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From Director's Desk

Air is the most essential element for life. Without air there would be no life. Clean, breathable air should be every individuals' right. However, the same is almost impossible to get in the present times. Air pollution, which kills more than 6 million people every year, is the biggest environmental health risk of our time causing death due to chronic respiratory disease and lung cancer. Air pollution is also responsible for climate change, thus affecting the health of our planet as well. To combat this pressing environmental concern, the United Nations designated this year's theme for World Environment Day, celebrated every year on 5th June, as "Beat Air Pollution". It is done for creating worldwide awareness among people for doing something to take care of the Earth, which may be at local, national or global level.

Botanical Survey of India also celebrated this day by organising workshops, talks, awareness rallies, etc. involving local people, school and college students to create awareness at the grassroot level and to educate them in ways of reducing and tackling air pollution.

Like earlier issues, hope this issue will also be well received by readers for its contents. I appreciate the efforts of entire team of ENVIS Resource Partner on Biodiversity in bringing out this informative Newsletter.

(Dr. A.A. Mao)
Director
Botanical Survey of India, Kolkata

CONTENTS

Guinea Guava

Botanical Name: **Psidium guineense** Sw.

Family: Myrtaceae

Common Names: Brazilian guava, Guinea guava, Mystery guava, West Indies guava, Wild guava; Malayalam: *Kattupera, Munthiripera*; Tamil: *Manikoyya*

General Morphology: Shrubs or small trees, up to 5 m tall; branchlets terete, pubescent. Leaves sub-opposite or opposite, sub-coriaceous, 8–10 cm, broadly elliptic-oblong, pellucid dotted, entire, pubescent; lateral nerves 8–10 pairs, looping; petiole 1–1.5 cm long. Flowers white, slightly fragrant. Calyx tube adnate to ovary, 5-lobed, green, pubescent. Petals 5, white, spathulate, 1.5 x 1 cm, caducous. Stamens numerous, white; filaments 1–1.2 cm long; anthers oblong, 0.1–0.5 cm long, introrse, dehiscing longitudinally. Ovary many celled, ovules many in each locule; style 1.3 cm long, white; stigma capitate. Berry globose, 2–3 cm diameter, pubescent, yellow when ripe; seeds many, embedded in creamy-yellow flesh.

Distribution: The native range of distribution of the species is Mexico to Argentina and includes parts of the Caribbean. It has been widely introduced outside of this range and cultivated in some places. The plant is naturalized in Tripura (Agartala) and also in southern Western Ghats of Kerala (Thiruvananthapuram, Kollam) and Tamil Nadu (Kanyakumari). Occasionally, it is found in margins of tropical evergreen forests and tropical montane forests (shola) at an elevation of 1000 m. The species is locally known as wild guava though it is not a native species.

Flowering: January to June; peak blooming in April.

Fruiting: April to September.

Uses: Ripe fruits are eaten raw; it can also be baked, stewed or made into a paste for jam and jellies. The small, greenish-yellow fruits are sub-acidic to acidic, with a strawberry like flavour. The ovoid fruit is a bit smaller than the common guava. The plant is reported to be used as medicine to treat urinary diseases, diarrhoea and dysentery. It is said to reduce varicose veins and ulcers on the legs. A leaf decoction is taken to relieve colds, bronchitis and diarrhoea. The juice of the young fruit is squeezed and used for treating dysentery and upset stomachs. The bark is rich in tannin. The wood is strong and used for making handles of tools, beams, planks and agricultural instruments.

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Psidium guineense: **a.** Close view of the flower; **b.** Close view of immature fruits; **c.** Fruiting twig

Vegetative propagation of *Phaius flavus* through back bulb cutting – a conservation tool

Orchidaceae is one of the largest families among the flowering plants with more than 28000 accepted names till date (The Plant List-2010, accessed on 27.08.2019) and found distributed worldwide barring the Arctic and Antarctic regions. Orchids are highly evolved group of plants, well known for their complex structure, beautiful flowers and specialized mechanism for effective pollination and seed germination. Such dominance of orchids can be owed to the fact that, they can inhabit areas where competition with other species is very less; they can remain alive for longer period of stressed condition through the reserve food material in tubers/ pseudobulbs; they have pollen grains aggregated into pollen masses (pollinia) and specialized mechanism to ensure pollination; they also produce large number of non-endospermic, ultra-light, microscopic seeds which can be dispersed by wind to far and wide; and most importantly, they have effective vegetative mode of propagation for ensuring the survival. Despite having all these qualities, orchids are being considered as threatened world-wide because of their over-exploitation for horticultural/ medicinal importance and habitat loss due to natural/ anthropogenic causes. To meet the commercial demand and to conserve the germplasm in their natural habitat, various conservation tools (*in-situ*, *ex-situ*, mass multiplication through seed / explant culture, etc.) are in practice. However, to ensure conservation in a more effective and cost-friendly way, new methods or ideas need to be explored.

Orchids usually exhibit two types of growth habit. The monopodial orchids have shoots with potential for indefinite apical growth. They add a few leaves each year and the flowers/inflorescence generally come from between the leaves. However, the sympodial ones usually grow in a horizontal direction and the stem is called as rhizome. Each shoot has limited growth and new shoots arise from any part of the older shoots where there is an axillary bud. These new propagules are capable to grow and reproduce independently if detached from the mother plant. Most of the sympodial, pseudobulbous orchids produce new propagules annually forming a chain. Usually, the older pseudobulbs become inactive for further propagation as the axillary buds are already occupied into new shoots in the growth cycle. But they still have enough reserve food to survive for further 3-5 years or even more. Ornamental orchid genera like *Cymbidium* Sw., *Calanthe* R. Br., *Phaius* Lour., *Acanthephippium* Blume, etc. possess large pseudobulbs with more reserve food in comparison to other sympodial orchids and the inactive pseudobulbs remain attached as the back-bulb in the sympodium for 5-10 years.

Figure 1: *Phaius flavus*: **a.** Habit, **b.** Inflorescence, **c.** Flowers, **d.** Close-up view of pseudobulbs. **b** and **c** are not to scale. **Source:** *D.K. Agrawala* 37614 (BSHC).

While studying the Himalayan orchids for their taxonomy and conservation under Himalayan Research Fellowship scheme of NMHS, a trial was conducted to recharge the inactive back-bulbs in *Phaius flavus* (Blume) Lindl. by applying artificial stress and vegetative propagules could be developed successfully.

Phaius flavus is a terrestrial, sympodial orchid with large, beautiful flowers (Fig. 1). The inflorescence is stout and produce four to many flowers with good shelf-life and can be exploited

as cut flowers. It is often found as cultivated by farmers and gardeners for ornamental purpose. Although the species is distributed in all the north-eastern states in India, also extending in neighboring countries and spread up to southeast Asia and Pacific Islands, its population size is not that significant. It occurs in scattered patches with few individuals at one sub-population. Fruiting plants are very rare to sight in natural habitat. They produce new vegetative propagules from the base of matured pseudobulbs during June-July.

Few specimens of *Phaius flavus* were collected from West Kameng district of Arunachal Pradesh, India during 2014 and the germplasm was maintained at the orchid house of Botanical Survey of India, Sikkim Himalayan Regional Centre, Gangtok. The plants were grown into chain of five pseudobulbs at the end of 2018. During May 2019, two inactive pseudobulbs were separated from the mother plant; wrapped with moist jute bag and were kept in a dark place with some load applied on it (the traditional method of ripening of Mango, Banana etc.). After 10 days, white, glabrous propagules were observed in both the pseudobulbs (Fig. 2). These were transferred into a good potting medium containing soil, charcoal, brick pieces and leaf-litter. After few days, these white propagules were developed into green, normal plantlets and started to grow normally. Thus, by providing artificial stress by putting the pseudobulbs in wrapped, anaerobic condition, the inactive shoots also became active and produced the propagule.

Figure 2: *Phaius flavus*: **a.** Back-bulbs with newly initiated white propagules (10 days old), **b.** the same back-bulbs after transplanting in to potting medium (25 days old), **c.** Fully grown plants along with the back-bulbs (75 days old). Source: *D.K. Agrawala* 37614 (cult.-BSHC).

This method can be used as an effective conservation tool as it involves very low cost and make use of the otherwise use-less pseudobulbs. Farmers in East-Sikkim district are practicing this method for obtaining new plants from the back-bulb cutting of *Cymbidium* hybrids. It provides good opportunity for income generation as well.

The National Mission on Himalayan Studies is thankfully acknowledged for financial support. The Director, BSI and Head of Office, BSI, SHRC is also thankfully acknowledged for providing facilities and motivation for this work.

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Report on the workshop on Flowering & Non-Flowering Plant Identification and Herbarium Methodology

A workshop on 'Flowering & Non-Flowering Plant Identification and Herbarium Methodology' was organised by ENVIS Resource Partner on Biodiversity, Botanical Survey of India (Ministry of Environment, Forest & Climate Change, Government of India, New Delhi) in collaboration with Internal Quality Assurance Cell (IQAC) and Dum Dum Motijheel College, Kolkata at the Department of Botany, Dum Dum Motijheel College, Kolkata on 7th June, 2019. The resource persons for the workshop were Dr. Kanad Das, Scientist 'E', Hqrs., BSI & In-charge, BSI ENVIS RP, Dr. R.K. Gupta, Scientist 'D', Hqrs, BSI, Dr. Subir Bandyopadhyay, retired Scientist, BSI, Dr. Monalisa Dey, Scientist 'C', Hqrs., BSI., Dr. M.E. Hembrom, Botanist, Cryptogamic Unit, BSI, Dr. Gopal Krishna, Bot. Asstt., CNH, BSI, Dr. Anant Kumar, Bot. Asstt., Hqrs., BSI, Dr. Basant Kumar Singh, Pres. Asstt., AJCBIBG, BSI, Sri Arvind Parihar, Bot. Asstt., Cryptogamic Unit, BSI, Dr. Sudipta Kumar Das, AJCBPDF, BSI, Sri Kanai Lal Maity, retired Curator, BSI and Sri Alok Mukherjee, retired Mounter, BSI.

A total of 90 participants attended the workshop. Sixty-four B. Sc. students from Hooghly Mohsin College, Charuchandra College, Barasat Govt. College, Derozio Memorial College, B.N. Mahavidyalaya, Itachuna, R.B.C. College, Naihati, East Calcutta Girls' College, Vijaygarh Jyotish Ray College, B.K.C. College, Mrinalini Dutta Mahavidyapith, Birati, Vivekananda College, Thakurpukur, Basirhat College, Dum Dum Motijheel College and 2 M.Sc. students of Pune University and Nalanda University attended the workshop. The rest of them were lecturers and Assistant Professors from different Colleges. The workshop started with the welcome address of Dr. Pradeepta Gupta Roy, Principal, Dum Dum Motijheel College, followed by a brief introduction about the workshop by Dr. A.A. Mao, Director, Botanical Survey of India. Dr. Kanad Das and Dr. Haradhan Saha, Head of the Dept. of Botany, Dum Dum Motijheel College also put forth valuable comments during the inaugural session.








After the inauguration the technical session started. The students were taught the method of plant identification (angiosperm) by Dr. Gopal Krishna. After that the practical session commenced in 2 batches consisting of 32 students in each batch. The hands on training on plant taxonomy was given to the students by Dr. Gopal Krishna, Dr. Basant Kumar Singh, Dr. Anant Kumar and Sri Kanai Lal Maity with special emphasis on Brassicaceae, Malvaceae, Leguminosae, Asteraceae, Euphorbiaceae, Myrtaceae, Convolvulaceae, Vitaceae, Asclepiadaceae, Solanaceae, Acanthaceae, Ranunculaceae, Poaceae and Cyperaceae. Dr. Subir Bandyopadhyay delivered a lecture on herbarium methodology. A short film on collection and processing of plant specimens and the technique of making herbarium sheets was also shown to the students for better understanding of the techniques by him. Thereafter, lectures and practical sessions on 'Identification and herbarium methodology on Bryophytes' and 'Identification and herbarium methodology on Macrofungi' was delivered by Dr. Monalisa Dey and Dr. M.E. Hembrom, respectively. After the lunch break a talk and practical session on 'Identification and herbarium methodology on Algae' was taught by Dr. R.K. Gupta and Dr. Sudipta Kumar Das. The processing of plant specimen and preparation of herbarium sheets were demonstrated by Sri Alok Mukherjee.

The students actively interacted with the resource persons during their presentations. The filled-up feedback forms were received from the participants. During the valedictory function, Dr. Kanad Das, Dr. Haradhan Saha and faculty members of Dum Dum Motijheel College awarded the certificates to the participants. The participants expressed that they were immensely benefitted by attending the workshop. On behalf of the Department, Dr. Haradhan Saha and Dr. Pranab Giri, Dept. of Botany, Dum Dum Motijheel College extended hands of collaboration to all to utilise the available facilities for this workshop. On behalf of organiser, Dr. Haradhan Saha expressed his sense of gratitude to Dr. A.A. Mao for his kind consent to organise the workshop. He was also grateful to Dr. Kanad Das, as well as all resource persons and the entire team members of ENVIS Resource Partners for successfully organising the workshop. The workshop ended with a formal vote of thanks given by Dr. Pranab Giri.

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Sphagneticola trilobata (Asteraceae): First record of a worst invasive species in West Bengal state and its potential medicinal uses

Sphagneticola trilobata (L.) Pruski, commonly known as creeping daisy, Singapore daisy, yellow dots, has been found to grow luxuriantly, forming mat in moist and shady places in and around Howrah town as weed. In India this species has been reported only from Andhra Pradesh, Karnataka, Kerala and Tamil Nadu (Chowdhery, 1995; Sudhakar, 2015). Perusal of literature (Prain, 1903; Garg, 2016) reveals that this species has not so far been reported from West Bengal state.

The native range of *Sphagneticola trilobata* is Mexico to south tropical America, and Trinidad. However, it now grows throughout neotropics as weed. In the year 2000, 'The IUCN Invasive Species Specialist Group' (ISSG) included this species in the list of '100 of the world's worst Invasive alien species' (www.issg.org/booklet.pdf). It is generally cultivated as an ornamental or ground cover and then spread into surrounding areas by dumping of garden waste. It reproduces by vegetative propagation by using fragments of stems. It rapidly forms a dense ground cover and prevents other plant species from regenerating.

It is a perennial prostrate or diffuse herb, rooting at basal nodes. Stems terete, puberulous or glabrous. Leaves are opposite-decussate, sub-sessile, lamina 4–6.5 x 2.5–4.5 cm, ovate-dentate or 3-lobed, irregularly toothed or serrate at margins, sometimes upper ones unlobed, apex acute, base cuneate, 3-nerved at base, scarbid above, puberulous to glabrous beneath, fleshy. Heads are solitary, usually in axils of upper leaves, yellow, 1.5–2 cm across; peduncles 5–15 cm long, ebracteate. Involucral bracts lanceolate or oblong, 0.9–1.1 cm long, acute or obtuse, ciliate. Ray florets 5–9, unisexual (female); corolla yellow, 0.9–1.5 x 0.4–0.5 cm, 3–4-denticulate at apex. Ovary trigonous; style exerted; stigma bilobed, slightly hairy. Pappus connate into a spathiform, fimbriate cup at apex, without awns. Disc florets many, bisexual; corolla yellow; tube 5–9 mm long, 5-lobed; lobes deltoid, densely ciliate within. Anthers syngenecious, included, usually black. Ovary oblong, biconvex; style bifid, flattened, pubescent at margins. Achenes crowned with the persistent pappus cup, strongly warty, blackish, dimorphic, trigonous.

Flowering & Fruiting: Almost throughout the year.

Specimens examined: INDIA: West Bengal: wayside of D.S. Lane, Howrah town, 15.07.2019, *T.K. Paul*, TKP 25 (CAL).

Uses: The aerial parts of this plant are used in traditional medicine in the Caribbean and Central America against bronchitis, cold, and abdominal pains, dysmenorrheal and even as a fertility enhancer. In folk medicine, it is employed to treat backache, muscle cramps, rheumatism, stubborn wounds, sores and swellings, and arthritic painful joints. The Miskito Indians of eastern Nicaragua use its leaves for treatment of kidney dysfunctioning, cold, stingray wounds, snakebite, purge and amenorrhea (Sabnam, 2011). The leaves and flowers of this species collected from Karnataka, India possess antimicrobial, antioxidant and anti-inflammatory properties (Govindappa & al., 2011).

Sphagneticola trilobata: **a.** Habit; **b.** Flower

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Natural root dye from *Arnebia* (Boraginaceae), a vital source for India

The dye can be simply defined as natural or synthetic chemical substances, which have the property of producing the phenomenon of color by light absorption. Since time immemorial, the art of dyeing has been used by the people from prehistoric era for imparting color to an infinite variety of materials like textiles, paper, wood, varnishes, leather, foodstuff, cosmetics, medicine, etc. Including these, natural dye was also used for coloring of cave paintings and their remarks are still available. These were common and predominant in the ancient history of India, Egypt, Greece, Aztec and other countries. Our Atharva Veda carries a description of natural dyes. Bhrugu Samhita was written using natural dyes. The frescos of Ajanta dating as far back as 1st century A.D. were painted with natural dyes. There has been a significant revival of interest in the application of natural dyes on textile materials all over the world, possibly because of increasing awareness on environmental issues such as hazards of synthetic dyes. Natural dyes are extracted from the various plant parts like seeds, flowers, leaves and roots for various colorants.

However, due to modernization of society, a revolutionary change came in dyeing industry. In 1856 low costing synthetic dyes were introduced in the market and they badly affected the market of natural dyes. Ecologists are always worried about the random use of such harmful chemicals in dyeing industry which causes water pollution and waste disposal problem also. On the other hand, natural dyes are non-polluting, non-carcinogenic and do not cause any health hazards. Recently, many commercial dyers have started using natural dyes to overcome the environmental damage caused by synthetic dyes. From the available literature (Chaudhury, 2011; Quadri, 2012), it is evident that azo dyes, which are synthetic carcinogenic dyes, can cause allergic reactions. Germany was the first country to take initiative to put ban on production and use of numerous specific azo dyes. The Netherlands, India and some other countries also followed the ban. Indians have been considered as forerunners in the art of natural dyeing. Natural dyes are well known for producing very uncommon, soothing and soft shades as compared to synthetic dyes. Natural dye exhibits several important properties that provide them a significant edge over synthetic dyes. Some of these advantages are, being biodegradable, non-toxic and non-allergic; easy extraction of colors by boiling the plants, berries, leaves, bark or flower heads in water. They also provide scope of employment generation and utilization of wasteland. Fabric dyed with natural dyes exhibits higher UV absorption that can result in reduced incidence of melanoma (Chaudhury, 2011; Malik & al., 2016; Pal & Chaudhury, 2010; Quadri, 2012). Many natural dyes have antibacterial properties, they are mostly renewable as most of them are plant based, whereas synthetic dyes are often petroleum-based that is a non-renewable source of energy.

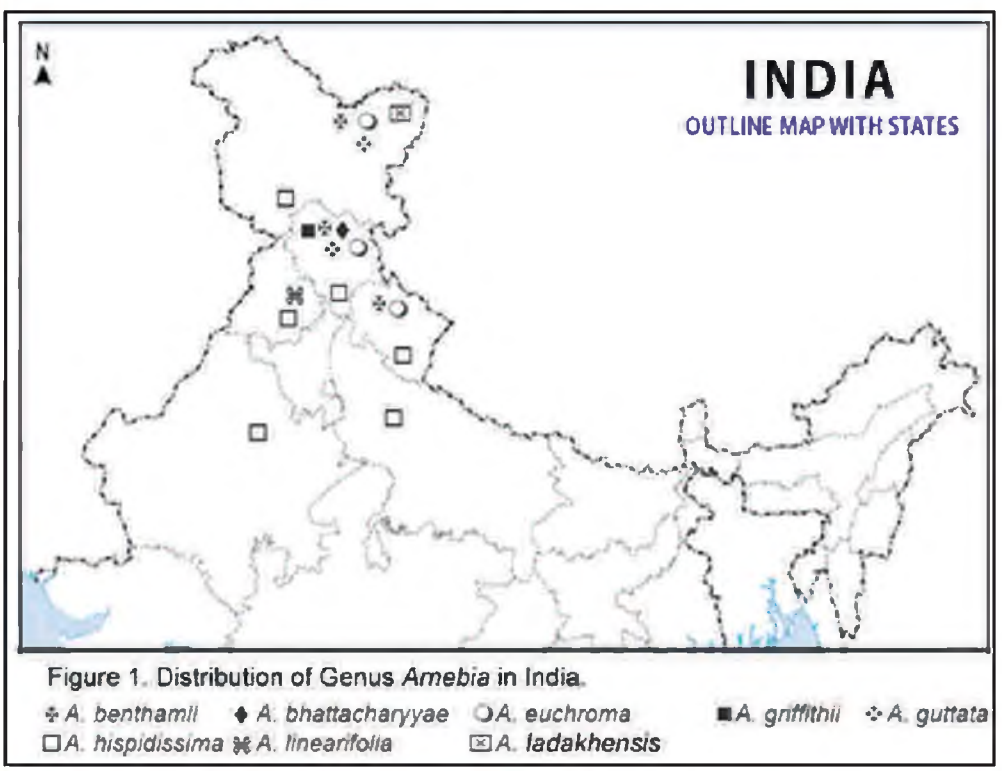

Figure 1. Distribution of Genus *Arnebia* in India.

India is one of the mega biodiversity centres and offer a number of plants recorded for the extraction of natural dyes. Many plants are still unexplored which are having potential in dyeing industry. During survey and documentation of Western Himalayan flora (Flora of Jammu and Kashmir, Flora of Himachal Pradesh, Flora of Uttarakhand and adjoining states) and consultation with available literature on a plant genus *Arnebia* Forssk., an important member of family Boraginaceae, it has been found that the roots of various species of the genus are dye yielding. This genus is known as an economically important genus for natural dye extraction (Kumar & Srivastava, 2014). These naturally occurring dyes are mainly hydroxyl napthoquinones and isohexenyl napthazarins, commonly known as alkanin and

shikonin, and collectively called as Ratanjot. These naptho-quinone form the main active constituent of this plant and are used as colorant (Arora & al., 2012). Due to high demand of various species of this genus for natural colorant, it has been tried for conservation and cultivation by the various workers through micro propagation (Chaudhury, 2011; Malik & al., 2016; Pal & Chaudhury, 2010; Quadri, 2012). This genus, with about 30 species is distributed worldwide in North Africa, Trans Caucasus, Syria, Iraq, Iran, Afghanistan, Pakistan, China and India. In India this genus is represented by 10 taxa including 8 species and 2 varieties *viz.*, *Arnebia bhattacharyyae* K. Ambrish & S.K. Srivast., *A. benthamii* (Wall. ex G. Don) I.M. Johnst., *A. euchroma* (Royle) I. M. Johnst., *A. griffithii* Boiss., *A. guttata* Bunge, *A. hispidissima* (Sieber ex Lehm.) A.DC., *A. ladakhensis* K. Ambrish and P. Singh (in press), *A. linearifolia* A.DC., *A. euchroma* var. *grandis* (Bornm.) Kazmi and *A. guttata* var. *thomsonii* (C.B. Clarke) Kazmi, distributed in Jammu & Kashmir, Himachal Pradesh and Uttarakhand in North-West Himalaya to Uttar Pradesh, Punjab and Rajasthan in India (Figure 1). Out of all the 08 species of genus *Arnebia*, some have potential to release dye of various colors. For instance, red dye is extracted from the roots of *Arnebia benthamii* and *A. hispidissima*; while purple dye is extracted from *Arnebia euchroma*, *Arnebia euchroma* var. *grandis*, *Arnebia guttata*, *Arnebia griffithii* and *A. ladakhensis* (Kumar & Srivastava, 2014) (Figure 2).

Although such ancient knowledge has been used over the years in the past yet slowly this information has been diminishing fast over successive generations due to lack of proper methodology and information for the extraction of dyes from the plant. As a result, the market of natural dyes is not commercially successful as compared to synthetic dyes. Presently all environmentalists are very much worried regarding the environment and health issues also.

The main objective of this paper is to spread the knowledge of *Arnebia* dyes and provide fair scope in natural dying industry. Thus, it is important to develop appropriate technology for extraction of natural dyes from the plants and spread such precise knowledge and benefits of natural dye to the local people, so that people can become aware and use natural dyes in their daily life. Cultivation of some potential species will not only provide them the raw material for dye extraction but can generate a source of income after selling the material.

In such a way, they can maintain the sustenance of ecofriendly environment and also play an important role to remove the hazardous health issues from synthetic dyes.

Figure 2. a. *Arnebia benthamii*, **b.** *A. euchroma*, **c.** *A. guttata*, **d.** *A. hispidissima*, **e.** Red dye yielding root of *A. benthamii*, **f.** Purple dye yielding root of *A. euchroma*

Prof. K.S. Thind

Taxonomic studies on macrofungi (fungi whose fruiting bodies/fructifications are visible through naked eyes) in India will remain incomplete if we don't remember Prof. Kartar Singh Thind (30th October 1917–3rd December 1991) and his contribution. He was born at Saidpur, Kapurthala and passed High School from Paramjit High School, Sultanpur Lodhi. He earned graduate degree from Khalsa College, Amritsar followed by Post-graduation from Panjab University, Lahore. He completed his doctoral research at University of Wisconsin, Madison USA. He was one of the leading persons to strengthen cryptogamic (non-flowering plant) studies in Botany at the Department of Botany, Punjab University, Chandigarh.

From Taxonomic point of view he was the pioneer researcher who initiated detailed macro- and micromorphological characterization of macrofungi (Ascomycota and Basidiomycota mostly) with limited resources. He was the person who introduced application of tissue concept in the study of Indian mycobiota, which was originally put forth by Prof. R.P. Korf for Discomycetes and E.J.H. Corner for Aphyllophorales. He, along with his research team and collaborators initiated taxonomic studies on almost all the groups of macrofungi (Poroid fungi/Bracket fungi, Crust fungi, Tooth fungi, Stink horns, Bird's nest fungi, Jelly fungi, Stereoid fungi, Puff balls, Earth star, Carbon and cushion fungi) and fungi allies (Slime Moulds). His laboratory and mycological herbarium 'PAN' (with *c.* 20,000 fungal accessions) was located at the Department of Botany, Punjab University, Chandigarh. PAN became very rich with this huge macrofungal collections because thorough exploration were undertaken in North-western Himalayas (1952–1976) and Eastern Himalayas (1977–1986) under his guidance. He left about 186 significant research papers which are still considered as milestone referral work even in the rapidly changing molecular era of fungal taxonomy. His highly appreciated taxonomic monographs are "The Clavariaceae of India" and "Myxomycetes of India" published by ICAR, New Delhi.

His first novel discovery was along with renowned mycologist G.W. Martin and Sohi describing *Stemonites mussooriensis*, a fungal allies. His contribution to Indian mycobiota is so significant that genera like *Thindia* and *Thindiomyces* were erected by subsequent workers to commemorate his contribution. At least 19 species are named in his honour belonging to different groups of fungi. He produced well known Indian mycologists like Surjit S. Rattan and G.S. Dhingra (Crust fungi); I.P.S. Thind and B.M. Sharma (Stomach fungi); H. Khara (Toothed fungi); R.M. Sharda and Khurana (Coral fungi); S.S. Virdi and R.S. Dhanda (Poroid & bracket fungi); J.S. Dargan and Waraitch (Carbon and cushion fungi); H.S. Garcha, K.S. Waraitch, M.P. Sharma, S.C. Kaushal and R. Kaushal (Cup & Saucer fungi); R. Sharma and S.S. Dhillon (Slime moulds) and T.N. Lakhanpal (Slime moulds and poroid mushrooms).

Botanical Survey of India paid tribute to him with two novel taxa of macrofungi naming *Cyathus thindii* and *Russula thindii*.

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a. Sri Ravi Agrawal, IRS, Additional Secretary, Ministry of Environment, Forest and Climate Change (MoEF & CC), New Delhi visiting Type Section at Central National Herbarium (CNH), BSI, Howrah; **b.** Sri Ravi Agrawal, releasing Book 'Macrofungi of Acharya Jagadish Chandra Bose Indian Botanic Garden: A Pictorial Guide' at CNH, BSI, Howrah; **c.** Dr. A.A. Mao, Director, BSI explaining to the visitors from NE India; **d.** Mass Rally by children during the World Environment Day 2019 at AJC Bose Indian Botanic Garden, BSI, Howrah; **e.** Sri Gourav Sharma, CP, Howrah distributing certificates to the successful participants of Sit & Draw Competition during Vanmahotsaba 2019 at AJC Bose Indian Botanic Garden.

ENVIS RESOURCE PARTNER

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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 and its ENVIS Resource Partner on Biodiversity 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 PUBLICATION 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) Rs. 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. Macrofungi of Acharya Jagadish Chandra Bose Indian Botanic Garden: A Pictorial Guide
7. Bibliography and Abstracts of Papers on Flora of different States and Union Territories [West Bengal I & II, North East India – I, Andaman & Nicobar Islands, Maharashtra, Kerala, Tamil Nadu, Karnataka, Goa, Andhra Pradesh (including Telangana), Odisha, Bihar & Jharkhand, Madhya Pradesh & Chhattisgarh.]

II. Newsletters: Up to Vol. 24(1), 2019

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and to be sent to the address of the ENVIS Resource Partner given above