ISSN-0974-1992

भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

ENVIS CENTRE ON FLORAL DIVERSITY

ENVIS NEWSLETTER

Vol. 21(2), 2016

From Director's Desk

The thirteenth meeting of the Conference of the Parties (CoP 13) to the Convention on Biological Diversity and of the Meetings of the Conference of the Parties to the Nagoya and Cartagena Protocols, collectively called the 2016 United Nations Biodiversity Conference took place in Cancun, Mexico, from 2 to 17 December, 2016. Over 6,000 participants including some 4,300 delegates from 170 countries and over 400 intergovernmental, nongovernmental, indigenous and local community organisations, academic and private sectors attended the conference. India being one of the parties in the CBD, has actively participated in the conference. The conference resulted in significant commitments for action on biodiversity, conservation and climate change. The parties of the conference agreed to implement actions to integrate biodiversity in forestry, fisheries, agriculture, and tourism sectors and to achieve the 2030 Agenda on Sustainable Development.

A total of 33 different decisions have been adopted during the conference, of which, expanding considerably the Protected Areas in the oceans and seas, is notable. India has not supported inclusion of any Ecologically Biologically Significant Marine Areas within its Exclusive Economic Zone. During the conference, India also proposed that women should be considered as the key stakeholders in both conservation and sustainable utilisation of natural resources and it also expressed its concern regarding lack of financial resources for effective implementation and called for additional support.

The Environmental Information System (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

DISCLAIMER

CONTENTS

The Little Star Bush

Botanical Name: Wrightia antidysenterica (L.) R. Br.

Family: Apocynaceae

Common Names: Arctic Snow, Asian Snow, Coral Swirl, Milky Way, Snow Flakes, White Angel, Winter Cherry; Malayalam: *Ceylon Mulla, Kodagapala*; Sanskrit: *Kutaja*; Tamil: *Kudakappalai*.

Etymology: The generic name *Wrightia* honours William Wright (1735–1819), a British botanist and physician, and the specific epithet *antidysenterica* is attributed to the antidysenteric property of the plant.

General Morphology: A semi-deciduous, laticiferous shrub, to 2 m high, dichotomously branched with a spreading canopy of about 1.5 m wide; bark greyish brown with vertical streaks; nodes subcompressed and wide. Leaves opposite, ovate or ovate-oblong, 2–5 × 1–3 cm, rounded or obtuse at base, entire at margins, acute or with a short acumen at apex, glabrous, emerald green above, parakeet green beneath; lateral veins 6–8 pairs, faintly raised above, more prominent beneath, reticulate; petioles 1–3 mm long. Inflorescence a cyme, corymbose, 2–8-flowered; peduncle with prominent scars of fallen pedicels. Flowers 1.5–2.5 cm across, erect; pedicels longer than calyx. Calyx greenish, cupular, 5-lobed; lobes 1.5–3 mm long, alternating with glandular scales, glabrous. Corolla tube white or slightly green-tinged, 1–2 cm long; lobes 5, white, spathulate; corona in clustered row, staghorn-shaped, minutely puberulous throughout. Stamens inserted at the mouth of corolla tube with very short filaments; anthers cream-yellow with whitish acute apices, lanceolate-sagittate, cohering each other, exserted from corolla tube. Fruits a follicle of two merocarps, cylindrical, acuminate, to 15 × 0.5 cm, glabrous, green, many-seeded; seeds linear, pale greyish brown with a tuft of hairs at one end.

A flowering branch

Flowers in close-up view (Inset: Staghorn-shaped corona)

Distribution: Native to Sri Lanka; cultivated in gardens of India, Philippines, Mexico, and United States, for its star-like elegant, white flowers, as well as for its medicinal value.

Uses: A promising ornamental shrub, grown for its white flowers. The plant has been long known in Ayurvedic system although it is endemic to Sri Lanka. The plant is widely used in traditional medicinal system for treatment of colic and diarrhoea. Bark, root, leaves and flowers of this plant are widely used for their various medicinal properties. Bark extract is antimicrobial and anti-inflammatory, administered for mouth sores, psoriasis, dermatitis and other skin ailments. Bark is an adulterant for the well-known drug plant, *Holarrhena pubescens* Wall. ex G. Don [= *H. antidysenterica* (Roth) Wall. ex A. DC.] with which, sometimes, this species is also taxonomically confused.

Propagation: The plant can be propagated through seeds. This plant prefers bright light, and can also be grown in partial shade localities but will result in production of fewer flowers. It can also be grown in indoors in pots or any containers.

P.V. Sreekumar

Thanamakua, Bakultala Check Post, Bakultala,
Howrah – 711 109, West Bengal.

E-mail: drpvsreekumar@gmail.com

Alarming spread of *Rumex nepalensis* (Polygonaceae) in the Western Himalaya – A cause of concern

Rumex nepalensis Spreng., one of the well-known Himalayan Sorrels, belongs to the buckwheat family Polygonaceae. It is distributed throughout the Himalaya from Afghanistan to Myanmar, Southwest Asia and up to Indonesia and Vietnam. *Rumex nepalensis* belongs to the group (Docks and Sorrels), which includes a few invasive weeds such as the Eurasian *R. acetosella* L. (Sheep's Sorrel) and *R. crispus* L. (Yellow Dock). Hooker (1886) categorised *R. nepalensis* as a temperate Himalayan species reaching up to subalpine belt at elevations ranging from 1300 to 3000 m and an exceptional report at 4000 m as recorded by J.L. Stewart from Chenab Valley (Jammu and Kashmir). Observations carried over the last 10 years (2005–2015) covering areas from cold desert of Northwestern Himalaya (Jammu and Kashmir and Himachal Pradesh) to Garhwal-Kumaun Himalaya (Uttarakhand) led us to conclude that it has now become one of the most common and locally abundant invasive plant species, seriously affecting the composition and dominance of the flora at higher elevations of Western Himalaya. In colonial patches, each 5–50 sq m, at first it looks like a small threat, but when considered cumulatively, it account for the significant area of alpine meadows, the most floristic diversity rich habitat of the Western Himalaya. The alarming spread of this species, breaking both southern and northern distributional limits and extending to most of the temperate to alpine Western Himalayan valleys at elevations ranging from (800–)1500 to 3700(–4300) m, needs immediate attention.

The primary reason for the widespread of Himalayan Sorrel is grazing by herds of nomadic sheep and goats in Himalayan meadows every summer. At places even facilitated by mules and horses, mainly along trek routes and footpaths, especially valleys with religious and tourist places. The species has specialised fruits (adapted for animal dispersal) with hooked teeth on marginal wings, which easily get entangled with the wool/body hair of sheep, goats, horses and mules and migrate with them. Fruits usually fall on the way and more commonly in and around resting grounds (in alpine meadows/gentle slopes). High and quick germination, speedy growth in short duration (attain flowering stage within 30–40 days), high regeneration and abundant axillary branching in response to cutting of main axis, many-flowered inflorescence and high seed set give the species all

Western Himalayan slopes invaded by *Rumex nepalensis*

essentialities for its invading behaviour. Availability of animal droppings/urine along trek routes and in resting grounds supports its luxuriant growth. This has resulted in the development of large patches of this species in subalpine and alpine meadows and along trek routes, threatening and replacing other herbaceous species. Its growth and dominance remain unchecked in contrast to other native species, which are under grazing pressure (primary choice) by local and non-native herbivores. This has caused a continuous depletion in population of the local flora, more commonly so in 'Tall-Forbs' type of meadows, which are rich medicinal herbs. Due to its invasive nature, *R. nepalensis* has not only become one of the dominant herbs but also reduces the available area for (already anthropogenically threatened) RED-listed species and other high value alpine medicinal herbs such as *Aconitum heterophyllum* Wall. ex Royle, *A. violaceum* Jacquem. ex Stapf, *Angelica glauca* Edgew., *Dactylorhiza hatagirea* (D. Don) Soó, *Dolomiaea macrocephala* Royle, *Heracleum candicans* Wall. ex DC., *Malaxis muscifera* (Lindl.) Kuntze, *Nardostachys jatamansi* (D. Don) DC., *Picrorhiza kurrooa* Royle, *Polygonatum verticillatum* (L.) All., *Pleurospermum angelicoides* (Wall. ex DC.) Benth. ex C.B. Clarke and *Swertia ciliata* (D. Don ex G. Don) B.L. Burtt and also threatens other highly nutritive fodder species including grasses (*Danthonia* grassland), sedges (*Carex* meadows) and associated dwarf herb meadow (*Kedarnatha garhwalica* (H. Wolff) Pimenov & Kljuykov dominated meadows – *Dhania bugi*), which supports native wild herbivorous fauna. Since yesteryear's grazed areas get covered by *Rumex*, every next year nomadic

Gregarious populations of *Rumex nepalensis* at Namik-Hiramani Valley, Kumaun

Habit (close-up)

herd move to newer pastures, facilitating further spread of the species.

Notably, this species uses elevational climatic conditions and annual to and fro movement of nomadic herbivores to its greatest advantage for seed dispersal. At lower elevations in temperate zone, the species flowers and bears fruits during May–June so that the upwardly moving sheep and goats carry the entangled fruits to higher reaches, whereas in subalpine and alpine areas the fruit-setting occurs during September–October so that downward moving herbivores carry the seeds to lower valleys. Thus, both upward and downward seed dispersal is ensured, which helps the species to break both, southern and northern distributional boundaries and retain its abundance in already occupied zones. Though, the spread of *R. nepalensis* is credited to nomadic fauna (courtesy anthropogenic activities), but considering such grazing that has been happening for centuries its acclimatisation and dominance at the higher reaches of alpine belt in recent years is a possible contribution by climate change events and related increasing temperature at higher elevations. Field observations during floristic surveys supported by herbarium collection data from Western Himalayan region indicate the locally abundant and invasive occurrence of the species in most of the temperate to alpine valleys of the Western Himalaya. Considering its acclimatisation to broad elevation range with variable temperature, the species has a potential of further overriding and severely affecting survival of other vulnerable native species, endemics, rare and threatened plants, and thereby altering the composition and dynamics of the native flora.

Rumex nepalensis is known in Garhwali as 'Amalya', 'Khatura', 'Kholya', 'Khodya', 'Khunkhuya' and 'Jangli Palak'.

Fl. & Fr.: April–October.

Young shoots and leaves are eaten as vegetable; infusion of leaves is given to cure ulcers; crushed leaves are rubbed on body parts to provide relief from irritation caused by contact with nettles (*Urtica* leaves).

Control measures suggested: Controlled and regulated grazing, change in movement of nomadic herds and early uprooting and burning of young plants in selected invaded areas.

The present report highlights the importance to undertake floristic studies to document potential native and introduced species under 'Future Invasive Plant Threat Assessment' programme and to understand the changing floristic composition/dominance in response to climate change in different parts of the Himalaya. All such introduced species with invasive tendencies (well-established as well as potential) need to be listed, monitored and develop an 'Invasive Species Control Protocol' to check future heavy invasion overriding and threatening existence of other native flora in general and rare, threatened, endemic and economically important plant species in particular.

Reference

Hooker, J.D. 1886. Polygonaceae. *The Flora of British India*. Vol. 5. L. Reeve & Co., London. pp. 22–61.

P.K. Pusalkar* & S.K. Srivastava

Northern Regional Centre, Botanical Survey of India, Dehradun – 248 195, Uttarakhand.

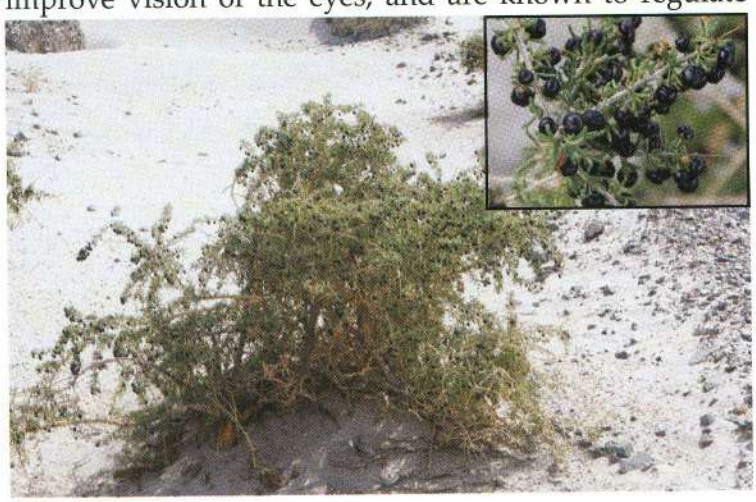
*E-mail: lecyth@yahoo.com

Lycium ruthenicum (Solanaceae), a rare potential crop for posterity: Plea for its cultivation and conservation in India

Lycium L., a genus of c. 80 species (Mabberley, 2008), is distributed worldwide but mainly concentrated in South America, S. Africa, Europe, Transcaucasus and Asia, from tropical to temperate regions. *Lycium* species are perennial shrubs and many inhabit arid to semiarid environments, though some are found in coastal saline habitats. The majority of species have perfect flowers, and produce red or purple, fleshy berries. In India, the genus is known by three species, distributed in Northwest Himalaya, Punjab and Rajasthan.

Lycium ruthenicum Murray is a unique nutritional and medicinal plant species, commonly known as Black Goji Berry. In India, it is narrowly confined to open, dry areas along sand dunes or with sandy soil in the cold deserts of Ladakh, at elevations between 2800 and 3200 m. It is locally known as 'Khichar', 'Khitsar' and 'Kitserma'. The plant produces flowers and fruits during June–August. Globally, it is distributed sporadically in salinised cold deserts of Pakistan, Afghanistan, Kazakistan, Kyrgyzstan, Mongolia, China, southeast Russia, Tajikistan, Turkmenistan and Uzbekistan.

Its special physiological characteristics of drought resistance and salt-resistance make it an ideal plant for preventing soil desertification and alleviating the degree of soil salinity-alkalinity, which are very important for the ecosystem and agriculture in the remote areas. In addition to that, *L. ruthenicum* has been recorded in Tibetan medical classic "Jing Zhu Ben Cao" as a traditional medicinal herb. The plants are rich in Oligometric Proanthocyanidins, which has great antioxidant properties, helps in the elimination of toxins. It inhibits the growth of cancer cells, thus used in controlling cancer. It is also used in the treatment of heart diseases and menstrual disorders. The antioxidants also have antiaging properties; they nurture and regulate the functioning of liver and kidneys; cure fatigue and weakness in the knees and waist, relieve stress, improve vision of the eyes, and are known to regulate circulation of blood throughout the body thus replenish the body and skin. The antioxidants improve the immune system, and also useful in treating impotency.



Habit (Inset: Fruiting-twig)

During a recent tour to the Nubra Valley, Ladakh, the authors collected this interesting thorny bush in fruiting, which grows in acute arid condition in the sandy cold desert part of Ladakh in India.

The local people in Nubra Valley use this plant to treat eye disease in double-humped camels. The berries can be a good resource for income generation of local people. Its cultivation on field bunds will not only provide the useful berries but can also serve as bio-fencing against wild animals to save traditional crops. The shrub is also a good soil binder and checks soil erosion in xeric areas.

Because of overexploitation and deterioration of its habitat, the number of populations and individuals of this species has dropped considerably in recent decades to the point where it is now considered to be threatened in some range countries like China and has been listed among the important wild conservation plants (Chen & al., 2008). Recent experimental studies mainly focused on chemical components and pharmacological properties have shown that *L. ruthenicum* is so far a Tibetan herb for traditional medicine, and also been used as a unique nutritional food, could now be developed and utilized as an effective health product after radiation therapy in cancer patients (Fa & al., 2012).

Analysis of the genetic diversity of an endangered species is an important prerequisite for conservation as it reflects the status and survival potential of populations. There is an urgent need to develop package of practices for Indian cold desert region in Ladakh for this potential crop. The present paper also emphasises the need for further experimental work in India on this potential medicinal plant.

References

Chen, H., Pu, L., Cao, J. & Ren, X. 2008. Current research state and exploitation of *Lycium ruthenicum* Murr. *Heilongjiang Agric. Sci.* 5: 155–157.

Fa, O-Y., Ji, T-F., Su, Y-L., Li, J. & Liu, H. 2012. Chemical constituents of the fruits of *Lycium ruthenicum*. *Zhong Yao Cai* 35: 1599–1601.

Mabberley, D.J. 2008. *Mabberley's Plant-Book: A Portable Dictionary of Plants, their classification and uses.* Cambridge University Press, Cambridge.

P. Singh[1]* & Kumar Ambrish[2]

[1]Botanical Survey of India, CGO Complex, Salt Lake City, Kolkata – 700 064, West Bengal.

[2]Northern Regional Centre, Botanical Survey of India, Dehradun – 248 195, Uttarakhand.

*E-mail: pchanna@gmail.com

Rhopalocnemis phalloides (Balanophoraceae): A root parasite from Neora Valley National Park, West Bengal

During a floristic survey in the Neora Valley National Park (NVNP), Darjeeling district, West Bengal (26°52'3"–27°7'3" N and 88°45'–88°50' E) in September 2016, the authors came across *Rhopalocnemis phalloides* Jungh., a curious rare root parasite at Rhenock block, North Range, at an elevation of 2522 m (27°6'48" N and 88°42' E). The plants were yellowish brown with thick rhizome and endogenously originating stem.

The species was described by Junghuhn (1841) from China. The same plant was described by Griffith (1844a, b) as *Phaeocordylis areolata* based on his collection from Khasia hills during 1835–36. Hooker (1886) and Kanjilal & al. (1940) included this species in their respective Floras on the basis of Griffith's collection. Joseph & Chauhan (1983) recorded it from Namdapha Wildlife Sanctuary in Tirap district, Arunachal Pradesh. Chauhan (1988) assessed it as a rare species in India. Hara (1966) and Grierson & Long (1983) reported its distribution in Sikkim without mentioning the specific locality. According to Balakrishnan (2012) this species is distributed in the states of Arunachal Pradesh, Meghalaya and Sikkim in India. However, its recent report by Rai & Das (2013) based on a collection from NVNP (Jaributi) in 1993 shows its extended distribution in West Bengal. The present report is a recollection of this species from NVNP after a gap of 23 years.

This species thrives well under diffused sunlight in dense evergreen undisturbed forests. It grows either solitary or in clusters on the roots of members of Fagaceae and Araliaceae, and can easily be recognised in its reproductive stage. It is the only species of the genus reported from India.

Habit

References

Balakrishnan, N.P. 2012. Balanophoraceae. In: Balakrishnan, N.P., Chakrabarty, T., Sanjappa, M., Lakshminarasimhan, P. & Singh, P. (eds.), *Flora of India*. Vol. 23. Botanical Survey of India, Kolkata. pp. 71–78.

Chauhan, A.S. 1988. *Rhopalocnemis phalloides*. In: Nayar, M.P. & Sastry, A.R.K. (eds.), *Red Data Book of Indian Plants*. Vol. 2. Botanical Survey of India, Calcutta. p. 71.

Grierson, A.J.C. & Long, D.G. 1983. *Flora of Bhutan*. Vol. 1(1). Royal Botanic Garden, Edinburgh. p. 153.

Griffith, W. 1844a. On the root parasites referred by authors to Rhizantheae and their allies. *Proc. Linn. Soc. London* 1(22): 219–221.

Griffith, W. 1844b. On the Indian species of *Balanophora* and on a new genus of the family Balanophoraceae. *Trans. Linn. Soc. London* 20: 93–108.

Hara, H. 1966. *The Flora of Eastern Himalaya*. Vol. 1. The University of Tokyo Press, Tokyo. p. 66.

Hooker, J.D. 1886. *The Flora of British India*. Vol. 5. L. Reeve & Co., London. p. 239.

Joseph, J. & Chuahan, A.S. 1983. Namdapha Wild Life Sanctuary, Tirap, Arunachal Pradesh. In: Jain, S.K. & Sastry, A.R.K. (eds.), *Botany of some tiger habitats in India*. Botanical Survey of India, Calcutta. pp. 26–29.

Junghuhn, F.W. 1841. Ueber Javan'sche Balanophoreen. *Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur.* 18(Suppl. 1): 215.

Kanjilal, U.N., Kanjilal, P.C., De, R.N. & Das, A. 1940. *Flora Assam*. Vol. 4. Government of Assam, Shillong. p. 133.

Rai, P.C. & Das, A.P. 2013. Occurrence of *Rhopalocnemis phalloides* Junghuhn (Balanophoraceae) in Neora Valley National Park, a new record for West Bengal, India. *Pleione* 7: 247–249.

Gopal Krishna[1], Anant Kumar[1], Vinay Ranjan[1]* & Nisha Goswami[2]

[1]Central National Herbarium, Botanical Survey of India, Howrah – 711 103.

[2]Neora Valley National Park, Gorumara Wildlife Division II, Jalpaiguri – 735 101, West Bengal.

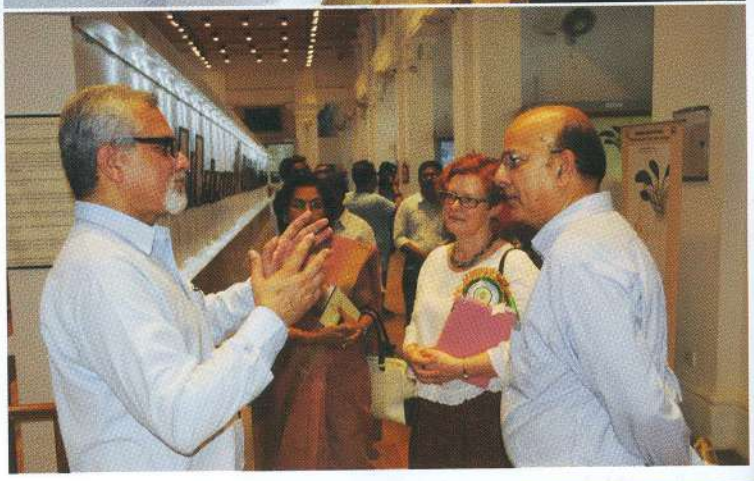
*E-mail: ranjanv_alld@rediffmail.com

A report on the international exhibition on "Joseph Dalton Hooker: conference on the "Natural

A year-long international exhibition on "Joseph Dalton Hooker: Botanical Trailblazer and Botanical Heritage of India" along with a two-day conference on the "Natural History Heritage of India" on 1st and 2nd of October 2016 was organised by the Centre for World Environmental History, University of Sussex, UK in collaboration with Royal Botanic Gardens, Kew, UK, Botanical Survey of India (BSI) and Indian Museum, Kolkata. Sri Ajay Narayan Jha, IAS, Secretary, Ministry of Environment, Forest and Climate Change (MoEF & CC), New Delhi, inaugurated the exhibition at the recently refurbished gallery in the Indian Museum. The life history and works of Sir J.D. Hooker and Dr. E.K. Janaki Ammal are displayed in the exhibition for the general public, students and researchers. The inaugural function of the two-day conference began by lighting of lamp by the dignitaries and a welcome song. Dr. Paramjit Singh, Director, BSI, welcomed the guests and gathering. Ms. Gina Fullerlove, Head of Publishing at Royal Botanic Gardens, Kew delivered the introductory speech on the international exhibition on Sir Joseph Dalton Hooker. Dr. Vinita Damodaran, Professor of South Asian History at University of Sussex, Brighton, UK, who is currently leading an Arts and Humanities Research Council (AHRC) network project on the botanical and meteorological history of the Indian Ocean, outlined the project briefly.

Sri Ajay Narayan Jha, Secretary, MoEF & CC, delivered the inaugural address, and released the books: "Endemic Vascular Plants of India" (by P. Singh, K. Karthigeyan, P. Lakshminarasimhan & S.S. Dash), "Liverworts and Hornworts of India: An annotated checklist" (by D.K. Singh, S.K. Singh & D. Singh) and the Silver Jubilee Issue of Vanaspati Vani (Hindi) by BSI, besides two books authored by Dr. Henry Noltie, Royal Botanic Garden, Edinburgh, "Indian Forester, Scottish Laird: The Botanical Lives of Hugh Cleghorn of Stravithie" and "The Cleghorn Collection" and "Tilling the Land, Agricultural Knowledge and Practices in Colonial India" (by Deepak Kumar & Bipasha Raha). Vote of thanks was proposed by Dr. M.U. Sharief, Scientist 'E', BSI, and the guests were felicitated.

The two days conference had four technical sessions, and the first session on 1st October with the theme, "The Archive for South Asian Environmental History" began with a speech by Ms. Antonia Moon, Lead Curator, British Library on "Resources for South Asian Environmental History at the British Library", followed by lectures on "BSI Archives and Collections" by Mr. Subir Dey, a research scholar from Jawaharlal Nehru University (JNU), New Delhi, and Dr. K. Anupama, Researcher at the French Institute of Pondicherry delivered the last speech of the session on "Confluence: Six decades of Franco-Indian collections and ecological studies at the French Institute of Pondicherry". The second technical session began after the lunch break, "Colonial Science and Empire" was the theme of the session, Prof. Deepak Kumar, an Indian Historian and Professor of History of Science and Education, JNU, New Delhi, spoke on "William Roxburgh,



Botanical Trailblazer and Botanical Heritage of India" and a two-day History Heritage of India"

Nathaniel Wallich and Indian Botany", Dr. Rohan D'Souza, a specially appointed Associate Professor of Graduate School of Asian African Area Studies, Kyoto University, Japan talked about the Roxburgh monument and the AJC Bose Indian Botanic Garden, and Ms. Gina Fullerlove outlined the life history of Joseph Dalton Hooker, Kew and the plants of India introduced and grown at Kew Gardens by Hooker. After the session, a round-table discussion on natural history, environment and climate change was held; the discussion was chaired by Dr. A. Pramanik, Scientist 'E', BSI, Dr. Robert Prys-Jones, Natural History Museum, London, Prof. Deepak Kumar, JNU, New Delhi, Prof. Sutapa Sarkar, West Bengal State University, Prof. Mahua Sarkar, Jadavpur University and Ms. Jenia Mukherjee, IIT, Kharagpur. The third technical session on "Indigenous Collections of Natural History and Environment" began after a short tea break. Two lectures, "Oral narratives, environmental history and Jhumur songs" by Prof. Mahua Sarkar, and "Life, literature and folk deities in the mangroves" by Prof. Sutapa Sarkar were delivered during this session. The first day of the conference ended with a cultural programme.

The second day of the conference had two sessions, the fourth and fifth session with the themes, "Environmental history in South Asia: New challenges and empire", and "Natural history and forestry", respectively. The fourth session began with a lecture by Dr. Rohan D'Souza on "Politics at Boiling Point: South Asian Environmental History and the Anthropocene", followed by Dr. Vinita Damodaran on the colonial science and post-colonial Botany, and the life of E.K. Janaki Ammal, whereas, Prof. Deepak Kumar spoke on science popularisation in colonial and post-colonial India, and Prof. Bikramaditya Kumar Choudhary, JNU, New Delhi delivered a speech on "Disease and environmental history of India". After a short tea break, the fifth and the last session of the conference began with a speech by Dr. Henry Noltie on "Hugh Cleghorn, the then Indian Forester and Scottish Laird", followed by Dr. Robert Prys-Jones spoke about "Allan Octavian Hume (1829–1912), the Pope of South Asian ornithology", and the session ended with a lecture by Prof. Bipasha Raha, Visva-Bharati, on the "Flora of Birbhum district: Ethnomedicine and the Santals". The concluding session and discussion on climate change and history was chaired by Dr. Rohan D'Souza, Dr. Vinita Damodaran and Prof. Bipasha Raha. The delegates were taken to AJC Bose Indian Botanic Garden and Central National Herbarium for a visit after lunch and shown the monuments, Roxburgh building, over 250-year old Great Banyan tree and botanical archives housed at type herbarium.

W. Arisdason

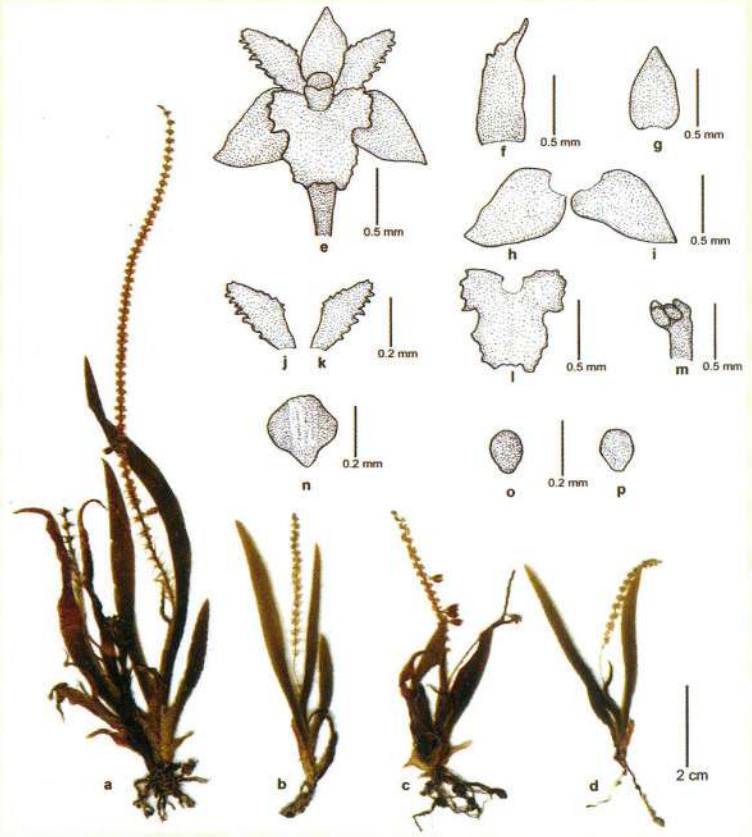
Central National Herbarium, Botanical Survey of India, Howrah – 711 103, West Bengal.

E-mail: dasonaris@yahoo.co.in

On the occurrence of *Oberonia brachystachys* (Orchidaceae) in Balpakram National Park, Meghalaya

During a field tour in Balpakram National Park (BNP), South Garo Hills district of Meghalaya in December 2013, a few mature individuals of an epiphytic orchid were found on the tree trunks of *Syzygium tetragonum* (Wight) Wall. ex Walp. at Khundol Gup (25°15'37.05" N, 90°53'06.6" E). The epiphytic orchid was found on hillslopes at an elevation of 183 m. Subsequent study of the specimens and consultation of literature revealed that the plants are of *Oberonia brachystachys* Lindl. In India, the species is found rarely in Sikkim and Meghalaya. It is distributed in the Eastern Himalaya, Northeast India, Myanmar, Thailand and Malaysia.

Oberonia brachystachys Lindl., Sert. Orchid.: t. 8B. 1838. Plants 5–16 cm long. Leaves articulate, linear-ensiform, 2–9 × 0.3–0.5 cm, acute at apex. Inflorescence adnate at base to uppermost leaf, slender, 3–13.5 cm long; peduncles subterete, longitudinally grooved with several sterile bracts; bracts reddish brown, linear-lanceolate, 2–6 mm long; rachis 2.5–10.5 cm long, c. 0.3 mm in diam. Floral bracts reddish brown, lanceolate, c. 1 × 0.3 mm, obscurely crenulate at margins, acute at apex. Flowers creamy, c. 1.7 × 1.2 mm, 1–1.5 mm apart; pedicels c. 0.8 mm long, narrow at base, thickened at apex. Sepals subequal, ovate, entire; dorsal sepal c. 0.7 × 0.3 mm; lateral sepals c. 0.9 × 0.5 mm. Petals ovate-elliptic, c. 0.7 × 0.3 mm, erose-dentate at margins, obtuse at apex; lip c. 0.7 × 0.8 mm, 3-lobed; lateral lobes square-shaped, c. 0.3 mm, erose-dentate; midlobe c. 0.5 × 0.6 mm, erose-dentate at margins, obscurely 2-lobed and truncate at apex. Column c. 0.3 mm long. Anther cap somewhat rhomboid, c. 0.2 × 0.2 mm, slightly beaked at apex. Pollinia 2, subpyriform, c. 150 × 112 µm. Capsules pyriform, 2.5–3 × 1–1.2 mm, 5-ridged.



a–d. Habit; **e**. Flower; **f**. Floral bract; **g**. Dorsal sepal; **h & i**. Lateral sepals; **j & k**. Petals; **l**. Lip; **m**. Column; **n**. Anther cap; **o & p**. Pollinia. (*D.K. Roy* 129648, ASSAM)

Habitat of *Oberonia brachystachys* in Balpakram National Park, Garo hills, Meghalaya

Fl. & Fr.: November–January.

While surveying the tropical evergreen forest of BNP a population of about 15 mature individuals of *O. brachystachys* in a single location was found. No evident threat to the habitat of the plant was noticed as the location was inside the core zone of the National Park. Other commonly growing epiphytic orchids found in the vicinity were *Agrostophyllum khasianum* Griff., *Cleisostoma subulatum* Blume and *Panisea uniflora* Rolfe.

Oberonia brachystachys belongs to the subgenus *Menophyllum* and it can be distinguished from other species of this group by the presence of verticillate inflorescence with many close, flat flowers in nearly horizontal layers, petals and lip with erose-dentate edges. Few specimens from present population slightly

differ from previously described plants of this species in having much longer leaves and inflorescences and the inflorescence with nearly acuminate apex.

D.K. Roy[1,*], H.A. Barbhuiya[2] & B.K. Sinha[3]

[1]Eastern Regional Centre, Botanical Survey of India, Shillong – 793 003, Meghalaya.

[2]Landscape and Cosmetic Maintenance Section, Architectural and Structural Engineering Division, Bhabha Atomic Research Centre, Trombay, Mumbai – 400 085, Maharashtra.

[3]Botanical Survey of India, CGO Complex, Salt Lake City, Kolkata – 700 064, West Bengal.

*E-mail: dilipbsierc@gmail.com

Recollection of *Erythroxylum sinense* (Erythroxylaceae) after a gap of nearly four decades from Meghalaya

Erythroxylum sinense Wu has recently been collected from Shella in Meghalaya. Perusal of relevant literature (Kanjilal & al., 1936; Balakrishnan, 1981; Chatterjee & Sharma, 1993) and consultation of herbaria (ASSAM and CAL) revealed that this species was reported earlier in India from Meghalaya (near Mawsmai Falls, 11.12.1975, *G.H. Bhaumik* 65593 – ASSAM) and Nagaland (Naga Hills, May 1936, *N.L. Bor* 20882 – ASSAM). Thereafter no further collection or report was made from these regions. Hence, the present collection (Shella, 140 m, 28.7.2012, *S. Panday* 130327 – ASSAM) is a recollection of this species after a gap of 37 years from Meghalaya.

Erythroxylum sinense Wu, Bot. Jahrb. Syst. 71(2): 189. 1940. *E. kunthianum* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41(4): 294. 1872, non A. St.-Hil., 1829; Hook.f., Fl. Brit. India 1: 414. 1874; Kanjilal & al., Fl. Assam 1(2): 187. 1936; N.P. Balakr., Fl. Jowai 1: 107. 1981; U. Chatterjee & B.D. Sharma, Fl. India 3: 588. 1993.

Habit

Khasi: 'Dieng-pain-khar', 'Dieng-sugsi'.

Shrub, c. 3 m high, much-branched, glabrous. Leaves simple, alternate, petiolate, oblanceolate or obovate, 2–14 × 1–4 cm, chartaceous. Flowers 2–6 in axillary fascicles on a very short peduncle; petals white or whitish pink. Drupes oblongoid with persistent calyx, 8–15 × 3–5 mm, slightly ventrally curved, subtrigonous, glabrous, shining, greenish, turning reddish on maturity.

Fl. & Fr.: April–September.

Habitat: Margins of evergreen forest on sandy hillslopes.

Distribution: Bangladesh, China, India (Meghalaya and Nagaland), Myanmar and Vietnam.

Use: The bark is chewed along with 'Paan'.

References

Balakrishnan, N.P. 1981. *Flora of Jowai and vicinity.* Vol. 1. Botanical Survey of India, Howrah.

Chatterjee, U. & Sharma, B.D. 1993. Erythroxylaceae. In: Sharma, B.D. & Sanjappa, M. (eds.), *Flora of India*. Vol. 3. (Portulacaceae – Ixonanthaceae). Botanical Survey of India, Calcutta. pp. 585–595.

Kanjilal, U.N., Kanjilal, P.C., Das, A. & Purkayastha, C. 1936. *Flora of Assam*. Vol. 1 (Part 2). (Linaceae – Moringaceae). Government of Assam, Shillong.

S. Panday[1,*], B.K. Sinha[2] & D.K. Roy[3]

[1]Central National Herbarium, Botanical Survey of India, Howrah – 711 103, West Bengal.

[2]Botanical Survey of India, CGO Complex, Salt Lake City, Kolkata – 700 064, West Bengal.

[3]Eastern Regional Centre, Botanical Survey of India, Shillong – 793 003, Meghalaya.

*E-mail: samicnh@gmail.com

Medicinal uses of some fruits and seeds collected from Botanic Garden of Indian Republic, Noida

The various medicinal properties and uses of fruits and seeds of 15 species of flowering plants belonging to 15 genera and 12 families that are growing in Botanic Garden of Indian Republic (BGIR), Noida are provided here. These plants were introduced from various phyto-geographical regions of India. The table given below provides botanical name, family name, Hindi name(s), collection period, and uses or medicinal properties based on literature for every species along with photographs of either fruits or seeds. The serial number in the table corresponds with the number on the photographs.

Medicinal uses of fruits and seeds collected from BGIR, Noida

Sl. No.	Botanical name, family and Hindi name(s)	Collection period	Uses/Properties
1.	*Abrus precatorius* L. Fabaceae *Ratti*	Nov.–Dec.	Purgative, emetic, tonic, and are used in nervous disorders. Paste of seeds is used in stiffness of shoulder joint and paralysis (Kirtikar & Basu, 1984).
2.	*Aristolochia indica* L. Aristolochiaceae *Hooka-bel*	Jan.–Feb.	Extensively used as an antidote for snake-bite. Also used in inflammation and biliousness (Kumar & Jain, 1998).
3.	*Asparagus racemosus* Willd. Asparagaceae *Shatavari, Shatamuli*	Feb.–March	Extract used for the treatment of gastric ulcers, dyspepsia and as galactogogue. Also used for nervous disorders (Jha & Kumar, 2003).
4.	*Azadirachta indica* A. Juss. Meliaceae *Neem*	June–July	Seeds yield oil which used for healthy hairs, to improve liver function and also detoxify the blood (Prajapati & al., 2006; Khatkar & al., 2013).
5.	*Cassia fistula* L. Fabaceae *Amaltas*	March–April	Seeds are emetic and are used in jaundice. The gum of the seeds is used as a substitute for Gaur gum obtained from *Cyamopsis tetragonoloba* (L.) Taub. (Kirtikar & Basu, 1984).
6.	*Ceiba pentandra* (L.) Gaertn. Malvaceae *Safed semal*	July–August	Oil yield from seeds called as Kapok oil has some potential as a bio-fuel and in paint preparations (Friday & al., 2011).
7.	*Coix lacryma-jobi* L. Poaceae *Samkru, Vyjanti*	Nov.–Dec.	Grains are useful as a source of food (cereals) and folk medicine. Vyjanti beads are available in dried form and cooked as a grain (Neuwinger, 2000).
8.	*Guazuma ulmifolia* Lam. Malvaceae *Jangli rudraks*	March–April	A beverages of crushed seeds soaked in water is used to treat diarrhoea, dysentery, cold, cough, contusions, and venereal disease. It is also used as a diuretic and astringent (Sharma & al., 2015).
9.	*Holoptelea integrifolia* (Roxb.) Planch. Ulmaceae *Papri, Kanju*	June–July	The seeds soaked in water are applied over swellings, and the seed paste is useful in treating ringworm diseases. (Sharma & al., 2015).
10.	*Jatropha curcas* L. Euphorbiaceae *Ratanjot, Jamal ghota*	Oct.–Nov.	Seeds yield high quality oil which is used in production of biodiesel. Also edible once the embryo has been removed. Seed oil also used to treat ulcers, tumour, scabies, wound, rheumatism and skin diseases (Prajapati & al., 2006; Sood & Sudershna, 2008).
11.	*Putranjiva roxburghii* Wall. Euphorbiaceae *Jivaputrak, Jiyopota*	April–May	Seeds contain fatty oil and kernel contains essential oil. Seeds are sweet, acrid, refrigerant and diuretic. Seed paste used in headache and powered seed used for knee pain. The seeds also known as *Putrajivak beej* and are procreant. Also used to treat habitual abortions (Chauhan, 1999).

Sl. No.	Botanical name, family and Hindi name(s)	Collection period	Uses/Properties
12.	*Schleichera oleosa* (Lour.) Merr. Sapindaceae *Kusum*	Feb.–March	Seeds yield edible oil. Oil can be used in cooking and lighting, and is used for skin problems such as acne, itching, and burns. It is used as massage oil to relieve the pain of rheumatism (Chauhan, 1999).
13.	*Spondias pinnata* (L.f.) Kurz Anacardiaceae *Amra, Ambari*	Oct.–Nov.	Seeds of this plant along with seeds of *Garcinia cowa* Roxb. ex DC. made into a paste and applied on blistering spots, rashes and itches (Kirtikar & Basu, 1984).
14.	*Terminalia bellirica* Roxb. Combretaceae *Bahera*	March–April	Oil obtained from seeds is sweet, good for hair and mitigates pitta and vatta (Kirtikar & Basu, 1984).
15.	*Ziziphus mauritiana* Lam. Rhamnaceae *Ber*	March–April	Seeds possess anti-cancer potential. Seeds given with butter milk in bilious affections. Ointment made of seeds with some bland oil is used as a liniment in rheumatism. Seeds are anti-diarrhoeal and their kernels are used for abdominal pain in pregnancy, as an antidote to aconite poisoning (Dastur, 1962).

References

Chauhan, N.S. 1999. *Medicinal and aromatic plants of Himachal Pradesh*. Indus Publishing Company, New Delhi.

Dastur, J.F. 1962. *Medicinal plants of India and Pakistan*. 2nd edition. D.B. Taraporevala Sons & Co. Pvt. Ltd., Bombay.

Friday, E.T., James, O., Olusegun, O. & Gabriel, A. 2011. Investigations on the nutritional and medicinal potentials of *Ceiba pentandra* leaf: A common vegetable in Nigeria. *Int. J. Pl. Physiol. Biochem.* 3(6): 95–101.

Jha, B.J. & Kumar, M. 2003. Herbal remedies for various diseases. In: Singh, V. & Jain, A.P. (eds.), *Ethnobotany and medicinal plants of India and Nepal*. Vol. 1. Scientific Publishers, Jodhpur. pp. 78–87.

Khatkar, S., Dhiman, P., Malik, S.N., Khatkar, A. & Redhu, N. 2013. Biological and medicinal properties of *Azadirachta indica*: A review. *Int. J. Pharma Profess. Res.* 4(2): 979–985.

Kirtikar, K.R. & Basu, B.D. 1984. *Indian medicinal plants*. Bishen Singh Mahendra Pal Singh, Dehradun.

Kumar, V. & Jain, S.K. 1998. A contribution of ethnobotany of Surguja district in Madhya Pradesh, India. *Ethnobotany* 10: 89–96.

Neuwinger, H.D. 2000. *African traditional medicine: A dictionary of plant use and applications*. Medpharm Scientific, Stuttgart.

Prajapati, N.S., Purohit, S.S., Sharma, A.K. & Kumar, T. 2006. *A handbook of medicinal plants*. Agrobios, Jodhpur.

Sharma, M., Chopra, S. & Prasad, S.B. 2015a. *Guazuma tomentosa* (*Guazuma ulmifolia*): A valuable medicinal plant. *Int. J. Pharmac. Phytochem. Res.* 7: 197–200.

Sharma, P.C., Yelne, M.B. & Dennis, T.J. 2015b. *Database on medicinal plants used in Ayurveda*. Central Council for Research in Ayurveda and Siddha, New Delhi. pp. 171–176.

Sood, S.K. & Sudershna 2008. *Root drug plants of ethnic India*. Satish Serial Publishing House, Azadpur, Delhi.

K.S. Dogra[1*], S.K. Chauhan[2], M. Singh[1] & J. Kumar[1]

[1]Botanic Garden of Indian Republic, Botanical Survey of India, Noida – 201 303, Uttar Pradesh.

[2]Botanical Survey of India, Ministry of Environment, Forest and Climate Change, New Delhi – 110 003.

*E-mail: dograks6@gmail.com

Notes on *Rhynchoglossum lazulinum* (Gesneriaceae): A species endemic to Northeast India

The generic name *Rhynchoglossum* Blume is derived from the Greek words, '*rhynchos*' (beak) and '*glossa*' (tongue) which alludes to the narrow corolla tube or to the pointed petal tips (for '*rhynchos*') and the broad, tongue-like lower lip of the corolla (for '*glossa*'). In India, the genus is represented by 4 species, viz., *R. ampliatum* (C.B. Clarke) B.L. Burtt, *R. lazulinum* A.S. Rao & J. Joseph, *R. notonianum* (Wall.) B.L. Burtt and *R. obliquum* Blume (Skog & Boggan, 2007).

Rhynchoglossum lazulinum is a distinct species which can readily be recognised in the field by having soft, turgid, gregarious herbaceous habit with terminal, glabrous, moderately tortuous, few to several-flowered, 15–30 cm long racemes and flowers with narrowly bell-shaped calyx, bright blue to violet, 2-lipped corolla. The species is represented by a very few voucher specimens, including two type specimens (the holotype and an isotype) at CAL. *Rhynchoglossum lazulinum* is endemic to Northeast India (Arunachal Pradesh, Assam) and so far it is not recorded from any other phytogeographical regions of the country. During a recent field tour in West Kameng district of Arunachal Pradesh in August 2016, the authors came across this species (in flowering) on the way from Tipi to Dirang on moist hillslopes in two subpopulations at elevations ranging from 1530 to 1550 m with about 100 mature individuals. As it grows on the roadsides, it is exposed to anthropogenic activities, especially broadening of roads.

Habit (Inset: Flower)

Reference

Skog, L.E. & Boggan, J.K. 2007. *World Checklist of Gesneriaceae*. http://botany.si.edu/gesneriaceae/checklist/query.cfm

Bandana Bhattacharjee[1], Krishna Chowlu[2], Avishek Bhattacharjee[1*] & Gopal Krishna[1]

[1]Central National Herbarium, Botanical Survey of India, Howrah – 711 103, West Bengal.

[2]Arunachal Pradesh Regional Centre, Botanical Survey of India, Senki View, Itanagar – 791 111, Arunachal Pradesh.

*E-mail: avibsi@rediffmail.com

Joseph Dalton Hooker

Joseph Dalton Hooker (1817–1911) was one of the illustrious British botanists and explorers and also a pioneer plant geographer of 19th century. Hooker was born on 30th June, 1817, at Halesworth, Suffolk, as the younger son of Sir William Jackson Hooker (1785–1865), a Regius Professor of Botany at University of Glasgow. He had a brief education at Glasgow High School, and graduated from the University of Glasgow as a physician in 1839. Subsequently, he was offered the position of Assistant Surgeon on HMS Erebus in a four-year (1839–1843) scientific expedition of Sir James Clark Ross to the Antarctic, but his main objective was to study the plants and their geographical distribution during the voyage; he returned to Britain in September 1843 with preserved specimens of over 1500 plant species. Based on his expedition, he published a three-volume, 'The Botany of the Antarctic Voyage' during 1844–1860 and 'Flora Antarctica' in two parts from 1844 to 1847. He also published 'Flora Novae-Zelandiae' (1852–1855) and 'Flora Tasmaniae' (1855–1859) based on his voyages. He embarked for India, and the Himalayas of Nepal and Tibet in November 1847 for his second major expedition, which lasted for three years. Hooker returned to Britain in 1851 with a collection of about 7500 plant species, including 25 new species of Rhododendrons. He recorded his astounding botanical findings during this expedition in 'The Rhododendrons of Sikkim-Himalaya' (1849–1851), which included drawings and descriptions made on the spot. In fact, Hooker was the first European to collect plants from the Himalayas.

In July 1851, Hooker married Frances Harriet, eldest daughter of John Stevens Henslow, a professor of Botany at Cambridge, who had taught Charles Darwin. Hooker was appointed as the assistant director of the Royal Botanic Gardens, Kew in 1855. Frances died in 1874 and two years later Joseph married Hyacinth, the only daughter of William Samuel Symonds. Charles Darwin was one of the closest friends of Hooker, with whom he had regular contact for over 40 years on both scientific and family issues. Hooker was the first to publicly support Darwin's theory of evolution by natural selection, and in fact, Hooker was the only scientific man acknowledged by Darwin in his book 'On the origin of Species' published in 1859. Hooker became the director of the Royal Botanic Gardens, Kew in 1865, succeeding his father Sir William Hooker, and held the post till his retirement in 1885. During his lifetime, he had identified more than 12000 new plant species. He co-authored the 'Genera Plantarum' with George Bentham that was published during 1862–1883, and 'Flora Indica' with Thomas Thomson in 1855. 'His greatest botanical work 'The Flora of British India' assisted by various botanists was published in seven volumes during 1872–1897.

His significant scientific contributions had brought him many honourary degrees, including those from Oxford and Cambridge. His outstanding research contributions, especially to the progress of systematic botany had also been recognised by the Royal Society, which awarded him their Royal Medal in 1854, Copley Medal in 1887 and the Darwin Medal in 1892. Hooker also received the first Linnean Medal and the first Darwin–Wallace Medal of the Linnean Society of London in 1888 and 1908, respectively. Hooker was made 'Knight Commander of the Order of the Star of India' in 1877, and subsequently made 'Grand Commander of the Order' in 1897, which he considered the most honourable distinction of all. *Hookerella*, *Hookerina*, *Josephia*, and *Sirhookera* are some of the plant genera named after him, besides, there are several hundreds of plant taxa named after him. Joseph Dalton Hooker died on 10 December 1911, aged 94, after a short illness and was buried, alongside his father in the churchyard of St. Anne's Church, within the vicinity of Kew Gardens.

W. Arisdason[1]* & P. Lakshminarasimhan[2]

[1]Central National Herbarium, Botanical Survey of India, Howrah – 711 103, West Bengal.

[2]Western Regional Centre, Botanical Survey of India, Pune – 411 001, Maharashtra.

*E-mail: dasonaris@yahoo.co.in

a. Sri Ajay Narayan Jha, Secretary, MoEF & CC, New Delhi, releasing BSI ENVIS Newsletter; **b & c.** Hon'ble Secretary visiting the Great Banyan Tree at AJCB Indian Botanic Garden (AJCBIBG) and Digital Herbarium at Central National Herbarium (CNH), BSI, Howrah; **d.** Dr. (Mrs.) Amita Prasad, Addl. Secretary, MoEF & CC, New Delhi, discussing about Giant Water lily at AJCBIBG, BSI, Howrah; **e & f.** Dr. (Mrs.) Anandi Subramanian, Sr. Economic Advisor, MoEF & CC, New Delhi, visiting Cryptogamic Section and ENVIS Centre on Floral Diversity, BSI, Howrah; **g & h.** Dr. Paramjit Singh, Director, BSI presenting a plant sapling to Dr. A.K. Sanyal, Chairman, West Bengal Biodiversity Board, Kolkata and student participants planting a sapling during *Van Mahotsav* Day celebration at AJCBIBG, BSI, Howrah; **i.** Dr. V. Sampath Kumar, Scientist-in-Charge, ENVIS, BSI delivering a speech during a training course on 'Basics of Plant Identification and Nomenclature' held at Eastern Regional Centre, BSI, Shillong.

ENVIS CENTRE

Established : April, 1994
Contact Person : **Dr. V. Sampath Kumar**
Address : Scientist 'D', CNH & Scientist-in-Charge
ENVIS Centre, Botanical Survey of India
Central National Herbarium
P.O. Botanic Garden, Howrah – 711 103

Subject Area : Floral Diversity
Phone : (033) 2668 0667
Fax : (033) 2668 6226
E-mail : envis@cal2.vsnl.net.in; bsi@envis.nic.in
Website : http://www.bsienvis.nic.in

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. Phytodiversity of Chilika Lake
6. 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(2), 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