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From Director's Desk

In India, during the last decade, due to drastic changes in the climate and environment some regions in the country are experiencing torrential rains and flash floods, while other regions have received scanty rains for a long time. This direct impact of climate change is becoming frequent at local and regional levels, and this would certainly affect the livelihoods and food security of the country considerably. The lack of public awareness on the importance of biodiversity considered to be one of the most serious barriers to achieve the objectives of the Convention on Biological Diversity, and of the other biodiversity-related conventions. Convention's Communication, Education and Public Awareness (CEPA) programme is an important instrument to achieve this target. Therefore, it is very essential to create awareness among the local communities about climate change and the need to develop local level adaptations to overcome the consequences of climate change.

In India, UNDP has been partnered with the Ministry of Environment, Forest and Climate Change, Government of India and supporting the efforts to promote low carbon, building resilience within the ecosystems and national development, and also to build capacities of stakeholders (i.e., the local communities) to manage the existing natural resources and promote sustainable livelihoods. The enhancement of capacity-building and issues related to CEPA are some of the provisional agenda for the thirteenth meeting of the Conference of the Parties to the Convention on Biological Diversity, to be held from 4 to 17 December 2016 at Cancun, Mexico.

The ENVIS Centre on Floral Diversity, Botanical Survey of India through its publications and website, aims to disseminate information on the various critical issues on biodiversity, environment and conservation, to create awareness among the general public. Newsletter is one of its publications, which publishes articles on biodiversity (especially plants), traditional utilisation of plant resources, endemic and threatened, medicinal and interesting plants of India, and their conservation.

I appreciate the efforts of entire team of ENVIS Centre in bringing out this informative issue.

(Paramjit Singh)
Director
Botanical Survey of India, Kolkata

CONTENTS

East Indian Red Wood

Botanical Name: Caesalpinia sappan L.

Family: Leguminosae: Caesalpinioideae

Common Names: Brazil Wood, East Indian Red Wood, East Indian Sappan Wood; Hindi: *Bakam, Patamg*; Kannada: *Sappange*; Malayalam: *Chappannam, Pathimugham, Sappangam*; Marathi: *Patang, Pathang*; Sanskrit: *Bharyavriksha, Kashtha, Patang*; Tamil: *Patamgam, Sappamgu*; Telugu: *Bakaruchakka*.

General Morphology: A shrubby tree grows to height of 10 m; trunk is armed with short straight or recurved prickles with swollen base. Leaves bipinnate, alternate; stipules modified into recurved spines; rachis 20–40 cm long, slender, pubescent, pulvinate; pinnae 10–14 pairs, 2–10 cm long, slender; a spine present at the junction between pinnae pairs on the upper side; leaflets 20–40, opposite, subsessile, oblong, 1–2.5 × 0.5–1 cm, oblique at base, entire at margins, obtuse at apex, coriaceous, glabrous. Flowers in supra-axillary and terminal racemes, bisexual; pedicels 1–2 cm long; sepals 5, unequal; petals 5, orbicular, subequal, yellow with a red spot at base; stamens 10, declinate, densely woolly at base; ovary half-inferior, grey-velvety. Pods obliquely oblong, 7–10 × 3–4 cm, woody, glabrous, black; seeds oblongoid or ellipsoid, brownish black.

Distribution: The plant is distributed widely in dry areas of central and southern India through Myanmar and Thailand to Peninsular Malaysia and to southern China. It is cultivated and naturalised in many parts of the tropics.

Uses: The slightly pinkish colour water obtained after boiling heartwood chips of sappan wood is a hot herbal drink and is being used in Kerala for its antithirst, blood purifying, antidiabetic, improvement of complexion and several other properties. Once the water is boiled with chips of sappan wood, the water gets medicated and its intake can prevent epidemic diseases spreading through water. The plant is also being used worldwide for a large number of traditional medicinal

a. Heartwood chips of sappan wood; **b.** Herbal drink obtained after boiling the heartwood chips in water

a. Inflorescence; **b.** Fruiting-twig; **c.** Dehisced pod

purposes. Decoction of the wood is a powerful astringent and emmengogue and also prescribed for diarrhoea and dysentery. Seed powder sprinkled over cuts and wounds for quick healing. Recent research confirms its anticancer, antitumor, antimicrobial and several other medicinal properties.

The wood of *C. sappan* yields a valuable red crystalline dye, 'brazilin' that known to have used at a large scale throughout world. It remained a major source of a red dye till the end of the 19th century. It is still used for dyeing textiles, but only on a smaller scale by craftsmen and artists. Silk, wool, cotton, matting and basket fibres can be dyed red with it and it is also best natural dye to colour food, beverages and pharmaceuticals.

The tree is the source of timber and commercially known Redwood or Brazil Wood. Sapwood is white and heartwood is yellow or deep orange when fresh, turning to dark red. Heartwood makes up to 90 per cent of the total volume and the wood is straight-grained with a fine to moderately fine texture, fairly heavy, hard and lustrous. It is difficult to dry and susceptible to warping and collapse, but fairly easy to work; it takes high finish and is tough and resistant to termite attack. It is used for inlaying work, cabinet making, violin bows and for walking sticks. The tree is planted as a hedge and boundary marker in villages. The leaves are used to hasten ripening of fruits such as bananas and mangoes.

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Traditional use and processing of loincloth from the stem bark of *Careya arborea* (Lecythidaceae)

a. A tree of *Careya arborea*; **b & c.** Steps involved in removal of bark from a stem; **d.** A local monk showing loincloth made from the bark

During an ethnobotanical survey in Nayagarh district, Odisha, we came across an interesting traditional use of *Careya arborea* Roxb., a medium-sized tree with thick, dark brown bark and distributed throughout Odisha state. The tree is locally known as *Kumbhi* and its stem bark is used by the local monks (*Sadhu Babas*) as a loincloth (*Kopin*).

A local monk from Krishna Chandrapur in Mahipur forest shared this interesting traditional use with us during the survey in August 2015. He told us that a stem/trunk of the *Careya arborea* tree having 6–7 feet long and 0.5–1 feet girth with intact bark will be inserted in the ground and the bark will be separated or peeled from the top end with the help of a 1–1.5 feet long wooden piece of the same tree. After removing the bark, it is seasoned in stagnant water for 10–15 days to remove the unwanted rough outer particles. The resultant fibrous bark will be seasoned further in curd for a few days to make it smooth. This processed smooth bark piece will be dried in sunlight for a few days and used as a loincloth.

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Science Express Climate Action Special Train

Science Express is an innovative mobile exhibition on a specially designed 16 coach AC train, travelling across India since October 2007. The eighth phase of Science Express was redesigned on the theme, 'Climate Change' and was moving as Science Express Climate Action Special (SECAS) from 15th October 2015 to 7th May 2016. During this period, the SECAS halted at 64 Railway stations in 20 states by covering about 19,800 km.

The SECAS was stationed at Barrackpore Railway Station from 18th to 21st January 2016 as its 32nd destination. As directed by the ENVIS Secretariat, New Delhi, the ENVIS Centre on Floral Diversity, Botanical Survey of India, Howrah had participated in the mobile exhibition. Flex banners on 'Algae of India', 'Mushrooms of India', 'Interesting Plants' and 'State Tree and Flower' (including National Tree and Flower) and various scientific publications by this Centre were displayed at the Barrackpore Railway Station (Platform no. 1). The scientific officials and research students from different units of Botanical Survey of India, Howrah, were deputed to explain about the importance of plant diversity and its conservation in our country to the visitors, especially the students.

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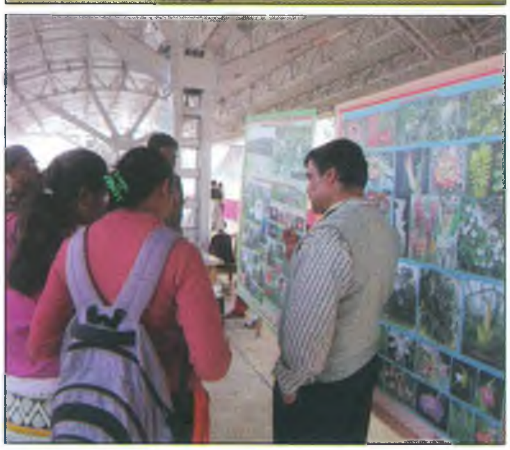

Report on the training course on herbarium

A one-day training course on herbarium techniques and methodology was organised by the ENVIS Centre on Floral Diversity, Botanical Survey of India (BSI) at Central National Herbarium (CNH), Howrah on April 2, 2016. The primary objective of this training course was to practically impart the techniques and methodology involved in herbarium preparation to post graduate students and research scholars from various universities. The inaugural session was commenced with a welcome address by Dr. P.V. Prasanna, Scientist 'F' & Head of Office, CNH, BSI, followed by the introductory remark on the training course by Dr. Paramjit Singh, Director, BSI, and keynote address by Dr. Subir Bandyopadhay, Scientist 'B', BSI. On this occasion, Prof. Shobhan Kumar Mukherjee, Kalyani University, West Bengal and Dr. M.U. Sharief, Scientist 'E' & Curator, AJC Bose Indian Botanic Garden (AJCBIBG), BSI, Howrah also expressed their views about the training course. This session was attended by scientists and scientific staff from various units of BSI, Howrah, professors from three universities in West Bengal and 34 students from six universities in West Bengal, namely, Calcutta University, Burdwan University, Kalyani University, Vidyasagar University, Visva-Bharati University, West Bengal State University and one student from T.N.B. College, Bhagalpur, Bihar.

After the inaugural session, the trainee students were taken out for a field visit by the experts of BSI to different parts of Botanic Garden and explained the method of collection and identification of plants in the field. In the afternoon session, the students were divided into four groups to provide practical demonstration on four plant groups on rotation basis. The drying, disinfecting and mounting of flowering plant specimens were practically demonstrated by Mr. K.L. Maity, former Scientist, CNH, BSI; Mr. Gopal Krishna, Mr. Anant Kumar and Mr. Shyam Biswa, Botanical Assistants, CNH, BSI. The practical demonstration of preservation and identification of algae was demonstrated by Dr. R.K. Gupta, Scientist 'D' and Dr. Sudipta Das, AJCBPDF; on Macrofungi/mushroom by Dr. Kanad Das, Scientist 'D' and Mr. Aravind Parihar, Botanical Assistant, Cryptogamic Unit, BSI, and on bryophytes by Dr. Monalisa Dey, Scientist 'B', BSI, Hqrs. Each group was given 15–20 minutes demonstration by the experts. After this, Ms. Monika Mishra, Botanical Assistant, Central Botanical Laboratory (CBL), BSI delivered a power point presentation on 'Ethnobotanical Collections' housed at Economic Botany Section. For the trainees, the course material on 'Herbarium Techniques and Methodology', prepared by the Scientists of BSI were also provided.

The trainee students were also taken to type section of dicotyledons in which, Dr. T.K. Paul, former Scientist, CNH, BSI and Mr. Saurabh Sachan, Botanical Assistant, BSI and to monocotyledons type section, where Dr. K. Karthigeyan, Scientist 'D', CNH, BSI and Dr. Avishek Bhattacharjee, Scientist 'B', CNH, BSI, explained about different kinds of type specimens and significance of type specimens in plant taxonomic research. The students were also shown and explained about the archival botanical paintings/illustrations (made by Indian artists using natural dyes), descriptions, colonial botanists correspondences, catalogues and collections made by Dr. William Roxburgh and Dr. Nathaniel Wallich. Finally, all the students were taken to the Digital Herbarium Unit and were explained about the ongoing process of digitizing the herbarium holdings of CAL by Dr. Avinash Bharati, Scientist 'B', CNH, BSI.

During the valedictory session, Dr. P.V. Prasanna, Scientist 'F' & Head of Office, CNH, BSI, Dr. A. Pramanik, Scientist 'E' & Head of Office, AJCBIBG, BSI, Dr. Harish Singh, Scientist 'D' & Head of Office, CBL, BSI and Prof. Sobhan Kumar Mukherjee, University of Kalyani, Kalyani, shared their views on the training course and commended the ENVIS Centre on Floral Diversity, BSI and its staff for organising the training programme. The students also expressed their views and also gave written feedback on the training course. The participation certificates were issued to the students by the senior scientists of BSI.

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On the occurrence of *Barringtonia acutangula* (Lecythidaceae) in Nawabgunj Bird Sanctuary, Uttar Pradesh

Barringtonia acutangula (L.) Gaertn. is an arboreal species, native to Madagascar and tropical Asia. It grows on the banks of rivers, the edges of freshwater swamps and lagoons, on seasonally flooded lowland plains near rivers and in regions adjacent to riverbanks. However, trees of 7–8 m high are predominantly riparian in habitat found in the catchment area of the central pond in the Nawabgunj Bird Sanctuary, Uttar Pradesh, located at 26°37'7.9" N and 80°39'13.7" E. Its curious occurrence within the limits of the Nawabgunj Bird Sanctuary, which is devoid of a flowing river, invokes interest on the origin of the central pond and in turn, on the history of this Sanctuary. It further paves way to inference that there might have been a river or stream passing through this region in the past, which perhaps changed its course and leaving only the pond behind. This recent living tree specimens open vistas for studies in the direction of tracing the past vegetation, information on the origin, and age of the Nawabgunj Bird Sanctuary and also whether there was actually a river or stream in this area in the past.

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Barringtonia acutangula: **a.** A tree on the bank of central pond; **b.** A close-up of flowering twig

Tapping of an unrecorded traditional herbal formulation for jaundice in Bihar

The traditional folk healing of various ailments is prevalent in rural areas of Bihar. During the course of floristic survey in different parts of Bihar, it was observed that a 67-year old local traditional healer, Jogi Mandal of Chakrami village of Bhagalpur district, collecting a plant secretly and claimed that he has been engaged in the treatment of jaundice using an herbal formulation successfully. On repeated requests, Mandal agreed to show the herb and disclose the formulation. Later, the plant was botanically identified as *Sida cordata* (Burm.f.) Borss.Waalk. (Malvaceae), a common plant growing throughout the state in wastelands and on roadsides.

Mandal explained that the fresh whole plant (about 50 gm) except the flowers is grounded with 15–20 black peppercorns and made into a drink by mixing with 100 ml of water. The drink is given in empty stomach twice in a day for normal jaundice (thrice in a day for chronic condition) to adult patients, while only 50 ml to children for 4–5 days. Consumption of liquor and spicy and oily foods is restricted during the period of treatment. It is learnt that Mandal successfully cured more than 50 patients so far by this herbal formulation during the past 10 years.

a & b. *Sida cordata*: **a.** Flowering-twig; **b.** Close-up view of a flower; **c.** Traditional healer Sri Jogi Mondal

Further, the scrutiny of literature revealed that the uses of this plant for the treatment of jaundice have not been mentioned in any of the standard medicinal plant literature (Dutta, 1877; Kirtikar & Basu, 1935; Chopra & Chopra, 1955; Chopra, 1958; CSIR, 1972; Jain, 1991). Therefore, phytochemical and biological screening of this plant is suggested for scientific verification of the claim, which would be a new source of medicine in future for the treatment of the jaundice.

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Report on the flowering and seed formation in *Ensete superbum* (Musaceae) in AJC Bose Indian Botanic Garden, Howrah

Ensete superbum (Roxb.) Cheesman, an endemic species of Peninsular India, was first introduced in Calcutta Botanical Garden (now known as AJC Bose Indian Botanic Garden [AJCBIBG]) in the year 1800. It was reintroduced in the Garden in 2004, and a plant in nursery number 1 flowered in 2009 (Hameed & al., 2010). There was fruit setting but no seed formation. The plant, however, did not survive thereafter.

In 2011, 25 healthy seeds of this plant were obtained from Lalbagh Botanic Garden, Bengaluru. The seeds were sown in pots after dipping them for 10 minutes in 1% Hydrochloride for softening the hard seed to enhance their germination. Of these, 23 germinated and the seedlings were fostered for about 6 months in the nursery, of which only 18 seedlings were survived and attained to a height of about 15 cm. Among these, 6 seedlings were planted in the nursery number 1 and the rest were planted in a row in front of Large Palm House. Unfortunately, all the seedlings planted in nursery number 1 were died within 2–3 years of growth due to severe 'Bunchy top' disease, which is prevalent among banana plantations. Of the 12 seedlings planted in a row on either side of road opposite Large Palm House 7 of them also died due to the same disease within 2–3 years of growth phase and another one in mid-2014 just before flowering. Of the four surviving plants, one flowered in the last week of December 2014 and one more in the third week of February 2015 and the remaining 2 are expected to flower in the coming days. In one of the flowered plants, seeds have been formed and it is hoped that they would be viable ones and would certainly help in multiplying this rare and endemic species.

Ensete superbum at AJC Bose Indian Botanic Garden, Howrah

Reference

Hameed, S.S., Sreekumar, P.V., Mahapatra, H.S. & Giri, G.S. 2010. *Ensete superbum* (Roxb.) Cheesman (Musaceae), a curious banana plant endemic to Western Ghats, flowered in Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah. *ENVIS Newslett.* 15: 4.

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The infauna of pitcher plants

Nepenthes are known to be one of the carnivorous plants and comprising about 90 species (Mabberley, 2008). Most of them trap preys within their pitchers generally by luring them by their attractive colour, nectar that is exuded from glands present at the rim of the pitcher and on the under surface of the lid and odour. The trapping process is driven by gravity, i.e., the prey falls into a hollow pitcher and is unable to climb out (Adlassnig & al., 2011), subsequently, get drowned in the pool of enzymatic fluid present inside the pitchers and get digested with no energetic active movement on the part of the plants. Thus the popular belief, pitchers trap preys by closing the lid of the pitcher as soon as they enter inside it, is false one. The preys include invertebrates such as insects (predominantly ants), spiders, scorpions, centipedes, millipedes, mollusks, slugs and rarely even vertebrates such as lizards, frogs, small birds and rats as well.

It is surprising that some species of flies and midge larvae, spiders, mites, ants, and even a crab, *Geosesarma malayanum* inhabit the deadly pitchers of *Nepenthes* plants and they are known as *Nepenthes* infauna. Some of these organisms are so specialised that they cannot survive anywhere else, and are referred to as nepenthebionts. Joseph & Joseph (1986) reported the presence of mosquito larvae from the enzymatic fluid of the pitchers of *N. khasiana* Hook.f., an endemic to India (Meghalaya), and under laboratory conditions, the larvae developed into *Aedes* mosquitoes. The nepenthebionts may be species specific and are totally dependent on them at least in some stage of their life cycle, for example, mosquito larvae of *Culex rajah* in the pitchers of *N. rajah* Hook.f. The complex relationships between these various organisms and the *Nepenthes* species are not yet fully understood. Now, the question arises how some organisms can survive within the digestive juice of the pitchers, which is normally deadly for others. Probably the organisms do get drowned within the pool of digestive enzymes and presumably have defenses against acidity and pitcher's enzymes (Dover, 1928; Schilthuizen, 2008).

The question of whether infaunal animals "steal" food from their hosts, or whether they are involved in a mutually beneficial (symbiotic) association has yet to be investigated and is the source of considerable debate. However, Clarke (1997) suggests that mutualism is a "likely situation", whereby "the infauna receives domicile, protection and food from the plant, while in return, the infauna helps to break down the prey, increase the rate of digestion and keep bacterial numbers low".

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Nepenthes rajah: **a.** An entire pitcher; **b.** Pitcher showing mosquito larvae; **c.** Close-up of mosquito larvae **Source:** www.google.com

Acharya Jagadish Chandra Bose

Acharya Jagadish Chandra Bose (1858–1937), an Indian physicist, who pioneered the investigation of radio and microwave optics and regarded as India's first modern scientist. Bose was born on November 30, 1858 at Mymensingh (now in Bangladesh). Bose had his early education from a village school in Bengali medium. In 1869, he joined the Hare School and then St. Xavier's School at Calcutta (now Kolkata). He passed the entrance examination (equivalent to school graduation) of University of Calcutta in 1875 and was admitted to St. Xavier's College, Calcutta, and received a B.A. in physical sciences from University of Calcutta in 1879. He went to England in 1880, studied medicine at London University, for a year but could not continue due to his ill health. In January 1882, Bose joined Christ's College to study natural sciences, and obtained a Bachelor of Arts with a second class in natural sciences tripos in 1884, and in the same year, he also obtained a Bachelor of Science from the University of London. After completing his education, he came back to Kolkata, where he was appointed as a professor of physical science at Presidency College, Calcutta and served in the post till 1915.

Bose carried out experiments involving refraction, diffraction and polarization at Presidency College. During 1894–99, he did experimental research on the Hertzion waves, and created the shortest radio waves (5 μm). He was the pioneer in multimedia communication, conducted his first public demonstration of electromagnetic waves (i.e. communication experiment) in 1895. Bose was the first to given patent (No. U.S. 755840) worldwide, for his invention of 'Galena Detector', a solid-state diode detector to detect electromagnetic waves. In fact, Jagadish Chandra Bose, was the first inventor of Marconi's wireless detector. Furthermore, recently, Bose was acknowledged by the Institute of Electrical and Electronics Engineers (IEEE–USA) as one of the pioneers in the discovery of radio. In the years between 1899 and 1902, Bose made detailed study of coherer (an early form of radio detector), which led him to discover the common nature of electric response to all forms of stimulation, in animal and plant tissues. On May 10, 1901, at the central hall of the Royal Society in London, Bose demonstrated his experiment to prove that plants too have feelings like other living beings, using his own invention, the crescograph, which received mixed responses; indeed, he was criticised by some plant physiologists. However, he further researched to detect the response of the plants to fertilizers, light rays and wireless waves, and the devise received widespread acclaim. Bose also extensively researched the behaviour of radio waves, and devised another instrument called 'Coherer', for detecting the radio waves.

In 1917, Bose founded Bose Institute at Calcutta and served as the founder Director of the institute and remained in the post until his death. The institute has been evolved over the years into one of the few multi-disciplinary institutions in India. Bose authored two illustrious books namely 'Response in the Living and Non-living' (1902) and 'The Nervous Mechanism of Plants' (1926). Bose was elected Fellow of the Royal Society in 1920, for his amazing contributions and achievements. Although most of them regarded him as "Plant Physiologist" he was a "Physicist". Jagadish Chandra Bose died on November 23, 1937 in Calcutta at the age of 79.

On June 25, 2009, the 230-year old Indian Botanic Garden in Howrah was rechristened as Acharya Jagadish Chandra Bose Indian Botanic Garden, to honour his contribution to plant science.

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a. Sri Prakash Javadekar, Hon'ble Minister of State for Environment, Forest and Climate Change visiting ENVIS, BSI stall at 'the Ashok', New Delhi; **b & c.** Dr. Anandi Subramanian, Sr. Economic Advisor, MoEF & CC visiting ENVIS, BSI stall and looking at a banner at MoEF & CC, New Delhi; **d.** Brainstorming session of Eastern Regional ENVIS Centres held at Gangtok, Sikkim; **e.** Dr. Paramjit Singh, Director, BSI delivering a keynote address during the celebration of International Day for Biological Diversity, 2016 at CNH, Howrah; **f.** Participation of students in a 'Sit and Draw' Competition organised during the celebration of World Environment Day at AJC Bose Indian Botanic Garden, Howrah

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Activities of the Centre: The Botanical Survey of India having involved in exploration activity has been collecting diverse data pertaining to floral diversity of the country and its ENVIS Centre proposes to disseminate this information by building databases on various scientific themes such as status of plant diversity in Indian States and Union Territories, Biodiversity Hotspots, distribution of endemic and threatened plants, CITES, interesting plants, carnivorous plants, invasive alien species, wetlands, mangroves, and traditional/ethnobotanical knowledge. It is also engaged in publication of state-wise bibliography including abstracts of papers pertaining to plants of India and also selected publications that have relevance both in documentation and conservation.

LIST OF PUBLICATIONS BROUGHT OUT SO FAR

I. Books

1. Mangroves, Associates and Salt Marshes of the Godavari and Krishna Delta, Andhra Pradesh – India
2. Diversity of Coastal Plant Communities in India (Priced publication) ₹ 804.00*
3. Red List of Threatened Vascular Plant Species in India
4. A Pictorial Guide to some of the Indian Plants included in CITES and Negative List of Exports
5. Bibliography and Abstracts of Papers on Flora of different States and Union Territories [West Bengal I & II, North East India – I, Andaman and Nicobar Islands, Maharashtra, Kerala, Tamil Nadu, Karnataka, Goa and Andhra Pradesh (including Telangana)]

II. Newsletters: Up to Vol. 21(1), 2016

*Demand Draft (DD) is to be drawn in favour of ACCOUNTS OFFICER, PAO (BSI/ZSI) payable at Kolkata and to be sent to the address of the ENVIS Centre given above