-4000 m); NEPAL; BHUTAN (Southern & Northern); S.E. TIBET; N. MYANMAR; CHINA (Western, Central & Northern).

Status

The Himalayan ginseng is rare and

vulnerable in the Eastern Himalaya due to reckless deforestation, grazing of ground flora by Yaks, road construction, commercial exploitation accompanied with illegal trading.

Active principles, medicinal value and trading

The Himalayan Ginseng contain sapogenins consisting of a very high quantity of oleanane-type triterpene and only a very little quantity of dammarane - type triterpene (Hara, 1966). Ginseng is a highly esteemed traditional and folk phytomedicinal plant and is believed as medical panacea in China. Its constituents have the power of remedies of the following treatments : general tonic effect, anti-fatigue action, aphrodisiac properties, increase appetite and sound sleep, sedative effect on the cerebrum and mildly stimulating action on the vital centres, root extract as a vasodilator and increase blood flow to the coronary artery, articulation, relief from pains in bones, recovery from anemia, arteriosclerosis, chronic granular angina, release of bronchial asthma. The Chinese believe it is a stamina-giving plant, with a potential to ensure evergreen health and vitality. It is also reported to be used locally for the therapy of some cancers. Two related species of *Panax* (*P. pseudoginseng* and *P. fruticosum*) have been known to use in India and Nepal. The former used as an aphrodisiac and controlling vomiting and dyspepsia while the later as a febrifuge and astringent substance (Goldstein, 1975). Commercial trading of Ginseng roots and rhizomes has been established very profitable in China, Korea and Japan since more than a century ago. Once China was almost the only market for Ginseng. The roots obtained from American ginseng growing wild and also being cultivated in U.S.A. and Canada are exported into China. The governments of the U.S.A. and China took necessary legislation measure to regulate the bulk of wild ginseng harvested in order to check its extinction (Goldstein, 1975). Recently in Vietnam the extract obtained from *Panax vietnamensis* is used as a medicine and a health tonic in commercial scale. In India a few pharmaceutical companies prepare ginseng tonic from ginseng

extract in natural fruit concentrate and trade as an ayurvedic medicine in the retail chemist shops in the market.

Cultivation

Ginseng cultivation is reported from China, Korea and Japan. In China the cultivation is carried on in small plots. The seeds are sown about 5 inches apart in carefully prepared soil. After two years the young rhizomes from which the leaves and rootlets have been cut off, are transplanted to other plots; and in the 4th year the rhizomes are dug up and sun dried. The growing juvenile plants are protected from the direct sun by necessary coverage or has to be planted under trees (Burkill, 1902). In India, the cultivation of ginseng has not been reported. However, few unsuccessful trials have been carried out in Gangtok (1800 m). The whole plant brought from wild habitat along with soil, but did not survive. The best period for harvesting the Ginseng plant is at the end of the growth season, which may be the period of accumulation of active constituents in the underground organs (Nham *et al.* 1995).

Conservation

Virtually so far no effort has been depicted regarding its conservation. Plant with as many as 32 annulate root-stock germplasm is available in nature (Raju & Singh, 1990). About a century ago the *Panax* species were frequent but now the species exists only in small populations even in protected zones. *In-situ* conservation can be promoted by policy reforms and by introducing and enforcing appropriate legislation towards habitat destruction. Natural regeneration is mainly through viable seeds and occasionally by root-stocks. Other limiting factors are effective pollinators, fruit & seed set and optimal climatic parameters like the mean annual temperature, low quantity of light received by the plants, the high

humidity in soil and air and the percentage of organic humus in the soil. Moreover, the declaration of Dombeyang valley in North Sikkim and Kanchendzonga National Park (KNP) - the Yoksam - Dzongri area in West Sikkim as the protected areas may ensure conservation of this species in *in-situ*. *Ex-situ* conservation approaches may be focused on enriching gene banks and the establishment and maintenance of biological reserves and botanical gardens. Vegetative propagation of *Panax pseudoginseng* may be amenable through root stock cutting during rainy season providing other climatic and eco-physiological factors favourable for its growth. Being a very slow growing species, plant tissue culture based bio-technology could play significant role in the *in-*



Marketing of ayurvedic tonic 'Ginseng' in the medicine shop.

vitro multiplication and conservation of its germplasm. Rapid propagation of this rare and medicinally important taxon could be applied through somatic embryogenesis, callus differentiation; seed and cell culture. In Vietnam large scale cell-culture of *Panax vietnamensis* is under progress (Nham, 1995).

Though according to Hooker (1879) and Hara (1966, 1971) it was a common and frequent forest flora throughout the Eastern Himalaya at higher elevation, it is now found in very small and scattered population. Field observation at West Sikkim (on the way to Dzongri) and Darjeeling Himalaya (on the way to Sandakphu at Tonglu & Chitrey) during June 1996 and June 1997 respectively indicates the ginseng community is vanishing rapidly as this species represents as a solitary colony

composed of five plants of different ages sheltered under rocks in cool shady place on humus at a few meters ascent from Bakkim Forest Rest House (3000m) and four km above the Praig Chhu stream and on the gentle grassy slopes besides the perennial stream along with *Iris clarkei* between Tonglu & Chitrey (3000-3070m). However, at Eastern Sikkim (Chhangu area - 3600 m) it is most disappointing where none of this species which was reported by Raju & Singh in 1990 was located.

Acknowledgement

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THE DITCH - GRASS - A noteworthy plant species from wetlands of West Bengal with interesting floral biology.

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The genus *Ruppia* L., commonly Known as ditch - grass, is a submerged dainty annual or perennial herb of cosmopolitan distribution found in temperate & tropical regions of the world, usually in brackish water in coastal areas, except some fresh water species reported from South America, New Zealand, & recently from India. Plants have also been collected from about 4000 m in the Andes (Heywood (Ed.) 1978). This genus has been treated variously by the taxonomists from time to time. Some consider only one species, whereas others recognize 2-7 species. This uncertainty is probably due to its polymorphic habit. In India is represented by a single species with two sub-species. This genus is closely related to *Potamogeton* L.

The genus was described by Linneaus (1753) in his Species Plantarum and *Ruppia maritima* L. as type species, based on a material from Europe. Since then, this genus has been studied by various workers from different points of view.

Phytogeographically *Ruppia* L. is a cosmopolitan species as mentioned earlier, distributed in South Africa, North America, Central America,

South America, Asia (India, Pakistan, China, Formosa), Comoro Islands, Europe, Madagascar, Malay Peninsula, Mauritius, New Caledonia, New Zealand, Phillipines, West Indies including Bermuda.

In India it is found in the coastal areas of Kerala, Maharashtra, Orissa, Tamil Nadu and West Bengal. Recently it has been reported from Uttar Pradesh (Lucknow) and some areas of West Bengal like Malda and 24-Parganas in fresh water pools and lakes.

The ditch - grass is a glabrous, rhizomatous herb having fibrous root system. Leaves are linear or filiform, alternate or opposite, entire, with a single midvein expanded at the base into a sheath, often interpreted as stipules. Flowers bisexual, ebracteate, borne in two flowered spikes initially concealed in the sheath of the uppermost vegetative leaf; peduncle may or may not be coiled. Stamens two, opposite; anthers sessile, dithecous extrorse; pollen grains trinucleate; carpels four; stigma sessile, obovate. Fruits ovoid with pendulous seeds.

The pollination biology of *Ruppia* L. is quite interesting. It perhaps

demonstrates the transition leading from the wind to water pollination (Meeuse & Morris, 1984). The pollination in this ditch - grass is generally under water, but in some cases it takes place at the surface of the water by wind when pollens are carried near the stigma head. In the former case the peduncle elongates, anthers dehiscence under water, releasing the pollen which are trapped in the air bubbles which remain adhered with the inflorescence and rise to the surface of water, the pollens get liberated from the air bubble and float. On coming in contact with stigma cross fertilization takes place (Haynes, 1988). Its pollination biology shows a transition between wind pollinated genus *Potamogeton* L. (except some species where pollination takes place under water) and *Zannichellia* L. which exhibits totally submerged pollination.

Economically, the plant serves as a source of food for water fowl and provides shelter to fishes, the cellulosic matter in *Ruppia* L. can be exploited for the generation of biogas through introduction of methane bacteria by seeding with cow-dung. The residual matter is an excellent manure as

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reported by Khadi & Village Industries Commission. They are also used as aquarium plants (Muhlberg, 1982).

The systematic position of *Ruppia* L. has been a matter of controversy among the taxonomists. Many workers have included *Ruppia* L. under the family Potamogetonaceae. Hutchinson (1973) included this genus in a separate family Ruppiaceae on the basis of its habitat, terminal spikes, absence of perianth and long stipitate fruiting carpels with pendulous seeds. This was also supported by Takhtajan (1988) in his system of classification.

Ruppia tuberosa Davis et Tomlinson, the species recorded from Australia has swollen shoot rich in starch at the end of nearly all axes recalling the turions of *Potamogeton* L. (Davis & Tomlinson, 1974). They support inclusion of the two genera *Ruppia* L. and *Potamogeton* L. in the same family. In spite of the similarities between *Ruppia* L. and *Potamogeton* L., it still remains a controversy whether *Ruppia* L. should be included in a separate family or to be retained under Potamogetonaceae. Present authors while dealing with the genus *Ruppia*

L. support the taxonomic circumscription of the genus, in favour of two valid subspecies *Ruppia maritima* L. ssp. *maritima* and *Ruppia maritima* L. ssp. *spiralis* L. ex Dumort, from India.

Since, the ditch - grass provide very beautiful habitat for many fishes and other aquatic animals in the brackish water, its conservation and protection is urgently needed for survival of those fishes and animal communities. However, conservation of the ditch-grass can be done by proper protection and management of wetland ecosystem.

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Ruppia maritima L. ssp. *maritima*

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LOCAL TECHNOLOGY FOR EXTRACTION OF FIBRE FROM BANANA PLANT - *MUSA* sp. IN MIZORAM

Jh. Lalramnghinglova* & L.K. Banerjee**

Many species of the genus *Musa* L. (Musaceae) representing "Banana plants" are of great economic and commercial importance due to its significant use as food and fibre. Some species of this genus are cultivated pantropically for edible fruits in various vernacular names. Its stem pith, immature flowering spike and young shoots also provide good source of food. The sheathing leaf bases of many species are the source of fibres. In the Philippines the best quality of "Abaca cloth" or "Manila hemp" is obtained from *Musa textilis* Nee. In Mizoram, some of the wild species of *Musa* are used for preparation of different types of fibres in different ways. The technology involved in this process is very interesting, informative



Saisu (*Musa glauca* Roxb.)

and helpful for sustainable livelihood.

Out of 14 species recorded in India (Anon, 1962) about 6 wild species and 4 cultivars occur in Mizoram. The wild species (plantains) are locally known as 'chang-el' and the cultivars (bananas) are called 'bal-hla'. The wild species are *Musa accuminata* Colla., *M. balbisiana* Colla., *M. velutina* Wendl., *M. glauca* Roxb. etc. and the cultivars are *Lalkel*, *Poovan*, *Rajeli* and *Rasthali*. *Strelitzia reginae* Dryand. the "bird of paradise" also occur as an ornamental crop.

In consideration of fibre quality, local people prefer wild plantains chronologically as "Saisu", "Changthir", "Changpui",

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Bundles of dyed fibres

"Changpawal", "Lairawk" and "Changvandaw" types. Except the "Saisu" type these wild species are found very common along the river banks, marshy and damp places throughout Mizoram, but *Musa glauca* Roxb. - the "Saisu" type which occurs in dry, sandy or rocky places is not very common in Mizoram.

Musa L. is a large herb often tree like appearance; stem stout, unbranched with sheathing leaf bases; leaves large, alternate, pinnately veined, convolute; flowers arranged in spike or panicle subtended by spatheaceous bracts, each flower borne in the axil of a bract with perianth in two series; stamens 6, one staminodium and five fertile; ovary trilobular, inferior; fruit a 3-celled capsule or elongated berry; seeds arilated.

Collection, processing and extraction of fibres

The "Chang-el" group or the wild species of plantains are usually collected from the wild are never cultivated for fibre purpose. The pseudostem is cut into 1 - 2 m long from the base above the ground. The stalks are cut into 60 - 90 cm and the leaf-sheaths are ripped off and again cut into smaller sizes (5 cm) to facilitate boiling in water for 2-3 hours to make further processing.

The simple devices employed for the extraction of fibres are 'Kui' (8cm x 12 cm) made of 16.5 m RC sheet, a bench and dyes. The splitted leaf-

sheath (5 cm x 90 cm) is laid down on a bench and both the upper and lower surfaces are removed till a desired fibre is obtained. The pressure so exerted upon the leafsheath should be such that the fibres are not hampered with. The fibres thus obtained are washed and then left for 24 hours on cold water to enhance toughness of the fibres.

The fibres are made into bundles and dyed with different colours as per desire. Dying takes about 6-12 hours in order to get reliable colour. These bundles are properly washed and dried.



Ropes, velhats, chappals & bags on sale.

Commercial uses and marketing of fibres

The fibres are made and designed into different fibre products. These are ladies bags, baskets, ladies chappals, shoe brushes, door mats, tea stands, telephone stands, ropes, dust cleaners, velhats etc. The fibre-chips are also made into a board as by-products. An adhesive (fevicol) is applied on a plywood-frame and fibre-chips are spread over the plywood as evenly as possible. The fibre

chips are then pressed with an iron over a cloth for uniformity.

It is estimated that a man can earn Rs. 80/- per day as net amount. The local prices are fixed at Rs. 50-60 for baskets; Rs. 20/- for shoe brushes; Rs. 5/- for ropes (5m long); Rs. 120/- for door-mat (24 cm x 30 cm); Rs. 50/- for velhats; Rs. 60/- for ladies bags etc. It is learnt that velhats could be sold at \$ 40-50 in international markets. Many fibre exporters in New Delhi and Calcutta are taking keen interest for all the above materials and are regularly investing money to the local people for these fibre products.

The technology

This local technology was developed by what called, "Hnam Chhantu"-the rescuer of ethnicity or community, established in 1994, with an aim to achieve self-support from locally available bio-resources. The headquarters is at Aizawl and functioned under the presidentship of Mr. Lalhmangaiha, Lower Zarkawt, Aizawl. At present, "Hnam Chhantu" has ten units (villages) only, who are the main producers of the fibre products in the state.

The advantages of the technology are simple, low-cost, easily available raw materials, manual work being able to be done day in and out, throughout all seasons under one man's roof. Another advantage is that even the jailers and



Jailers handy-work displayed. Ropes, chappals, shoe brushes, doormat etc.

drugs addicts can also make use of their time to work on it in the Jails and also in Remand homes and De-addiction Centres.

Conclusion

This local technology or *chang-el* technology could be a vital role in the sustenance of a poor man's livelihood and unemployed persons also. The technology does not require education,

but skill and labour. It is necessary to standardise the products by providing training and better equipments.

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RURAL TECHNOLOGY FOR HARVESTING 'MAKHANA' SEEDS - *EURYALE FEROX* Salisb. IN BIHAR.

Vidyanath Jha, A. M. Verma*, A. K. Jha** and L.K. Banerjee***

North Bihar abounds in natural and man made wetlands which are utilized for fishery purposes and also for growing Makhana (*Euryale ferox* Salisb.) as a cash crop. *E. ferox* is widely known for its nutritional and medicinal properties and popped Makhana worth Rupees ten crore per annum is exported outside Bihar. The fishing community derives their livelihood from its cultivations. However, only the skilled fishermen of Bihar are capable to harvest the seeds from the water bed with the help of some indigenous devices. Knowledge of this rural technology would be very informative and useful, therefore, brief information is discussed here.

Euryale ferox Salisb., locally known as Makhana is wellknown in India from the 16th century, reported from Sanskrit medicinal text, "Bhavaprakasa". It is a large prickly annual or short lived perennial aquatic herb growing in standing fresh water. Stem rhizomatous, stout, thick. Leaves in rosettes; petioles densely prickly; matured leaflets floating, peltate, orbicular, up to 1 m or more in diam., both surface with spines. Flowers blue or violet or reddish velvety, submerged and cleistogamous, 5-6 cm in diam.. Fruit crowned with persistent sepals and covered with stout prickles. Seeds with pulpy aril.

It grows in fresh water up to 5 m depth in lakes, pools or in slowly

flowing water. It is highly autogamous and disseminate by large seeds with pulpy arils.

Distribution

The Indian distribution of this species is in Assam, Bihar, Jammu & Kashmir, Meghalaya, Manipur, Orissa, Rajasthan, Tripura, Uttar Pradesh and West Bengal. In India, it is extensively cultivated in North Bihar and wild in the lakes of Indian Botanic Garden, Howrah and Kashmir.

Uses

The seeds, fruits and rhizomes are eaten locally. It is also used for medicine and ornamentation. Powder of seed is aphrodisiac and spermatogenic. It also acts as expectorant and emetic medicine. Leaves are used for cure of rheumatism.

Cultivation

Average per hector yield of raw seeds is 2,100 kg of which 1/3rd comes as end result.

Development, processing and rural techniques

The four stages in its life cycle comprise seeding (mid October-December), seedling (January - March), grand growth (April - July) and harvest (August - mid October). Asynchronous fruit formation starts from June onwards. Fruits are spongy

berry and covered with dense prickles. Each fruit contains a minimum of 30-50 globular seeds with hard seed coat and mucilaginous aril. The burst seeds float on water for 2 to 3 days before sinking to the bottom when the golden aril flattens and then sticks to the seed coat. These seeds are collected during harvest from the pond bottom. This arduous task is performed by the skilled menfolk of the fishing community who have to make countless dives inside the water. Next to North Bihar, the crop is cultivated on a moderate scale in lower Assam beels also. Skilled fishermen from North Bihar only are hired for performing the harvest operations in Assam beels.

The wetlands dominated with the sprawling Makhana leaves with dense overlapping spines all over the plant body are difficult for any one to enter into the areas unless the plants are uprooted and decomposed. Wild populations of *E. ferox* are reported to be perennial but the cultivated ones in North Bihar wetlands have to be extricated to facilitate the harvest which involves collection of seeds at the water bed and their transportation ashore. The indigenous fertility status of the crop is related to the deposition of the plant debris at the water bottom and no part other than seeds are taken out of the system. The plant debris after mineralisation during

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Fishermen employing "Gaanj" for collecting seeds from the pond.

the next summer are available to the subsequent crop during its grand growth stage.

Fishermen employ "GAANJ" and "AUKA" as two bamboo appliances for collecting seeds from the pond bed. These appliances are prepared by the skilled fishing community itself during July - August. "GAANJ" is an inverted bell and comma shaped appliance (50 cm length and 35 cm diameter) whereas "AUKA" is cylindrical (1.5 - 2 m long and 1 - 1.5 m diameter) in shape with one end closed. Non-fishing bamboo crafts are practised by the Dom and Halkhor castes who use fine bamboo sheets and petiolar portion of *Borassus flabellifer* for cordage also. The use of "AUKA" is prevalent in the Benipur subdivision of Darbhanga district where the big Makhana farmers run this cottage industry by forming larger

co-operatives. At other places the harvest is done by marginal farmers on individual basis and as such utilization of "GAANJ" is rather more prevalent. A smaller "GAANJ" is used for fishing purpose.

Two locally available vines - *Ichnocarpus frutescens* R. Br. vernacularly known as "Dudhlatti" and *Tiliacora acuminata* Colebr. vernacularly known as 'Kariyauti' are utilized as cordage in these indigenous appliances. The vines are first dried under sun and then soaked in water for 24 to 48 hours. Bisected or quadrisectioned portions are utilized as cordage in the bamboo appliances. *T. acuminata* is a relatively stronger cordage and as such is used at handle points and in the front rims while *I. frutescens* is utilized mostly in the intermediary rims. These vines are also utilized as cordage in Khainji

(or Daily meant for storing raw and popped Makhana) and in other bamboo made fishing tackles like Saraila, Tapi, Khonghi etc. Coir fibres are often used as the supplementary ones. The life of the cordage vines in the appliance ranges between 1-2 years if protected properly from sun and water.

Threat to the basic cordage materials

Rapid loss of wild vegetation has made it difficult for the fishing community to collect these vines in their immediate vicinity. Fish farmers around Darbhanga town generally collect *I. frutescens* from inside the campus of the Postal Training Centre (the erstwhile palatial estate of Darbhanga Raj with a big maintained garden) while *T. acuminata* is collected from the Bhigo area on the town outskirts (with sizeable populations of the fishing community). At other places these are often purchased at the rate of Rs. 30-50 per kilogram.

Acknowledgement

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THE WATER FERN - AZOLLA Lam., A PROMISING BIOLOGICAL RESOURCE

Anirban Roy & L.K. Banerjee
Botanical Survey of India, Howrah - 3

The water fern, *Azolla* is such a highly potential resource due to its magnificent symbiotic association for production of hydrogen, high rate of nitrogen fixation, rapid growth as well as decomposition for increasing soil fertility and crop yield, that attracts scientists for its application in the field of fuel, agriculture and to check the

rapid use of chemical fertilizer which badly affects the agroecosystem. The genus *Azolla* belonging to the family Azollaceae (Salviniaceae) under the order Salviniales was first described by Lamarck in *Encycl. meth.* 1 : 343. 1783. Currently it has six species throughout the world under two sections of *Azolla* and

Rhizosperma (Mey.) Mett. The section *Azolla* includes *A. caroliniana* auct. non Willd., *A. filiculoides* Lam., *A. microphylla* auct. non Kaulf and *A. mexicana* Persl. and section *Rhizosperma* includes *A. nilotica* Decne. ex Mett., and *A. pinnata* R.Br. (Sounders & Fowler, 1992). Sounders and Fowler also divided *A. pinnata*

R. Br. into three subspecies such as *A. pinnata* ssp. *pinnata*, *A. pinnata* ssp. *asiatica* R.M.K. Sounders & K. Fowler and *A. pinnata* ssp. *africana* (Desv.) R.M.K. Sounders & K. Fowler. Of these three subspecies only *A. pinnata* ssp. *asiatica* occurs in India. Besides India, this subspecies also occurs in Japan, China, Myanmar and South-East Asia. In India it is distributed most of the districts under fresh water. The fossil remains of *Azolla* indicate its origin during the tertiary period (Surange, 1966).

Azolla pinnata ssp. *asiatica* R.M.K. Sounders & K. Fowler is a free floating small, branched, annual or perennial plant. Roots fascicled, feathered, filamentous. Fronds oblong or deltoid, 1.1-2.6 cm long with crowded branches. Leaves alternate, sessile, trapeziform, fleshy, green or reddish brown, leaf lobes ovate, broad, brittle. Sporocarps borne or submerged leaf lobe, monosporangiate; megasporangia ellipsoid, megaspores with

ponds, ditches, streams and the paddy fields. In India, large scale growth of this species has been experimented (Gopal, 1967) and is shown that during growing season it can grow double its weight in less than 7 days. Some of the essential environmental factors which regulate the growth rate of *A. pinnata* ssp. *asiatica* have been observed as follows:

Temperature

Though *Azolla pinnata* ssp. *asiatica* can tolerate and survive within 14-40°C water temperature but 20-30°C temperature helps its high growth. So, during winter the vigorous growth of *Azolla* is noted. From September to January the growth of *Azolla* is maximum and within April to June it dies due to high temperature condition.

Light intensity

High light intensity inhibits its growth and the plant body turns into red. It has been observed that if the *Azolla* plant bodies are kept in a shadow

Wind flow

As the leaves of *Azolla* are very brittle, so the high wind flow breaks the *Azolla* leaves and keeps plant bodies to the edge of the tank.

pH

For the growth of *Azolla* the soil pH should be 5.5-7.0. If the pH is 3-3.5, the medium will be highly acidic and the plant body soon dies. Though at high pH (pH 10) it can survive but does not grow luxuriantly.

Though the genus *Azolla* is a serious weed in Europe, South Africa, Australia, Japan and other countries but it has been reported as a very useful biological resource for controlling mosquitoes and other weeds and for feeding poultry, swine and ducks. The largest contribution of this species to the developing countries is the green manure, specially for rice. The farmers of Thailand and Vietnam deliberately cultivate *A. pinnata* in rice field and it has been reported to rice yields 50% higher than the normal (Galston, 1975). Some of the interesting uses and chemical analysis of this species are as follows -

As a source of Nitrogen

For the symbiosis of *Azolla* - *Anabaena*, the atmospheric nitrogen is fixed and increases the soil fertility. So, in the field of agriculture especially in paddy cultivation *Azolla* application shows a good response for crop yield other than chemical fertilizer. Within 8-20 days life span of *Azolla*, 8-10 tons of organic matters per hectare is produced from which 30 kg N₂ can be obtained (Sing, 1977).

As water purifier

Azolla purifies the eutrophicated water after absorbing the nutrients from the water body. But in the highly eutrophicated water it can not survive. It has been observed that in the polluted water it grows not in pure form but associated with other floating macrophytes like *Lemna*, *Spirodela* and others.

As food

The young and green *Azolla* plants are very favourite food for chicken. It has been reported that 100 birds containing a poultry farm needs 9 kg of young *Azolla* plants which fulfil 20% of their food. It is found that 9-



Azolla pinnata ssp. *asiatica* growing in Chilka Lake.

9 swimming bladders; microsporangia spherical.

The most interesting feature of *Azolla* is the symbiotic association of a blue green alga namely *Anabaena azollae* Stras. (Cyanophyceae). This alga lives endophytically in the intercellular spaces of the basal leaves of *Azolla*. Due to presence of heterocyst in the algal cell, the alga fixes atmospheric nitrogen. The fixed nitrogen by this alga transferred to *Azolla* leaf in the form of ammonia. This species grows floating on the fresh water lakes,

condition it remain green but in open scorching sunlight the plant bodies turn into red. Watanabe (1978) from Japan reported that in low land paddy field, within 5K, 10K & 40K lux light intensity the growth of *Azolla* is optimum.

Humidity

As *Azolla* is a wetland plant so it prefers much more humidity for its growth and development. Within 85-90% relative humidity *Azolla* grows very fast and below 60% it gets dry.

12 kg of *Azolla* plant can be obtained from a culture tank of 20 sq. m area with 30 cm depth in a season (Mandal & Ghosh, 1990). It serves a good food for swine, ducks and other animals.

As antifungal agent

Extract of *Azolla* has strong antifungal activity. It strongly inhibits the growth of *Fusarium nivale* (Kasmi & Trivedi, 1978).

As a natural fertilizer

In many parts of the country, specially in Kashmir and Manipur, this species is used as fertilizer to the floating garden for production of vegetables and flowers.

As a source of Hydrogen gas

The symbiotic alga, *Anabaena azollae* not only fixes atmospheric nitrogen with the help of light energy but also releases hydrogen to water. In nature the fixed nitrogen combines with hydrogen forms ammonia but in the laboratory this *Azolla-Anabaena* symbiosis can be diverted from producing ammonia to hydrogen gas. Though this biological method for production of hydrogen gas is in a small scale but if it is possible to produce this hydrogen gas in a large scale, it would be potentially important for obtaining these days of dwindling petroleum supplies (Newton, J.W., 1976).

The chemical analysis of *Azolla* suggests that it contains very considerable amount of organic and inorganic substances. The following table shows the chemical constituents of *Azolla* (Subudhi & Sing, 1978).

Ash	- 10.5%
Crude fat	- 3.3.7%
Crude protein	- 24.30%
Nitrogen	- 4.5%
Phosphorous	- 0.5-0.9%
Calcium	- 0.4-1.0%
Potassium	- 2-4.5%
Magnesium	- 0.5-0.65%
Manganese	- 0.11-0.16%
Iron	- 0.06-0.26%
Soluble carbohydrate	- 3.5%
Crude fibre	- 9.1%
Starch	- 6.5%
Chlorophyll a	- 0.45%

Multiplication

The multiplication of *Azolla* is performed in rice fields, in small plots or in small tanks throughout the year. The standing water in the plots or tanks should be only a few cm depth.

A sowing density of 0.1-0.3 kg/sq. m, with an addition of superphosphate 4-6 kg P₂O₅/ha and Potash 5-8 kg K₂O/ha/week, a temperature of 15-30°C and pH 6-7 give the best growth of plants. The growth increases at the rate of 2-6 times in a week. The plants are collected per week and inoculum left for further multiplication. It is reported that a plot of 32 sq.m area yields approximately 80-100 kg fresh weight of *Azolla* per week (Sing 1977).

Central Rice Research Institute suggested some important points for the growth and multiplication of *Azolla* are as follows :

For 12 sq. m area of *Azolla* cultivation 4 kg of *Azolla* with 36 gm superphosphate and 4 gm Furadon is sown for one week.

For 30 sq. m area 12 kg *Azolla* is to be sown mixed with 90 gm superphosphate and 12 gm Furadon.

For 100 sq. m area 110 kg *Azolla* is to be sown mixed with 900 gm superphosphate and 110 gm Furadon.

For 900 sq. m area 330 kg *Azolla* is to be sown mixed with 3 kg superphosphate and 330 gm Furadon.

If the area of *Azolla* multiplication is very large, then the total area is to be segmented into several parts each containing 300-400 sq. m mainly for checking the wind flow, and other unfavourable condition.

Azolla is being attacked by some Lepidopterous and Dipterous insects, Molluscs and Fungi. The following

table shows the causal organism, symptoms of nature of the attack and control measure (Mandal & Ghosh, 1990).

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Causal organism	Nature of attack	Control measure
Insects		
1. <i>Nymphula</i> sp.	The larvae of these two genera feed on the leaves and plants appear as brown patches and ultimately die.	2.5 Kg Carbofuran/ha or 1.25 Kg Forate/ha
2. <i>Chironomus</i> sp.		
Molluscs		
Species of <i>Gastropoda</i>	They also feed the leaves and destroy the plants.	1.25 Kg Forate/ha
Fungi		
<i>Sclerotium rolfsii</i>	Leaf blight in which leaves are rotting.	Not known.

CERATOPTERIS THALICTROIDES (L.) BRONGN.- A FRESH WATER, EDIBLE FERN

R. D. Dixit

Botanical Survey of India, Central Circle, Allahabad.

The Ferns by virtue of their attractive foliage forms, have drawn the attention and appreciation of the Horticulturists and plant lovers throughout the world over centuries. The ethnobotanical and medicinal importance of *Ceratopteris thalictroides* is very much informative.

Ceratopteris thalictroides (L.) Brongn. is a perennial fresh water fern, rhizome small, erect, unbranched and covered with the leaf bases; stipes 10-20 cm long, the scales are present on the rhizomes stipes and young leaves which are sessile, ovate, nonclathrate,

margins smooth, apex acute to obtuse ending into a glandular cell with the broad basal attachment; small unicellular glandular hairs present on the upper surface of leaves. The size and form of the leaves are exceedingly variable, 10-70 cm in length, the first few leaves are simple, entire, attenuated at the base, pinnate whereas successive leaves larger, broadly-ovate to narrowly-ovate and finally once to several times dissected. The mature plants produce only fertile leaves which are narrower than the vegetative leaves.

It grows gregariously in submerged fresh water ponds, swampy places, ditches among grasses, along the banks of ponds, tanks and paddy fields etc. in open sunny situation.

Distribution

Tropics and sub-tropics of the world. (India - throughout in fresh water tanks, ponds, swamps, ditches and paddy fields etc.)

Medicinal Importance

Plants used in China as tonic and styptic. Poultice of fresh fronds used in skin complaints.

Ethnobotanical Importance

The young leaf tips are used as vegetable in Assam, Meghalaya, Uttar Pradesh and even exported to the best hotels in New York.

Acknowledgement

Author is grateful to the Director, Botanical Survey of India and Project Co-ordinator ENVIS, B.S.I. for their help and guidance.

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Ceratopteris thalictroides (L.) Brongn. Plants growing in hilly pool of Central Circle, B.S.I., Allahabad. A man plucking fresh fronds for curry.

Dhenki shak — COMMON EDIBLE FERN

(Mrs.) Shilpi Das & M. K. Manna
Botanical Survey of India

Ferns make an important contribution to the world's plant diversity. They are rich in secondary compounds and some of which provide medicine, insecticides and food. *Diplazium esculentum* Sw. is a very common fern found in warmer parts of the world. The genus *Diplazium* is the derivative of Latin *Diplaze* which means the

double indusia, on each side of the vein, each furnished with a linear indusium, the one opening interiorly, the other exteriorly. The term *esculentum* means edible. In India it is distributed from Himalaya upto 3000 ft. to Kanniyakumari, covering almost all the districts. Very recently young fronds of this species are seen

to be used vigorously in the Bengal market, that attract scientists to collecting information.

Diplazium esculentum (Retz.) Sw. ex Schrad. an erect fern, densely clothed with narrow, lanceolate scales. Stipes 15-60 cm long, strong, erect, tufted. Fronds 60-180 cm long or longer, 2-pinnate, deltoid or broadly lanceolate.

Lower pinnae 30-45 cm long, 15-20 cm broad. Pinnulae 7-15 cm long, 1.5-2.5 cm broad, short-stalked, acuminate, edge crenate to shallowly lobed, lobes entire or serrate, base truncate often auricled on both sides. Rachis often pubescent; main veins distinct, copiously pinnate with 6-10 veins on each side. Sori copious, occupying all veins, up to margin. Lowest pinnae sometimes simple.

Economic uses

Young fronds are eaten as salad and as vegetable after cooking. It is a delicious preparation for Bengal. They contain moisture 86%, albuminoides 7%, and carbohydrates. Village people bring bunches of young fronds in bundles for selling in city market. This fern species is commonly known as "dhenki shak" in West Bengal.

Socio-economic aspect

There is no systematic method of cultivation of this plant. Natural habitats of this plant spread over mostly throughout India. It grows well in damp soil. The sellers cut the young fronds 20-30 cm from apical portion

and make bundles with a portion of banana leaf and sell in daily market. Sellers make the bundle with 4-6 young fronds portion and the cost of each bundle varies from Rs. 1-1.50.



Marketing of Dhenki Shak
(*Diplazium esculentum* Sw.)

Poor villagers by selling these young fronds in the market without any investment earns their livelihood.

Market Survey of Calcutta and 24-Parganas reveals that average 5 poor lady village sellers in each market earn at least Rs. 50/- to 100/- per day. The hightime for selling dhenki shak in market is from April to September.

Acknowledgement

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CULTURAL DIVERSITY OF INDIA CONSERVES BIOLOGICAL DIVERSITY *

Aparajita Hajra **

India is a country where one discovers a unique amalgamation of the past and the present, the past is alive in our exquisite cultural extravaganza. Ancient cultural practices are devoutly adopted even today and they seem to have blended with our modern day norms in such a manner that the past has not become archaic. It lives on, mingling with the present like a bountiful river that enriches the land it waters. India boasts of an ancient civilisation that has worshiped and conserved natural diversity since time immemorial. Our religious texts like the Vedas, Puranas, Upanishads etc. stand testimony to the fact that the people of India have always had an intimate relationship with nature and natural resources and that the ethos of conservation has been ingrained

in our cultural heritage.

The ethnic community of India occupies about 18.74% of the total area of this country spread over 24 States and Union Territories, there is immense heterogeneity of cultures ranging from hunting and gathering to nomadic herding and subsistence cultivation. A fairly large percentage of the total tribal population is concentrated in the states of Madhya Pradesh, Orissa, Bihar, Gujarat and Rajasthan. The tribals of North-Eastern region and the islands show considerable ethnic diversity. Each community has a distinct social and cultural identity. About 106 different languages and 227 subsidiary dialects are used by these communities. They usually occupy the

forested regions and their lifestyles blend harmoniously with nature. Such people are also known as 'Ecosystem people'. These ecosystem people have developed a stake in conserving and in some cases enhancing bio-diversity during the course of time.

The position of India at the junction of Ethiopian, Palaearctic and Oriental realms of biogeography and its rich variety of biological community types that includes coral reefs and alpine meadows, rain forests and desert scrub is responsible for its rich biological diversity. The total number of living species identified so far is about 1,26,188. With over 7% of the earth's living species in just 2% of its surface, India is justifiably considered as one of the top 12

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megadiversity countries of the world. Our country is one of the world's 12 centres of origin of cultivated plants. India's rich germplasm resource includes 51 species of cereals and millets, 104 species of fruits, 27 species of spices and condiments, 55 species of vegetables and pulses, 24 species of fibre crops, 12 species of oil seeds and various wild strains of tea, coffee and sugarcane. In addition to this, there are several hundred species of wild crop relatives distributed all over the country especially in the Western and Eastern Himalaya, the West Peninsula, East Peninsula and North-Eastern India. The ancient practice of domesticating animals has resulted in India's diverse livestock, poultry and other animal breeds. This forms a significant percentage of world diversity.

The Ministry of Environment & Forests, Govt. of India, has set up an All-India Coordinated research project on Ethnobiology. Under this project, tribal areas are surveyed and information on plant folklore, identification and documentation is collected about the plants used by the different ethnic groups in India. In one such survey report, it has been estimated that out of the 9000 species on which data was collected; 750 are used for medicinal purpose, 390 are edible, 520 are used as fibre crops, 400 for fodder, 300 as gum, resin and dye, 100 provide incense and perfumes and the rest are of other cultural and economic value. It is thus evident that the tribal communities would look for measures to ensure sustainable use of the forests which provide them with innumerable benefits. There are instances of protection and or cultivation of both individual plant species as well as entire forest patches by the ethnic communities of our country.

The Khasi community of N.E. Himalayas have domesticated several plants like "Sophlong" (*Moghania vestita*), for its tuberous roots which are edible; "Raisin" (*Digitaria cruciata* var. *esculenta*), which is used as a minor cereal as well as a staple fodder etc. the tribals of Lahul and Spiti valley in Himachal Pradesh cultivate "Kut" (*Saussurea lappa*) in a large scale. The root of this species is a major raw

material of the perfume industry. It may be noted that this species is listed in Appendix I of CITES as it has become endangered in its natural habitat. Fortunately, it has not become totally extinct due to the intervention of the people of Lahul and Spiti valley.

India is one of those regions where an entire forest patch is worshipped and rigorously conserved by several tribal groups. This custom is prevalent among tribal communities of Meghalaya, Sikkim, Maharashtra, Western Ghats etc. The sacred groves of Meghalaya in N.E. India are unique in this respect. These patches of forests harbour a large number of economically important plants (*Taxus wallichiana*), primitive plants (*Corylopsis himalayana*) wild relatives of cultivated plants, (*Camelia* spp.) and a magnificent array of orchids like *cymbidium*, *Dendrobium* etc. The forests are surrounded by grasslands which are virtually devoid of any tree species. The knowledge of conservation practices in these areas by the ecosystem people is transmitted through generations by cultural transmission. Similar forest patches have been observed in Sikkim (Eastern Himalaya). These forests can be compared with Biosphere Reserves and one typical example of Ecosystem conservation where the indigenous Flora and Fauna are conserved *in situ*. 'Kabi Long-Chok' is one such example of 'in situ' conservation and is the place of Union of Lepchas and Tibetans. According to folk-lore, the Tibetans and Lepchas inhabiting the forest vicinity were constantly with each other. At Kabi they pledged for a peaceful co-existence and Nine stones were erected to mark the place where they held their covenant. These forests have since been regarded as a symbol of peace and brotherhood. The tribals still conserve these forests and they annually visit this area to reinforce peaceful co-existence on the fifteen day of the ninth month (Tibetan calendar) and offer the rice drink (Zo); Indian corn (TA-FA), Sugarcane (MUT-PAAM) and flowers (RIP) - Although such practices have helped in conservation of biodiversity to a certain extent the ecosystem people are recently in a precarious position. These people depend largely on resources produced or gathered from

their immediate vicinity. The quality of their life depends on the maintenance of modest level of biological diversity in their own areas. In contrast the "Biosphere people" (Dusmann, 1988) i.e. the citizens of developed countries have a convenient access to resources in any corner of the world. They have thus been practising the non-sustainable utilization of biological resources. This has played havoc in the lives of the ecosystem people who are compelled to live in increasingly degraded and poor biodiversity environs. Conservationists are becoming increasingly aware of this vice and consequently several clauses have been put up in the biodiversity conservation. One of them is equitable sharing of benefits. According to this, all the benefits that are obtained from an area including collection of data, publication etc. should be equally shared with the ecosystem people of that region. This is essential not only for the economic upliftment of the ecosystem people but also for maintaining an atmosphere of cooperativeness and cordiality between them and the "biosphere people". The implementation of the Intellectual Property Rights add the Traditional Resource Rights may elevate the present scenario to a considerable extent as it would further ensure the well-being of the traditional communities.

Therefore, keeping in mind that the enrichment of biological diversity includes the enrichment in the life style of human beings who play an important role in maintenance of an ecosystem; any measure adopted for conservation of biodiversity should always go in favour of the people inhabiting the concerned area. In India, where there is a large population of ethnic communities, along with a rich diversity in life, the practice of equitable sharing of benefits is absolutely essential. People in our country have believed in conservation since the dawn of civilisation and with the modern day implementations like the IPR etc. the future looks promising enough provided the benefits actually reach the concerned people. If only a handful of persons care for their individual interests, they will be hearing themselves more than

anyone else. This simple fact which forms the basis of all our recent endeavours to safeguard the world's biodiversity was stated by a chief of an American Indian tribe, Chief Seattle way back in 1851. I quote-

"This we know : The earth does not belong to man; man belongs to the

earth. All things are connected like the blood that unites us. Man did not weave the web of life, he is merely a strand in it, whatever he does to the web, he does it to himself." Thus we should be able to respect and learn from the immense knowledge our ethnic people possess for a better and more efficient conservation of our

biological diversity.

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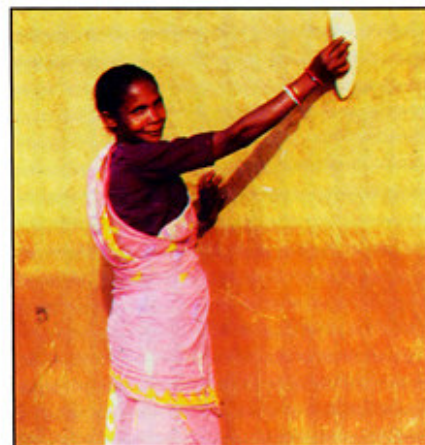
A NEW USE OF *BAUHINIA VAHLII*

S. Bandyopadhyay, S. Mitra, S. Bandyopadhyay and V. Mudgal
Botanical Survey of India

During an ethnobotanical survey in the Ajodhya hills in Purulia district of West Bengal, it was found that the tribals use the endocarp of *Bauhinia vahlii* Wight & Arn. as a trowel for smoothing the mud walls of their huts during the construction. For separating the endocarp from the epicarp, a fresh, mature and unsplit pod is, at first, carefully heated inside an oven amidst the smouldering firewood and their ashes for about five minutes. Resultantly, the pod swells up a little. The epicarp and the mesocarp are then, manually pulled apart together

from the apex to the base one after another from either side of the pod, leaving the endocarp intact. The endocarp is now divided lengthwise by giving a slight pressure on the sutures. Each half of the endocarp, so obtained, is used as a trowel by holding it in the hand in such a way that the surface with seed impressions face the palm.

We are grateful to the Ministry of Environment & Forests for financial assistance and to Sri Phani Bhusan Lohar of Bagmundi village for giving practical demonstration.



A woman using endocarp of *Bauhinia vahlii* Wight & Arn.

BIRDS OF INDIAN BOTANIC GARDEN, SHIBPUR, HOWRAH

Kalyan Dey
Secretary, PRAKITI SAMSAD

"PRAKITI SAMSAD" in Calcutta, recorded following 60 species of birds from the different divisions of Indian Botanic Garden, Botanical Survey of India, Shibpur, Howrah during the "World Birdswatch 1997" on 4th and 5th October. Since this would be useful information regarding the Avifauna of the Botanic Garden, Botanical Survey of India, it is included in the Newsletter.



Birds watch at Indian Botanic Garden, Shibpur, Howrah.

Birds recorded during Birdwatch 1997 from Indian Botanic Garden

Common Name	Genus / Species	Common Name	Genus / Species
Little Cormorant	<i>Phalacrocorax niger</i>	Lesser Goldenbacked Woodpecker	<i>Dinopium benghalense</i>
Pond Heron	<i>Ardeola grayii</i>	Swallow	<i>Hirundo rustica</i>
Cattle Egret	<i>Bubulcus ibis</i>	Brown Shrike	<i>Lanius cristatus</i>
Little Egret	<i>Egretta garzetta</i>	Golden Oriole	<i>Oriolus oriolus</i>
Night Heron	<i>Nycticorax nycticorax</i>	Blackheaded Oriole	<i>Oriolus xanthomus</i>
Pariah Kite	<i>Milvus migrans</i>	Black Drongo	<i>Dicrurus adsimilis</i>
Indian Whitebacked Vulture	<i>Gyps bengalensis</i>	Greyheaded Myna	<i>Sturnus malabaricus</i>
Redheaded Merlin	<i>Falco chicquera</i>	Pied Myna	<i>Sturnus contra</i>
Whitebreasted Waterhen	<i>Amauromis phoenicurus</i>	Common Myna	<i>Acridotheres tristis</i>
Yellowlegged Green Pigeon	<i>Treron phoenicoptera</i>	Indian Treepie	<i>Dendrocitta vegabunda</i>
Indian Ringed Dove	<i>Streptopelia decaocto</i>	House Crow	<i>Corvus splendens</i>
Spotted Dove	<i>Streptopelia chinensis</i>	Jungle Crow	<i>Corvus macrorhynchos</i>
Roseringed parakeet	<i>Psittacula karmieri</i>	Redwhiskered Bulbul	<i>Pycnonotus jocosus</i>
Redbreasted Parakeet	<i>Psittacula alexandri</i>	Redvented Bulbul	<i>Pycnonotus cafer</i>
Blossomheaded Parakeet	<i>Psittacula cyanocephala</i>	Jungle Babbler	<i>Turdoides striatus</i>
Common Hawk-Cuckoo	<i>Cuculus varius</i>	Redbreasted Flycatcher	<i>Muscicapa parva</i>
Indian Cuckoo	<i>Cuculus micropterus</i>	Tailorbird	<i>Orthotomus sutorius</i>
Koel	<i>Eudynamis scolopacea</i>	Plain Leaf Warbler	<i>Phylloscopus neglectus</i>
Coucal	<i>Centropus sinensis</i>	Dull Green Leaf Warbler	<i>Phylloscopus trochiloides</i>
Spotted Owlet	<i>Athena barma</i>	Magpie-Robin	<i>Copsychus saularis</i>
House Swift	<i>Apus affinis</i>	Blue rock Thrush	<i>Monticola solitarius</i>
Palm Swift	<i>Cypsiurus parvus</i>	Smallbilled Mountain Thrush	<i>Zoothera dauma</i>
Common Kingfisher	<i>Alcedo atthis</i>	Grey Tit	<i>Parus major</i>
Storkbilled Kingfisher	<i>Pelagopsis capensis</i>	Grey Wagtail	<i>Motacilla cinerea</i>
Whitebreasted Kingfisher	<i>Halcyon smyrnensis</i>	Pied Wagtail	<i>Motacilla alba</i>
Green Bee-eater	<i>Merops orientalis</i>	Tickell's Flowerpeacker	<i>Dicaeum erythrorhynchos</i>
Indian Roller	<i>Coracias benghalensis</i>	Purplerumped Sunbird	<i>Nectarinia zeylonica</i>
Lineated Barbet	<i>Megalaima lineata</i>	Purple Sunbird	<i>Nectarinia asiatica</i>
Bluethroated Barbet	<i>Megalaima asiatica</i>	House Sparrow	<i>Passer domesticus</i>
Crimsonbreasted Barbet	<i>Magalima haemacephala</i>		
Rufous Woodpecker	<i>Micropternus brachyurus</i>		

SCIENTIFIC AND TECHNICAL ACTIVITIES IN BRIEF

The Envis Centre on Plant diversity, of the Botanical Survey of India, Ministry of Environment & Forests, is situated at the Industrial Section, Indian Museum, 1 Sudder Street, Calcutta - 700 016. The main activities of this Centre is to provide useful information on Plant Diversity with the help of publishing Newsletters and disseminating the information to all ENVIS Centres, Universities, Research Institutes, Scientists and Scholars in India and abroad. This year the Centre has upgraded its Hardware system by installing Pentium Processor, Windows '95 and 16 MB RAM. The Centre has developed application software on Database for Rare & Threatened Plants in India. The ENVIS Centre Database presently holds data on Mangroves, Coastal Plant Diversity, Flora of Arunachal Pradesh, Plant Diversity of the Tiger Reserves in India, Plant Diversity of Godavari-Krishna Delta and Wetland of Chilka and Kabar lake. This year

on the occasion of 50th Anniversary of India's Independence, this centre has published a book entitled "Mangroves, Associates and Salt marshes of the Godavari-Krishna delta, Andhra Pradesh," which provides more information regarding the plant diversity of this delta.

The Centre has received more than 200 National and International queries during the period under report in the field of Plant Diversity, Ecology, Economic and Medicinal Plants, Wetlands, Mangroves, Rare and Threatened plants, Biosphere Reserves, National Parks, Information on less known agricultural products, Chemical alkaloids of Plants, Plants and animal interaction and their relationship with the environmental factors,

International Queries from different countries :

USA	4
France	1
U.K.	2
Canada	2
Sri Lanka	2
Italy	1
Indonesia	2
Australia	3
Brazil	1
Bangladesh	2

Statistics of Queries and Replies during 1997-1998 (in part) :

Total No. of National Queries	180
Total No. of International Queries	20



Sri Shrideep Bhattacharya, Secretary Vigyan Manch and Dr. V. Singh, incharge of Botanical Survey of India, releasing the Book "Mangroves, Associates and Salt marshes of the Godavari Krishna Delta, Andhra Pradesh. Published by ENVIS, B.S.I., to Celebrate 50th Anniversary of India's Independence.

CELEBRATION OF 50TH ANNIVERSARY OF INDIA'S INDEPENDENCE



Sit and Draw Competition on the eve of World Environment Day on 5.6.98



Dr. L. K. Banerjee, Deputy Director, Indian Botanic Garden awarding the NGO's regarding Pollution hazard of Plastic in IBG on 5th June 1998.



Prof. Nemai Sadhan Basu ex vice-chancellor, Viswavarati planting *Michelia champaca* L. before the opening of the Seminar on "Development, Progress and its problems of Indian Botanic Garden, Botanical Survey of India" on 28th and 29th July 1998.



Mass tree plantations by the school students on the eve of Golden Jubilee Celebration of India's Independence on 11.8.98 at Indian Botanic Garden.



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