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Van Sangyan

Note to Authors:

We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

by e-mail to vansangyan_tfri@icfre.org

or, through post to The Editor, Van Sangyan,
Tropical Forest Research Institute,
PO-RFRC, Mandla Road,
Jabalpur (M.P.) - 482021.

The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number. TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve
Photo credit: Dr. N. Roychoudhury and Dr. Rajesh Kumar Mishra, TFRI, Jabalpur (M.P.)

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From the Editor's desk

In the current issue of the Van Sangyan is containing seven articles on varied subject ranging from opportunities and challenges NTFP marketing, importance of Tecomella undulata for agroforestry in hot arid region, distribution, importance and threats to Wetlands in national perspective, vermicopost production technique, climate change, broom making as source of livelihood and ants as predator of sal borer.

The lead article of the issue is on issues of marketing sector NTFP in the country and and describes in details about the opportunies and challges. Major challeges faced by NTFP marketing sectors includes unorganised market, un-availability of demand and supply data, lack of proper herb identification and final product classification, non-sustainable harvesting, lacking of modernization, price fluctuations, etc. On the other hand opportunities include increasing demand, government egencies continuous effors and support to primary collectos, SHGs, herbal industries for HRD development.

This article is followed by an article on Tecomella undulate, an endangered important timber species in hot arid region and describes its importance in agroforestry. T. undulata is commonly known as 'desert teak' or 'Marwar teak' being the main source of timber amongst the tree species of desert region of Rajasthan.

I hope that readers would find maximum information in this issue relevant and valuable to the sustainable management of forests. Van Sangyan welcomes articles, views and queries on various such issues in the field of forest science.

Looking forward to meet you all through forthcoming issues

Dr. Naseer Mohammad

Chief Editor

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Opportunities and challenges faced in NTFP marketing in India

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Introduction

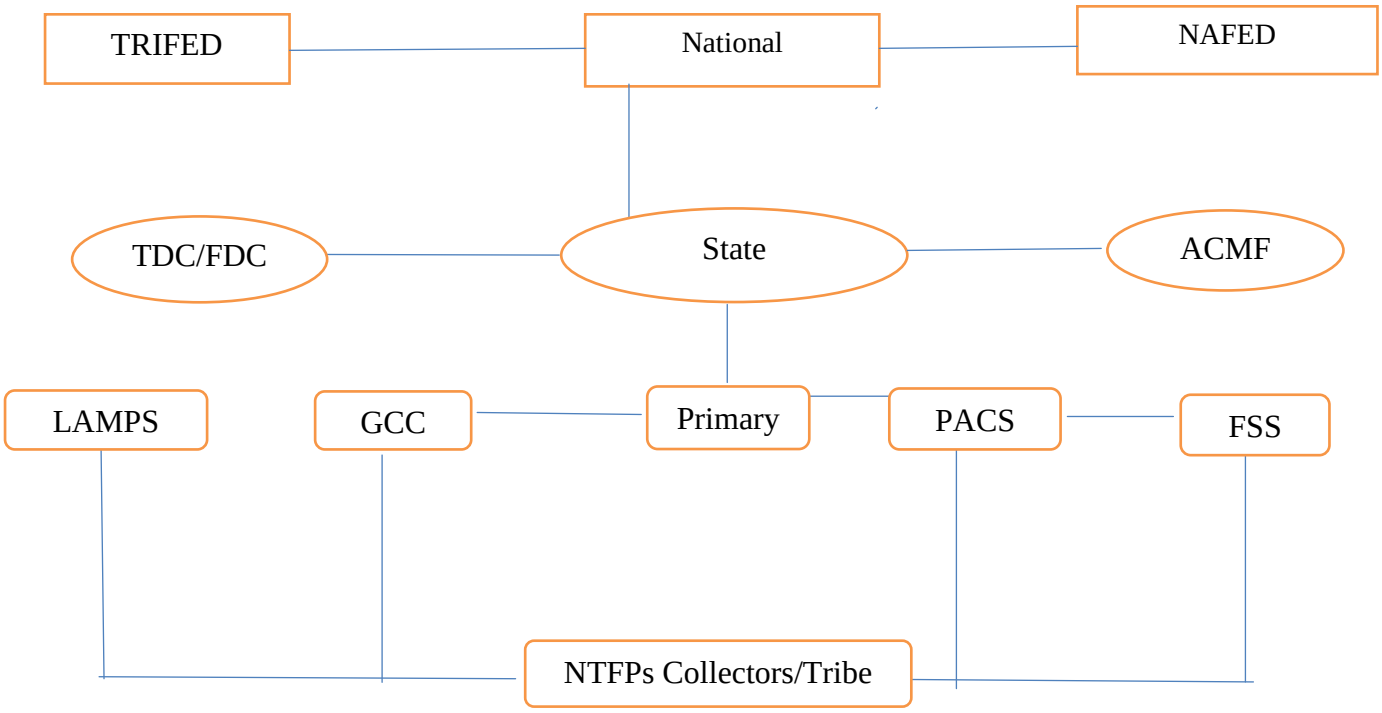
Non-timber forest products (NTFPs) are any biological materials that are extracted from forests for human use other than timber. Alternative, secondary, minor, and non-wood forest products are all other names for these products. Fibers and floss, feed, aromatic and medicinal plants, gums, oils, dyes, spices, fruits, seeds, mushrooms, honey, lac, and other items are included. They provide a significant means of subsistence for millions of people living in forest-edge communities all over the world. In India, NTFPs are linked to the economic and cultural life of communities that depend on forests in a wide range of ecological and geo climatic conditions. In India, approximately 100 million people depend on NTFPs for part of their daily income.70 million people are tribal, most of whom live in the forest. In a lot of countries, including India, the people who live in forests rely heavily on forest products as their primary source of income. According to (Kill man 2003), it is estimated that 350 million people who live in or near dense forests and depend heavily on the forest's resources for their subsistence or livelihood account for 25% of the 6.2 billion people on the planet. According to Malhotra & Bhattacharya (2010), it is estimated that 275 million poor rural people in India, or 27% of the total population, rely on NTFPs for at least some of their cash and subsistence needs. The economic, social and environmental significance of NTFPs, including medicinal plants, is immense for nations like India. In addition, India accounts for 42% of all plant products removed, including lac and tendu leaves, followed by Brazil and Mexico. Exports of forest-based products and minor forest products account for 70% of total forest revenue for the Indian government. Over 60 billion US dollars are traded globally for medicinal and aromatic goods. In the country's tribal belt, approximately 70% of the NTFP collection takes place. The industry accounts for approximately 55% of employment in the forestry sector are attributed to the sector alone.

NTFP marketing

The indigenous communities that live on the outskirts of the forest are primarily supported by the sale of non-timber forest products (NTFP). Because it provides safety nets for the income of rural households during the agricultural season or when crops fail, marketing NTFP products has assumed significance. The marketing of NTFPs is carried out by a

variety of marketing agencies. Depending on the nature of the product, demand, market distance, and other factors, NTFPs are marketed through a variety of channel.

INSTITUTIONAL SET UP FOR NTFPs MARKETING IN INDIA



Developing and facilitating NTFP marketing are the responsibilities of a number of federal and state agencies. The National Medicinal Plant Board (NMPB), the Tribal cooperative marketing development federation (TRIFED), the National Agricultural cooperative marketing federation of India Ltd. (NAFED), the Forest Development Corporation (FDC), the Tribal Development Corporation (TDC), the Girijan Cooperative Corporation (GCC), the Large Multi-Purpose Cooperative Society (LAMPS), the Primary Agricultural Cooperative Society (PACS), and the Farmers Service Societies (FSS).

Marketing system

The NTFPs value chains are complex, with multiple stages and actors involved in the process of getting a product from forest to consumer; they are also dynamic and change over time. Therefore, information about the quantity and quality of the product, price and its market is very important. The NTFP market is extremely unorganized and imperfect. Currently, people who live in the forest collect NTFPs and sell them to local traders, who then sell them to the city and finally to consumers. There are three to five middlemen in the distribution chain from the forest collector to the urban wholesaler. These men are referred to as kutchias, or middlemen, and they act on behalf of the traders. The kutchias speak the tribal language and frequently provide loans as an advance payment for NTFP. They deceive the tribes regarding weights and rates because the tribes typically count and measure using conventional scales and are unfamiliar with metric units. Because they require funds to purchase weekly supplies, the tribal members are forced to sell their goods. However, the majority of forest dwellers lack access to markets, capital to invest in enhancing their standard of living, and bargaining power when selling their products in markets. They rely on intermediaries to sell their products because they do not have direct access to markets, which reduces their share of the revenue. Between the collectors and gatherers and the processing centre, there were at least four different levels of intermediaries.

Oppurtunities in NTFP marketing

1. NTFP products have been utilized for a wide range of uses, including food, fiber, fodder, traditional medicine, agricultural amenities, house hold materials, construction materials, and other similar uses. These products are also associated with a lot of old cultures and belief. Since there is more interest, it further develops the promoting channels and the framework, since request is the super driving variable for any market.
2. Major organizations like TRIFED, LAMPS, FDCs, TDCs, and others facilitate NTFP marketing via a variety of market channels. They provide MSP for the products, which aids in maintenance marketing.
3. The use of numerous medicinal plants in various pharmaceutical industries raises their marketing value. The extraction and processing of

various oils is made easier with the assistance of institutions like CIMAP (the Central Institute of Medical and Aromatic Plants).

4. NTFPs can add value in sufficient quantities through minor processing. Adding value to products raises their prices. These products, as well as those with higher demands, receive a better market price. For instance, the collector charges for a kilogram of Kalmegh Rs. 8 and are the market prices for processed Kalmegh.450.
5. There is a lot of room for units like soap and oil drilling, pharmaceuticals, cosmetics, ropes, food products like dry fruits, mats, furniture, honey, tendu leaves, gums, brooms, varnish, salt plate making, and so on.
6. Because it provides a safety net for the income of rural households during the agricultural season or when crops fail, marketing NTFPs has gained prominence. Increasing household incomes empower women because most of the gathering and marketing at the local level is done by women.
7. According to (Ghosal et al.2009), India's annual value of firewood, feedstock, timber, and non-timber forest products (NTFPs) may exceed Rs.300 billion, or 7.5 billion US dollars. It demonstrates that NTFP is utilized extensively in India and contributes to the Indian economy in some way.
8. Tribal collection of NTFP is easier because they can identify the species.

Challenges in NTFP marketing

Complexity of the NTFP Market Structure and Supply Chain

The NTFP market is highly complex with a large number of players at the producer, trader and manufacturer levels.

Lack of Proper Herb Identification and Final Product Classification

A single herb may be identified by different names in different regions and in different languages in different parts of India. This leads to incorrect quantity figures in cases where the local name for each herb is not correctly identified with its equivalent scientific name. The presence of large numbers of species and languages makes the generation of national level statistics a challenge, hence the greater reliance on estimates rather than precise data.

Lack of Governmental Control and Monitoring of the Market

1. Unlike the control and monitoring mechanisms of the government on production, pricing and supply of the staple food commodities, MAPs are not covered under monitoring mechanisms.
2. Low and fluctuating market prices of NTFPs are primarily followed by the existence of bad weather and lack of developed market infrastructure for NTFPs.

3. Lack of proper information about the demand and supply of the products being traded.
4. Lack of assured markets for the collectors and cultivators.
5. Lack of transport facilities for marketing NTFPs and high transportation costs in moving NTFPs from rural to urban centres.
6. Lack of skilled oriented training programme related to collection, processing and marketing of NTFPs.
7. Unique characters of medicinal plants and uncertainty regarding their availability.
8. Inadequate knowledge about the herbs being collected, cultivated or traded.
9. Quality issues in collection of medicinal herbs and the processing of final products.
10. Market barriers for new entrants in a closed market with scarce market information.
11. Problems in marginal cost pricing of the medicinal herbs, i.e. with sellers unable to receive fair value
12. There is a limited number of wholesale markets compared to the forest area. The traders in some places run an almost monopoly business in NTFPs.
13. After collecting the NTFPs, when the collectors go to the market to sell, they sell at a low price in some seasons when NTFPs are more available.
14. The distance between the market and the production area being high, the carrying cost of collected products is also high, which is posing some problems.
15. There is not sufficient place to store the collected NTFPs in the houses of the members. So, they are compelled to sell their collection at a low price.
16. Ineffective policies and legislation.
17. Production and processing methods are rudimentary.
18. Collection, processing and marketing continue to operate in a traditional way in most parts of the country.
19. No proper research on market development for NTFPs
20. Non-sustainable harvesting.
21. Lacking of value added NTFPs.

Suggestions

1. A market information system (MIS) is needed for the NTFP sector at local, state and national level in India.
2. Eliminating Poor Cultivation and Collection Practices.
3. Improving Processing and Storage Techniques.
4. Removing Market Imperfections.
5. Generating Awareness about Quality and Property Rights.
6. Value additions - an option for fine-tuning marketing of NTFPs.
7. Development of existing market infrastructure by the government for marketing of NTFPs.
8. Checking of the collection of NTFPs by outsiders.
9. Flexibility in forest rules and regulations for NTFPs collection.
10. Selling prices of various NTFPs should be fixed by the government.

11. Availability of transport facilities for marketing of NTFPs
12. A regular training programme should be organized for skill development in collection, processing and marketing of NTFPs.
13. The government should provide subsidies and bonuses for all NTFPs.
14. Low-cost storage facilities should be provided.
15. Good road connectivity between villages and markets.

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Tecomella undulata: An endangered important timber species for agroforestry in hot arid region

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Introduction

Due to the high risk involved with arable farming, which is affected by low and highly variable rainfall, low soil fertility, and high velocity wind, agroforestry plays an important role in the economy of arid regions. Since ancient times, the people of western Rajasthan have developed a variety of site-specific agroforestry systems. Farmers allowed scattered trees and shrubs to grow in their agriculture or grazing fields to sustain their lives. They regard these trees as a boon to the region, especially during droughts when rainfed crops fail. For rural livelihoods, the trees provide fodder, fruit, vegetables, fuelwood, timber, and fibre. Agroforestry meets 62% of rural people's needs for fodder, fuelwood, and timber.Rohida is a significant agroforestry tree species in the hot arid region. However, it has become a threatened tree species as a result of large-scale tree felling for high-priced timber, as well as slow growth and poor regeneration. Superior trees yielding high quality timber and growing quickly have been preferentially felled, leaving poor quality germplasm in the desert ecosystem that must be managed for conservation. As a result, there is an urgent need to begin work on genetic improvement and large-scale rohida cultivation under agroforestry.

Distribution

Roheda (*Tecomella undulata*) (Family-Bignoniaceae) is one of the best quality timber tree species in hot arid region.This wood is treated equivalent to teak; thus, it is also called as Marwar Teak. It found in drier parts of Arabia, southern Pakistan and north-western India up to an elevation of 1,200 m (Tewari, 2007). It is found in the regions of Sindh and Baluchistan in Pakistan while in India, it occurs naturally in Gujarat, Maharashtra, Rajasthan, Haryana and Punjab. Major population of this species is mainly concentrated in western parts of Rajasthan while in other states its population is scanty and very rare. It grows in areas of scanty rainfall almost as less as 150–500 mm annually and extreme temperatures; it can withstand extreme low temperature (0 to -2 C) during winter and high temperature (48–50 C) in summers. Roheda is drought, frost, fire and wind hardy; can tolerate drained loamy to sandy loam soil having pH in the range of 6.5–8.0 and is a strong light demander.

Phenology

Tecomella grows to a height of 2.5-5 m (Fig. 1), with drooping branches that are

glabrous and minutely stellately haired when young. The greyish-green leaves are simple, oppositely arranged, and lance-shaped with wavy margins (5cm-12cm long). Leaf fall occurs from November to March because the tree is deciduous.The tree blooms in April-May and bears fruits after that. Fruit is a capsule 15-35 cm 9 8-10 mm long, curved, linear-oblong, smooth, with thin valves. Seed winged and measure 2-2.5 cm (9 9-10 mm). The wood is greyish or yellowish brown, close-grained, with light streaks, and is tough, strong, and long-lasting.

Fig. 1 *Tecomellaundulata* tree
Pic credit: Rohit Kumar

Propagation

Tecomella undulata can be propagated through two ways: 1) Seed and 2) Clone. In nurseries, seeds are sown in polybags/raised nursery beds during the month of May *i.e.*, just before the arrival of monsoon. However, the rate of success through this method of propagation is very low due to non-heritability of superior qualities from mother plant. The viability period of seeds is very low *i.e.*, 12-18 months with germination percentage ranging from 26-46%. Thus GA_3 (1ppm-50ppm) is used for seed treatment which can thus increase the germination up to 80%. As the sexual method of propagation has many constraints, propagation through clones can be the best solution to tackle this issue. Hence through the method of micro and macro propagation, clones are

prepared. Among these two, macro propagation is usually preferred due to its ease of establishment, cost and time effectiveness.

Pest and diseases

The natural enemy complex found on *T. undulata* insect pests played an important role in controlling insect pest outbreaks in this economically important tree species. Twenty parasitic species, thirteen predatory species, and three entomopathogens were discovered to be associated with the potential insect pests of Khejri and Rohida(Ahmad *et al*. 1994). Throughout the tract of its distribution in arid and semiarid areas, seedlings and young plantations of *T. undulata* are frequently severely attacked by a serious defoliator *curculionid* pest, *Patialustecomella*. Its larvae are voracious leaf feeders that cause severe skeletonization. The adults feed on the margins of the leaves and cut them, leaving large and irregular holes.

Role in agroforestry and ecology

Tecomella undulata is a well-known tree in the traditional agroforestry systems of India's northwestern dry region. The tree is a key species in the drier regions and plays an important role in the region's ecology. The tree's roots and lateral roots spread across the top surface of the soil, forming a network and acting as a soil binder. It serves as a windbreak and aids in the stabilisation of shifting sand dunes. *T. undulata*, which is highly mycorrhizal in its natural habitat, also plays an important role in increasing carbon, nitrogen content, and the prolific growth of various microorganisms in the rhizosphere. Rohida'smycorrhizal nature makes it one of the most important tree species for research, including the 'bio-fertilizer' aspect as well as afforestation programmes (Srivastava *et al*. 2004) in arid zones of the country. *Tecomella*also used for phytoremediation. Its use in phytoremediation of crude petroleum oil-contaminated soil was reported by Mathur*et al*. (2010). It is a common agroforestry tree in the Thar Desert region (Rajasthan). The tree has played a significant role in improving conditions in arid and semi-arid lands and providing livelihood support to local communities. It can be found growing alongside *Prosopis cineraria* in community land and forestland (Singh, 2009).

Conclusion

Tecomella undulate is a medicinally and economically important tree species which is getting extinct due to massive deforestation and its low rate of regeneration. Proper and dedicated research should be made to find out a way to increase its population and protect it from further decline.

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Wetlands: Distribution, importance and threats in India

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Introduction

Lands transitioning between terrestrial and aquatic eco-systems where the water table is typically at or near the surface or the land is covered by shallow water," is how wetlands are described. They store water during dry spells, maintaining a high and largely steady water table. According to Ghermandi et al. (2008), wetlands are one of the planet's most productive ecosystems and offer a variety of crucial benefits to human society. They are adaptive and ecologically sensitive systems, nonetheless. Based on their hydrological, ecological, and geological characteristics, wetlands were divided into five different types: marine (coastal wetlands), estuarine (including deltas, tidal marshes, and mangrove swamps), lacustarine (lakes), riverine (along rivers and streams), and palustarine ('marshy' - marshes, swamps, and bogs). This classification system was developed by Cowardin et al. in 1979. According to the Ramsar Convention definition, India's wetlands include the majority of its natural water bodies, including rivers, lakes, coastal lagoons, mangroves, peat bogs and coral reefs, as well as man-made wetlands, including ponds, farm ponds, irrigated fields, sacred groves, salt pans, reservoirs, gravel pits, sewage farms and canals. As a result of urbanization, population expansion, and increased economic activity, many freshwater wetlands habitats are threatened and many have already been lost. Wetlands are extremely valuable in terms of culture, society, ecology, and business. Wetland degradation has been linked to a variety of factors in India, including unsustainable agricultural practises, the development of human settlements near wetlands, cattle grazing, and the building of dams. Additionally, wetland regions are declining due to rising human population, unsustainable development, and lack of awareness (Ramachandra et al., 2002). The stated wetland degradation is also a result of natural disasters. Lands are utilised for crop cultivation, which changes their environment and has an impact on biodiversity. Wetlands often depend on seasonal variations; they are neither totally aquatic nor truly terrestrial. The Ramsar Convention is the sole international agreement that was signed in 1971 to create action plans for the preservation of wetlands and their resources on a national and worldwide level. There were 2400 Ramsar sites introduced at this meeting, all of which were targeted for conservation. "Areas of the marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of marine water the depth of which at low tide does not exceed six metres," is how the Ramsar Convention defines wetlands in article 1.1.

Classification system of wetlands

S.No	Wetland Category	Type of Wetland
1	Estuarine	Deltas, Tidal marshes and Mangrove swamps
2	Lacustrine	Natural Lakes
3	Marine	Coastal wetland
4	Riverine	River and Stream
5	Palustarine	Marshy – Marshes, Swamps and Bogs

Source: Cowardin et al. (1979)

Distribution of wetlands in India

India, with its varying topography and climatic regimes, supports diverse and unique wetland habitats (Prasad et al., 2002). At a global level, wetlands cover a total area of 12.1 million km2 and account for 40.6% of the total global ecosystem services (ES) value. India has 757,060 wetlands covering about 15.26 million hectares area, which is around 4.63 % of the total geographical area of the country. Out of these, 45,658 are Inland natural and 142,812 Inland man-made wetlands (Table 3; Fig-1). India has a very large area of coastal wetlands, including the 10,204 natural and 2829 man-made coastal wetlands (SAC, 2011). Inland wetlands cover an area of 10.56 million hectares (69.23%) and area under coastal wetlands is 4.14 million hectares (27.13%). The small types wetland (< 2.25 ha) cover about 3.64 percent of land area (0.56 million hectares) and it is assumed that each is about of one ha (SAC,2011). World wetland day is celebrated Feburary 2nd every year.

Ramsar sites in India

The Ramsar Convention, also known as "The Convention on Wetlands," is an international environmental agreement that was developed in 1971 by UNESCO and went into effect in 1975. It designates certain wetland sites as being of worldwide importance. These locations are known as Ramsar sites. In order to conserve wetlands and responsibly utilise their resources, it calls for both national and international collaboration. Ramsar recognises wetlands that are significant on a global scale, particularly those that provide as habitat for waterfowl.

Importance of wetlands

- Wetlands provide many ecological services like carbon sequestration, flood control, recharge underground water level and maintenance to the biodiversity (Turner et al., 2000).
- Wetland ecosystem is highly supportive to the fish production. The maximum fishes (about 66%) are collected from the level I type of wetland (Inland water bodies), i.e. canals, rivers, ponds, water reservoirs and natural lakes.
- Different types of wetland structures like mangroves, swamps and marshes play a significant role in the carbon cycle. Wetlands store carbon as the biomass of aquatic flora, fauna and microbes.
- Multiple free water surface flow constructed wetlands technique are man-made ponds or tanks for impounding run-off, which function as the wastewater treatment plant.
- They help to reduce the impacts of flooding by absorbing water and reducing the speed at which floodwater flows (Bassi et al., 2014). The wetlands play an important role in the hydrological cycle also, influencing groundwater recharge, low flows, evaporation and floods (PattisonWilliams et al., 2018).
- Different types of invertebrates and vertebrates spend their life cycle around the wetlands because of a suitable environment and food availability. These habitats support the food chain also (Juliano and Simonovic, 1999).
- Wetland areas provide a unique habitat for many water birds and water migratory bird species,
- In India, lakes, rivers and other freshwater bodies support a large diversity of biota representing almost all taxonomic groups. The total numbers of aquatic plant species exceed 1200 and they provide a valuable source of food, especially for waterfowl (Prasad et al., 2002). The freshwater ecosystems of Western Ghats, a biogeographic region in southern India which runs along the west coast covering a total area of 136,800 km2, alone has about 290 species of fish; 77 species of Mollusc; 171 species of Odonates; 608 species of aquatic plants; and 137 species of amphibians. Out of these, almost 53% of freshwater fish, 36% of freshwater Mollusc, and 24% of aquatic plants species

are endemic to this region (Molur et al., 2011).

Ramsar wetland sites (As on August, 2022), ENVIS Centre on Wildlife & Protected Areas

Sl. No	Name of Site	State Location	Date of Declaration	Area (in Sq. Km)
1	Kolleru Lake	Andhra Pradesh	19.8.2002	901
2	Deepor Beel	Assam	19.8.2002	40
3	Kabartal Wetland	Bihar	21.07.2020	26.20
4	Nanda Lake	Goa	06.08.2022	0.42
5	Khijadia Wildlife Sanctuary	Gujarat	13.04.2021	5.12
6	Nalsarovar Bird Sanctuary	Gujarat	24.09.2012	120
7	Thol Lake Wildlife Sanctuary	Gujarat	05.04.2021	6.99
8	Wadhvana Wetland	Gujarat	05.04.2021	6.30
9	Bhindawas Wildlife Sanctuary	Haryana	25.05.2021	4.12
10	Sultanpur National Park	Haryana	25.05.2021	1.425
11	Chandertal Wetland	Himachal Pradesh	8.11.2005	0.49
12	Pong Dam Lake	Himachal Pradesh	19.8.2002	156.62
13	Renuka Wetland	Himachal Pradesh	8.11.2005	0.2
14	Wular Lake	Jammu and Kashmir	23.3.1990	189
15	Hokera Wetland	Jammu and Kashmir	8.11.2005	13.75
16	Surinsar-Mansar Lakes	Jammu and Kashmir	8.11.2005	3.5
17	Tsomoriri Lake	Jammu and Kashmir	19.8.2002	120
18	Hygam Wetland Conservation Reserve	Jammu and Kashmir	13.08.2022	8.0182
19	Shallbugh Wetland Conservation Reserve	Jammu and Kashmir	13.08.2022	16.75
20	Ranganathittu Bird Sanctuary	Karnataka	15.02.2022	5.18
21	Asthamudi Wetland	Kerala	19.8.2002	614
22	Sasthamkotta Lake	Kerala	19.8.2002	3.73
23	Vembanad Kol Wetland	Kerala	19.8.2002	1512.5
24	Tso Kar Wetland Complex	Ladakh	17.11.2020	95.77
25	Bhoj Wetlands	Madhya	19.8.2002	32.01

		Pradesh		
26	Sakhya Sagar	Madhya Pradesh	01.07.2022	2.48
27	Sirpur Wetland	Madhya Pradesh	01.07.2022	1.61
28	Yashwant Sagar	Madhya Pradesh	13.08.2022	8.229
29	Lonar Lake	Maharashtra	22.7.2020	4.27
30	Nandur Madhameshwar	Maharashtra	21.6.2019	14.37
31	Thane Creek	Maharashtra	13.08.2022	65.2108
32	Loktak Lake	Manipur	23.3.1990	266
33	Pala Wetland	Mizoram	31.08.2021	18.5
34	Satkosia Gorge	Odisha	10.12.2021	981.97
35	Bhitarkanika Mangroves	Odisha	19.8.2002	650
36	Chilka Lake	Odisha	1.10.1981	1165
37	Tampara Lake	Odisha	13.08.2022	3
38	Hirakud Reservoir	Odisha	13.08.2022	654
39	Ansupa Lake	Odisha	13.08.2022	2.31
40	Beas Conservation Reserve	Punjab	26.9.2019	64.289
41	Harike Lake	Punjab	23.3.1990	41
42	Kanjli Lake	Punjab	22.1.2002	1.83
43	Keshopur-Miani Community Reserve	Punjab	26.9.2019	3.439
44	Nangal Wildlife Sanctuary	Punjab	26.9.2019	1.16
45	Ropar Lake	Punjab	22.1.2002	13.65
46	Keoladeo Ghana NP	Rajasthan	1.10.1981	28.73
47	Sambhar Lake	Rajasthan	23.3.1990	240
48	Gulf of Mannar Marine Biosphere Reserve	Tamil Nadu	04.08.2022	526.72
49	Karikili Bird Sanctuary	Tamil Nadu	04.08.2022	0.584
50	Koonthankulam Bird Sanctuary	Tamil Nadu	11.08.2021	0.72
51	Pallikaranai Marsh Reserve Forest	Tamil Nadu	04.08.2022	12.475
52	Pichavaram Mangrove	Tamil Nadu	04.08.2022	14.786
53	Point Calimere Wildlife and Bird Sanctuary	Tamil Nadu	19.8.2002	385
54	Udhayamarthandapuram Bird Sanctuary	Tamil Nadu	04.08.2022	0.44
55	Vedanthangal Bird Sanctuary	Tamil Nadu	04.08.2022	0.40
56	Vellode Bird Sanctuary	Tamil Nadu	04.08.2022	0.77
57	Vembannur Wetland Complex	Tamil Nadu	04.08.2022	0.20
58	Chitrangudi Bird Sanctuary	Tamil Nadu	13.08.2022	2.6047

59	Suchindram Theroor Wetland Complex	Tamil Nadu	13.08.2022	0.9423
60	Vaduvur Bird Sanctuary	Tamil Nadu	13.08.2022	1.1264
61	Kanjirankulam Bird Sanctuary	Tamil Nadu	13.08.2022	0.9689
62	Rudrasagar Lake	Tripura	8.11.2005	2.4
63	Bakhira Wildlife Sanctuary	Uttar Pradesh	29.06.2021	28.94
64	Haiderpur Wetland	Uttar Pradesh	8.12.2021	69.08
65	Nawabganj Bird Sanctuary	Uttar Pradesh	19.9.2019	2.246
66	Parvati Agra Bird Sanctuary	Uttar Pradesh	2.12.2019	7.22
67	Saman Bird Sanctuary	Uttar Pradesh	2.12.2019	52.63
68	Samaspur Bird Sanctuary	Uttar Pradesh	3.10.2019	79.94
69	Sandi Bird Sanctuary	Uttar Pradesh	26.9.2019	30.85
70	Sarsai Nawar Jheel	Uttar Pradesh	19.9.2019	16.13
71	Sur Sarovar	Uttar Pradesh	21.8.2020	4.31
72	Upper Ganga River (Brijghat to Narora Stretch)	Uttar Pradesh	8.11.2005	265.9
73	Asan Conservation Reserve	Uttarakhand	21.7.2020	4.444
74	East Kolkata Wetlands	West Bengal	19.8.2002	125
75	Sunderbans Wetland	West Bengal	30.1.2019	4230

Threats to wetlands

- It has been estimated that about 35% loss in the global wetland since 1970.
- This region lost a very large area of wetlands per year due to agricultural and developmental activities.
- The improper management of wetlands, lack of implementation of conservation plans, increase in the pollution, and rapidly increase the requirements of water by local peoples are also affected the water bodies and pushing these good eco -balancers to extinction.
- Maximum areas of the major river basins in India have changed into different land use pattern. They have increased into the agricultural field and non-agricultural area have converted into flood plain areas, forest, and grassland area and associated freshwater ecosystems fulfil the food requirements of the population.
- In India, several development projects like irrigation and water supply have changed the patterns of water inflows and water spread areas of many natural water bodies.
- Population pressure and development activities in India are responsible for the land use pattern, and habitats are degraded rapidly and their adverse impact on avian diversity.
- In India, maximum water bodies such as rivers, lakes and streams have been degraded due to unsustainable agriculture practices.

- Using of chemicals as pesticide and fertilizer in agriculture fields, discharge of untreated industrial and municipal waste into the water bodies are responsible for the degradation of natural water resources these nutrient contents encourage the algal growth, responsible for eutrophication of surface water bodies.
- Agricultural run-off is one of the major sources of non-point pollution to the Indian water bodies in Indo-Gangetic plains.

Conclusion

The protection of wetlands by taking proper measures increases the diversity of fauna and flora and provides many ecological services.

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Technique of vermicompost production

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Introduction

Environmental degradation is a major threat confronting the world and the use of chemical fertilizers contributes largely to the deterioration of the environment through depletion of fossil fuels, generation of carbon dioxide(CO_2) and contamination of water resources. It leads to loss of soil fertility due to imbalanced use of fertilizers that has adversely impacted agricultural productivity and causes soil degradation. Now, there is a growing realization that the adoption of ecological and sustainable farming practices can only reverse the declining trend in the global productivity and environment protection (Aveyard 1988, Wani and Lee 1992, Wani *et al*., 1995).

On one hand, tropical soils are deficient in all necessary plant nutrients and on other hand, large quantities of such nutrients contained in domestic wastes and agricultural byproducts are wasted. It is estimated that in cities and rural areas of India, nearly 700 million organic waste is generated annually which is either burned or land filled (Bhiday 1994). Such large quantities of organic wastes generated also pose a problem for safe disposal. Most of these organic residues are burned currently or used as land filling. In nature's laboratory, there are a number of organisms (micro and micro) that have the ability to convert organic waste into valuable resources containing plant nutrients and organic matter which are critical for maintaining soil productivity. Microorganisms and earthworms are important biological organisms helping nature to maintain nutrient flows from one system to another and also minimize environmental degradation. The earthworm population is about 8-10 times higher in uncultivated areas. This clearly indicates that earthworm population decreases with soil degradation and thus can be used as a sensitive indicator of soil indicator of soil degradation.

In organic farming, vermicomposting and vermiwash become essential in order to back it up.

Vermi technology

It is a method of converting organic waste in to useful products through the action of earthworm comprising two main component processes, such as vermiculture and vermicomposting. The transfer of vermiculture technology was highly successful and widely adopted by community. It has a visible impact on the economic upliftment of them and providing employment opportunities to the youth and farmwomen.

Vermi composting

It can be defined as a process of converting organic waste into vermicompost through the activities of earthworm. It is the advanced method of

composting where earthworms eat the decomposed material and excrete it out as casting which is known as vermicast or vermicasting. During feeding, earthworms use 5-10% of the food intake for their growth and the rest is excreted.

Vermicompost is a biofertilizer excreted by earthworms after consuming plant litters, organic debris, waste materials etc. It is also called as biodegradation and stabilization of organic matter through ingestion by earthworms. It consists of a large number of essential nutrients like NPK, many species of micro and macro flora and fauna including soil fungi, nitrogen fixing bacteria and young juvenile earthworms. The micro and macro fauna including juvenile and adult earthworms help in breaking down the soil particles, facilitating drainage, porosity and stimulating microbial decomposition. It has been shown that earthworm casting contain up to a twice as much available potassium as the surrounding soil. Bacterial growth is also greatly stimulated which helps in the creation of soil supporting humus. Good amount of work on the vermicompost production by using agricultural and residential organic waste has been done in past. Forest development Corporation of Maharashtra Ltd., was producing vermicompost by using dry grass in its production unit and selling to the farmers and plant growers (Chafekar, 1999).

Preliminary treatments of organic waste:

Container/pit

Container of any size can be used. The container may be made of plastic earthen or concrete that depends on the choice of the person who want to do composting.

Bedding materials

Pre-decomposed organic waste mixed with 80% organic waste and 20% cowdung.

Moisture content

Moisture content during composting should be maintained at 30-40%.

Temperature

Optimum temperature for food material is 20-30^{0}C.

Cover to feed substrate

Cover o feed material by using gunny bags or black plastic sheet helps to reduce water loss, unwanted movement of worms and more feeding by worms as they do not prefer light.

Selection of right type of worms

The most important worms are as follows:

Exotic species

a) *Eisenia foetida*- Red worm, Tiger worm.

b) *Eudrillus euginae*- Night crawler

Local worms

a) *Perionys excavates*

b) *Perionx sansbaricus*

1. Sieve: 3-4 mm

2. **Bucket and watering cans.**

3. **Hoe and forks etc.**

Vermicompost production process

Pre-decomposition organic waste

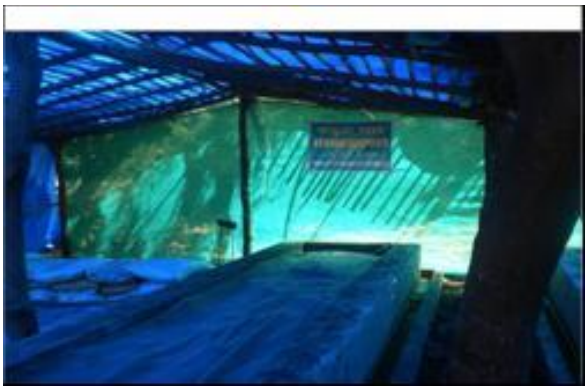
Preliminary treated organic waste materials (dry grass/leaf litter) have to be pre-decomposed.Heaps should be prepared for quick decomposition.

Dry grass/ leaf litter for production of vermicompost

Preparation of vermin beds

The beds size 10x1x0.5 m. First put one layer of (30cm) semi decomposed materials and then one layer of cowdung, maintaining the ratio of 80% waste and 20% cow dung. Release the worms 1 kg per bed. Repeat the layering process.Regular watering is must to keep the food materials moist.

Worms



Vermin bed

Harvesting of vermicompost

Earthworms start feeding from the upper surface of the feed material. When the materials become granular, blackish in colour, just like used tea, It indicates that the material is ready for harvesting. Scrapped this material up to the depth where there are no vermicompost worms. Collect all scrapped material and make one heap and leave it for 2-3 days. All worms will go down to the bottom of the heap and it will be easier to separate the worms manually. From the bed (size 10x1x0.5 m), 5-6 quintal vermicomost per bed can be produced.


Harvesting of vermicompost


Drying and sieving **Packing**

Drying and sieving

Vermicompost should be dried in shade, as sunlight will destroy the cocoons. There should be 20-25% moisture, in this time. For this measurement, make a small ball of vermicompost and if it immediately cracks down it indicates 20-25% moisture. Then sieve it by using 3-4 mm sieve. Sieved material is the vermicompost ready to be used. Material on the sieve can be put in to the composition bed or it can be used around the plants.

Packing

Sieved material is ready for packing. So, depending on the choice it can be packed in plastic bags.Closed the opening of the bag tightly as it may absorb moisture from the atmosphere.

Maintainance of vermi Beds

1. After inoculation of worms in the bed, regular watering is a must to keep the feeding moist. Depending upon the weather condition 1-2 times watering is necessary.
2. During summer months, covering of the beds gunny bag is essential, it will check moisture loss from the beds and restrict upward movement of worms.
3. After harvesting of vermicompost, if the feeding material is compact, loosen it by using one bamboo stick.
4. Periodical removal of cast also increasing the feeding efficiency of worms.
5. Almost al the worms will get accumulated in the last layer of feed material. So, place the worm with organic waste in to other beds which is ready to be inoculated with worms. So, minimum 2 beds will help to recycle the worms.

Advantages of vermicompost application

1. Improves soil physical structure.
2. Helps multiplication of microbes and maintain normal soil pH.
3. As particle size is very small, so plant can absorb very easily.
4. Contains almost all essential nutrients and hormones for plant growth.
5. Improves water holding capacity of soil.
6. Due to healthy plant growth, plant can resist insect disease attack.
7. Products have good taste, odour and nutritive value.

Mode of application

Crop	Rate of application
Horticulture	3 kg/plant
Forestry	5 kg/plant
Agriculture	2-3 ton/ha
Medicinal plants	400-500 gm/plant

Nutrient content of vermicompost

Nitrogen- 1.5-2.5%	Calcium- 0.5-1.0%
Phosphorus- 0.9-1.7%	Magnessium- 0.2-0.3%
Potash- 1.5-2.4%	Sulpher - 0.4-0.5%

Cost of Vermicompost Unit (TFRI, Jabalpur)

Shade Size: 7.50 x 12.0 x 2.40 m

Overview of Vermicompost unit of TFRI

- Cost Rs. 65/ sqft = 65,000/
- No. of vermicompost Beds 5 nos. (size 10x1x0.5 m)
- Bricks 2500 nos. Rs.7500/
- Cement 10 bags Rs. 2500/
- Earthworms 5 kg Rs. 1500/
- Cowdung 1 trolley: Rs. 500/
- Polythene sheet 60 m. Rs. 1000/

- Gunny Bags 60 nos. Rs. 1800/
- Semidecomposed materials 1 trolley Rs. 400/
- Labour cost Rs. 3000/
- Miscellaneous Rs. 500/ Total outlay Rs. 83, 700/ approx.

Economic Analysis

- Production of vermicompost per year 16000-20000 quintal.
- Cost of vermicompost: Rs. 3-5 /kg.
- Cost of earthworms Rs. 0.25 per worm

Precaution during the process

The following precaution should be taken during vermicomposting:

- The exotic species of the earthworms are ideal for the preparation of vermicompost. Most local species are not suitable for the purpose.
- Only plant based materials such as grass, litter or vegetablespeelings should be utilized in preparing vermicompost.
- Materials of animals are not suitable for preparing vermicompost.
- Unit should be protected against birds, termites, ants and rats.
- Adequate moisture should be maintained during the process. Either stagnant water or lack of moisture could kill the earthworms.
- After completion of the process, the vermicompost should be removed from the bed at regular intervals and replaced by fresh waste material.

The research work on the vermicompost and its effect plant growth was also carried out in Tropical Forest Research Institute, Jabalpur (Humne *et al.*, 1995). The results showed that the vermicompost made out of seven forest litters viz. *Tectona grandis, Populus* sp., *Albizia lebbek, Dalbergia sissoo, Pongamia pinnata, Eucalyptus* and *Cassia fistula* developed between 42 to 54 days during rains. The best medium for earthworm development was observed *T. grandis* leaf litter in which maximum population developed in shortest time period. It contains 0.95 % available nitrogen, 0.04% potassium and 0.006% phosphorus. *Populus* sp. leaf litter proved to be next to *T. grandis* in which slightly less number of individuals developed but it contains more nitrogen (1.25%) than *T. grandis*. It has also been concluded that a mixture of one part of vermicompost and 5 parts of soil + sand is effective to boost up the growth of seedlings of *Jatropha curcas* and *Albizia lebbek.*

Understanding life movement

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Commemorating World Environment Day on June 05, 2022, Hon'ble Prime Minister of India launched a global initiative Lifestyle for the Environment (LiFE) Movement to encourage individuals across the globe to undertake simple climate-friendly actions in their daily lives or adoption of environment-conscious lifestyle in our fight against climate change.

As nature has evidently started showing signs and symptoms of global warming and climate change due to exacerbated exploitation, mindless consumerism, and irresponsible individual behaviour, time has come to revisit and transform human behaviour to a mindful and deliberate utilisation promoting environmentally conscious lifestyle. Using this idea, the LiFE movement seeks to leverage the strength of social networks to influence social norms surrounding climate.

LiFE Movement, originally introduced by India during the 26th United Nations Climate Change Conference of the Parties (COP26) in Glasgow in 2021 seeks to replace current "use-and-dispose" economy by a circular economy whose principles are anchored on individual consciousness and mindful consumerism. Individuals who practice such a lifestyle on day-to-day basis will be recognised as 'Pro-Planet People' (P3). LiFE mission plans to create and nurture a global network of Pro-Planet People who will have a shared commitment to adopt and promote environmentally friendly lifestyles. As reiterated by Hon. Prime Minister of India, Mission LiFE borrows from the past, operates in the present and focuses on the future. Reduce, Reuse and Recycle are the concepts woven into our life. The Circular Economy has been an integral part of our culture and lifestyle. The LiFE movement, additionally, also seeks to leverage the strength of social networks and alliances to influence social norms surrounding environment and climate. Hence, abiding by the notion of responsible citizens, onus lies on us to practice, profess and propagate the essence advocated by LiFE Movement. Through the people of the country, and world as a whole, the mission eyes to reinforce our ecosystem through environment friendly lifestyles to render the nature self-sustainable, resilient and replenishable.

LiFE Movementfinds concrete agreement with the constitution of India as two specific provisions i.e., Article 48- A and Article 51-A (g) puts a duty respectively on the State and the citizens to protect and conserve the environment. Moreover, Indian Judiciary has explicitly propounded that the right to life under Article 21 of the Constitution contains right to have a healthy environment.

However, the challenge that lies ahead is to identify measurable and scalable climate friendly behaviour / behavioural patterns

to spearhead and sustain the movement among the people. Some of the well acknowledged eco-friendly behaviour that can be easily imbibed in our lifestyles is as follows;

1. Prefer public transport system over private vehicles. Drive and fly less, instead ride a bike and walk wherever possible. It would help drastically tone down per capita carbon footprint.
2. Use energy efficient lights and rechargeable batteries.
3. Switch off the extra lights and other appliances as and when required
4. Practice voluntary aversion of usage of plastic in daily lives. Always carry cloth bags for accessing daily needs
5. Reduce, reuse and recycle resources wherever possible
6. Safe dumping of domestic wastes into specifically earmarked dump yards only.
7. Inclusion of climate friendly food items in our daily lives. Millets over cereals, and plant based over meat-based diet wherever conceivable.
8. Turn off the taps while brushing and washing our hands.
9. Have a shower instead of bath. It would help reduce water use and subsequent loss of water
10. Let use of online / e-technologies ride over offline necessities such as bill payments, note makings and institutional functioning. It would help reduce the usage of paper, which in turn reduce deforestation.

Above all, the primary and the most significant single step to conform to the LiFE movement is to sincerely acknowledge that climate change is happening and by abandoning all qualms that 'climate change is a hoax', only to be a relatable messenger who is ready to offer positive social reinforcement of climate friendly behaviour.

Actions through LiFE movement also support the implementation of Sustainable Development Goals. The Sustainable Development Goals are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. The LiFE mission can be met within the framework of a revitalized global partnership for sustainable development. Specifically, the SDGs focused on sustainable cities andcommunities (SDG 11), responsible production and consumption (SDG 12), climate change (SDG 13), or life on land (SDG 15), and life under water (SDG 14) require that allindividuals temper their lifestyles in sync with the resources available on the planet.

SDG 12, in particular, entails decoupling economic growth and environmental degradationand demands more efficient and environmentally friendly management of resources, including improving energy efficiency, sustainable infrastructure, access to basic services, and providing green and decent jobs to ensure a better quality of life for all. The societalresponsibility towards SDG 12 goes beyond businesses, to involve individual consumers asactive participants

in the process of achieving this goal.Given the global commitment to achieving the SDGs by 2030, it is important to note thatMission LiFE contributes directly or indirectly to almost all the SDGs. Public participation ably supported by strong politicalfor protecting and conserving the environmentwill help translate the vision of LiFE into measurable impact.

झाड़ू निर्माण : बस्तर वनांचल का महत्त्वपूर्ण कौशल

सौरभ दुबे
वन सुरक्षा प्रभाग
उष्णकटिबंधीय वन अनुसंधान संस्थान
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छत्तीसगढ़ राज्य का बस्तर वनांचल वानस्पतिक विविधता से परिपूर्ण हैं, साथ ही साथ यह अंचल विभिन्न आदिवासी समुदायों का घर भी हैं। घने वनों तथा आदिवासी बहुलता वाला बस्तर, जंगल पर मानव की निर्भरता का सटीक उदाहरण हैं। यहाँ निवास करने वाले आदिवासी समुदाय अपने जीवकोत्पार्जन के लिये बहुत हद तक वनों पर ही आश्रित हैं। ये लोग वनों से विभिन्न प्रकार के अकाष्ठ वनोंपज को एकत्र करते हैं तथा उसे हाट - बाजारों या वनोपज खरीदने वाले व्यापारियों अथवा बिचौलियों को बेच देते हैं। वनोंपजो के विक्रय के साथ ही साथ आदिवासी समुदाय के कला कुशल लोगों द्वारा कुछ वनोंत्पादो को एकत्र करके, उनसे विभिन्न सामान बनाकर उन्हें बाजार में अच्छे दाम पर बेंचा जाता हैं। ऐसे ही वनोंत्पाद जिसमें कुछ किस्म के घास तथा बाँस आदि शामिल हैं, को एकत्र करके उनसे दैनिक जरुरत में उपयोग आने वाले सामान जैसे टोकरी और झाड़ू आदि, तथा अन्य सजावटी सामान तैयार किया जाता हैं। कुसल घास, फूल घास, छींद घास (तना रहित खजूर की छोटी किस्म) तथा बाँस ऐसे ही महत्तवपूर्ण वनोंत्पाद हैं, जिनसे आदिवासी विभिन्न सामग्री तैयार करते हैं। घास आदि सामग्री से झाड़ू बनाना इस अंचल का एक महत्तवपूर्ण कौशल हैं, जो आदिवासियों को न केवल रोजगार प्रदान करता हैं, बल्कि प्लास्टिक आदि पर्यावरण को नुकसान पहुचाने वाले कारको से बनी झाड़ू के स्थान पर, प्राकृतिक चीजों से बनी परम्परागत झाड़ू को उपयोग करने के लिये प्रोत्साहित करता हैं।

फूल घास

फूल घास का वान्स्पतिक नाम *Thysanolaena latifolia* हैं। बस्तर अंचल में इसे इसे फूल घास या झाड़ू घास कहाँ जाता हैं। अंग्रेजी मे इसे टाईगर ग्रास, एशियन ब्रूम ग्रास तथा बेम्बू ग्रास कहते हैं। यह बारहमासी पौधा भारत सहित दक्षिण तथा दक्षिणपूर्व एशिया के देशों में पाया जाता हैं। सामान्य तौर पर यह नदियों के रेतीले किनारों, पहाडियों की नम ढ़लानों तथा नमी वाले स्थानों पर ऊगता हैं। इसका पौधा बाँस के पौधे की तरह दिखाई देता हैं, तथा बाँस की तरह इसकी क्ल्म (तना) समूह में अथवा भिर्रा के रुप में होता हैं। इसके परिपक्व पुष्पगुच्छों को तनों

सहित जनवरी से मार्च तक सर्दियों के मौसम में काटा लिया जाता है, जिससे झाड़ू बनायी जाती हैं।

झाड़ू को दिखने में ज्यादा आकर्षक बनाने के लिये उन पर रंग–बिरंगे हेण्डिल तथा रस्सियों से बाँधा जाता हैं। झाड़ू का मूल्य उनके आकार, मजबूती व सुंदरता के आधार पर तय किया जाता हैं। जागरुक महिलाएं स्वासहायता समूह बनाकर फूल घास से झाड़ू बनाकर उनको थोक व्यापारियों तथा माँग के अनुसार बाजार में बेचती हैं। इस प्रकार समूह में कार्य करने से महिलाओं की जहाँ आमदनी बढ़ी हैं, वही उनके आत्मविश्वास में भी मजबूती आयी हैं।

फूल घास न केवल झाड़ू बनाने के काम आती हैं, बल्कि इसकी पत्तियाँ पशु चारे के रुप में भी उपयोग लायी जाती हैं। झाड़ू बनाने के उपयोग मे न आने वाले बचे हुये तने को जलावन की तरह इस्तेमाल किया जाता हैं।

कुसल घास

कुसल घास का वान्स्पतिक नाम *Heteropogon contortus* हैं। बस्तर की सामान्य बोलचाल की भाषा में इसे काँटा बहरी कहाँ जाता हैं। यह घास उत्तर बस्तर, काँकेर के अधिकतर वनों के खुले हुये किनारों, वृक्षारोपण के क्षेत्रों तथा राजस्व भूमियों पर बहुतायत में पायी जाती हैं। अनुकूल परिस्थियों में यह घास 1 मी. से अधिक ऊँचाई तक बढ़ सकती हैं। इसकी पत्तियाँ हरे – भूरे रंग के होते हैं। यह घास फूल आने से पहले चारे के लिये उपयोग लायी जा सकती है, परंतु पुष्पन के बाद यह चाराई के लिये अनुउपयुक्त हो जाती हैं। बीज के सिरो पर स्पाइक (क़ाँटा) होता हैं, जो जानवरों के शरीर से चिपक जाता हैं, और इससे इसका प्रसारण दूर तक हो जाता हैं।

झाड़ू बनाने के लिये पुष्प वाले दंड को एक – एक करके आदिवासी महिलायें काँटकर एकत्र करती हैं। इनको एकत्र करने में सबसे बडी समस्या इनके काँटे होते हैं, जो कि कपडों पर चिपक जाते हैं, और आसानी से निकलते भी नही, इसलियें महिलायें कमर से पैर तक कपडों को पॉलीथिन से ढ़क लेती हैं, जिससे ये क़ाँटे उनके कपडों पर नही चिपक पाते हैं। घास के पुष्प दंडो को एक साथ बाँधकर उनसे झाड़ू बनायी जाती हैं तथा उन्ही के बढ़े हुये भाग की गुथाई करके कलात्मक हेंडिल बनाये जाते हैं। जो झाड़ू को देखने में आकर्षक बनाते हैं सामान्य रुप से अधिकतर महिलायें इससे बनी झाड़ू को स्वयं घर पर उपयोग के लिये बनाती हैं, क्योकि इसकी बाजार में माँग तथा भाव बहुत अधिक नही होता और यह जल्दी खराब भी हो जाती हैं।

छिंद घास

साल के जंगलों में पायी जाने वाली खजूर की तना रहित छोटी किस्म, जिसे स्थानीय आदिवासी समुदाय छिंद घास कहते हैं, उसका प्रयोग भी झाड़ू बनाने में किया जाता हैं।

खजूर की इस किस्म का वानस्पतिक नाम *Phoenix acaulis* हैं । इसकी पत्तियाँ खजूर के बडे वृक्षों की पत्तियो के मुकाबले अधिक मुलायम होती हैं। साल वनों से इसकी पत्तियों को काँटकर धूप में सुखाने के बाद उनकी पत्तियों को बीच से चीरा लगाकर आधा किया जाता हैं और इस प्राकार के टुकडो को रस्सियों की सहायता बाँधकर झाडू का रुप दिया जाता हैं। बाजार में इस तरह की झाडू का मूल्य 10 से 20 रुपये तक मिल जाता हैं। इससे बनी झाडू ज्यादा मजबूत तथा लम्बे समय तक उपयोग की जा सकती हैं।

बाँस

बस्तर के समृद्ध वनों में बाँस की अच्छी उपस्थिति देखी जा सकती हैं। नारायणपुर, दरभा तथा कोलिंग जैसे स्थानों में देशी तथा पानी बाँसों के समूह अच्छी मात्रा में दिखाई देते हैं। वनों के निकट रहने वाले आदिवासी परिवार बाँस से झोपडी, पशु सुरक्षा हेतु बाढ़ व टोकरी आदि बनाते हैं। इसके अलावा इन बाँसो से विभिन्न कलात्मक चीजें और दैनिक जरुरतों के सामान भी बनाते हैं। बाँस कला में निपुण ये आदिवासी समूह इनसे झाडू भी बनाते हैं। बाँस को पतला चीरकर उसकी सींक बनाने के बाद, उन्हें झाडू के आकार में लगाकर, लकडी के हेंडिल से बाँध दिया जाता हैं। इस प्रकार बनी झाडू बहुत मजबूत व लम्बे समय तक चलने वाली होती हैं। सामान्य तौर पर बाँस से बनी झाडू को आँगन तथा पशुशाला की साफ – सफाई करने के लिये काम में लाया जाता हैं।

Ants as predators of sal borer

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Abstract

Sal heartwood borer, *Hoplocerambyx spinicornis* Newman (Coleoptera: Cerambycidae), commonly known as sal borer, is the most devastating insect pest responsible for catastrophic damage of sal (*Shorea robusta* Gaertn. f.) forests of the country. During the emergence of borer beetles in sal forests of Madhya Pradesh and Chhattisgarh, three species of ants, viz. red tree ant, *Oecophylla smaragdina* Fabricius, unidentified small red ant and large Indian black ant *Camponotus compressus* Fabricius (Hymenoptera : Formicidae) were found feeding on eggs/grubs/adults of sal borer. The present article deals with these aspects and succinctly describes two identified ant species.

Key words

Ants, *Oecophylla smaragdina*, *Camponotus compressus*, predators, sal borer

Introduction

Shorea robusta Gaertn. f. (family Dipterocarpaceae), commonly known as sal, is a large deciduous resiniferous tree having majestic shining foliage more or less semi-evergreen in habit (Fig. 1) (Anon, 1972). Sal is of Indian origin, the north east India is considered as homeland of sal (Kulkarni, 1956). This potential species is one of the most important timbers of India both ecologically and economically (Tewari, 1995). It is widely distributed in central and north India and constitutes an important ecosystem, which provides cool and calm environment rich in biodiversity. In Madhya Pradesh and Chhattisgarh, sal forests are found over an area of 25, 703 sq. km. (16.54%) (Anon, 2011).

Fig.1. Sal tree

Sal heartwood borer, *Hoplocerambyx spinicornis* Newman (Coleoptera : Cerambycidae), commonly known as sal borer (Fig. 2), needs no introduction, because of the fact that this destructive insect is very well known to forest entomologists, scientists, officers, frontline staff of forest department and forest dwellers residing in close proximity of sal forest areas. Sal entomology has received special attention, since inception of forestry research in India (Stebbing, 1914; Beeson, 1941; Mathur, 1962; Roonwal, 1978; Singh and Mishra, 1981; Tewari, 1995; Thakur, 2000; Bhandari and Rawat, 2001; Roychoudhury *et al*., 2004; 2018; Joshi *et al*., 2006, Joshi, 2009, Roychoudhury, 2015, 2016), because it has a major insect pest problem mainly due to sal borer, which causes large scale catastrophic damage of sal forests (Fig. 3).

Eggs

Grubs

Pupae

Adult beetle

Fig.2. Developmental stages of sal borer

Fig.3. Sal borer damaged forest

Regarding the natural enemy complex of sal heartwood borer, information is scanty, apparently, there are not many (Nair, 2007). However, natural enemies consisting of parasitoids, predators and pathogens play an important role to influence the population of sal borer (Roychoudhury *et al*., 2013). Roychoudhury (2016, 2017) have recorded a total of seven natural enemies of *H. spinicornis* in sal forests and timber depots, out of which one species is larval-pupal parasitoid and six species are predators. Among the predators, three species are ants, such as red tree ant, *Oecophylla smaragdina* Fabricius (Fig. 4), unidentified small red ant (Fig. 5) and large Indian black ant, *Camponotus compressus* Fabricius (Fig. 6) (Hymenoptera : Formicidae) that found to be feed on different developmental satges of *H. spinicornis* in sal forests. The present article deals with these aspects and succinctly describes two identified predator ant species.

Fig.4. Predator ant, *Oecophylla smaragdina* on sal borer

Fig.5. Predator ant, unidentified small red ant on eggs and adult beetle of sal borer

Fig.6. Predator ant, *Camponotus compressus* on sal borer *Oecophylla smaragdina* Fabricius (Hymenoptera : Formicidae)

The red tree ant or weaver ant, *Oecophylla smaragdina*, is one of the ants living in colonial nests in the foliage of trees (Beeson, 1941). This ant is widely distributed in the old world tropics (Browne, 1968). The nest is constructed by drawing together in to a branch the leaves of several adjacent shoots. It possesses long and formidable mandibles and inflicts their sharp bites if interfered. The presence of ant colonies is a nuisance to workers in the forest, particularly in forest areas, owing to the painfulness of the bite and their readiness to attack (Beeson, 1941). This insect is of some value as predator, killing their prey by stretching their appendages (Browne, 1968). *O. smaragdina* has been used for centuries in China and Java for the biological control of insect pests of fruit trees, although its efficacy for this purpose is very dubious.

Weaver ant is highly territorial (Holldobler, 1983) and capture many species of insect that feed on their host trees, which include cashew, cacao, coconut, mango, tea and Eucalyptus trees (Peng et al., 2004). The weaver ant has been used in mango orchards in Australia's northern territory as a biocontrol agent of the mango leafhopper, *Idioscopus nitidulus* (Peng and Christian, 2005). As far back as 304 CE they were used in China to protect citrus trees from insect pests. The quality and yield of fruits treated with such biocontrol methods have proved greater than those obtained through conventional insecticide application (Van Mele, 2008). Weaver ant is a perfect example of successful pest management.

***Camponotus compressus* Fabricius (Hymenoptera : Formicidae)**

The large Indian black ant or carpenter ant, *Camponotus compressus*, is one of the commonest species and nests in numerous tree species (Beeson, 1941; Browne, 1968). The most favoured site for the selection of the formicary is at the base of a large tree. There the ants dig themselves into the soil and heap the ejected debris into a mound about the nests. They also use natural cavities and hollows in rocky ground, walls, tree trunks, etc. This ant also preys on its predators. They collect dead insects and also attack and overcome live caterpillars.

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