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# Van Sangyan

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## 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:

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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.)

## From the Editor's desk



*Resin is a hydrocarbon secretion of many plants, particularly coniferous trees. It is valued for its chemical properties and associated uses, such as the production of varnishes, adhesives, and food glazing agents; as an important source of raw materials for organic synthesis; and as constituents of incense and perfume. In perfumery such products are often termed "ambered", based on fossilized resins being the source of the gemstone amber. Resins are also a material in nail polish. The term also encompasses synthetic substances of similar properties, as well as shellacs of insects of the superfamily Coccoidea. Resins have a very long history that is documented in ancient Greece Theophrastus, ancient Rome Pliny the Elder, and especially as the forms known as frankincense and myrrh in ancient Egypt. They were highly prized substances, and required as incense in religious rites. There is no consensus on why plants secrete resins. However, resins consist primarily of secondary metabolites or compounds that apparently play no role in the primary physiology of a plant. While some scientists view resins only as waste products, their protective benefits to the plant are widely documented. The toxic resinous compounds may confound a wide range of herbivores, insects, and pathogens; while the volatile phenolic compounds may attract benefactors such as parasitoids or predators of the herbivores that attack the plant.*

*Natural gums are polysaccharides of natural origin, capable of causing a large viscosity increase in solution, even at small concentrations. In the food industry they are used as thickening agents, gelling agents, emulsifying agents and stabilizers. In other industries, they are also used as adhesives, binding agents, crystallization inhibitors, clarifying agents, encapsulating agents, flocculating agents, swelling agents, foam stabilizers, etc. Most often these gums are found in the woody elements of plants or in seed coatings. Natural gums can be classified according to their origin. They can also be classified as uncharged or ionic polymers (polyelectrolytes).*

*Research and development efforts and international collaborations could have strong potentials to the conservation, production and commercialization of these vast and untapped renewable natural resources for the benefits of the local, national as well the international communities.*

*In line with the above this issue of Van Sangyan contains an article on Natural plant gums and resins: Source of livelihood. There are other useful articles viz. Red velvet mite, विलुप्त होती प्राचीन फल प्रजातियाँ, ट्राइकोडर्मा: एक महत्वपूर्ण जैव नियंत्रक, New record of saw-toothed grain beetle, DRYZAEPHILUS SURINAMENSIS on stored mahua flowers, भारतीय संस्कृति एवं वृक्षारोपण, Natural dye yielding plants, Improved production technology of tomato-overview and Biodiversity of Cedrus deodara and Pheretima posthuma.*

*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. R. K. Verma**  
Scientist G & Chief Editor

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**Contents****Page**

1. **Natural plant gums and resins: Source of livelihood** 1  
- Mahtab Z. Siddiqui
2. **Red velvet mite** 5  
- Shalini Bhowate
3. **विलुप्त होती प्राचीन फल प्रजातियाँ** 7  
- अनिता तोमर, अनुभा श्रीवास्तव एवं सत्येन्द्र देव शुक्ला
4. **ट्राइकोडर्मा: एक महत्वपूर्ण जैव नियंत्रक** 11  
- निधि गुप्ता, अम्बिका, ज्योति रानी, विजय वर्धन पाण्डेय, अमित पाण्डेय
5. **New record of saw-toothed grain beetle, *Oryzaephilus surinamensis* on stored mahua flowers** 15  
- P. B. Meshram, Jagruti Roy and R.K.Malviya
6. **भारतीय संस्कृति एवं वृक्षारोपण** 19  
- ममता पुरोहित, राजेश कुमार मिश्रा एवं नितिन कुलकर्णी
7. **Natural dye yielding plants** 24  
- P. Shivakumar Singh, G. M. Vidyasagar
8. **Improved production technology of tomato-overview** 29  
- Ompal Singh, Pragya Singh and Zubay Gohar Ansari
9. **Know your biodiversity** 36  
- Swaran Lata, Preeti Kaushal, Varsha and Isha

## Natural plant gums and resins: Source of livelihood

Mahtab Z. Siddiqui

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Natural gums and resins are one of the most important non-timber forest products (NTFP) and viable source of income for thousands of forest dwellers, especially tribals, in India. These are perhaps the most widely used and traded NWFPs, other than the items consumed directly as food, fodder and medicine. Gums and resins production, a kind of supporting pillar for family economy and considered as an income-generating source need only low inputs. India, because to its geographical and environmental position, has traditionally been a good source of such products amongst Asian countries. Thousands of forest dwellers particularly in the Central and Western Indian States depend on gums and resins as a dependable source of income. Use of gums and resins for domestic consumption as sale for earning some cash is quite common amongst the forest dwelling communities, particularly tribals, in India. Gum is classified as exudate gum, seed gum and microbial or marine gum. Exudate gums are considered to be the pathological products formed due to injury to the plant or due to unfavourable conditions, such as drought, or breakdown of cell walls or extra cellular formation i.e. gummosis. Some examples of plant exudate gums are *Karaya* (*Sterculia urens*), *Babool* (*Acacia nilotica*), *Arabic* (*Acacia senegal* / *Acacia seyal*), *Vilayati Babool* or *Kikar* (*Prosopis juliflora*), *Desert Date* (*Balanites aegyptiaca*), *Khair*

(*Acacia catechu*), *Tragacanth* / *Katira* (*Astragalus* species), *Dhawara* / *Ghatti* (*Anogeissus latifolia*), *Kondagogu* (*Cochlospermum gossypium*), *Palas* (*Butea monosperma*), *Chironji* (*Buchanania lanzan*), *Moringa* (*Moringa oleifera*), *Neem* (*Azadirachta indica*), *Jhingan* (*Lannea coromandelica*), *Galwang* (*Albizia lucida*) etc. Few examples of seed gums are *Guar* (*Cyamopsis tetragonoloba*), *Okra* (*Abelmoschus esculentus*), *Cassia tora* (*Cassia obtusifolia*), *Tamarind* (*Tamarindus indica*) etc. Microbial gums are produced by certain selected microorganisms like, *Xanthomonas campestris* and *Penicillium* spp., during the course of fermentation. Marine gums are either cell walls of variety of algae, or other sea weeds or stored in intracellular regions as reserve food materials.

The distinct advantages of natural gums over their synthetic counterparts are their bio-compatibility, lower cost, low toxicity, eco-friendliness and relatively widespread availability. The industrial uses / applications of gums, in particular, have been widely reported, notably in food, pharmaceutical, adhesive, cosmetic, textile, paint and print industries, wherein these are used as food additives, dietary fibres, binders, thickeners, stabilizers, emulsifiers, suspending, gelling agents and surface coating agents etc. The bulk of commercially important gums in the country come from the forests of Central

Indian States *i.e.* Madhya Pradesh (22.0 %), Andhra Pradesh (20.3 %), Jharkhand (16.2%), Maharashtra (15.4 %), Chhattisgarh (8.8%) and the remaining about 17% from Gujarat, Rajasthan and other minor gum producing States in the country. India is the largest producer, processor and exporter of *karaya* gum and *guar* gum in the world.

Exploitation of *babool* tree for gum tapping will not only help farmers to strengthen their socio-economic conditions but also help conserve environment and biodiversity. Conserving biodiversity and eliminating poverty are two global challenges. The poor, particularly the rural poor, depend on Nature for their livelihood, including food, fuel, shelter and medicines. In addition to industrial applications, the products are consumed locally as traditional medicines, foods and beverages, and are also used in religious and cultural rituals. Similarly, *Buchanania lanzan* Spreng, commonly known as *piyar*, *char*, *achar* and *chironji*, is a socio-economically important underutilized life-supporting tropical medicinal species for the tribal populace of North, West and Central India.

All natural resins are vegetables in nature with the exception of lac which is a resinous material derived from the secretions of a tiny female bug *Kerria lacca* (Order: Hemiptera, Family: Tachardiidae) in India and *Kerria chinensis* in Thailand, China and other South Asian countries. Lac cultivation is an important source of income and sustenance for tribals, forest-dwellers and poor of Jharkhand, Madhya Pradesh, Chhattisgarh, Maharashtra, Odisha, West Bengal and parts of Andhra Pradesh, Gujarat, Telangana, Uttar Pradesh and

NEH region. Jharkhand contributes around 51% of the total production of lac in India. India is the largest producer, processor and exporter of lac and holds monopoly in world trade.

Resins can broadly be classified into three types *i.e.* oleo resins, oleo gum-resins and hard resins. A variety of oleo resins are extracted from various plants. Amongst them, the important ones are pine oleo resin obtained from pine trees, dammar oleo resin from *Dipterocarpus spp.*, and copal from *Agathis dammara*. Some oleo resins are high terpene resins from *Pinus* species *viz.* chir pine (*Pinus roxburghii* Sargent), blue pine (*Pinus wallichiana* Jackson), khasi pine (*Pinus keyisia* Royle ex Gord), *Pinus gerardiana* Wall (Chilgoza pine), *Pinus armandi* French and *Pinus merkussi* (Sumatra pine), only chir pine is tapped commercially for resin. Chir pine forests are found in the provinces of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, parts of Sikkim, West Bengal and Arunachal Pradesh. It is also known as Himalayan long needle pine, long leaved Indian pine, Indian chir pine etc. Chir pine yields a good quality oleo resin, which on steam distillation generates two industrially important products *i.e.* volatile turpentine oil (~70%) and transparent solid material called rosin (~17%). The world's total annual import/export of rosin is around 330,000 tonnes. China accounts for about one-third of total world production and exports, whereas India has secured sixth position amongst the top ten countries across the world.

Dammar represents a group of resins obtained from Indian or East Asian trees belonging to family Dipterocarpaceae and Burseraceae and genera *Shorea*,

*Balanocarpus* or *Hopea*. The principal dammars of India are sal dammar (*Shorea robusta*, Family: Dipterocarpaceae), white dammar (*Vateria indica*, Family: Dipterocarpaceae) and black dammar (*Canarium strictum*, Family: Burseraceae). Locally, these are known by different names viz. *sal dhuna*, *lal dhuna*, *ral*, *dhup* in Hindi and Bengali. Dammars are solid resins, generally less hard and durable than the copals (*Copaifera officinalis*) and the color ranges from very pale grades to grey-black. Sal dammar is widely used as an incense and disinfectant fumigant, in the preparation of varnish; inferior quality paints and skin ointments, whereas white dammar is used as substitute for amber in photographer varnish and in medicines. Black dammar, which is derived from the bark, is utilized for varnish making, bottling wax, and caulking boats.

The oleo gum resins contain approx. 30-60% resin, 5-10% essential oils, which are soluble in the organic solvents, and the rest is made up of polysaccharides. The oleo gum-resins have a fragrant aroma because of the presence of essential oils and this account for their commercial importance. Few potential oleo gum-resins are guggul (*Commiphora wightii*), salai (*Boswellia serrata*), hing (*Ferula asafetida*) etc. The earliest reference of medicinal and therapeutic properties of guggul (*Commiphora mukul* Engl. / *Commiphora wightii* (Arnott.) Bhand.) is in Atharva Veda. Detailed account of guggul as a drug is available in the treaties of Charaka (1000 B.C.), Sushruta (600 B.C.), Vagbhata (17th century A.D.) and various Nighantus written in India between 12th and 14th centuries. In fact, the herb is mentioned as early as 3000 to 10,000 years ago in the Vedas, the holy scriptures of

India, for treating various human ailments. Guggul is quite well known as a yog-vahi rasyan, which improves the action of other herbal medicines that are used in its combination. In India, the main States producing guggul are Rajasthan, Gujarat, Madhya Pradesh and Karnataka. Traditional uses of guggul are as an anti-inflammatory, antispasmodic, anti-suppurative, antiseptic, carminative, hypoglycemic, diuretic, expectorant, thyroid-stimulant, anthelmintic, depurative, vulnerary, demulcent, aphrodisiac stimulant, liver tonic etc.

*Boswellia serrata* is also one of the ancient and most valued herbs in Ayurveda. 'Gajabhakshya', a Sanskrit name sometimes used for *Boswellia*, suggests that elephants enjoy this herb as a part of their diet. It is also beneficial in arthritis. This oleo gum-resin is also mentioned in traditional Ayurvedic and Unani texts as an effective remedy for diarrhoea, dysentery, ringworm, boils, fevers (antipyretic), skin and blood diseases, cardiovascular problems, mouth sores, bad throat, bronchitis, asthma, cough, and many more. In India, the main commercial sources of *Boswellia serrata* are Andhra Pradesh, Gujarat, Madhya Pradesh, Jharkhand and Chhattisgarh. Gums and resins are low volume, high value produce. These can be processed to add value to their quality for higher returns. In some cases, value-addition through primary processing alone results in 2-3 times higher returns. In India, lac and *guar* gum are processed but for most of other resins and gums, the processing and value-addition is simply meagre. There is an urgent need to carry out post harvest processing using modern machinery as also processes for processed

product of high purity, which can fetch higher value in export market. Developing products for commercial uses would further augment the returns, employment and export earnings. There is ample scope to develop value added products/derivatives for export market, fetching several times higher return. This will also benefit the poor resins and gum pickers in the disadvantaged areas.

### **Conclusion**

The production of gums and resins is a dependable source of livelihood support to millions of people residing in the forests and a major source of employment to them. People living in the semi-arid regions depend on collection of gums and resins for cash income and livelihood.

Forests are an inseparable part of tribal populace. They are almost completely dependent on forest for food, shelter, medicines and clothing. They collect NTFPs like roots, tubers, flowers, fruits, fibers, gums, resins, dyes, tannins, honey & wax etc. India holds monopoly in world trade in some of the natural resins and gums viz. lac, gum *karaya* and *guar* gum as also an important exporter of gum *karaya*, *guar* gum, lac and *psyllium*.

Natural gums and resins have tremendous potentials for a host of strong considerations, which the country can ill-afford to ignore or overlook. Instead, all-out efforts must continue to be made to fully exploit and harness this precious segment of Nature's bounties.

## Red velvet mite

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Chhindwara (M.P.)

Red velvet mite *Trombidium grandissimum* Koch is one of the beautiful mites belonging to the family Trombidiidae. These mites are bright red in colour and their bodies are covered with fine hair to give them a velvety appearance. Hence it is named as Red velvet mite. These mites grow around 1.5 cm to 2.0 cm long which is huge compared to other mites. There are lots of other velvet mites around the world, all comprising the trombidiidae family and have varied range of sizes. However, only the Indian one is graced with dozens of common names like Rain's mites, velvet bride, Rani Kida, Badal kida, Birbahut etc.

In India, these mites are found in dry areas, wood lands, forest soils, litter, humas, organic soils etc. They stay under the soil most of the year and come out of the soil only after rain. They spend only a few days outside the soil every year and during this time they look for food and mate.

The velvet mites are predators and they feed on other invertebrates like small arthropods and their eggs. The adult mites look for food and feed on them for only a few days every year. They have two tiny eyes and they sense their prey through vibrations and chemicals. They use their front pair of legs to sense surroundings. The adult mites have four pair of legs while the larvae have three pair of legs. These mites have chelicerae which is used to suck food from their host. The red velvet mites are diurnal and hide beneath

the soil during night. They hibernate during winter. They secrete anti fungal oil. Also, their haemolymph contain antifungal properties.



Red velvet mite- *Trombidium grandissimum*



Dried red velvet mites stored for usage by herbal healers

### Life cycle

The life cycle of mites begins with the eggs which are laid in clumps of 60 to 100000 (depending upon species). After about two months, eggs hatch and mite pre-larvae appear. They last for one to three days. After a larva gets its fill (usually about two weeks) it will detach

and enter the protonymph stage. After the mite comes out of its protective cuticle it has eight legs and is called deutonymph. The deutonymphs are predatory. The mite is called tritonymph in the final stage before adulthood. This is the time of dormancy where the mite doesn't eat or move. Finally the mite enters the adult stage. Adult mites are inactive most of the year but come out after first rain shower which has earned them the nickname of rain mites. During this time, the mites feed and mate but once the rainy season is over they go underground and hangout until the rains returns.

#### Uses of red velvet mites

1. The oil from the red velvet mite *Trombidium grandissimum* is used in traditional Indian medicine to treat paralysis. It is also used as an aphrodisiac.
2. In Chhindwara and Betul district of Madhya Pradesh the tribals/rurals use this insect in the treatment of fit, pneumonia and dog bite. The herbal healers of this area sell the insect at the rate of Rs 20/- per insect.
3. In different part of India (North India, Central India, Madhya Pradesh, Chhattisgarh) the dried mites are sold in the markets & are used by villagers/tribals for the treatment of different kind of diseases.
4. They are known best for pest control as they feed on pests like spider, mites, cabbage moth, lace bug and other arthropods which eat the bacteria and fungi. Thus, they help in increasing the rate of decomposition of soil.
5. In larval stage of mites they infest those insects which are harmful pests for the crops and these pests feed on bacteria and fungi which are important

for decomposition of organic waste in soil ecosystem. Hence they play an important role in biological control.

6. They are soil arthropods that aid the ecosystem by feeding on small insects. Red velvet mites keep the number of insect in check and prevent them from vegetation. Most importantly they are absolutely harmless to human beings. These mites play a very important role in the ecosystem. But they are becoming extinct due to their huge demand and rare breed. This is resulting into destruction of ecosystem. Thus there is increasing need of their conservation.

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<https://www.macalester.edu/ordway/biodiversity/inventory/redvelvetmite.html>

## विलुप्त होती प्राचीन फल प्रजातियाँ

अनिता तोमर, अनुभा श्रीवास्तव एवं सत्येन्द्र देव शुक्ला

सामाजिक वानिकी एवं पारि-पुनर्स्थापन केन्द्र

(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

इलाहाबाद

मानव सभ्यता में जंगली फलों का उपयोग पिछले कुछ समय से फल, औषधि, धार्मिक तथा वैवाहिक उत्सवों आदि में करते रहे हैं। जंगली तथा स्थानीय फलों के पेड़ ग्रामीण इलाको के विकास में महत्वपूर्ण भूमिका निभा रहे हैं। फल कई देशों की समृद्धि में महत्वपूर्ण भूमिका निभा रहे हैं, जैसे हवाई में अनानास, वेस्ट इंडीज में केले और अमेरिका में सन्तरा। इन देशों की अर्थव्यवस्था फल संस्कृति पर भी निर्भर है। जंगली खाद्य फल ग्रामीण निवासियों के पोषण में महत्वपूर्ण भूमिका निभा सकते हैं। भोजन की कमी के समय में हम इन फलों का उपयोग खाद्य सामग्री के रूप में कर सकते हैं। कई फल प्रजातियाँ एससी है जो विलुप्त होने के कगार पर हैं जिनका उपयोग हम प्राचीन काल में खाद्य सामग्री के रूप में किया करते थे परन्तु आधुनिक समय में हम खाद्य के रूप में ज्यादा प्रचलित प्रजातियों का ही उपयोग कर रहे हैं, जिसके चलते इन विलुप्त हो रहे फलों की प्रजातियों के रोपण हेतु कोई नर्सरी तकनीक नहीं विकसित की जा रही है। एससी ही कुछ विलुप्त हो रही फल प्रजातियों का विवरण दिया जा रहा है।

आमरा (Amra)

वानस्पतिक नाम- स्पांडियस पिनाटा  
(*Spondias pinnata*)

कुल - एनाकार्डिएसी (Anacardiaceae)

आमरा भारतवर्ष के मैदानी भागों में अधिकतर पाया जाता है, आमरा को जंगली आम भी कहा जाता है, उ-प्र- में आमरा प्रायः इलाहाबाद, मिर्जापुर, सोनभद्र, चन्दौली, प्रतापगढ़ तथा वाराणसी आदि क्षेत्रों में पाया जाता है। इसका आसानी से उत्पादन सम्भव है, इस कारण इसे गरीबों का फल भी कहते हैं।

वानस्पतिक विवरण

आमरा का वृक्ष सदाबहार होता है। इसके पेड़ की ऊँचाई 15- 25 मीटर तक होती है। जड़े लम्बी व मूसलाकार, पत्तियाँ एकान्तर क्रम में वृन्त युक्त तथा साधारण होती हैं, पत्तियों का रंग गहरा हरा लम्बाई 15-20 सेमी तथा चौड़ाई 5-10 सेमी तक होती है। आमरा का पुष्प गुच्छदार शाखादार होता है, जो प्ररोह के उपरी भाग (शीर्ष) से निकलता है। पुष्प मंजरी की लम्बाई 45 सेमी, पीली या हल्की गुलाबी रंग की होती है, आमरा का फल प्रायः अण्डाकार होता है। फल आस्वादित, सुवासित, स्वादिष्ट आकर्षक एवं अच्छे रंग वाले होते हैं।

जलवायु

आमरा नम तथा सूखी दोनों ही प्रकार की जलवायु में पैदा किया जा सकता है। आमरा की अच्छी वृद्धि के लिए तापक्रम का विशेष महत्व है। आमरा के लिए 5-10<sup>0</sup> न्यूनतम, 42<sup>0</sup> अधिकतम तापमान की आवश्यकता होती है।

**मिट्टी**

आमरा का उत्पादन सभी प्रकार की मिट्टियों में किया जाता है। इसका उत्पादन 6.5-8.5 पीएच में अच्छा किया जा सकता है, केवल कंकरीली, पथरीली मिट्टी को छोड़कर सभी प्रकार के मिट्टी में उत्पादन किया जा सकता।

**प्रवर्धन या प्रसारण**

आमरा का प्रवर्धन प्रायः बीजों के द्वारा किया जाता है। आमरा का प्रवर्धन कटिंग तथा एयर लेयरिंग (गूटी) के द्वारा भी किया जाता है। आमरा में गूटी पर रूटेक्स के साथ 65 प्रतिशत तक सफलता प्राप्त की गई है।

**रोपण**

आमरा के पौधों के क्षेत्र को गहरी जुताई द्वारा तैयार किया जाता है। आमरा के पौधों को लगाने के लिए 90 x 90 x 90 सेमी. आकार के गड्ढे की आवश्यकता होती है। इन गड्ढों में खाद, बालू तथा मिट्टी का मिश्रण भर देना चाहिये तथा पौधों को वर्षा ऋतु में लगाना चाहिए।

**पौधों की रक्षा**

आमरा के पौधों को पाले से तथा दीमक आदि से बचाना चाहिए।

**फूल आना तथा फल लगना:-** आमरा में प्रायः फूल फरवरी, मार्च में आता है तथा फल सितम्बर-नवम्बर तक लग जाते हैं।

**फलों का उपयोग**

आमरा के फलों का उपयोग प्रायः अचार बनाने में किया जाता है।

**बड़हल (Barhal)**

**वानस्पतिक नाम-** आरटोकार्पस लकूचा

(*Artocarpus lakoocha*)

कुल - मोरेसी (Moraceae)

बड़हल प्रायः भारत के ग्रामीण क्षेत्रों में पाया जाने वाला फल है, बड़हल को आजकल नई पीढ़ी कम पसन्द करती है। बड़हल का परिपक्व फल लगभग 150-250 ग्राम तक होता है, इसके पके फलों का रंग पीला होता है, बड़हल का फूल भी पीले रंग का होता है, इसे गाँवों में प्रायः फुलैरी नाम से जाना जाता है। इसके फल का स्वाद हल्का खट्टा-मीठा होता है।

**वानस्पतिक विवरण**

बड़हल का पेड़ सदाबहारी 9-18 मीटर तक ऊँचा होता है। इसके पेड़ों का जीवन 80 वर्षों तक होता है। पत्तियाँ मध्यम आकार की होती हैं, इसके फूल का रंग पीला तथा आकार गोल होता है जो कि परागण के उपरान्त गिर जाते हैं।

**जलवायु तथा मिट्टी**

बड़हल के लिए गर्म-तर जलवायु सबसे उपयुक्त होती है। बड़हल के लिए अच्छी जल निकास वाली जलोढ़ मिट्टी की आवश्यकता होती है। इसके लिए 6-8 पीएच की मृदा में अच्छी तरह से उगाया जा सकता है।

**प्रसारण**

बड़हल को प्रायः बीजों के द्वारा ही उगाया जाता है। इसके बीज फल से निकलने के 10 दिनों तक ही अंकुरित होते हैं, उसके बाद बीजों में अंकुरण नहीं होता है, इसमें कटिंग तथा गूटी 12-15 प्रतिशत तक ही सफल है अतः सबसे अच्छा अंकुरण बीजों द्वारा ही होता है।

**रोपण**

बड़हल के पौधों को लगाने हेतु 90 x 90 x 90 सेमी. के आकार के गड्ढे खोदे जाते हैं, गड्ढों के बीच का अन्तराल 9-12 मीटर रखा जाता है। औसतन 10 मीटर रखना उचित रहता है। गड्ढों

को गोबर की खाद तथा मिट्टी को बराबर मात्रा में मिलाकर भर देना चाहिए। पौधों को वर्षा ऋतु में पहली बारिश होने के बाद लगाना उचित रहता है।

#### फूल आना तथा फल लगना

बड़हल के पौधों में फूल फरवरी, मार्च में लगता है तथा जून-जुलाई तक फल मिलते हैं।

#### फलों का उपयोग

कच्चे परिपक्व फलों का उपयोग अचार, सिरके आदि में डालने के लिए किया जाता है। बड़हल के पके फल बड़े ही स्वादिष्ट तथा पौष्टिक होते हैं। बड़हल के कच्चे तथा पके फलों का बाजार में अच्छा दाम मिलता है।

#### बेर (Ber)

वानस्पतिक नाम- जिजिफस मोरिसियाना  
(*Zizyphus mauritiana*)

कुल - रैमिनेसी (Rhamnaceae)

बेर भारत के लगभग सभी भागों में पाई जाती है लेकिन आजकल इसको कम पसंद किया जाता है इसलिए यह लगभग विलुप्त होने के कगार पर है। इसमें विटामिन ए तथा बी की कुछ मात्रा पाई जाती है। बेर को ताजे रूप में प्रयोग करने के अतिरिक्त सुखाकर जेली, मुरब्बा, चटनी, जैम इत्यादि के रूप में भी प्रयोग किया जाता है।

#### जलवायु तथा मिट्टी

बेर उष्ण एवं शुष्क जलवायु का फल है जिसको नमी या पानी की कम आवश्यकता होती है। यह विभिन्न प्रकार की जलवायु में पैदा हो सकता है। बेर को समुद्र से 900 मीटर की ऊँचाई पर भी आसानी से उत्पन्न किया जा सकता है। बेर सभी प्रकार की मिट्टियों में पैदा किया जाता है यहां तक की क्षारीय मृदा के

प्रति यह अधिक सहिष्णु होता है, बेर की वृद्धि एवं फलत जीवांशपूर्ण दोमट मिट्टी में अच्छी प्रकार से होती है।

#### प्रसारण

साधारण रूप से बेर को बीज के द्वारा प्रसारित किया जाता है। बेर को गुट्टी द्वारा भी प्रसारित किया जा सकता है।

#### रोपण

बेर के पेड़ काफी इधर-उधर फैलते हैं अतः इनको अधिक स्थान दिया जाता है। पौधों को 8 X 8 मी. स्थान देकर लगाते हैं।

#### फूल आना तथा फल लगना

बेर में फूल नये प्ररोहों पर पैदा होते हैं। इसके पेड़ चौथे या पांचवें वर्ष फल देना शुरू कर देते हैं। उत्तर भारत में बेर फरवरी-अप्रैल तक तोड़े जाते हैं। पूर्ण वृद्धि किये हुए पेड़ से 3-4 कुन्तल फल मिलता है।

#### उपयोग

बेर के सूखे फलों से पेक्टिन निकाल कर जेली, मुरब्बा, चटनी, जैम आदि बनाया जाता है। गाँव में बेर का उपयोग चूर्ण के रूप में प्रचलित है, जो पेट के रोगों में बहुत फायदेमंद है।

#### फालसा (Phalsa)

वानस्पतिक नाम- गेविया सबिनाकैलिस  
(*Grewia subinaequalis*)

कुल - टीलिएसी (Tiliaceae)

फालसा भारत वर्ष के सभी राज्यों में पाया जाता है। इसका पौधा झाड़ीनुमा, सहिष्णु स्वभाव का होता है। पकने पर फलों का रंग गहरा लाल एवं बैंगनी होता है, फल छोटे-छोटे अम्लीय स्वाद के होते हैं, पकने के बाद फलों को ज्यादा दिन तक नहीं रखा जाता है, फालसा का फल अष्टिल होता है, स्वाद मीठा, खट्टास

युक्त तथा परागकण काफी बड़े 60-125 माइक्रान तथा इनमें जनन क्षमता अधिक होती है। इसका गूदा खाया जाता है, जो सम्पूर्ण फल का 69 प्रतिशत होता है।

#### जलवायु तथा मिट्टी

फालसा केवल उत्तरी भारत के ऊँचे पहाड़ी स्थानों को छोड़कर शेष सभी स्थानों पर सफलता पूर्वक पैदा किया जा सकता है। यह गर्म एवं अधिक शुष्क मैदानी भागों में तथा अधिक वर्षा वाले नम स्थान दोनों ही प्रकार की जलवायु में सरलता पूर्वक हो सकता है। फालसा के लिए सभी तरह की मिट्टियाँ उपयुक्त होती है। यह ऊसर जमीन में भी अच्छी वृद्धि करता है।

#### प्रसारण

फालसा का प्रसारण बीज की सहायता से किया जाता है। मई के महीने में स्वस्थ एवं पके फलों से बीजों को निकाल लिया जाता है, बीजों को अधिक समय तक रखने से अंकुरण क्षमता नष्ट हो जाती है। अतः इसको 15-20 दिनों के अंदर में बुवाई कर देनी चाहिए।

#### रोपण

फालसा को उगाने हेतु गर्मियों में गड्डों 30 X 30 X 30 सेमी. आकार के तैयार किए जाते हैं। गड्डों को गोबर की खाद तथा मिट्टी का मिश्रण बना कर अच्छी तरह से भर देना चाहिए तथा वर्षा के शुरूआत में पौधों को लगा देना चाहिए।

#### फूल आना तथा फल लगना

फालसा में फूल नई वृद्धि पर पैदा होता है, पौधा लगाने के 3 वर्ष पश्चात यह अच्छी उपज देने लगता है। उत्तर प्रदेश में इसके फल मार्च-मई तक लगते हैं।

#### उपयोग

फालसा को शुष्क फल के रूप में उपयोग में लाया जाता है, कुछ जगहों पर इसका उपयोग शरबत तथा पेय पदार्थ के रूप में किया जाता है। ग्रामीण इन पेड़ों से दवाइया, भूसा, जलावन लकड़ी, भवन सामग्री आदि के रूप में प्रयोग कर रहे हैं। इन जंगली पेड़ों से ग्रामीण लोगों को औषधियों, तेल, विटामिन और खनिज तत्व पर्याप्त मात्रा में प्राप्त हो जाता है। हमारे अच्छे स्वास्थ्य को लगातार बनाये रखने में ये स्थानीय फल महत्वपूर्ण भूमिका निभा सकते हैं। भारत में ग्रामीण इलाकों में कुपोषण की समस्या आम है परिणाम स्वरूप बहुत से लोग विशेषकर बच्चे महामारी का शिकार हो रहे हैं। शरीर में पोषक तत्वों की कमी को पूरा करने में ये जंगली फल महत्वपूर्ण भूमिका निभा सकते हैं। सौभाग्य से भारत इस प्रकार के देशी खाद्य पौधों से परिपूर्ण है जो की हमारे स्वास्थ्य को उत्तम रखने में सक्षम है। बढती हुई जनसंख्या धनत्व के कारण मनुष्यों ने जंगल को काट कर खेतों को निर्माण किया है जिससे इन जंगली फलों के पेड़ों में कमी आयी है। हम इन जंगली फलों के पौधों का रोपण करके पर्यावरण तथा अपने स्वास्थ्य की रक्षा कर सकते हैं।

## ट्राइकोडर्मा: एक महत्वपूर्ण जैव नियंत्रक

निधि गुप्ता<sup>1</sup>, अम्बिका<sup>1</sup>, ज्योति रानी<sup>2</sup>, विजय वर्धन पाण्डेय<sup>1</sup>, अमित पाण्डेय<sup>1</sup>

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वन अनुसन्धान संस्थान, देहरादून

(भारतीय वानिकी अनुसन्धान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

वन लकड़ी, ईंधन, चारे और छोटे वनों के उत्पादन के लिए मानव के लिए स्रोत के रूप में कार्य करते हैं एवं साथ ही मिट्टी और पानी की रक्षा, जलवायु को नियंत्रित करने, वन्य जीवन के लिए भोजन और शरण देने का दायित्व भी निभाते हैं। वनों में कई प्रकार के रोग होते हैं जिससे उनकी उत्पादकता में भारी गिरावट आती है। रोग, रोगजनक जीवों के कारण होते हैं जो संक्रामक होते हैं, जिसका अर्थ है कि रोगजनक संक्रमित पेड़ से अन्य पेड़ों में भी फैल सकता है। रोगजनकों में सूक्ष्मजीव जैसे की वायरस, बैक्टीरिया, नेमैटोड्स और कवक शामिल हैं; जिनमें कवको के कारण होने वाले रोग प्रमुख होते हैं। कवक कृषि एवं वनों को गंभीर नुकसान पहुंचाते हैं, जिसके परिणामस्वरूप पैदावार, गुणवत्ता, और लाभ को महत्वपूर्ण नुकसान हो सकता है। रासायनिक कवकनाशी पौधों पर कवक रोगजनकों को मारने के लिए इस्तेमाल किया जाता है। यद्यपि पौधों की रक्षा करने में रासायनिक कवकनाशी का स्पष्ट लाभ होता है, परन्तु कुछ संभावित छिपे हुए खतरों भी होते हैं। समय के साथ, कवक की प्रजातियां रासायनों के प्रति प्रतिरोधी हो सकती हैं, और रासायनिक कवकनाशी का आवेदन अप्रभावी हो सकता है। पारिस्थितिकीय पत्रों में प्रकाशित 2012 के एक अध्ययन के मुताबिक, संयुक्त राज्य अमेरिका में सबसे अधिक इस्तेमाल किये जाने वाले सिंथेटिक कवकनाशक - क्लोरोथोनिल - मछली जैसी जलीय जानवरों के लिए विषाक्त है। इसके विकल्प के रूप में कई फायदेमंद कवक और जीवाणुओं को मिट्टी से पृथक

किया गया है एवं प्रयोगशालाओं में भी परीक्षण किया गया है ताकि पादप रोगजनकों को नियंत्रित करने में एक सफलता प्राप्त हो। ट्राइकोडर्मा एक ऐसा ही महत्वपूर्ण कवक है, जो मिट्टी से पृथक किया जाता है।

कवक जीवों का एक विशाल समुदाय है। इस वर्ग के सदस्य पर्णहरिम रहित होते हैं और इनमें प्रजनन बीजाणुओं द्वारा होता है। ट्राइकोडर्मा कवक, लगभग सभी मिट्टी और जड़ के पारिस्थितिकी प्रणालियों में मौजूद हैं। इसकी कई प्रजातियों को अवसरवादी, अव्यावहारिक पौधसहजीवी, साथ ही अन्य कवक के परजीवी होने की विशेषता है। ट्राइकोडर्मा की कई प्रजातियों के जीनोम अनुक्रमित किए गए हैं। ट्राइकोडर्मा जीनस को क्रिस्टियान हेन्ड्रिक पर्सून ने 1794 में वर्णित किया था, यह विश्वास है कि ट्राइकोडर्मा मोनोटाइपिक था जो कि 1969 में रिफाई के काम तक कायम था, जिन्होंने नौ प्रजातियों को मान्यता दी थी। वर्तमान में ट्राइकोडर्मा जीनस में 89 स्वीकार्य प्रजातियां हैं।

### ट्राइकोडर्मा का रूपात्मक विवरण

ट्राइकोडर्मा की संस्कृतियां आमतौर पर 25-30°C तापमान पर तेजी से बढ़ती हैं, लेकिन कुछ प्रजातियां 45°C तापमान पर भी जीवित रहती हैं। कॉनिडिया आमतौर पर हरे या पीले या कम बार सफेद रंग के रंगों में कॉम्पैक्ट या ढीले ट्यूफ्ट में एक हफ्ते के भीतर बनते हैं। कुछ प्रजातियां एक विशिष्ट मिठाई या 'नारियल' गंध का उत्पादन

करती हैं। कॉनिडीओफोर्स की मुख्य शाखाओं में पार्श्व की ओर शाखाओं का उत्पादन होता है, शाखाएं रीब्रांच कर सकती हैं, साथ ही द्वितीयक शाखाएं अक्सर जोड़े में और सबसे लंबी माध्यमिक शाखाएं मुख्य अक्ष के सबसे निकट होती हैं। मुख्य धुरी के संबंध में सभी प्राथमिक और माध्यमिक शाखाएं 90° पर या उसके निकट होती हैं। फिलाइड्स आम तौर पर बीच में बढ़े हुए हैं लेकिन बेलनाकार हो सकते हैं। क्लैमाइडोस्पोरस का उत्पादन सभी प्रजातियों द्वारा किया जा सकता है। क्लैमाइडोस्पोरस आमतौर पर एककोशिकीय होते हैं परंतु कुछ प्रजातियों के क्लैमाइडोस्पोरस बहुकोशिकीय होते हैं।

#### ट्राइकोडर्मा के औद्योगिक लाभ

ट्राइकोडर्मा, विभिन्न स्थितियों में पनपने के लिए अनुकूलित, किण्वक की एक विस्तृत शृंखला पैदा करता है। एक विशिष्ट प्रकार के किण्वक का उत्पादन करने वाले उन उपभेदों का चयन करके और निलंबन में संवर्धन करने से, किण्वक की औद्योगिक मात्रा का उत्पादन किया जा सकता है।

*ट्राइकोडर्मा रीसेई* का उपयोग सेल्युलेज़ और हेमीसेल्युलेज़ के उत्पादन के लिए किया जाता है।

*ट्राइकोडर्मा लम्बिब्राच्युटियम* को जियालेनस का उत्पादन करने के लिए प्रयोग किया जाता है।

*ट्राइकोडर्मा हर्जियायनम* का उपयोग काइटिनेस उत्पादन करने के लिए किया जाता है।

ट्राइकोडर्मा से होने वाले लाभ

#### रोग नियंत्रण

ट्राइकोडर्मा एक शक्तिशाली जैव नियंत्रण घटक है और बड़े पैमाने पर मृदा में पैदा होने वाले रोगों के लिए उपयोग किया जाता है। यह विभिन्न जातियों से संबंधित रोगजनक कवक के खिलाफ सफलतापूर्वक इस्तेमाल किया जाता है, जैसे फ़्यूज़ारियम, स्क्लेरोसिया इत्यादि।

पादप विकास प्रोत्साहक

ट्राइकोडर्मा फास्फेट और लघुपोषक तेजी से ग्रहण कर लेता है। पौधों के साथ ट्राइकोडर्मा उपभेदों के प्रयोग से गहरी जड़ों की संख्या बढ़ जाती है, जिससे पौधों की सूखा प्रतिरोध करने की क्षमता बढ़ जाती है।

#### रोग के जैव रसायनिक एलीसिटर

ट्राइकोडर्मा पौधों में प्रतिरोध को प्रेरित करने के लिए जाना जाता है। ट्राइकोडर्मा द्वारा निर्मित और मिश्रित यौगिकों में इथाइलीन उत्पादन, अतिसंवेदनशील प्रतिक्रियाएं और पौधे की खेती में अन्य रक्षा संबंधित प्रतिक्रियाएं होती हैं।

#### पारजीनी पौधे

ट्राइकोडर्मा से एंडोकाइटिनेस जीन का परिचय जैसे कि तंबाकू और आलू के पौधों में किया गया जिससे की उनमें फंगल वृद्धि के प्रति प्रतिरोध में वृद्धि हुई है। चयनित पारजीनी लाइनों के पौधे रोगजनकों के लिए अत्यधिक सहिष्णु होते हैं जैसे कि अलटेनरिया वैकल्पिकता और बोटीटीस सिरेरिया तथा साथ ही साथ मिट्टी से पैदा होने वाले रोगजनक, जैसे रहिज़ेक्टोनिया।

#### बायोरेमेडीएशन (जैविक उपचार)

ट्राइकोडर्मा की किस्में मिट्टी की बायोरेमेडीएशन में एक महत्वपूर्ण भूमिका निभाती हैं जो कीटनाशकों और जड़ी बूटियों से दूषित होती हैं। उनके पास कीटनाशकों की एक विस्तृत शृंखला को नीचा दिखाने की क्षमता है: ऑर्गेनोक्लोरीन, ऑर्गेफॉस्फेट्स और कार्बोनेट।

#### ट्राइकोडर्मा जैव नियंत्रक के रूप में

जैविक नियंत्रण में फायदेमंद जीवों, और उत्पादों जैसे कि चयापचयों का उपयोग शामिल होता है, जो पौधे के रोगजनकों के नकारात्मक प्रभावों को कम करते हैं और पौधों में सकारात्मक प्रतिक्रिया को बढ़ावा देते हैं। सफल जैव नियंत्रण बातचीत के लिए आवश्यक है कि इसमें शामिल फायदेमंद जीवाणु विभिन्न प्रकार के विषाक्त पदार्थों के प्रति प्रतिरोधी हो, जिनमें स्वयं द्वारा निर्मित या एंटीबायोटिक्स या फिर अन्य रोगकारकों, संयंत्र

एंटीमिक्रोबियल यौगिकों, और सिंथेटिक रसायन या दूषित पदार्थ शामिल हैं। ट्राइकोडर्मा सबसे व्यापक रूप से लागू जैव नियंत्रक कवक है, जो कि विभिन्न रासायनिक तनावों का सामना कर सकते हैं ट्रायकोडर्मा के कई उपभेदों को पौधों के कवक रोगों के खिलाफ जैव नियंत्रक के रूप में विकसित किया गया है। विभिन्न तंत्र में एंटीबायोसिस, परजीवी आदी, मेजबान-पौधे प्रतिरोध को प्रेरित करना, और प्रतियोगिता शामिल है। अधिकांश जैव नियंत्रक प्रजातियां *टी. हर्जियानम*, *टी. विरीड* और *टी. हैमट्रूम* से हैं।

एक जैव नियंत्रक के लक्षण

- यह लक्षित रोगजनक को कुशलतापूर्वक और आर्थिक रूप से नियंत्रित करना चाहिए।
- रोगजनक के लिए अनुकूल उपयुक्त परिस्थितियों के तहत यह सक्रिय होना चाहिए।
- इसकी तैयारी, वितरण और अनुप्रयोग में स्वास्थ्य जोखिम नहीं होना चाहिए।
- यदि संभव हो तो, यह लक्ष्य जीवों के लिए विशिष्ट होना चाहिए।
- प्रयोगशाला में गुणा करना सरल और सस्ती होना चाहिए।
- जीवों को सीधे या अप्रत्यक्ष रूप से रसायनों के प्रसार के द्वारा रोगजनकों से संपर्क करना चाहिए।
- सबस्ट्रेट में लंबे समय तक अस्तित्व।

ट्राइकोडर्मा के जैव नियंत्रक तंत्र

मायकोपार्सीटिसम

मायकोपार्सीटिसम हाइड्रोलाइटिक या विषाक्त यौगिकों का भौतिक संपर्क और संश्लेषण है। शब्द मायकोपेरासिटिज़्म एक रिश्ते को परिभाषित करता है जिसमें एक जीवित कवक एक पोषक स्रोत के रूप में दूसरे के लिए कार्य करता है। मायकोपेरासिटिज़्म एक जटिल प्रक्रिया है जिसमें ट्राइकोडर्मा प्रजाति के कवक तन्तु, रोगजनक कवक तन्तु के पास रसायनवार्ति अनुक्रिया से बढ़ जाते हैं

और कुण्डल बनाके दूसरे कवक तन्तु से जुड़ जाते हैं। रोगजनक कवक तन्तु की दीवार की आंशिक गिरावट सामान्य रूप से परजीवी प्रक्रिया के बाद के चरणों में होती है।

एंटीबायोसिस

एंटीबायोसिस दो जीवों के बीच एक सम्बन्ध है, जिसमें एक दूसरे के लिए हानिकारक है। ट्राइकोडर्मा एंटीबायोटिक्स की विविधताएं जैसे की ग्वाइओवाइरिन, ग्लोऑटोक्सीन, विरिडिन, पैरोनेस और पेप्टाइबोल्स, रोगजनक कवक के खिलाफ उत्पादित करते हैं। पेप्टाइबोल्स ट्राइकोडर्मा द्वारा निर्मित एंटीबायोटिक पेप्टाइड्स का एक बड़ा परिवार है जोकि मिटोकोन्ड्रियल ए.टी.पेज़ के निषेध को बढ़ावा देते हैं।

फंगीस्टैटिस

ट्रायकोडर्मा मिट्री में तेजी से बढ़ता है, क्योंकि वे स्वाभाविक रूप से कई विषैले यौगिकों के लिए प्रतिरोधी होते हैं, सहित हर्बाइसाइड, कवकनाशी और डीडीटी और फेनोलिक यौगिक। ट्रायकोडर्मा में एबीसी परिवहन प्रणालियों की उपस्थिति के कारण जहरीले यौगिकों के प्रतिरोध हो सकता है।

पोषण और स्थान के लिए प्रतिस्पर्धा

ट्रायकोडर्मा प्रतिस्पर्धा के जरिए पौधों के क्षेत्र में रोगजनक जनसंख्या के विकास को रोक सकता है और इस तरह बीमारी के विकास को कम कर सकता है। जैविक नियंत्रक पौधों के साथ पोषण और स्थान के लिए प्रतिस्पर्धा करता है। यह पर्यावरण के कुछ संसाधनों के उपयोग करने की वजह से दूसरे कवक के लिए उपलब्ध नहीं हो पाते हैं, इस तरह अन्य सूक्ष्मजीवों के विकास और संक्रमण का निर्धारण किया जाता है।

ट्राइकोडर्मा के इस्तेमाल करने की विधि

बीज उपचार

बीज बोने से पहले किलोग्राम में ट्रायकोडर्मा पाउडर में 6-10 ग्राम मिला सकते हैं।

#### नर्सरी उपचार

नर्सरी बिस्तर के प्रति 100 मीटर 2 ट्रायकोडर्मा पाउडर के 10-25 ग्राम मिला सकते हैं। नीम केक और एफवाईएम का उपचार करने से पहले प्रभावकारिता बढ़ जाती है।

#### काटना और अंकुर जड़ डुबकी

10 ग्राम ट्रायकोडर्मा पाउडर के साथ 100 ग्राम अच्छी तरह सड़ा हुआ एफआईएम प्रति लीटर पानी डालें और रोपण के पहले 10 मिनट के लिए डुबोएं।

#### मृदा उपचार

हरी खाद के लिए मिट्टी में सूरज भांग या डैनन की बारी के बाद हर हेक्टेयर में ट्रायकोडर्मा पाउडर के

5 किग्रा मिला सकते हैं या 100 किलोग्राम खेत की खाद में ट्रायकोडर्मा के 1 किलोग्राम मिक्स करें और इसे पॉलिथिन के साथ 7 दिनों के लिए कवर करें। प्रत्येक 3-4 दिनों के अंतराल में मिश्रण को मिलाएं करें और फिर क्षेत्र में प्रसारित करें।

अतः इस लेख से यह निष्कर्ष निकाला जा सकता है कि ट्रायकोडर्मा बहुत सी कवक प्रजातियों के खिलाफ एक शक्तिशाली जैविक नियंत्रण है और ट्रायकोडर्मा आधारित जैव नियंत्रक उत्पादों के उत्पादन और विकास की आवश्यकता को दर्शाता है।

## New record of saw-toothed grain beetle, *Oryzaephilus Surinamensis* on stored mahua flowers

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### Introduction

Mahua is a large sized multipurpose forest tree that is found throughout the mixed deciduous forests of Madhya Pradesh. It is an important economic tree used as food, medicine and for other commercial uses. Mahua flowers are edible and contain about 65 to 70% sugar. Mahua flowers are used to make jams, jellies, biscuits, many other food items due to their nutritional value and also used alcoholic drink of by fermentation (Anon., 1952).

Forest Circle, Shahdol, Madhya Pradesh has purchased the large quantity of mahua flowers through Forest Village Committee in Shahdol district and stored in old Godowns of state forest department. In pursuance to the information regarding the insect pest problem and the samples of mahua flowers received from Chief Conservator of Forest, Forest Circle, Shahdol, M.P. vide letter no. Steno/Te.P/2017/9116 dated 20<sup>th</sup> November, 2017. Samples of mahua flowers are thoroughly checked in the laboratory of Forest Entomology Division, Tropical Forest Research Institute, Jabalpur. It was observed that the samples of mahua flowers are attacked by stored insect pest saw toothed grain beetle, *Oryzaephilus surinamensis* L. (Coleoptera: Silvanidae).

Scientist and team of Forest Entomology Division, Tropical Forest Research

Institute, Jabalpur also visited and surveyed the entire Godowns viz. Sohagpur (range-Shahdol, South forest division, Shahdol); Jaisinghnagar (range-Jaisinghnagar, North forest division Shahdol); Kirar (range-Annupur, forest division Annuppur); Padmaniya (range-Ahrganva, forest division Annupur) and Umariya (range-Umariya, forest division, Umariya) under Forest Circle, Shahdol (Table 1). These Godowns are now facing the problem of this stored insect pest attack and reported the presence of saw-toothed grain beetle, *O. surnemensis*. The incidence of beetle ranges from 05-90 per cent was recorded. The cracks and crevices are seen in some godowns. Generally *O. surinamensis* occurs as secondary pest following the attack of other stored grain pests.

It is a small, narrow flat, brown beetle, about 2.5 to 3 mm long. Its common name is derived from the peculiar structure of the thorax of the adult which bears saw-tooth like projections on each side. The larva is free, active, slender and whitish in colour.

Both adult beetles and grubs feed on the flowers of mahua in storage condition. They cause roughening of mahua flowers surface and impart bad flavor. It is a bad insect pest when they become moist. Excessive infestation of this beetle makes them unpalatable and unsalable (Figs.1-6).

The eggs are dropped loose among mahua flowers or tucked away in crevices. From 45-300 small, slender, white eggs are laid by a single female. The eggs stage lasts from 3 to 5 days in summer and about 15 days in winter. A grub is slender whitish and free living. It is very active. In about 12 days to 10 weeks depending upon the climatic conditions grub becomes full grown, when it measures about 3 mm in body length. The grub makes cells by sticking together the food particles with their own secretion. Pre-pupal and pupal period lasts for 7-21 days. The larval period lasts from 12 days to as long as 10 weeks. The full grown larva makes cells by sticking together particles of food stuffs with a substance which it secretes. The pre-pupal and pupal stages are passed inside these cells. The pupal stage lasts from 1 to 4 weeks. The adult beetles are hardy insects with well developed wings but they seldom fly. Ordinarily, they can live for 6 to 10 months, but may sometimes live for more than 3 years (Chand, 1995). During visit, Scientist of TFRI, Jabalpur suggested the following control measures:

**Possible control measures to encounter the present problem of saw toothed grain beetle**

The measures adopted for control of saw toothed grain beetle *O. surinamensis* in stored mahua flowers are two types: -1) Preventive 2) Curative.

1) The preventive measures are employed to protect fresh stocks from the attack of insect pest while curative measures help to control the pest infestation in stores. For longer and safer storage, it is very essential that the mahua flowers should be sufficiently dry. Most of the products cannot multiply with less than 8%

moisture. Use of dry neem leaves and mixing of ash in products are some of the indigenous methods employed in the rural areas for protecting the stored products from the attack of the pests. When the product is properly dried and ready for storage, it should be bagged in gunnies free from pest infestation. As far as possible new bags, should be used.

In order to make the godown insect free, the following precautions are necessary:

- i. All dirt, rubbish, webbish or refuse materials from the godowns should be removed and destroyed. ii) All cracks, crevices, holes in walls floor or ceiling of the godowns should be filled with cement. It is necessary to fumigate godowns to avoid the chances for contamination. Spraying malathion 0.5% (10ml/lit of water) before storage new stocks, help to keep the stocks insect free. At the time of storing bags, proper dunnage is also necessary to protect products from moisture damage which usually occurs at the bottom layers of bags due to condensation of moisture as a result of temperature gradients.
- ii. The Curative measures become necessary when the products get infested with pest. The godown should be periodically examined and if the insects are noticed in the store, the products should immediately be removed, dried in the sun preferably on a pucca floor and cleaned. (Chand, 1995). The first step in making such products free from insect pest is to sieve and clean them to remove different stages of pests. Followed by

sunning and fumigation of products with suitable fumigants. The product required to be stored for a longer period should be atleast fumigated 3 to 5 times in a year.

As per the suggestions given by the private godown keepers / owners to the staff of Forest Division, Annupur, the staff of Kirar, range-Annupur, forest division Annupur has made the arrangement for keeping the open packets of insecticide like Phorate 10 G in godowns. These godowns are seen less attack of *O. surinamensis*.

No epidemics of saw-toothed grain beetle, *O. surinamensis* have been reported on stored mahua flowers (Beeson, 1941, Browne, 1968 and Chand, 1995). This is the new report and record of *O. surinamensis* on stored mahua flowers.

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**Table 1: Abstract of stored mahua flowers in different godowns in forest circle Shahdol**

S.N.	Locality	Range	Division	No. of Bags(40kg/bag)	% damage	Remark
1	Sohagpur	Shahdol	South forest division, Shahdol	14211	90.00	Cracks in Godown. Stored in June, 2017 and attacked of insect pest from Novemer,2017
2	Jaisinghnagar	Jaisinghnagar	North forest division Shahdol	1300	70.00	
3	Kirar	Annupur	forest division Annuppur	1436	5.00	
4	Padmaniya	Ahrganva	forest division Annupur	400	10.00	
5	Umariya	Umariya	forest division Umariya	13307	60.00	



Fig. 1. View of Godown



Fig. 2. Scientist visit in Godown



Fig . 3. Stored Bags of mahua flowers in Godow



Fig . 4. Dry Mahua flowers in Godown



Fig. 5. Damaged Mahua flowers



Fig . 6. Grubs / Beetles of *O. surinamensis*

## भारतीय संस्कृति एवं वृक्षारोपण

ममता पुरोहित, राजेश कुमार मिश्रा एवं नितिन कुलकर्णी

उष्णकटिबंधीय वन अनुसंधान संस्थान

(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

मण्डला रोड, जबलपुर – 482021 (म.प्र.)

वन, मानव एवं जीव जगत की सतत् सहायता एवं प्राणवायु देने वाले महत्वपूर्ण प्राकृतिक संसाधन हैं। अनादिकाल से मानव सभ्यता और वनों का घनिष्ठ सम्बन्ध रहा है। भोजन, आवास तथा प्राणवायु के लिये समूचा जीव-जगत पेड़ पौधों पर आश्रित है। वृक्षों के परोपकारी स्वभाव के कारण मानव का वृक्षों के प्रति हमेशा से प्रेम व आदर का भाव रहा है। वृक्ष हेतु पौधे लगाना और उनकी रक्षा करना भारतीय संस्कृति की प्राचीनतम परम्परा है। शिव पुराण उमा संहिता, 11/7 के श्लोक -

अतीतानागवान् सर्वान् पितृवंशांस्तु तारयेत् ।  
कान्तारे वृक्षरोपी यस्तस्माद् वृक्षांस्तु रोपयेत् ॥  
के अनुसार जो वीरान एवं दुर्गम स्थानों पर वृक्ष लगाते हैं, वे अपनी बीती व आनेवाली संपूर्ण पीढ़ियों को तार देते हैं। भारतीय ऋषि-मुनी वनस्पति विज्ञान के महान ज्ञाता एवं पर्यावरणविद् थे। उन्होंने पर्यावरण और पारिस्थितिकी तंत्र के संतुलन को बनाये रखने के लिए वनों के महत्व को समझा तथा आमजन को जागरूक करने के लिए वृक्षारोपण को पुण्य कार्य का दर्जा दिया। ऋषि मुनियों के समय में हरे-भरे वृक्ष को काटना पाप कार्य समझा जाता था तथा

वृक्ष काटने वाले के लिये दंड का विधान था।

अग्नि पुराण के श्लोक -

क्रियते पत्र विच्छेदः सपुष्प फलनिस्तये ।

अनावृष्टि भयं घोरं, तस्मिन्देशे प्रजायते ॥



खैर (अकेशिया कटेचु) - मंगल गृह वृक्ष

अर्थात् पत्तों, फूलों तथा फलों के साथ पेड़-पौधों का विनाश करने से उस देश में भयंकर अनावृष्टि होती है तथा अकाल पड़ सकता है। आज भी हमारे देश में पीपल, बड़, आंवला, केला, तुलसी आदि वृक्षों व पेड़-पौधों की पूजा की जाती है। वृक्ष/वनस्पति आधारित बहुत से तिथी-त्यौहार जैसे वट सावित्री अमावस्या, हरियाली तीज, आंवला नवमी, हलषष्ठी आदि हमारे देश की पहचान हैं। देश के कई प्रदेशों में विद्यमान देववन भारतियों की वृक्षों के प्रति आस्था के प्रतीक हैं। हजारों वर्षों पूर्व रचित भारतीय वेदों, पुराणों, महाभारत, चरक संहिता आदि में भी

वृक्षों के महत्व और उपयोगिता के बारे में विस्तृत उल्लेख है।



**बरगद (फाइक्स बेंगालेन्सिस) - मघा नक्षत्र वृक्ष**  
पेड़-पौधों का मानव, पशु-पक्षी एवं कीट-पतंगों के दैनिक जीवन में विशेष महत्व है। पेड़-पौधे पर्यावरण के महत्वपूर्ण घटक हैं। जीवन के लिये आवश्यक ऑक्सीजन इन्हीं पेड़-पौधों से मिलती है। कार्बन डाइऑक्साइड जैसी जहरीली गैस को अवशोषित कर ये वातावरण को शुद्ध करते हैं तथा सूर्य के प्रकाश में पानी व कार्बन डाइऑक्साइड से स्वयं तथा प्राणि मात्र के लिये भोज्य पदार्थ बनाते हैं। प्रचंड धूप में वृक्षों की शीतल छाया पशु-पक्षी, कीट-पतंगों व मानव आदि सभी को राहत देती है। वृक्ष के विभिन्न भाग जैसे जड़, लकड़ी, फूल, पत्ती, फल आदि औषधी के रूप में नाना प्रकार के रोगों में हमारे स्वास्थ्य की रक्षा करते हैं। वराह पुराण, 162-41-42 के श्लोक -

इन्धनार्थं यदनीतं अग्निहोमं तदुच्येत् ।

छाया विश्राम पथिकैः पक्षिणां निलयेन च॥

पत्रमूलं त्वगादिमिर्धं औषधं तु देहिनाम् ।

उप कुर्वन्ति वृक्षस्य पंचयज्ञः स उच्यते ॥

के अनुसार वृक्ष दैनिक पांच महाउपकार करते हैं। वे गृहस्थों को ईधन, पथिकों को छाया एवं विश्राम स्थल, पक्षियों को नीड़, पत्तों, जड़ों तथा छाल आदि से समस्त जीवों को औषधि देकर उनका उपकार करते हैं।

भारतीय दर्शन के अनुसार व्यक्ति की राशि तथा जन्म के समय ग्रह व नक्षत्रों की स्थिति के अनुसार वृक्ष वनस्पतियों का प्रभाव मनुष्य के जीवन पर पड़ता है। भारतीय विद्वानों ने ज्योतिष व वास्तु शास्त्र के आधार पर व्यक्ति के जीवन को स्वस्थ एवं समुन्नत बनाने में पेड़-पौधों की भूमिका पर विस्तृत प्रकाश डाला है। आयुर्वेद, नारद पुराण, विद्यार्णत वृत एवं शारदा तिलक में कहा गया है कि राशि, ग्रह एवं नक्षत्रों की अनिष्ट स्थिति में संबंधित पेड़-पौधों की जड़, लकड़ी, फूल, पत्ती, फल आदि का उपयोग विधि-विधान के अनुसार करने से दूषित प्रभाव को दूर किया जा सकता है। आयुर्वेद के स्पर्श सिद्धांत के अनुसार ग्रहों आदि से संबंधित वृक्ष-वनस्पतियों की जड़, लकड़ी, फूल, पत्ती, कंद आदि को शरीर पर धारण करने से निश्चित लाभ मिलता है। राशि ग्रह व नक्षत्रों से संबंधित इन पेड़-पौधों के पंचांग अर्थात् जड़, लकड़ी, फल, फूल, पत्ती, छाल आदि को सुखाकर हवन सामग्री में उपयोग करने से पर्यावरण शुद्ध करने, हानिकारक सूक्ष्म जीवाणुओं को नष्ट करने व मानव के स्वास्थ्य लाभ में विशेष योगदान है। नौ ग्रह, बारह

राशियों एवं सत्ताइस नक्षत्रों के प्रति लाभदायक

वृक्ष-वनस्पतियां इस प्रकार हैं।

ग्रहों से संबंधित पौधे एवं वृक्ष

क्र.	ग्रह	हिन्दी नाम	वानस्पतिक नाम
1.	सूर्य	आक (मदार)	<i>Calotropis procera</i>
2.	चन्द्र	ढाक या पलाश	<i>Butea monosperma</i>
3.	मंगल	खैर	<i>Acacia catechu</i>
4.	बुध	लटजीरा (अपामार्ग)	<i>Achyranthes aspera</i>
5.	बृहस्पति	पीपल	<i>Ficus religiosa</i>
6.	शुक्र	गूलर	<i>Ficus glomerata</i>
7.	शनि	शमी	<i>Prosopis cineraria,</i>
8.	राहू	दूब एवं चन्दन	<i>Cynodon dactylon and Santalum album</i>
9.	केतू	कुश एवं अश्वगंधा	<i>Saccharum Spontaneum and Withania somnifera</i>

नवग्रह के अनुसार पौधे व वृक्षों का रोपण

पूर्व

बुध ग्रह लटजीरा (अपामार्ग)	शुक्र ग्रह गूलर	चन्द्र ग्रह पलाश
बृहस्पति ग्रह पीपल	सूर्य ग्रह आक (मदार)	मंगल ग्रह खैर
केतू ग्रह कुश/अश्वगंधा	शनि ग्रह शमी	राहू ग्रह दूब/चन्दन

पश्चिम

राशियों से संबंधित पौधे एवं वृक्ष

क्र.	राशि	हिन्दी नाम	वानस्पतिक नाम
1.	मेष	बीजासाल (विजयसार)	<i>Pterocarpus marsupium</i>
2.	वृष	चितवन	<i>Alstonia scholaris</i>
3.	मिथुन	चम्पा	<i>Michelia champaca</i>
4.	कर्क	अशोक	<i>Saraca indica</i>
5.	सिंह	पाइल	<i>Steriospermum suaveolens</i>
6.	कन्या	आम	<i>Mangifera indica</i>

7.	तुला	मौलश्री	<i>Mimusops elengi</i>
8.	वृश्चिक	पलाश (ढाक)	<i>Butea monosperma</i>
9.	धनु	सेमल	<i>Bombax cieba</i>
10.	मकर	शीशम	<i>Dalbergia latifolia</i>
11.	कुम्भ	कदम्ब	<i>Anthocephalus cadamba</i>
12.	मीन	बेल	<i>Aegle marmelos</i>

## नक्षत्रों से संबंधित पौधे एवं वृक्ष

क्र.	नक्षत्र	हिन्दी नाम	वानस्पतिक नाम
1.	अश्विनी	कुचिला	<i>Strychnos nux-vomica</i>
2.	भरणी	आंवला	<i>Embllica officinalis</i>
3.	कृतिका	गूलर	<i>Ficus racemosa</i>
4.	रोहिणी	जामुन	<i>Syzygium cumini</i>
5.	मृगशिरा	खैर	<i>Acacia catechu</i>
6.	आर्द्रा	शीशम	<i>Dalbergia latifolia</i>
7.	पुनर्वसु	बांस	<i>Bambusa arundinacea</i>
8.	पुष्य	पीपल	<i>Ficus religiosa</i>
9.	अश्लेषा	नागकेसर	<i>Mesua nagassarium</i>
10.	मघा	बरगद	<i>Ficus bangalensis</i>
11.	पूर्वा फाल्गुनी	पलाश (ढाक)	<i>Butea monosperma</i>
12.	उत्तरा फाल्गुनी	पाकड़	<i>Ficus infectoria</i>
13.	हस्त	रीठा	<i>Sapindus mukorossi</i>
14.	चित्रा	बेल	<i>Aegle marmelos</i>
15.	स्वाति	अर्जुन	<i>Terminalia arjuna</i>
16.	विशाखा	कटाई	<i>Flacourtia indica</i>
17.	अनुराधा	मौलश्री	<i>Mimusops elengi</i>
18.	ज्येष्ठा	चीड़	<i>Pinus roxburghii</i>
19.	मूल	साल	<i>Shorea robusta</i>
20.	पूर्वाषाढा	जलमाला (जलवंती)	<i>Salix tetrasperma</i>
21.	उत्तराषाढा	कटहल	<i>Artocarpus heterophyllus</i>
22.	श्रवण	आक (मदार)	<i>Calotropis procera</i>
23.	धनिष्ठा	शमी (खेजड़ी)	<i>Prosopis cineraria</i>
24.	शतभिषक या शतभिषा	कदम्ब	<i>Anthocephalus cadamba</i>
25.	पूर्वा भाद्रपद	आम	<i>Mangifera indica</i>
26.	उत्तरा भाद्रपद	नीम	<i>Azadirachta indica</i>
27.	रेवती	महुआ	<i>Madhuca indica</i>

जन चेतना हेतु भारत सरकार, राज्य सरकारों एवं ग्राम पंचायतों द्वारा हर संभव प्रयास किया जा रहा है। गुजरात के वन विभाग तथा मध्यप्रदेश के भोपाल वन मंडल द्वारा राशि, ग्रह एवं नक्षत्रों के आधार पर पेड़-पौधों का रोपण किया गया है। सार्वजनिक स्थलों, बाग-बगीचों, धार्मिक स्थलों, निजी भूमि तथा सरकारी भूमि पर राशि, ग्रह एवं नक्षत्रों से संबंधित पेड़-पौधों



वन सम्पदा

को लगाकर, इन वाटिकाओं के निर्माण द्वारा लोगों का ध्यान पेड़-पौधों के महत्व व उनके रोपण व रक्षण के प्रति आकर्षित किये जाने में सहयोग मिलेगा। ऐसा करने से जनमानस में पेड़-पौधों के प्राकृतिक, औषधीय, पर्यावरणीय व आय संबंधी महत्व को समझकर वृक्षारोपण व वृक्ष सुरक्षा के प्रति जागरुकता बढ़ेगी। पर्यावरण प्रदूषण, बढ़ते तापमान, प्रभावित वर्षा चक्र के कारण बाढ़ व सूखा की स्थिति, ग्रीन हाउस गैसों का प्रभाव, प्रभावित कृषि चक्र, विलुप्त होती पशु-पक्षी व वृक्ष-वनस्पतियों की प्रजातियों आदि के बचाव व सुरक्षा के लिये प्रत्येक व्यक्ति, विद्यार्थी, किसान वर्ग, व्यापारिक वर्ग व गैर सरकारी संस्थाओं को आवश्यक रूप से जिम्मेदारी निभानी होगी तभी हम वन क्षेत्रों को बढ़ाकर, पर्यावरण को शुद्ध एवं संतुलित बना सकेंगे।

## Natural dye yielding plants

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### Abstract

The current report is the best outcome from documentation of natural dye yielding flora from ethnic people of Mahabubnagar district, concentrating in the documentation of natural dye preparation techniques and their usages. In the Mahabubnagar district of Telangana state having huge forests and also found more forest dependable rural, tribal people. The common four natural dye preparation techniques, their usages and their preservation methods were discussed in details. Every plants botanical name, family, part used in natural dye preparation, common names, traditional usages clearly recorded and presented. It will be very much useful to the next generations, researchers, biodiversity conservatives.

### Introduction

In Indian history the usage of natural dye and their preparations mentioned. The process of dyeing was started during the reign of King Taothing-Mang (264-364 AD). The system of dyeing progressed during the reign of King Yanglao Keiphaba (969-984 AD), who introduced the beautiful textile *Hij Mayek* (later known as *Hijam mayek*) colourfully dyed, and worn by the women folk of Many regions of India. During the reign of King Loyumba (1074 AD –1133 AD), the

traditional system of dyeing cloths using different varieties of plants leaves, flowers, fruits, and barks was at its best. It was during his reign that better designs of costumes were introduced, and different clothes worn for different occasions. He distributed the duty of dyeing of yarns with plant parts to different clans, where each was assigned for a particular colour of yarn and cloth.

Previously there was no cosmetics, dye etc., so that they were always depended on forests for various purposes including natural dye. The natural dye there is no side effects and preparation, preservation also could done by lay man. The minority of dyes, people may used in the rangoli, pooja, thilak (Hindi), Bottu (Telugu) some other were used in festivals like holy (Colours festivals) and used as ink for writing.

Telangana is a 29<sup>th</sup> state of India. It comprises 31 districts. Mahabubnagar district is one of the backward districts of Telangana state, it is located south west region of Telangana, latitude between 15 ° 55' and 17 °29' N, longitude between 77°15 ' and 79 °15 'E, area18,432 sq.km, the present study area Kodangal mandal is also one of the 64 mandals (Shivakumar Singh P 2015). This mandal area in 242.0 sq. Km, population in persons 48299 and density 200 (per sq. km). The people of

this mandal were economically little backward. They can speak four languages, knowledge flows from one culture to other. The forest diversity is extremely affluent and a high-quality of natural dye source plants was found in study area (Figure 1).

There was no preceding report or recognized contribution from the Palamuru district. Therefore, the present record resolves on the natural dye yielding plants, their preservations and usages from past, in the present and in future also.

### Methodology

Habitual field trips were undertaken to diverse localities of the study area during the period from Jan 2016 to May 2017. The information about the plants was recorded by means of discussions and interviews using standard questionnaire with the informers along with the field visits during the collection hours. The information was gathered like local name(s) of the plant, parts used, methods of preparation. The information about the preparation technique of administrations was also recorded.

The documented natural plant specimens were authentically identified with the help of floras such as, *Flora of Andhra Pradesh* (Pullaiah 2010), *Flora of British India* (Hooker, 1978), *Flora of Karnataka* (Saldanha, 1984) and *Flora of Gulbarga District* (Seetharam *et al.*, 2000).

### Results and discussion

In the current outcome, the four common dye preparation procedures, part used, viability, purpose of usages discussed with



**Figure 1: Study location (India to Mahabubnagar)**

botanical authentications like scientific name, family, common names etc., the figures 2-5 and table 1 given for identification and confirmation.

Table 1: The source of natural dye from Palamuru district

Sl. No	Botanical name	Purpose of use	Common names	Part used	Colour of the natural dye
01.	<i>Acacia nilotica</i> Fabaceae	Bottu / Teeka	Nalla tumma	Green Pods	Chalk let, Dark brownish
02.	<i>Phyllanthus reticulates</i> Phyllanthaceae	Ink / writing	Pulichera	Ripened fruits	Dark blue
03.	<i>Butea monosperma</i> Fabaceae	Bottu / Holy fragment	Mooduga	Flower	Red colour
04.	<i>Bixa orellana</i> Bixaceae	Bottu / Pooja	Sindhuurapu chettu	Seeds	Dark Red colour

**Telangana natural dye yielding plant***Acacia nilotica***Botanical name:** *Acacia nilotica***Synonym:** *Acacia arabica* (Lam.) Willd., *Mimosa Arabica*, *Kirganelia reticulata*, *Anisonema reticulatum*, *Cicca reticulata*, *Diasperus reticulates*, *Kirganelia reticulates*,**Family:** Fabaceae**Common names:****Part used:** Green pods**Method of dye preparation:** The fresh green pods directly crushed on iron metal gives dark blackish dye, will be collected and preserved.**Preservation technique:** For longer time usage the dye will be dried. Whenever in reuse just mix with 2-4 drops of water.**Purpose of usage:** Pooja, Bottu (Telugu), Thilak (Hindi).**Viability:** 12-14 months.**Telangana natural dye yielding plant***Phyllanthus reticulatus***Botanical name:** *Phyllanthus reticulates***Family:** Phyllanthaceae**Common names:**

Hindi buinowla, kala-maimuda, kalemadhkaper,

Kannada anamsulc, anamsule,

Malayalam katou-nirouri, katouniruri,

Marathi panjuli, pavan, pavana,

pavari, pitauri, sitki

Sanskrit bahupraja, bahupushpa, krishnakambhoji,

Tamil abirangi, apiranki, arunelli,

Telugu nalla-purugudu,

**Part used:** Ripped fruit

**Method of dye preparation:** Ripped fruits cover scratched and collected in separate plate, sometimes filtered using wire nut.

**Preservation technique:** It should be preserved in tight bottles.

**Purpose of usage:** Like Indian Ink, Writing on pages or on walls etc.,

**Viability:** 1-2 months.

**Telangana natural dye yielding plant**  
*Butea monosperma* (Palaas)

**Botanical name:** *Butea monosperma*



**Family:** Fabaceae

**Common names:** Palaas (Hindi), Moduga (Telugu),

**Part used:** Dried flower / fresh ripped flower

**Method of dye preparation:** dries / fresh flower crushed with 5-6 drops of water, filtered and preserved for further use.

**Preservation technique:** For excellent preservation the air tight bottles will be suggested.

**Purpose of usage:** Bottu (Telugu), Pooja / Abhshake, Holy festival etc.,

**Viability:** 4-6 days.

**Telangana natural dye yielding plant**  
*Bixa orellana*

**Botanical name:** *Bixa orellana*



**Family:** Bixaceae

**Common names:**

English anatto, arnatto,

Hindi gowpurgee, latkan,

Kannada aarnatu,

Malayalam korangumunga,

korungoomungal

Marathi kaesari, kesari, keshri, kesui,

Sanskrit karachhada, raktabija,

Tamil amudadaram,

Telugu jaabara, jaabura

**Part used:** Seeds

**Method of dye preparation:** Ripped seeds outermost layer will be coated by Sindhoo dye, using 1-2 drops of water the dye is being collected.

**Preservation technique:** Fresh metallic plates will be suggested.

**Purpose of usage:** Bottu (Telugu), Pooja, etc.,

**Viability:** 11-12 months.

**Conclusion**

The natural dye preparations from Palamuru forests are the first report. This may basis for further research works; it shows traditional culture to the further generations. Present documentation also strengthens the interrelationship of man, civilization and forests.

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## Improved production technology of tomato-overview

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### Introduction

Tomato (*Lycopersicon esculentum*) belongs to the genus *Lycopersicon* under Solanaceae family. It is grown in practically every country of the world in outdoor fields, greenhouses and net houses. Tomato is an herbaceous sprawling plant growing to 1-3 m in height with weak woody stem. The flowers are yellow in colour and the fruits of cultivated varieties vary in size from cherry tomatoes, about 1–2 cm in size to beefsteak tomatoes, about 10 cm or more in diameter. Most cultivars produce red fruits when ripe. Tomato is a native to Peruvian and Mexican region. Tomato is one of the most important "protective foods" because of its special nutritive value. It is one of the most versatile vegetable with wide usage in Indian culinary tradition. Tomatoes are used for soup, salad, pickles, ketchup, puree, sauces and in many other ways it is also used as a salad vegetable. Tomato has very few competitors in the value addition chain of processing.

Tomatoes, aside from being tasty, are very healthy as they are a good source of vitamins A and C. Vitamin A is important for bone growth, cell division and differentiation, for helping in the regulation of immune system and maintaining surface linings of eyes, respiratory, urinary and intestinal tracts. Vitamin C is important in forming collagen, a protein that gives structures to bones, cartilage, muscle and blood vessels. It also helps maintain capillaries, bones and teeth and aids in the absorption of iron.

### Varieties

#### Improved varieties

Arka Saurabh, Arka Vikas, Arka



Ahuti, Arka Ashish, Arka Abha, Arka Alok, HS101, HS102, HS110, Hisar Arun, Hisar Lalima, Hisar Lalit, Hisar Anmol, KS.2, Narendra Tomato 1, Narendra Tomato 2, Pusa Red Plum, Pusa Early Dwarf, Pusa Ruby, Co-1, CO 2, CO 3, S-12, Punjab Chhuhara, PKM 1, Pusa Ruby, Paiyur-1, Shakthi, SL 120, Pusa Gaurav, S 12, Pant Bahar, Pant T3, Solan Gola and Arka Meghali.

#### F1 hybrids

Arka Abhijit, Arka Shresta, Arka Vishal, Arka Vardan, Pusa Hybrid 1, Pusa Hybrid 2, COTH 1 Hybrid Tomato, Rashmi, Vaishali, Rupali, Naveen, Avinash 2, MTH 4, Sadabahar, Gulmohar and Sonali.

#### Climate Requirement

Tomato is warm season crop. Grows well in those regions that are free from frost. It can't be grown successfully in places of higher rainfall. Temperature after tomato crops in following ways.

- Optimum temperature for seed germination is 26 to 32°C.

- The optimum temperature required for its cultivation is 15 - 27°C. At higher temperature its blossoms drops off. The damages great when high temp is combined with dry wind. It will result in the failure of fruit set due to drying of stigmatic liquid.
- Colour development: In tomato red colour is due the pigment Lycopene. Lycopene is highest at 18 to 26°C while production of this pigment

drops off rapidly above 30°C and 'nil' above 40°C.

- Carothene is developed rapidly at high temperature.
- If fruits exposed to direct sunlight, their tops may turn whitish yellow & become leathery in texture. This is common in late varieties during summer season. This condition is known as sun - scald.
- Warm, sunny weather is most suited for proper ripening, colour, quality & high yield.



### Soils

The tomato grows on practically all soils from light sandy to heavy clay. Light soils are good for an early crop, while clay loam and silt-loam soils are well suited for heavy yields. Tomatoes do best in a soil that has a soil reaction from pH 6.0 to 7.0. If the soil is acidic liming is required.

### Seed rate

- For raising the seedlings in nursery bed 300 - 400 g/ha seeds are required.
- Hybrid seeds are very costly so it should be sown in plastic cups or ice cube tray, which require only 70-90 g.

### Time of planting

- Tomato is a day neutral plant so widely it found grown in any season.
- In the northern plains three crops are taken but in frost affected area rabi crop is not fruitful. The kharif crop is transplanted in July, rabi crop in

October - November and zaid crop in February months.

- In the southern plains where there is no danger of frost, the first transplanting is done in December-January, Second June-July Third in September-October depending on the irrigation facilities available.
- Raising seedlings
- Seedlings are grown before one months of transplanting raised beds of 60-100 cm width and of convenient length.
- Soil solarization of nursery bed by covering them with white transparent polythene sheet for one month should be done in hot summer months. It will kill the disease causing organisms like fungus, bacteria, nematode as well as insects and seeds of weeds.

- For one m<sup>2</sup> of nursery area apply 5kg well rotten FYM and 20 g of each N, P and K fertilizer and also apply 2.5g carbofuran or 200 g of neem cake and 10-25 g trichoderma.
- While preparing the nursery beds, neem cake /castor cake/ neem leaf/ castor leaf/ pongamia leaf/ calotropis leaf has to be incorporated @ 400 g/m<sup>2</sup> for protection against nematodes.
- After sowing the seeds, mulch with green leaves and irrigate with a rose-can daily in the morning. Remove the mulch immediately after germination of the seeds. Restrict irrigation one week before transplanting and irrigate heavily on the previous day of transplanting.
- Cover the nursery bed with fine nylon net to escape the damage by virus transmitting insects.

#### Seed treatment

1. Seeds should not be treated with any chemical fungicides or pesticides. Prior to sowing, the seeds should be treated with Trichoderma at the rate of 1 g per 150 g of seeds.
2. The treated seeds are dried in shade for 30 minutes and then sown sparsely along the lines in ½ cm depth and then covered by the topsoil.

#### Land preparation

The land may be ploughed and harrowed 3 or 4 times to obtain a fine tilth. About 10 tonnes of Farm Yard Manure (FYM) or vermicompost/compost @ 1-1.5 t per acre is applied at the last ploughing. Green manuring is recommended for areas with assured rainfall and also for irrigated crop. Beds are prepared against the slope and after levelling the bed, field channels of 50 cm breadth are prepared at intervals of 1 m.

#### Manuring

In order to maintain a fertile soil, organic matter should be added to it regularly. If organic farming is being performed on own land since many years, the soil will have a good nutrient content. Compost / Farmyard manures can also be added to further enrich the soil. Application of organic manure is very important for tomato cultivation. Farm yard manure of 10 t or 1-1.5 t of vermicompost per acre is generally applied. To prevent contamination, FYM can be treated with trichoderma at the rate of 500 g per a tractor load of manure. After mixing the required amount of trichoderma the manure should be allowed to remain in a heap covered with wet gunny bag for proper culturing.

#### Planting material

Tomato is propagated by seeds. Seed selection is an important aspect in organic tomato production. For raising nurseries, seeds of high yielding varieties with tolerance to pests and diseases may be used. They should be carefully selected from certified organic farms or from own seed plot which is raised organically. To start with, chemically untreated seeds from local high yielding varieties could also be used, in the absence of organically produced seeds.

#### Nursery development

In order to grow saplings in the nursery, beds of 1m X 3m are prepared with a height of 20 cm. Twelve to 15 beds are required for raising nursery for planting 1 acre of tomato. Soils are exposed to high temperatures, to prevent possible pest and diseases attack in the plants. After the beds are prepared 20 to 25 kg of farm yard manure along with 1.2 kg Kanranj/Neem cake is applied per bed. After necessary application of water the beds are covered with thin white plastic sheets for raising the temperature without loss of moisture. Such practice will further eradicate harmful bacteria and pests. For cultivation of tomato during Rabi season, seeds should be

sown in the nursery during the month of August/September. The requirement of seed /acre is approximately 150 g. Sowing of the seeds should be done in straight lines drawn at an interval of 5 cm with 2 cm spacing between successive seeds implanted. Seeds are to be planted at a depth of 0.5 cm to 1 cm. After sowing the seed, a thin layer of soil should be used as covering. Then beds should be covered by thin nylon nets keeping a gap of one foot from the bed and fully secured from all sides by placing adequate soil on the borders of the net. This practice will prevent pest infestation in the saplings.

### **Transplanting**

- The transplanting is done in small flat beds or in shallow furrow depending upon the availability of irrigation.
- In heavy soil it is usually transplanted on ridges and during the rains also it is advantageous to plant the seedlings on ridges.
- For indeterminate varieties/hybrids, the seedlings have to be staked using bamboo sticks of two meter length or planted in broad ridge of 90 cm width and 15 cm height. The seedlings are planted in the furrows at a spacing of 30 cm and the plant is allowed to spread on the broad ridge.

### **Spacing**

The spacing recommended for the autumn-winter crop is 75 x 60 cm and for the spring-summer crop 75 x 45 cm.

### **Cultural practices**

Effective, non-chemical weed management begins with well planned, diverse crop rotations, especially those including competitive cover (smoother) crops. Attention is to be given to careful site selection to avoid introduction of weed seeds and other propagules. Weeds are a big nuisance as they take up the nutrients in the soil and can also harbour insects and

diseases that cause harm to tomatoes. These weeds start growing four to five weeks after transplanting the tomato saplings. Hence focus has to be on extensive weed control during this period. Weeds should not be allowed to grow in numbers. Organic weed control can be achieved by using organic matter as mulches as these restrict weed growth. Crop rotation, mulching, sanitation, and shallow tilling also help in controlling the weeds. After transplantation, regular weeding is required to be done to remove harmful weeds from the field. The plants can be provided support with the help of small bamboo sticks to increase the production.

### **Irrigation**

Tomatoes need very careful irrigation that is just sufficient water at the right time. It is necessary to maintain an even moisture supply. During summer season, irrigation at every 5 to 7 days interval is necessary, whereas in winter 10 to 15 days interval is sufficient. A period of drought followed by sudden heavy watering during the fruiting period may cause cracking of fruits.

### **Weed Control**

- There is need of light hoeing during first four weeks in the field which encourage the growth but also remove the weeds from the field. The surface soil is loosened by hand hoeing as soon as it is dry enough after every irrigation or shower. All weeds should also be removed in this process.
- Mulching with straw, black polythene and many other materials has been found beneficial in moisture conservation, in controlling weeds and some diseases.

### **Plant Protection**

#### **Insects**

#### **Gram pod borer (*Heliothis armigera*)**

It is a polyphagous, attacks most of the cultivated crops, major pest of tomato, and widely distributed throughout the country. Young larvae feed on tender foliage, while

advanced stages attack the fruits. Larva bore circular holes in fruits.

#### **Serpentine leaf miner (*Liriomyza trifolii*)**

It is a polyphagous in nature very widely distributed throughout the India. Maggot mines into the leaf and feeds on the mesophyll of the leaves making serpentine mines/galleries.

#### **Tobacco caterpillar (*Spodoptera litura*)**

It is also polyphagous in nature, major pest of tomato, distributed widely. Freshly hatched larvae feed gregariously, scraping the leaves from ventral side, later stages and feed voraciously at night on the foliage. Larvae may also feed on fruits hollowing these out.

#### **Root-Knot Nematode (*Meloidogyne* spp.)**

This nematode has wide host range, widespread all over India, affects most of the vegetable crops, often tomato, brinjal, okra. Root-knot nematodes are small, microscopic, males are slender and females swollen. The most characteristic symptom on the root is production of root galls. Above ground symptoms are reduced growth, chlorosis of foliage, susceptibility to wilting, and reduced fruit production.

#### **Insects Management**

- Two rows of marigold for every 16 rows of tomato can be grown as a trap crop. Marigold flowers attract egg laying of *H. armigera*.
- Spray 5% neem seed kernel extract to kill early stages larvae.
- Placement of 15-20 bird perches (T shaped) per ha helps in inviting insectivorous birds.
- Spray NPV @ 625 LE/ha during evening hours.
- Jaggery @ 1 kg, sandovit or Teepol(100 ml) are to be mixed with NPV on need basis spray 2 ml Endosulfan, Chlorpyrifos or Quinolphos per litre of water

- Application of chopped leaves of Pongamia or Crotalaria reduces disease severity caused by nematode.
- Farmers of the Andhra Pradesh use garlic+ chilly extract and slurry of cow dung + urine for protection against pest and diseases.

#### **Disease**

Tomato is attacked vast range of fungus, bacteria and viruses. The most common diseases are anthracnose, bacterial spot, bacterial blight, bacterial canker, buck eye rot, damping off, early blight, fusarium blight, late blight, leaf curl, mosaic, powdery mildew, rots, and septorial leaf blight. Few major diseases are discussed below.

#### **Bacterial Wilt (*Pseudomonas solanacearum*)**

Deadly disease of tomato. Wilting, stunting, yellowing of the foliage and finally collapse of the entire plant are the characteristic symptoms of the disease. The lower leaves may droop first before wilting occurs.

#### **Damping Off (*Pythium aphanidermatum*, *Rhizoctonia solani*)**

Common in many parts of India, Occurring in nurseries of Tomato, Tobacco, Chilli, Cabbage, Cauliflower, Brinjal and Cucurbits. Young seedlings are killed before they emerge through the soil surface or collar region of grownup plants get rotten and toppling of small plants are seen in nursery bed.

#### **Early Blight (*Alternaria solani*)**

Common disease of tomato occurring all over India. The characteristic leaf spots and blight first becomes visible as small, isolated, scattered pale brown spots on the leaf which later on also develop on stem and fruits. Fully developed spots are irregular, brown to dark brown in colour, and with concentric rings inside the spot. In severe attacks the entire plant may be defoliated.

#### **Wilt (*Fusarium oxysporum* f.sp. *Lycopersici*)**

It is a worst disease of tomato occurring all over India. First symptoms appear as chlorosis of the leaf. Soon the petiole and leaves droop and wilt. When plant roots and basal stems are split open dark brown or black discoloration of the vascular tissues may be seen.

#### **Tomato Mosaic Tobacco mosaic virus, Cucumber mosaic virus**

The common symptom of mosaic is mottling of the leaves. The normal green colour of the leaf is interspersed with light green to pale yellow islands of irregular patches. The edges of the leaf turn downward and are stiffer than those of a healthy leaf.

#### **Powdery Mildew (*Leveillula taurica*)**

A light powdery covering of the lesions may occur on the lower surface. Heavily infected leaves die but seldom drop from the plant.

#### **Septoria Leaf Blight (*Septoria lycopersici*)**

It is a Major disease of tomato throughout India. In young plants numerous spots appear on older leaves or on plants with poor growth. Small, circular spots are first observed as water soaked areas on the under surface of the lower leaves. As the spots enlarge, they develop dark brown marking and sunken, white or grey centres.

#### **Rots**



#### **Harvest/storage**

- Leave your tomatoes on the vine as long as possible. If any fall off before they appear ripe, place them in a paper bag with the stem up and store them in a cool, dark place. If

#### **Black mold rot (*Alternaria alternata*, *Stemphylium botryosum*)**

Sunken or slightly flattened lesions with water soaked in appearance occur on fruits. Soon these lesions become brown to black in colour. Tomato fruits coming in contact with the soil are attacked by soil-borne fungi causing rotting of the fruits.

#### **Disease Management**

- Soil solarization or partial sterilisation of the soil by burning trash on the surface
- Seed treatment with trichoderma 5-10g or carbendazim 2g or thirum3 g/Kg seed.
- Field sanitation
- Crop rotation with non-solanaceous
- Providing better drainage, forming raised beds
- Uproot the heavily infected or virus infected plants
- Sanitation and crop rotation reduces the disease incidence
- Spraying the plants with a mixture of Streptocycline 200 ppm and Copper oxychloride 3g per litre of water gives fairly good control of the disease.

temperatures start to drop and your tomatoes aren't ripening, watch this video for tips.

- Never place tomatoes on a sunny windowsill to ripen;

they may rot before they are ripe.

- The perfect tomato for picking will be firm and very red in colour, regardless of size, with perhaps some yellow remaining around the stem. A ripe tomato will be only slightly soft.
- If your tomato plant still has fruit when the first hard frost threatens, pull up the entire plant and hang it upside down

in the basement or garage. Pick tomatoes as they redden.

- Never refrigerate fresh tomatoes. Doing so spoils the flavour and texture that make up that garden tomato taste.
- To freeze, core fresh unblemished tomatoes and place them whole in freezer bags or containers. Seal, label, and freeze. The skins will slip off when they defrost.

## Know your biodiversity

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### *Cedrus deodara*



*Cedrus deodara*, the state tree of Himachal Pradesh is one of the most important conifers in the Himalayan moist temperate forests. The tree belongs to Order Pinales and Family Pinaceae. The tree is commonly known as deodar, cedar and Himalayan cedar. The botanical name as well as English name “*Deodara*” derived from Sanskrit name “*devadaru*” which means “woods of the Gods” and thus *Cedrus deodara* is significant trees for religious purposes.

*Cedrus deodara* is a native species to Afghanistan, China, India, Pakistan and Nepal. In India it is commonly found in Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh, Sikkim, Arunachal Pradesh and Darjeeling region of West Bengal and occupies total area approximately 203,263 hectare. It grows between 1700-3000m elevation in western part and between 1300-3300m in eastern part. At higher elevations the plant species forms a conifer forest belt with other species viz. *Abies pindrow*, *A.spectabilis* in Nepal, *Pinus*

*wallichiana*, *Picea smithaina* and *Cupressus torulosa* etc in India.

*Cedrus deodara* is an evergreen tree and attains height up to 60 meter in general. Branches and branchlets are horizontal, shoots are pedunculated, and tips are slender and nodding. Trunk is straight and thick. Top branches are smaller than that of lower ones. The leaves are needle like sharp and dark green in color. These are in cluster of 30 and size varies from 2.5- 5cm in length. Bark is grayish or reddish brown with vertical and diagonal fissures. The plant is monoecious i.e male and female cones appear on separate branches. Male cones are numerous and 5-12cm in size, erect, solitary, cylindrical at the end of leaf. Female cones are barrel-shaped and borne singly at the tip of dwarf shoots. They are cylindrical and 2.5-4.5 cm. in length. Fruits are oval shaped and 3-6 inches in length and 3-4 inch broad. Flowers are bisexual and appear in the month of September and October. Seeds are triangular, winged, 2.5- 3.7 cm long and rounded. The apex of the cone is rounded and reddish brown in color at the time of ripening and its covering becomes hard or dry. These cones get matured in early winters. Life span of Deodar is approximately 600 years.

*Cedrus deodara* provides an excellent fuel wood and it is an important timber tree. Its wood is highly valuable and extensively used for building, railway sleepers, carriage and railway wagon work and other purposes for which durability is

required. It is also used in house building, beams, floorboards, door and window frames, furniture etc. It also produces quality plywood and also known for its historical uses as used since ancient times. The wood is considered as sacred and thus prefers to construct religious temples. Essential oils extracted from deodar have been used as antiseptics, against tuberculosis and inflammatory diseases. Its oil and extracts are used as insecticides and herbal remedies against many animal diseases in India. Deodar also has an antifungal property and has some potential for control of fungal deterioration. The herbal pesticide "pesto ban" is a liquid concentrate of three Indian medicinal plants which includes *Cedrus deodara* as a main ingredient. Beside this it is also a soil conservation and erosion control species in the Himalayas.

According to IUCN Red List *Cedrus deodara* comes under Least Concerned category.

But the overall population trend seems to be decreasing due to intensive legal and illegal logging which is a major threat to *Cedrus deodara*. Deforestation and conversion of forests for agriculture also pose threats in some parts of Pakistan and India. Despite the familiarity of this tree in India since ages, this species has sought very little attention in forestry. Not only this, the young plants are damaged by snow, fire and browsing by goats. Among wild animals, bears, porcupines and monkeys are the most injurious. *Rosa moschata* scrambles into the crowns of young trees of this species and suppress them. Among parasitic fungi, *Fomes annosus* and *Peridermium cedri* are injurious, causing its mortality and formation of witches' brooms on the trees. *Pestalotiopsis cryptomeriae* fungus causes

leaf blight on young trees, whereas *Ploioderma cedri* causes foliar infection and premature defoliation in plantations. An epidemic defoliator *Ectropis deodarae* has been reported to cause complete defoliation in this species. Forest fires are also a threat to the species as it damages young plants and also to fully grown trees. Deforestation now become a great social and national evil and should be checked on priority basis. Thus there is an urgent need to take proper conservation methods to save this important tree which benefits us by every means before it falls under threatened category

#### *Pheretima posthuma*



*Pheretima posthuma* commonly known as Earthworm is an invertebrate have long, stretchy segmented body. It belongs to order Haplotaxida and family Megascolecidae. The earthworms are cosmopolitan, except in polar or dry climates. They occur in moist temperate soils and many tropical soils. The earthworms are abundant in New Guinea and parts of South East Asia. They generally inhabit an upper layer of earth to a depth of about 30 to 45 cm. The rainy season is the most favorable period for the earthworms as during this season they live in the superficial soil of the earth and they often seen in abundance.

Earthworms are long, elongated, cylindrical narrow body which is bilaterally symmetrical. The body of

earthworm is slimy to touch and glistening dark brown color due to the presence of a pigment porphyrin in its skin. The life span of *Pheretima posthuma* varies from 3-10 years. An adult worm measures about 15-30 cm in length. The body is made of 100 to 120 segments, of which the first segment is divided into an anterior prostomium and posterior ring-like peristomium. Segments 14-16 form a girdle-like thick band of glandular tissue called clitellum that secretes mucus, albumen and cocoon inside which eggs are laid. All segments of body except the first, last and clitellum have chitinous setae embedded in each segment. These setae are used for anchoring and also help in locomotion. The alimentary canal is a straight tube. Mouth opens into buccal cavity that leads into pharynx in segments 3 and 4, followed by oesophagus that leads to a thick-walled, muscular gizzard in which food is grounded by muscular contractions. The salivary glands secrete mucin which lubricates food and protease which digests proteins. The stomach lies in segments 9-14. The intestine is wide tube and is divided into pretyphlosolar region in segments 15-26 and post-typhlosolar region after segment 26. The role of the typhlosole is to increase the surface of absorption. The glandular cells of intestine secrete pepsin, trypsin, amylase, lipase and cellulase. Undigested food and soil are eliminated through anus to the outside in the form of castings. Nephridia are the excretory organs of earthworm, which are of three types, namely, septal, integumentary and pharyngeal.

*Pheretima posthuma* commonly live in soil, rich in dead organic matters. They

are also common in agricultural fields where they increase the productivity of crops. Earthworms lie in the burrows during the day and come out at night for food. They only leave the burrow only during the rainy season when their burrows are flooded with water. The typical earthworm diet is decaying matter, humus, leaf litter, microbial fungi, and other microscopic organisms.

The earthworms are monoecious or hermaphrodite but protandrous, i.e. their testes mature earlier than ovaries to avoid self fertilization. The belt-like swollen area on the earthworm's body is called a clitellum. It secretes a slimy substance that forms capsules which protect the eggs. Inside the cocoon 4-20 eggs mature and taking between 60 to 90 days to hatch, depending on environmental factors such as humidity and temperature. Young worms come out of the cocoon after complete development. An earthworm takes up to a year to fully mature, and in the wild they can live from 4 to 8 years. July to October is the breeding season of earthworms.

Earthworms are important to the environment, breaking down organic matter and passing it through their gut as newly enriched soil. An earthworm has no teeth, so it swallows grit to help grind food in its multi-chambered gut. As an earthworm burrows and feeds, it aerates the soil and adds nutrients from deeper soil layers to upper layers, making easier new plant growth in the process. For this reason, they are valued by farmers and gardeners worldwide. These earthworms are used in vermiculture, the practice of feeding organic waste to earthworms to decompose food waste. Worm castings are a high-quality, excellent garden fertilizer.

They are ideal for organic gardening and contain microbes, bacteria and organic matter. Worms also make a great bat, fish food. The earthworm's burrowing creates a multitude of channels through the soil and is of great value in maintaining the soil structure, enabling processes of aeration and drainage. Many people earn their livelihood by catching these worms and supply to scientific laboratory. Ayurvedic and Unani system of therapy suggest these worm uses making medicine for cure diseases like bladder stone, jaundice, pyorrhea, piles etc.

These days' people are more relying on inorganic fertilizers instead of bio-fertilizers to get more quantity based crops and as a result continued use of these inorganic fertilizers disturb the entire natural biotic environment and affects the soil structure, which ultimately affects the populations of earthworm. Not only this, most of the species habitat are converted from forest to pasture land and as a result the range of its population has decreased. Earthworm is vulnerable to habitat deterioration due to its low recruitment rate and poor dispersal ability. Though *Pheretima posthuma* is not yet evaluated under IUCN red list, it can come under threatened category due to agricultural expansion, changes in drainage, urbanization, chemical pollutants from pesticides and herbicides. These threats lead to disturbance in its population. Earthworms are significant ecosystem engineers and are an important component of the diet of many vertebrates and invertebrates, so the ability to predict their distribution and abundance would have wide application in ecology, conservation and land management. The fact that

*Pheretima posthuma* contribute to a well balanced ecosystem and for this reason it also called as Farmer's friend, it is only natural that we take steps to conserve earthworms as it plays important role not only in ecology but in every aspects which benefits mankind.

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