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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

Pressures from urbanization, mass tourism and intensive agriculture have pushed more and more plant species towards extinction. The problem is particularly acute in some arid regions, such as the Aravali hills of Rajasthan (northwest India), which supports numerous plant species endemic to the region. Many serve as sources of food, fuel, fibre, timber and medicine, and function as an integral part of local agricultural production systems. Wild plants of the Aravali hills used for medicinal purposes are receiving ever-increasing attention from the scientific community and commercial enterprises. At the same time, these species continue to support indigenous and local communities that have relied on them for centuries in their traditional medicines. As well as in conservation terms, disappearance of plant species in such regions may be an irreversible loss from a socio-economic and scientific point of view.

Unsustainable overharvesting and indiscriminate felling of plants due to ever increasing needs of population pressure are causes of great concern. The IUCN includes, the species facing a high risk of extinction in the wild as threatened, and "endangered" is one of the sub-categories under "threatened" category. Commiphora wightii (Arnott) Bhandari is an arid region plant, highly valued for its medicinally important guggul gum-resin as a source of guggulsterone. It is listed in IUCN's Red Data List of threatened plants and now it is becoming endangered. Its population is fast depleting in its natural habitat, primarily due to over-exploitation, unsustainable and destructive methods of gum-extraction coupled with natural dry-arid habitat, slow growth and poor regeneration of the plant. Several other reasons have also been indicated for its declining population. Therefore, it demands severe measures for its conservation before we completely lose this important medicinal plant. A lot of research and study is underway but has vast scope for improvement, requiring efforts to supplement with such information that would aid transgenic development and breeding programmes for production and cultivation of improved varieties.

In line with the above this issue of Van Sangyan contains an article on Importance of endangered species Guggal (Commiphora wightii) for livelihood security. There are also useful articles viz. Collarwali tigress – A queen of pench national park, Palms of Eastern Ghats, Seed health problem in woody plants: Causes and solutions, Vanya silk: A non-mulberry silk, Wetlands degradation and its conservation measures and Xanthopimpla cera: A pupal parasite of teak leaf skeletonizer.

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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Importance of endangered species Guggal (*Commiphora wightii*) for livelihood security

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Abstract

The plant *Commiphora wightii* (Arn.) Bhandari is a source of Indian bedellium, a oleo-gum resin obtained from incision of the bark. The gum-oleo-resin is largely used in indigenous medicine as incense and as fixative in perfumery. It is very potent anti-arthritic, ant obesity, anti-inflammatory and hypolipidaemic drug used in many Ayurvedic formulations. It is now classified as endangered by IUCN due to its overexploitation. Therefore in the present scenario when many of our indigenous medicinal plants are going in the list of endangered species, conservation and development of better different propagation techniques are the need of time. That can enhance the production of plants and save from endangered.

Keywords: Anti-arthritic, Ayurvedic, Guggal, overexploitation, propagation

Introduction

Commiphora wightii (Arnott) Bhandari commonly known as Guggal is a medicinally important plant, which is now considered a critically endangered species of the family Burseraceae. It is one of the oldest and the most prominent herbs in Ayurvedic medicine; in this project we also check some more property of this plants compoundobtain. It is native in semi-arid rocky tracts of Rajasthan, Gujarat, Maharashtra and Karnataka. This plant is a source of Indian bdellium or guggul and the extract of this gum, called gugulipid, guggulipid or guglipid, located in ducts of the soft underbark. An oleo-gum-resin obtained by incision of the bark an extensively used in ASU (Ayurveda, Siddha & Unani) system of medicines. It is a aromatic complex mixture of steroids, diterpenoid, aliphatic esters, carbohydrates and varieties of inorganic ions. An improved gum-oleo-resin tapping for livelihood security is better option in guggal tree. It is excreted by specialized cells or ducts in plants, especially from stem-bark. As per constituents,it has 6.9% moisture, 0.6% volatile oil, resin 61%, gum 29.6%, and insoluble substances 3.2% (Farooqi and Sreeramu, 2004). *C. wightii* gum has been employed as a traditional remedy in the practice of Ayurvedic medicine. It induces relief from epilepsy, ulcer, obesity and rheumatoid arthritis (Gujral et al., 1960). It also has anti-inflammatory, antimicrobial activity (Kasera & Mohammed, 2007), hypolipidemic and hypocholesterolemic activity (Kapoor, N. K. Nityanand, S. 1971; Satyavati, 1991).

In this paperdiscuss about the conservation and propagation of endangered species for enhance livelihood contribution. Guggal tree prefers arid and semi-arid climates and its inhabitatdrought-tolerant area, deciduous nature, multi-purpose and one

of most useful tree due to its medicinal and nutritional properties in world and therefore described as a 'miracle tree'. *Commiphorawightii* has become an endangered species due to its overexploitation for its oleo-gum- resin. Guggul sterones present in gum resin are potent lipid and cholesterol lowering natural agents. Drugs based on these are currently used clinically in India. It is the most promising tree, which has used for nutritional benefits, medicinal properties, environmental conservation, and consumption and is the perennial, multipurpose.

Production level and major production areas in India

The Guggulu plant present in arid and semi arid climate and it is tolerant of poor soil.[29,30] In India its plant found in arid, Rocky tracts of Rajasthan, Gujarat and Karnataka. According to *Ayurveda,* there are five type of *Guggulu*namely; *Krishnan* (black), *Pita* (Yellow), *Nila* (blue), *Kapisha* (light brown) and *Rakta* (blood red) (Chunekar, K.Cetal., 1983). In India Major *Guggulu* producing centers are Kutch forest division in Gujarat and Jodhpur forest division in Rajasthan. Due to increasing demand of Guggulu it has become imperative that steps should be taken for its scientific and rational use and conservation (Sharma Ravindra., 2004.)

Description of the plants

The *Guggulu* plant is a Woody shrub or small tree. It is a slow growing plant and takes 8 to 10 years to reach to a height of 3 to 3.5 m with thin papery bark and branch are thorny. The branches are knotty, crooked aromatic and end in sharp spines. The bark is thin papery and peels in strips from the older parts of the stems. The branches are thorny. The leaves are simple or trifoliate, the leaflets ovate, 1–5 cm (0.39–1.97 in) long, 0.5–2.5 cm (0.20–0.98 in) broad, and irregularly toothed. It is gynodioecious, with some plants bearing bisexual and male flowers, and others with female flowers. The individual flowers are red to pink, with four small petals. Fruit is round, ovoid, up to 1cm long drops red, when ripe and the monocarps are yellow. When it is ripe, it splits into two celled stone. The ash colored bark comes off in flakes exposing the under bark which also peels off in thin papery tolls. The shrub defoliates in winter and reserves for gugulu gum extraction are high during April-May (Hocking D, 1993; Chopra; R.N 1992; Chopra; R.N 1958).

Climatic requirements

The plant has a wide adaptability and is found growing in it prefers arid and semi-arid climates. Its small leathery leaves and thick bark covered with a white waxy coat over the stems help it to withstand desert conditions. It prefers a warm, dry climate for good yield of oleo-gum-resin (Kulkarni, H.K. 1981).

Soil requirements

The plants are occurs in naturally, preferring hard, rocky soils off arid tracts of North West India. It is also considered as a drought aria salinity resistant plant. It prefers loams to sandy loam soils with pH ranging between 7.5 to. 9.0. Soils are coarse textured, well drained and calcareous soils are generally poor in organic carbon, nitrogen, high in potash ion, magnesium, zinc and copper, medium in phosphorus and calcium. Faster growth of the plants is observed in soil which has moisture retaining capacity. An average

soil is suitable for cultivation (Billore, K.V., 1987; Kulloohi RL et al., 2009).

Cultivation practices

Propagation

Guggal can be propagated by seeds and vegetative both. In vegetative propagation through stem cuttings, air layering is successful in this plant (Kant et al., 2010).

By Seed

Seeds are the major propagation source in nature. sIn tropical countries, there are several problems with the production of quality planting stocks of important plant species, such as irregularity of seed supply due to irregular flowering and fruiting, short viability period of seeds, poor-quality seeds, and lack of seed storage and handling facilities. These problems have hampered the development of plantations. The plant guggal become endangered because of its slow growing nature, poor seed setting, lack of cultivation, poor seed and germination rate. In Rajasthan and nearby arid regions flowers and seeds are constantly produced by guggal except in winter season. April May seeds are less viable compared to July to September seeds. Monsoon, season creates conducive atmosphere for germination. The temperature after monsoon ranges between 30-37°C maximum 20-25 °C rninimum with high relative humidity (Soni V., 2010).

By Cuttings

It can be successfully propagated vegetative by stem cuttings. Stem cuttings offer several advantages over seeds. They save time and labor, and produce genetically superior and uniform planting materials from superior parent stocks. Stem cuttings are also inexpensive and easier to practice than other vegetative - propagation methods, such as tissue culture. In addition, stem cuttings can continuously supply planting stocks throughout the year. Stem cuttings were collected from mature plants of *guggal*during March- April. High frequency of sprouting was observed in plantlets developed from 0.6-0.8 mm diameter stem cuttings and 30 cm long. Auxins triggered /enhanced rooting of cuttings; NAA (0.5 mg/L) and IBA (0.5 mg/L) were found to be the most effective. These cuttings were planted in plastic bagsat a depth of 15 cm containing soil and manure in the ratio of 1:3 and then transferred in green-shade house. Proper soil moisture is necessary for better rooting. Treatment of stem cuttings is beneficial which enhances the rooting to nearly 70% as against 30% under normal conditions. The sprouting was achieved within one month. In July- August, (during the monsoon) the well developed plantlets were transplanted in the main field.. The plants are kept in nursery for 5- 6 months (Kumar D et al., 2002; Puri, D.N 1972)

Harvesting (Tapping and Collection) (Source: Reddy CS 2012; Yadav BBL 1999)

1. After achieving the physiological maturity (8-10 years) of plant the gum resin is tapped during Mid Dec. and Feb. because the flow of gum is more during winter and summer.
2. Plant attaining 7.5 cm diameter is suitable for tapping the gum resin.
3. It is done by giving an incision 10 cm long and Usually 1.5 cm deep circular incisions are made on the main branches and stems at

uniform distance of 30 cm and at an angle of 60 manually.

4. Incision should not be deeper than bark.
5. It is done by sharp knife.
6. The knife should be dipped in an activator like guggal gum pest.
7. 2-4 incisions given per plant.
8. The yellowish white fragrant latex oozes out through the incision and slowly solidifies into vermicular pieces often forming big lump.
9. Gum is collect after 15-20 days of incision by manually or with spear.
10. Subsequently collection is done at the interval of 10-15 days.
11. Weather conditions influence the success of obtaining gum.

Yield

Starting from sixth year the guggal gum yield increases from 200 gm to 400 gm per plant. The mature plant (8-10 years) total guggal gum yield comes to be 700-900 gm per plant corresponding to 1750 -2250 kg per ha @ 2500 plants per ha. Gum is dried in shade.

Table 1: Schedules for Guggal Production in India

Name of Medicinal Plant	*Commiphoramukul*
Family	Burseraceae
Plant Part	Tree yield an olio sgum-resin-guggulipid
Important compound	guggulsterone,
Habit and Habitat	A shrub or small tree, reported to be found in arid and semi-arid region of Karnataka, Madhya Pradesh, Rajasthan, Deccan and Gujarat.
Propagation methods	by cutting, Air layering and tissue culture
Planting Time	July -August
Spacing **Plant Population /ha.**	Row to Row-2M,Plant to Plant-2M 2500 Plants
Fertilizer doses	Application of 5 kg FYM and NPK (nitrogen, phosphorus, potassium) @ 75:130:30 g/plant bush per year.
Irrigation Schedule	Require moderate irrigation
Diseases, pests and their control	Plants are affected by leaf-eating caterpillar, white fly, Termite (white ants). Leaf spot and bacterial disease leaf blight, Root rot Control: Pits are filled with FYM and treated with Chloropyriphos .5 ml per litre of water to protect the new plants from white ants.

Harvesting and yield	Plants attain (mature plant) normal height and girth after 8-10 years of growth when they are ready for tapping of the gum by shallow incision on the bark between December and March. Guggal gum yield 700-900 gm per plant in mature plant

Utilization

Chemical constituents

The gum resin contains 3.2% gum and 19.5%, mineral matter chiefly consisting of silicon dioxide, magnesium, calcium, iron, and aluminum. It also contains about 1.5% essential oil, which contains 6.5% myrcene and 11% dinyrcene. A number of steroidshave also been isolated from guggul like Z-guggul sterone and E-guggulosterol I, II, and III (Wright, SD 2003; Deng, R 2007; Nagarajan M et al., 2001; Parnet, R 1972).

Over a hundred metabolites of various chemical compositions were reported from the leaves, stem, latex, root and fruit samples. High concentrations of quinic acid and myo-inositol were found in fruits and leaves.

Guggalis sought for its gummy resin, which is harvested from the plant's bark through the process of tapping. It is completely soluble in most of the organic solvent and in castor oil drying and terpentine oil. It mixes with stearic acid, vegetable waxes and resins.

In India and Pakistan, guggal is cultivated commercially. The resin of guggal known as *gum guggulu* has a fragrance similar to that of myrrh and is commonly used in incense and perfumes. It is the same product that was known in Hebrew, ancient Greek and Latin sources as bdellium.

The gum can be purchased in a loosely packed form called *dhoop*, an incense from India, which is burned over hot coals. This produces a fragrant, dense smoke. The burning coals which let out the smoke are then carried around to different rooms and held in all corners for a few seconds. This is said to drive away evil spirits as well as remove the evil eye from the home and its family member.

Chemical structure of guggulsterone, & constituent of gum guggal

The extract of gum guggal, called gugulipid, guggulipid, or guglipid, has been used in Unani and Ayurvedic medicine, for nearly 3,000 years in India. One chemical ingredient in the extract is the steroid guggulsterone which acts as an antagonist of the farnesoid X receptor, once believed to result in decreased cholesterol synthesis in the liver. However, several studies have been published that indicate no overall reduction in total cholesterol occurs using various dosages of guggalsterone and levels of low-density lipoprotein ("bad cholesterol") increased in many people.

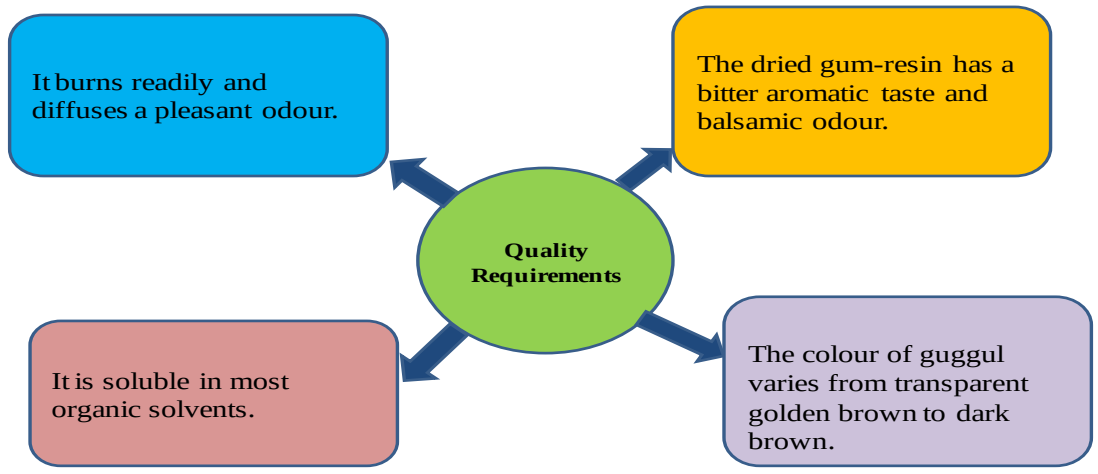
The essential oil (0.38%), obtained by steam distillation of oleo - resin of guggal is composed of chiefly terpermes like myrcene (64%), dimyrcene (11%) polymyrcene and cryophylene.

Table 2: Physico-Chemical properties of guggal

Properties	Information
Physical State	Viscous, moist; dry powder or granules

Odor	Fragrant; acrid
Taste	Bitter
Feel	Astringent, thermogenic
Color	Off-white or pale yellow; dusty (brown.)
Solubility	In water≥60% w/w , In alcohol≥40% w/w, In petroleum ether, ethyl acetatecastor oil, drying oils, andturpentine.
pH (1% w/v solution)	5 to 7
Loss upon drying at 105 ºC	≤5% w/w
Moisture content by K.F.	≤5% w/w
Ash content	≤5% w/w
Sulphated ash content	≤5% w/w
Gugulipidconcentrationsin ethyl acetate extract Guggulsterones by HPLC	≥2.5%
Assay of guggulsterones by HPLC and HPTLC	≥3%
Heavy metalsconcentration	≥20 ppm
Total bacterial count(CFU/g)	≤800
Total fungal count (CFU/g)	≤500
Microbial pathogens	None

The oleoresin "burns in fire, melts in the sun, and forms a milky emulsion with hot water". It mixes well with vegetable waxes, stearic acids, and resin.



Conclusion

Guggal has been a key component in ancient Indian Ayurvedic system of medicine. However, because of its overuse, it has become so scarce in its two habitats in India i.e Gujarat and Rajasthan. That the World Conservation Union (IUCN) has enlisted it in its Red Data List of endangered species.The gum guggal, has been used in Unani and Ayurvedic medicine, for nearly 3,000 years in India. All the above description proves its utility in the Indian system of medicine for its antiarthritic, hypolipidaemic and cholesterol lowering properties.

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Collarwali tigress – A queen of pench national park

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One of the most famous tigers in the country is the collarwali tigress. She was born in 2005 and the official name given to the tigress by the forest department was T-15 but she was fondly called 'Collarwali' by the native people. Collarwali tigress mother known as BARIMADA (T-7) / big mother was also a famous tigress. Her father's name was CHARGER (T-1). Later she was called collarwali, the one with a collar when she became the first tigress in the park to be fitted with a radio collar, which allowed her to be studied for years. She was also affectionately called MATARAM / Respected mother by wildlife lovers (A name she earned over her life). She played a big role in changing the fortunes of the Pench Tiger Reserve in the district Chindwara of central state Madhya Pradesh.

Family of Collarwali

Collarwali was the first of Barimada's (T-7) four cubs to set out on her own and establish her territory in the prime area of her mother's range. Her sister named Baghinnalawali female established her territory partially overlapping Barimada's on the fringes of Karmajhiri Forest Range. T-31 one of the collarwali's brother, finally settled in the Pench & Mowgli wildlife sanctuary and the other brother T-17 was last sighted in the Pench tiger reserve in September 2009. Minimum natal / growing area of collarwali's and her

siblings between May, 2006 to June, 2007 is 23.90 square kilometer. The most expert hunter among in her family is the great collarwali.

Collarwali and her cubs

During her first litter, as an inexperienced mother she was unable to protect her cubs from the harsh monsoon rains and her newborns died of pneumonia within three months. In October, 2008 she produced her second litter of four cubs of which three are male, which increased her popularity among wildlife lovers.

- In 2018, she gave birth to four cubs. This was the last time she delivered pubs.
- In 2010, she gave birth to five pubs. Tigresses giving birth to more than three / four pubs are very rare. For this reason, she was called "Supermum". She was also called "mataram" or respected mother.
- She had totally given birth to 29 cubs in eight litters during 11 years between 2008 to 2018 out of these 29 cubs 25 of them have been survived.

Radio collared collarwali

She gained the Collarwali title as she became the first tigress in the park to be fitted with a radio collar in 2008. A radio-collar was put on her when she was young to keep track of her movements. Radio Collar has been long defunct but it continues to hang around the neck and has become the literal identity of this tigress. The radio collar stopped functioning later, she was again radio collared in January, 2010. One of the collarwali's male cubs T-39 also had been radio collared.

Spy in the Jungle

The tigress earned popularity after it was featured in a BBC documentary called "Spy in the jungle". After this documentary, she became one of the best known tigers of India. The documentary tracked the life of four of her cubs for two years. The visitors to the tiger reserve increased mainly because of her popularity.

Specialty of Collarwali

Collarwali was special in many ways after establishing her own territory in the prime area of mother's range, she rarely stepped out of it and reigned there until her death. She was so big that other tigers were scared to fight with her. She was friendly tiger animal who would come very close to tourist vehicles without any fear. Collarwali rarely disappointed Pench visitors. Conservationist of Pench Tiger Reserve, call Collarwali as "THE FACE OF PENCH" crediting her unusual' temperament that allowed so many visitors and photographers to document her and her cubs'.

While, most tigresses keep their cubs with them for more than two years, collarwali encouraged them to become independent earlier by leaving them in areas where there was abundant prey. The trees such as *Tectona grandis, Syzygium cuminii* added protective to them. She was a strong mother, sometimes making two kills a day to feed her cubs. She and her three siblings chased a hungry leopard up a tree when it crossed their path, while hunting is marked as unforgettable story about collarwali.

She lived in the wild for more than 16 years, which is also a record. Her legacy is limited not to Pench as her female cub was shifted to Panna Tiger Reserve who gave birth to five cubs and contributed a lot in the success of the relocation project of tigers in Panna Tiger Reserve. The intelligent collarwali would often lie outside in the open when she was troubled or wounded, almost like she was waiting for help from the humans who took care of her, this happened even before her death.

End of Collarwali

India's super mom tigress died on January 15, 2022 at the age of 16. Collarwali walked barely when she was weak according to witness. The tigress was ill due to old age. She was last spotted near Bhura Dev Nullah on January 14. She was spotted lying down. She was under the observations of veterinary doctors and was unable to walk. Finally, the most friendly tigress and Queen Of Pench passed away on January15, 2022 at 6.15 PM in postmortem it was clear that her intestine was blocked with hair and mud, which led to rupture and further causing multiple organ failure.

Rites of Collarwali

Shantabai Saryam, a popular leader of the local forest-dwelling adivasi community, lit the funeral pyre of the tigress while forest officials along with the zila panchayat (District village council) member Ramgopal Jayaswal, offered floral tributes and garlands to the mortal remains

of the tigress on Sunday noon (January 16, 2022).

Nations mourns

Madhya Pradesh Chief Minister Shivraj Singh Chouhan said, “Tribute to the super tigress mom Collarwali” of Pench tiger reserve. The tigress, which gave birth to 29 cubs is key to the state Madhya Pradesh getting the tag’ tiger state’. Condolences poured in from various quarters over the death of the legendary tigress.

Palms of Eastern Ghats

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Introduction

Palms are an important group of monocots that provide enormous benefit to humanity. They are an essential component of forest and agricultural ecosystems, supplying a diverse range of economic items required for daily existence. Apart from their major contribution to the beautification of urban environments as horticultural ornamentals, palms rank with grasses in the socio-economy of the human race. In India, the Palms represents 20 genera and around 96 species, 24 of which are indigenous to India and belong to nine genera (Kulkarni and Mulani 2004).

Palms are an important group with significant economic potential, ranking second only to grasses and legumes. They give food, shelter, and other necessities to humanity, particularly to rural communities in the tropics. Palms are also often grown in gardens, parks, along avenues, and as interior plants due to their magnificent beauty and ornamental value as foliage plants. Because of their fibrous root system and lack of branches in general, they do not require much ground space.The majority of our forest palms are under significant threat of extinction, owing primarily to anthropogenic reasons. There are almost no conservation measures worth mentioning.

The Eastern Ghats are a mountain range that runs along India's eastern coast. The Eastern Ghats go through the states of Odisha and Tamil Nadu, as well as sections of Karnataka and Telangana. Peninsular India's four major rivers, the Mahanadi, Godavari, Krishna, and Kaveri, erode and pass through them (ENVIS)

The Eastern Ghats are well known for abundant flora and fauna. The Eastern Ghats consists of wide range of plant forms. Palms are one of the important plant forms to be explored. Aside from the popular cultivated palms such as coconut, areca-nut, and oil palm, wild types such as *Borassus flabellifer* and *Phoenix sylvestris* are found on plains. Apart from the plains, three important palms are unique to the Eastern Ghats are Canes, Fish tail Palm (*Caryotaurens*), Hill dates (*Phoenix loureiroi*) (Murali and *et al.*, 2000).

Canes (Rattans)

Canes (rattans) are less explored palms due to the difficulties in collecting them, which are found in inaccessible sections of the forest, and no inventory is done in the rattan habitats. The common rattan found in the Eastern Ghats is *Calamus viminalis varfasciulatus.* It is found in the moist deciduous type of forests.

Morphology

- It is a large climbing rattan that forms dense bunches.
- Leaves are 1.5-2m long, with leaflets arranged in fascicles and spinulose underside; the rachis and

petiole with scattered small hooked spines.

- Spadix is very lengthy and covered in long spathes.
- They feature trailing or climbing thorn palm stems that are long and thin. They are erect for the first few years before climbing or trailing.
- The stems are sturdy, cylindrical, and consistently thick, with spiky leaf sheaths covering them. They are flexible, elastic, and sturdy, with a hard and slimy surface and a spongy centre inside. Internodes are around 2.5 cm thick and have noticeable nodes.

Flowering and fruiting

- Flowering and fruits occur only from October to March.
- The fruits are sub-globose, about 8 mm in diameter, and covered with lustrous wide scales. Because the seeds contain an extremely hard sarcotesta (sarcotesta is fleshy when ripening and hardens when dried), seeds sown with pericarp and sarcotesta exhibit poor germination.
- Seeds can be viable for up to six months.

Nursery practices

- The germination of cane seeds is highly erratic.
- Germination begins 2 weeks after sowing and continues for 8-12 weeks.
- There are numerous issues with seed collection because the mother plants are located in remote areas.
- Suckers, rhizomes, and cuttings can also be used to propagating material.

Fish tail palm (*Caryotaurens L*)

Caryotaurens L. is belongs to the familyArecaceae/ Palmaceae (Renuka 1996; Loftus, 2014; AICRP 2014).It is popularly known as Fish tailpalm, Toddy palm, Jaggery palm, Indian sago palm, Kitul palm, Sulphi palm, etc., (Renuka 1996; Kumar et al., 2012; Loftus 2014; AICRP 2014). *Caryotaurens* has an important role in livelihood of tribal and forest fringecommunities (Renuka et al., 1996; Kumar et al., 2012).

Morphology

- Fishtail Palm is a medium-sized woody unbranched palm with a height of up to 20 m and a diameter of 30-50 cm (Loftus, 2004).
- *Caryotaurens* is a solitary or clustered tree with a smooth prominent leaf scar on the trunk (Sasidharan, 2006).
- Leaflets are bipinnate, measuring 4-6 m in length and 1-2 m in width (Mahabale 1982). 5-7 pairs of pinnae measuring up to 1.5 m in length.
- Leaves are glabrous, glossy, and green (Sasidharan and Sivarajan 1996). Cuneate fan-shaped like a fish's bottom fin. The leaves are 12-20 cm long and 7-10 cm wide (Renuka 1996).
- The leaves are premorse at the apex and heavily ribbed. Spadix with interfoliae, 40-50 cm long.
- Pendulous peduncle with a short peduncle and branches up to 4m long. In nature, there is a basipetal flower (Uhl and Dransfield 1987; Sasidharan and Sivarajan 1996).
- Many unisexual flowers arranged in triads, with a female bloom in

the centre (Sasidharan 2006). Male flower with no petals.

- Berry was stalked. Fruit is double seeded and is 5-5.5 cm in length and 3.8-4.0 cm in width (Mahabale 1982).

Flowering and fruiting

- It begins flowering once the vegetative stage is completed, which takes about 10-15 years (Uhl and Dransfield 1987; Kulkarni and Mulani 2004).
- The plant then produces 5-10 inflorescences before dying.
- Fishtail palm blooms from September to October and lasts for 3-4 months (Everett 1995).
- Fruiting will occur during the months of April and March (Murali 1997; Charles et al., 2011).

Hill dates (*Phoenix loureiroi*)

Phoenix loureiroi (also known as the mountain date palm, vuyavuy palm, or voyavoy palm) is one of flowering plants in the palm family, native to southern Asia.It can be found in deciduous and evergreen forests, as well as in open terrain from sea level to 1,500 metres above sea level.

Morphology

- It is either a solitary or clumping palm. Stem to 1 - 4 (5) m in length, without leaf sheaths to 10 - 30 (40) cm in diameter, with packed diamond-shaped, persistent leaf bases and very short internodes.
- Leaves to 2 m long; pseudopetiole 20 - 40 cm long; leaf sheath reddish-brown, fibrous; acanthophylls 15 on each side of the rachis, yellow-green to orange, to 20 cm long; leaflets arranged in more than one plane of orientation, proximally fascicled in 3s - 4s, more regularly arranged apically, to 130 on each side of the rachis.
- Staminate flowers are sweet-scented at first, then musty, with a three-pointed cupule 1.5 - 2 mm high; petals are yellow-white, oblong in shape, with an apex that is roughly undulate and often thickened; anthers are yellow-white.
- Pistillate inflorescences are erect, often arching with fruit maturity; prophyll is papery to coriaceous, breaking twice along or between borders.
- Pistillate blooms with 1.5 - 2 mm high yellow calyx cupules and 2 - 2.5 x 3 - 4 mm orange-pink to yellow petals.

Flowering and fruiting

- Spikes are surrounded by a densely branching spadix. The flowering takes place from October through December.
- An oblong drupe, green, orange to black in colour, with 1 grooved ventral seed. The plant bears fruit from March through May.

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Seed health problem in woody plants: Causes and solutions

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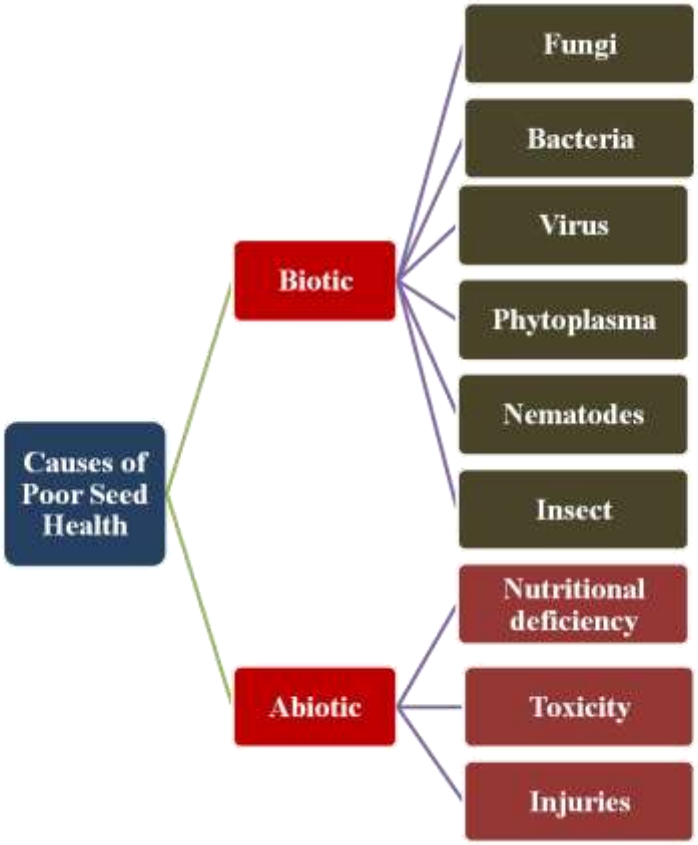
Introduction

Until recently only germination and purity were considered the main attributes for judging the quality of seed and important aspect relating to seed health status has not received due attention so far rather neglected especially in developing countries including India. More than that, according to International Rules for Seed Testing (ISTA), testing seed for health is not obligatory for issuance of quality certificate although there is hardly any plant species, where at least one seed -borne disease is not known. Seed -borne disease affects germination, vigour, seed quality as well as yield thereby posing threat to our plantationand forest restoration.Health of seed refers primarily to the presence or absence of disease-causing organisms, such as fungi, bacteria and viruses, and animal pests, including nematodes and insects, but physiological conditions such as trace element deficiency may be involved (ISTA rules, 2022)

Causes of poor seed health

These are classified into two main groups and further divided into subgroups



Biotic Causes **Insects**

Insects are one of the greatest destroyers of tree fruits and seeds. Damage is done through all reproductive stages, from developing buds to cleaned seeds in storage. Losses to seed insects are huge, and much is yet to be learned about their complete role in the reproductive cycle of woody plants. Insects of the orders Hymenoptera, Diptera, Lepidoptera, Hemiptera, Coleoptera, Homoptera, and Thysanoptera do the most damage to flowers, fruits, and seeds of woody plants. Damage ranges from causing reproductive structures to abort to causing loss of seeds in storage. General types of damage include:

a. Destroying the seeds only, Hymenoptera (wasps).
b. Forming galls and mine scales, Diptera (flies).
c. Free feeding, Lepidoptera (moths).
d. Consuming endosperm, Hemiptera (true bugs).
e. Mining cone axes, Coleoptera (beetles).
f. Causing cone abortion, Homoptera (aphids, etc.) and Thysanoptera (thrips, etc.).

Pathogens

Pathogenic organisms (fungi, bacteria, and viruses) cause great economic losses. Not only are seeds the victim of pathogens, but they also are passive carriers (vectors) of pathogens that may not directly affect the seeds but may endanger other organisms. All tree seeds carry micro-organisms, primarily on the surface of their seed coats. Pathology of tree seeds has not been studied extensively; much work remains to be done.

1. Viruses account for seven kinds of seed damage: (1) Abortion of seeds (2) Flower sterility (3) Seed coat wrinkling (4) Shriveling (5) Chalky endosperm (6) Staining (7) Necrosis
2. Bacterial infections account for four kinds of seed damage: a. Abortion b. Rot c. Discoloration d. Slime disease
3. Fungi are a serious threat to seed health simply because of the great numbers of representative species known as seed pathogens. Fungi account for eight kinds of seed damage: a. Abortion b. Shrunken seeds and reduced seed size c. Rot d. Sclerotization and stromatization e. Necrosis f. Discoloration g. Lowered germination capacity h. Physiological alterations

Abiotic Causes

It includes mainly nutritional deficiency or toxicity and injury caused by mechanical means.

Seed health testing

Seeds act as a very efficient means of transportation of plant pathogen (s) to new, far and wide spread areas are from one country to another and from one region of the country to another. These micro organisms are transmitted with the seeds in three different ways (a) accompanying or concomitant (b) externally on seed surface and (c) internally in different tissues of the seed. They cause in quantitative and/or qualitative losses manifest at all stages of crop development in the field or no seeds even under storage. Seed -borne diseases attack nearly all plants propagated by seed. Therefore, it is imperative to know the

health condition of a seed health status of a seed lot before it is sown in the field. Seed Health Testing is Science of a determining the presence or absence of disease-causing agents/insects. The object of a seed health test is to determine the health status of a seed sample, and by inference that of the seed lot. Health testing of seed is important for four reasons:

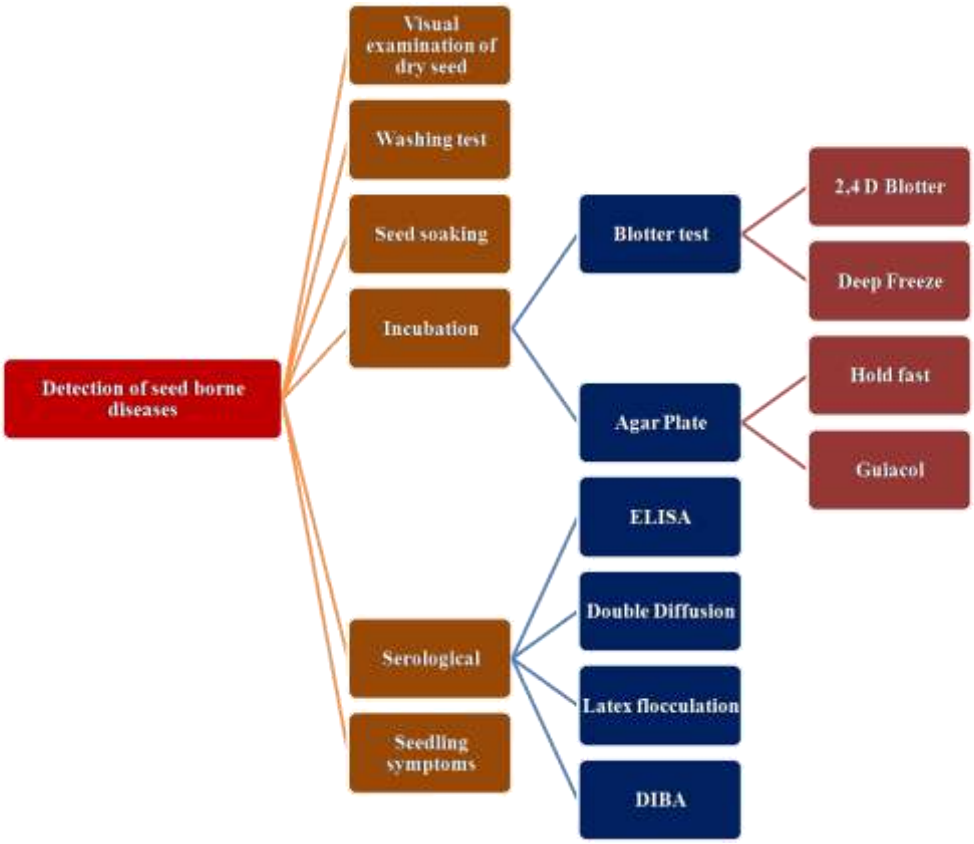
a. Seed-borne inoculums may give rise to progressive disease development in the field and reduce the commercial value of the plantation.
b. Imported seed lots may introduce diseases into new regions. Tests to meet quarantine requirements may therefore be necessary.
c. Seed health testing may elucidate seedling evaluation and causes of poor germination or field establishment and thus supplement germination testing.
d. Seed health test results can/may indicate the necessity to carry out/perform seed lot treatment(s) in order to eradicate seed-borne pathogens or to reduce the risk of disease transmission.

ISTA official seed health testing methods have been developed for 32 different plat pathogens so far (ISTA rules, 2022)

Detection technique chosen for conducting the seed health must be practicable, economic, and quick and the results obtained must be reliable, conclusive and reproducible within statistical limits.

Solutions for seed health problems

Collecting good seeds is the first preventive step in keeping down losses incurred due to infected seeds in storage.Curative treatment includes



treating seeds in laboratories, storage facilities, and nurseries.

1. Infection reduction—Infections in orchards can be reduced by: a. locating seed orchards in areas of low infection risk b. removing alternate host plants c. Sanitizing orchards d. Applying fungicides e. using good fruit-handling methods
2. Seed treatment in laboratories a. Surface sterilization b. Fungicides c. Hot water soaks
3. Seed treatment in storage
4. Seed treatment in nurseries a. Damping-off b. Seedling diseases F. Micro-organisms found on Tree Seeds

Concluding Remarks

Seed-borne pathogens cause a substantial portion of the total loss due to plant diseases. The association of micro-organisms with the seeds greatly affects the health status of the seed lots both in terms of quantitative and qualitative losses. It is therefore imperative to test the seed los for these aspects in addition to other age old quality parameters such as purity, germination, moisture etc, for which seed lots are tested in seed testing laboratories.Finally, seed health testing is a cross breed between seed technology and plant pathology, No single method is perfect which can highlight clear-cut picture pertaining to seed health status of a seed lot. Different pathologens/diseases require various laboratory methods for their detection. Therefore, no fixed method can be taken up as acceptable.

Vanya silk: A non-mulberry silk

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The natural silks are broadly classified as mulberry and wild or non-mulberry. Non-mulberry sericulture is universally known as forest or wild sericulture. Tropical and temperature tasar, eri, muga are the principle non-mulberry silks. Nearly 95% of the global production of non-mulberry silks is tasar. All branches of sericulture require food plants and manpower. In mulberry, sericulture over 60% of the cost of production goes into rising and maintaining the food plants, besides a heavy initial investment is necessary for rearing houses, rearing appliances and other essentials. Likewise, among the non-mulberry varieties, eri has the disadvantage of higher production costs. Tasar is endowed by nature with vast potential. Non-mulberry sericulture is a forest-based industry uniquely suited to the economy and social structure of developing countries because of its minimum investment requirement, high employment, and foreign exchange earning potential. In India about 12.43 million hectares of unexploited tasar food plants in the tropical and temperate belts could be put to use without investment.

Non-mulberry production offers rural populations an attractive source of income; arrest their migration to urban areas, thereby preserving their traditional skill and way of life. In India, Non-mulberry sericulture is an age old tradition, practiced mainly by the tribal's people. Non mulberry sericulture provides them moderate earnings. Wild sericulture remained obscure as an exclusive craft of tribal and hill folks inhabiting the forests of Central India, Sub-Himalayan region and North-Eastern India for long time.

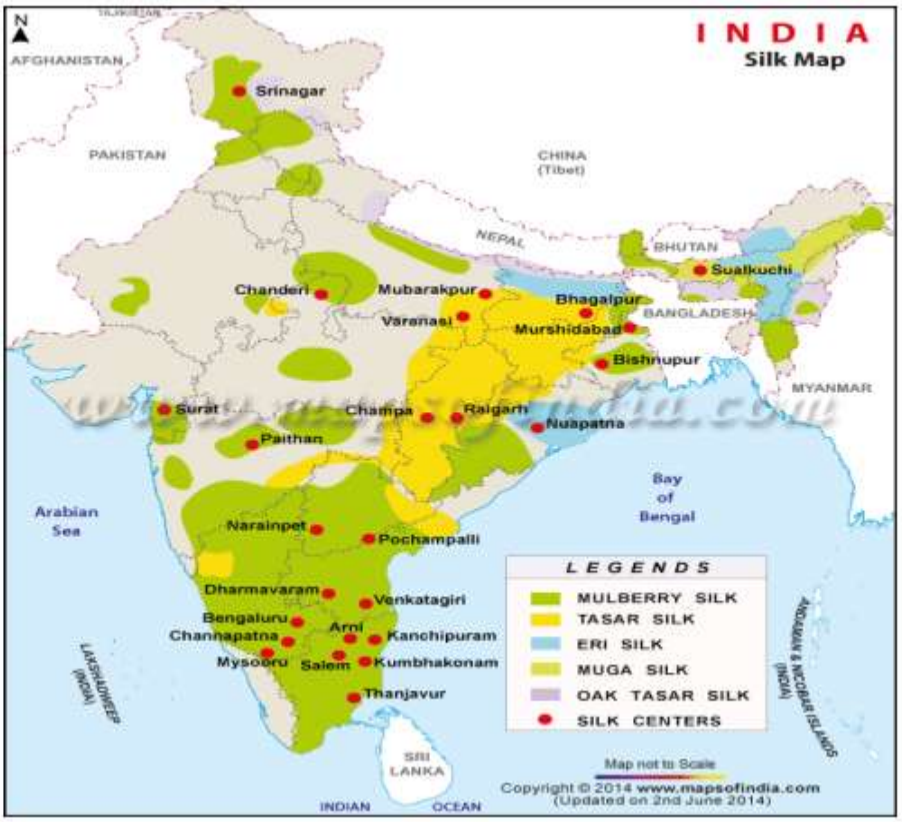
Vanya sericulture remained obscure for a long time as an exclusive craft of tribal and hill folks inhabiting the Central and North Eastern India. It is in the recent past that this tribal tradition assumed importance and attracted attention at National level. The rich production potentialities within the country, steady demand for vanya silk products outside, ecofriendly nature of the production and processing activities, women participation, promoted commercial exploitation of this craft, which culminated in the transformation of this age old tradition to an industry of immense potentiality. Vanya silks have been commercially exploited way back in 17th Century.

Distribution of non-mulberry silkworms in India

Tasar

Tropical Tasar growing area forms a distinct belt of humid and dense forest sprawling over the Central and Southern plateau, covering the traditional states of Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Orissa and touching the fringes of West Bengal, Andhra Pradesh, Uttar Pradesh and Maharashtra. Temperate tasar (oak tasar) extends from the sub-

Himalayan region of Jammu and Kashmir in the West to Manipur in the East covering Himachal Pradesh, Uttarkhand, Assam, Mizoram, Arunachal Pradesh and Nagaland.



Muga

Assam accounts for more than 95% of the muga silk production. The culture is also spread in different districts neighbouring Assam in Meghalaya, Nagaland, Manipur, Mizoram, Arunachal Pradesh and West Bengal.

Eri

Eri culture was mostly confined to the Brahmaputra valley of Assam in the tribal inhabited districts, followed by Meghalaya, Nagaland, Mizoram, Manipur and Arunachal Pradesh. Ericulture is introduced on a pilot scale in States like Andhra Pradesh, Tamil Nadu, West Bengal, Bihar, Chhattisgarh, Madhya Pradesh, Orissa etc.

Salient features of non-mulberry silkworms

Tasar Silkworm

These are reared in the tropical and temperate zones. Four species for the genus *Antherea* (Hubner) are used for commercial production. Tropical tasar silk are in dense, humid tropical forest of central and Southern parts of India. Tasar silkworm is polyphagous. The primary food plants are Tropical tasar silkworm: *Antherea Mylitta*, *Antherea proyli*, *Antherea pernyi* and *Antherea yamamai*.

Antheraea pernyi

Besides more than two dozens of secondary food plants namely *Terminalia tomentosa, Terminalia arjuna, Shorea robusta, Lagerstroemia parviflora, Lagerstroemia. speciosa, Lagerstroemia indica, Zizyphus mauritiana* and *Hardwickia binata.*

Muga Silkworm

The golden yellow silk is secreted by multivoltine silkworm *Antherea assamensis*, distributed in Assam. Assam accounts for more than 95 % of the muga silk production. This silk is very much admired for its durability, lustre and creamy white shade. The muga silk worm is multivoltine and passes through four moults and five instar stages. Generally 4-5 crops are raised in a year.

Like other Lepidopterans, muga silkworm is a holometabolous insect passing through a complete metamorphosis from egg (Koni) to adult (Chakari) stage through two intermediate stages of larva (Polu) and Pupa (Leta). The entire life cycle lasts for about 50 days in summer and 120 days in winter. The wings and body of the male moth are copper brown to dark brown, while those of female, yellowish to brown. Both pair of wings bears eye spots.

Antherea assamensis

Besides colouration, the male moth can be distinguished from the female by its slightly smaller size, slender abdomen, bushy antennae and sharply curved

forewing tips. It is a semi domesticated species in the sense that only the larval stage is spent in open, and the ripening worms are brought indoors for spinning the cocoons.

Eri Silkworm

The white or brick – red eri silk (Endi, Errandi) is produced by *Samia cynthia ricini*, - a domesticated multivoltine silkworm. Among the non-mulberry varieties, eri has the disadvantage of higher production costs because it is made from domesticated silkworms. Among the non-mulberry silkworm species, only eri silkworm is completely domesticated and reared indoor. It is a multivoltine insect completing six to seven generations in a year. The word 'Eri' is derived from the Sanskrit term "Eranda" which refers to the castor plant and also known as Ahimsa Silk.

Ericulture is an age-old tradition and culture of weaker sections of the society particularly in NE India. Eri silkworms require comparatively minimum care as they are easy to handle. Eri silk is widely used for preparing warm clothing like 'Erichadar', quilts and scarves, but other products like kurtas, maxis, dokhans etc. are also available. Eri fabrics are warm and more durable than mulberry silk. It is also resistant to perspiration, dust etc.

Samia Cynthia

Eri culture is believed to have originated in the North-eastern India especially Assam. North – eastern region of India produces more than 90 per cent of eri silk. Assam produces more than 50 per cent of eri silk of the world. Though castor is the main host plant of eri silkworm, but it is mainly annual in nature and has to be grown a fresh every six months. Castor leaf is not available throughout the year.

Initiatives from goverment of India

Central Silk Board, Government of India has branded the vanya silk and symbol is registered as trademark. It depicts a very unique concept of Indian-ness personified by the calligraphic Devanagari letter 'Va' crafted with bold brush strokes inside a cocoon. These symbolize multiple strands of silk. The term "Vanya" is of Sanskrit

origin, meaning untamed, wild, or forest based Vanya!–the wild silks of India.

The Government of India established the Central Muga and Eri Research & Training Institute, Jorhat under administrative control of Central Silk Board is the only institute for providing research and developmental support for the growth of Muga and Eri industry in the country.

Conclusion

Non-mulberry sericulture is a forest-based industry uniquely suited to the economy and social structure of developing countries because of its minimum investment requirement, high employment, and foreign exchange earning potential. Non-mulberry production offers rural population an attractive source of income, arrests their migration to urban areas, thereby preserving their traditional skill and way of life. Vanya silk culture is neither detrimental to the food plants available in forests, nor disturbing the forest ecology. However, continuous deforestation resulted in depletion of non-mulberry food plants. One should not forget that non-mulberry sericulture holds great promise for the world forestry as a supplementary activity.

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Wetlands degradation and its conservation measures

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Introduction

Wetlands are among the most significant ecosystems on Earth and are described as a unique ecosystem between terrestrial and aquatic environments or as transitional zone habitats amid dry land and unprotected water bodies. They also serve as the earth's "kidneys," which are critical for maintaining ecological functionalities. However, due to wetlands pollution, wetland reclamation, changes in land use, and other factors, wetlands around the world are seriously degrading or disappearing as a result of the rapid expansion in human populations. According to current estimates, the size of wetlands around the world shrunk by 64–71% over the mid - twentieth century, and wetland declines and degradation are still occurring now. People are deprived of the ecological services provided by wetlands as a result of wetland loss and degradation. The health of people, biodiversity, regional climate, and ecological security are all things that wetland degradation may have an impact on. Recovery of these damaged wetlands is therefore a top priority. Most governments and scholars now place a lot more emphasis on the preservation, restoration, and ethical utilisation of wetlands. In addition, wetland restoration has developed into one of the most cutting-edge areas of wetland science and has been identified as one of the conferences' key subjects. The restoration of wetlands can be more successful if wetland degradation processes are understood.

What is adversely affecting our Wetlands?

Wetlands are frequently viewed as wastelands and as impediments to human development; as a result, they have undergone extensive conversion to other land uses, such as drainage and filling for infrastructure advancement, grazing, pollution from waste disposal, water diversion/abstraction, and mining. Additionally, activities including soil erosion, land degradation, and deforestation are being carried out in larger catchments that have an impact on wetlands. Most risks to our wetland are anthropogenic rather than geological, with the exception of those that are far from where people live. Drainage for agricultural use, excessive grazing, deterioration of catchment areas, overharvesting of their resource's settlement, and urbanisation are the main risks. Among the major risks to the destruction of wetlands, another one is the invasion of other aggressive plant species.

What can be done for the conservation of wetlands?

The local institution plays a significant part in managing and conserving wetlands. Local leaders play a crucial role and local knowledge should be valued. According to Amsalu and Addisu (2014), the following issues must be taken into account for proper conservation:

- Recognizing the multi-sectoral interest in wetlands, i.e., the coordination of efforts by a wide variety of sectors to create reliable data on the assessment and other aspects of wetlands in attempt to persuade decision makers to take the necessary action. Including stakeholders in federal wetland policy, which are essential to the conception, debate, and execution of wetland protection measures..
- Protecting wetlands that are in satisfactory quality, restoring degraded wetlands when possible, and promoting acceptance of wetlands by safeguarding the biodiversity, services, and functions of wetlands as well as their social and economic advantages.

In addition to the mentioned solutions, the author also offers some potential conservation measures. Steps for effective management and conservation: - Preventing illegal encroachment of the lake for agricultural and other purposes:-

- Implementing soil conservation strategies and afforestation surrounding the wetland to stop the lake from becoming silted. Along with avoiding silt build up, this will assist in maintaining biological balance. Additionally, the ecosystem's general productivity will increase.
- Farmers should adopt suitable runoff water gathering systems, such as check dams, to apply the water to the vegetation in the post-monsoon season. This would supplement the current irrigation water source.
- The development of well-structured and methodical water management systems will benefit greatly from the construction of well-organized water users' groups, service cooperatives, and producer cooperatives.

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Xanthopimpla cera: A pupal parasite of teak leaf skeletonizer

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Abstract

The present article deals with *Xanthopimpla cera* Cameron (Hymenoptera: Ichneumonidae), a pupal parasite of teak leaf skeletonizer, *Eutectona machaeralis* (Walker) (Lepidoptera: Pyralidae). The diagnostic features of this parasite have been highlighted.

Key words: *Xanthopimpla cera*, pupal parasite, teak leaf skeltonizer, *Eutectona machaeralis*

Introduction

Teak (*Tectona grandis* L.f.) (family Verbenaceae), is an undisputed global leader of high quality tropical timbers. Teak is truly an Indian species (Hedegart, 1975) and referred to as standard timber for comparative evaluation of the qualities of other tropical hardwoods in assessing their utilization potential (Bhat *et al*., 2005). Madhya Pradesh is one of the important states with extensive teak forests and famous for its high quality wood (Tiwari *et al*., 1998a, b). This potential tree species is always under the serious threat of leaf skeletonizer, *Eutectona machaeralis* (Walker) (Lepidoptera : Pyralidae) in all teak growing states of India that commit frequent epidemic defoliation in teak forests including Madhya Pradesh (Beeson, 1941; Mathur, 1960; Tewari, 1992; Shukla *et al.*, 2001; Roychoudhury *et al*., 2002; Nair, 2007).

Natural enemies, such as parasites, predators and pathogens are important components to reduce pest attack in teak forests (Nair, 2007). These natural enemy complexes are the potential biocontrol agents, play a crucial role in controlling the outbreaks of insects and population suppression of teak pests in nature (Beeson, 1941; Mathur, 1960; Chatterjee and Misra, 1974; Patil and Thontadarya, 1983; Thakur, 2000; Joshi *et al*., 2001). The parasite complex of *E. machaearlis* in India, includes 74 species of insects (26 species of tachinids and 48 species of hymenopterans) (Sudheendrakumar, 1986). *Xanthopimpla cera* Cameron (Hymenoptera: Ichneumonidae), is one of the parasite of teak leaf skeletonizer, *E. machaeralis* (Beeson, 1941). The present article deals with this parasite, *X. cera*.

Xanthopimpla cera Cameron (Hymenoptera: Ichneumonidae)

Xanthopimpla cera Cameron, Zeits. Hym.-Dip. 1908, p. 38 (♀).

(Fig.1)

Diagnostic features

Flavous, Head smooth and shining, with the ocellar region triangularly black; face and clypeus white-pilose. Thorax smooth and shining; mesonotum with a broad and laterally dilated line between the tegulae; notauli slender and indicated only on the apical slope; metanotum laterally carinate, from the apex of its upper third a carina runs obliquely to near the inner angle of

the basal lateral area, which are not quite entirely black, their inner carina forming two oblique slopes, of which the inner is the shorter and more rounded, being neither so straight nor so oblique. Abdomen closely punctate from the base of the third segment and more finely towards its apex, with an apical transverse impression on segments two to six; basal segment vith two black and externally dilated spots; third with two broad, transverse black n1arks; fifth with two longer and narrower transverse marks; seventh with two yet narrower and subcoalescent ones; terebra 1·5 mm., or slightly shorter than the hind tarsi. Legs with the apices of the hind femora black. Wings hyaline with nervures and stigma black. Length 9 mm.

Fig.1. *Xanthopimpla cera*

Morley (1913) has mentioned that according to Cameron that "this species is closely related to *X. binghami*; it is 1arger, has all the marks on the abdomen separated, those on the first segment are distinctly narrowed on the inner side, not dilated there; the inner keel of the lateral area forms a broad, rounded curve, without angle, it being also wider compared with the width, and there is an area, open on the inner side, which does not exist in *X. binghami*".

According to Beeson (1941), *X. cera* is a parasite of the pupa of *E. machaeralis* (syn. *Hapalia machaeralis*), one individual developing in each host and emerging 3-4 days later than the day on which the moth would normally emerge. Roychoudhury (2010, 2016) has also recorded that *X. cera* is a pupal parasite of *E. machaearlis*, causes maximum of 1-2% parasitism. This parasite has been recorded from slightly moist (1200-1600 mm rainfall), dry (900-1200 mm rainfall) and very dry (<900 mm rainfall) teak forests, but its incidence has been noticed to be more in slightly moist teak forests.

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