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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

The ancient Romans cultivated roses, violets, and borage for culinary use. Today, edible flowers are a popular way to add color, texture, scent, and flavor to foods. There are only two important things to remember about edible flowers: First is that not every flower is edible. In fact, some flowers can be poisonous. So stick with flowers on the list below, or do sufficient research to ensure your safety. The second caution is to avoid flowers that may have been sprayed with an insecticide, fungicide or herbicide. Because most edible flowers—except for roses—are easy to grow, this is rarely a problem. Be sure to take dandelions off the list unless you have an organic lawn

Flowers have formed part of our diet for thousands of years. Chinese cooks were experimenting with edible flowers as far back as 3,000 B.C.E. and the Romans used violets and roses in their food as well as lavender in sauces. The practice is still going strong today, with many restaurants using petals to add a unique flavour and appearance. The most common (and safest edible flowers) are nasturtium, pansy, violet, Johnny-jump-up, calendula, chive, and sage. These flowers are easily grown without the use of chemicals or pesticides. Many roses are delicious, but you need to be sure they are grown organically. A good rule of thumb is: If you cannot positively identify a flower as edible, don't eat it. Also, if you have asthma, hayfever, or other allergies, do not eat flowers.

In line with the above this issue of Van Sangyan contains an article on Edible flowers: An alternative to nutritional security. There also useful articles viz. Seed collection, processing and nursery techniques for Sterculia urens Roxb. – An important NTFP tree in central India, गेहूँ फसल के प्रमुख रोग एवं प्रबंधन, Grewia Optiva Drummond: An autobiography, Impact of the weather pattern on population growth of insect pests of Teak (Tectona grandis) and potential damage of the host in central India and मोबाइल टॉवर विकिरण एवं पर्यावरण.

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. Pawan Rana
Scientist 'E' & Chief Editor

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Edible flowers: An alternative to nutritional security

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Introduction

Edible flowers, which have been used in the culinary arts for centuries, are experiencing renewed popularity. Flowers can serve as an essential ingredient in a recipe, provide seasoning to a dish, or simply be used as a garnish. Edible flowers add a boost of colour, flavour and texture to sweet and savoury dishes. They can lift the look of the simplest dishes, such as the side of a cheese board, or add



Fig. 1: Edible flowers

an elegant finishing touch to a beautiful wedding cake. It's not all about fancy aesthetics though. Edible flowers should be treated as ingredients in their own right (they also pack a powerful medicinal punch too with the likes of hibiscus being full of antioxidants and calendula aiding digestion). Most edible

flowers have distinctive flavours that can really enhance the taste of a dish be it sweet or savoury. Edible flowers are used in many different styles of cuisine and can be found on menus all over the world. Not all flowers are safe to eat, but those that are can offer a unique burst of flavour and colour in many dishes, including salads, sauces, beverages and entrées. Some of them may even offer health benefits.

The history of edible flowers

Edible flowers might be the latest foodie trend on *Instagram* but they're hardly a fad. The art of cooking with flowers has been around for many centuries. The ancient Greeks used violet petals in their wine, the Romans were partial to cooking with roses, as too were the Ottomans-hence their love of Turkish delight. The flower-obsessed Victorians were also big fans of edible flowers- adding violets, primroses and borage to their salads.

Production Considerations: While producing flowers for consumption purpose, following things must be kept in mind.

Plant selection

Many commonly cultivated annuals and perennials can be raised for their edible flowers. Because some flowers are edible but not palatable and others may be poisonous, it is important that only those known to be edible should be grown for this purpose. Differences in edibility may also exist between cultivars of the same

species. Common garden plants with poisonous flowers include anemone, autumn crocus, calla lily, daffodil, delphinium, foxglove, hyacinth, hydrangea, iris, lily of the valley, morning glory, ranunculus, sweet pea, and wisteria. Some popular edible flowers include chrysanthemum, daylily, lilac, mint, nasturtium, pansy, rose, tulip, and violet. Blossoms from various vegetable and fruit crops are also enjoyed for culinary purposes.

Site selection and planting

The cultural requirements for edible flowers are very similar to those of ornamental flowers. In general, edible flowers prefer fertile, well-drained soil and full sun throughout the day. Many producers prefer growing plants in raised beds to improve drainage and increase ease of harvest. A soil test is recommended before planting. Two to 3 inches of mulch will help to reduce weed pressure, maintain soil moisture and temperature, as well as reduce soil splashing in heavy rains. A source of water for irrigation is essential to production. Trickle or drip irrigation is preferred to overhead irrigation since keeping the foliage dry reduces the incidence of fungal and bacterial diseases.

Planting dates depend on the market and type of plant being grown. Annuals are planted as soon as danger of frost has passed in the spring and staggered plantings are common. Because transplants come into flower sooner than direct-seeded plants, growers may choose to use transplants to capture the early market and then direct-seed later plantings. Transplants can be started in a greenhouse or cold frame. Perennials, such as daylily, should be planted in late summer or fall for the best yield of blooms.

Pest management

Buyers of edible flowers will want their product to be free of diseases and insect pests. This could present a challenge since edible flowers must be grown without the use of any chemical pesticide. Insect control consists of hand picking harmful insects and the use of beneficial insects to help decrease insect populations. Following good cultural practices and diversifying plantings will aid in the control of both insect and disease problems. Weed control is critical since weed competition not only reduces plant quality and quantity, but also raises labour costs by increasing the time required for harvest.

Harvest and storage

Edible flowers are harvested in the cool of the day during the peak of bloom. Only flowers free of insect and disease problems should be selected. Generally, unopened flowers or those past their prime are not suitable. To maintain freshness, flowers should be cooled immediately after harvest.

The stems, sepals, pistils, and stamens of most flowers are removed prior to use. Pollen may detract from the flower's flavour and may cause allergies in some people. The sepals should be removed from all flowers except violas, pansies, and Johnny-jump-ups. In many flowers (including rose, lavender, tulip, calendula, and chrysanthemum) only the petals are edible. If the petals have a white base, this area should be removed as it may have a bitter taste. For example chrysanthemum, dianthus, marigold, and rose have bitter petal bases. To produce value-added flower products, the flowers must be dried or utilized immediately after harvest. Flowers can be used in a number of products to add aesthetic value in addition

to flavour. As a general rule, flowers from herbs have a flavour similar to the leaves and may be used in the same way. Candied flowers are prepared by painting each petal with pasteurized egg white, then sprinkling with granulated sugar. Once the sugar has crystallized, flowers are stored in an airtight container.

Labour requirements

Edible flower production is labour and management intensive. Planting, weeding, and harvesting all require trained labour. Since an edible product is being handled, extra time and care will be needed to transport the product from field to market. Packaging different edible flower varieties and/or colours together will require additional packing labour.

Suggestions for using edible flowers

1. Do not consume flowers bought from retail outlets unless you can confirm they have been grown without chemicals.
2. Grow them yourself or buy from a certified organic grower.
3. Start with small quantities to avoid possible allergic reaction.
4. Although flowers may be edible, they may not be palatable.
5. Eat only the parts known to be safe. The other parts of several plants are poisonous.
6. Wash as thoroughly as possible.
7. Do not eat flowers picked from roadsides due to poisonous car exhaust emissions.
8. Flowers grown by most florists, greenhouses and nurseries have been treated with fertilizers and pesticides and should not be consumed.
9. Do not eat any flower you do not know for sure is edible. Consult a specialist.
10. Remove pistils and stamens-eat only petals in most cases.

Flower prepping tips

When cooking with or serving edible flowers, clean them by washing them gently in a large bowl of cold water and letting them air dry on a paper towel. Use them immediately or store them in the refrigerator for up to a week in an airtight container lined with a damp paper towel.

Details of some popular edible flowers with health benefits

Rose: There are over 150 species of roses available in almost any imaginable size and colour. The best part is that they're all edible. However, roses don't all taste the same. Roses petals have a very aromatic, floral and slightly sweet flavour. They can be eaten raw, mixed into various fruit or green salads or dried and added to granola or mixed herbs. Fresh rose petals can also be muddled and added to liquid to create rose-infused beverages, jams and jellies. Chopped rose petals added to sugar or butter give a unique zing to otherwise ordinary ingredients. Like many other edible flowers, roses may offer health benefits. Some research suggests that certain compounds in roses may play a role in reducing anxiety and promoting relaxation. While roses have a strong floral scent, their flavour is quite subtle and fruity. Roses lend themselves well to everything from soups and salads to teas, jams, and desserts like this delicious strawberry, pomegranate, and rose petal treat. Gulkand is a sweet preserve of rose petals, used as flavouring in many parts of South Asia. It is prepared using special pink rose petals and is mixed with sugar.

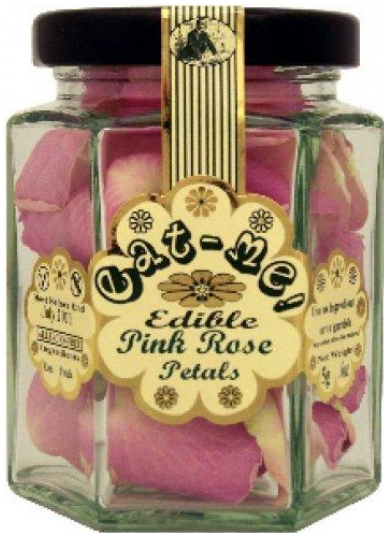


Fig. 2: Rose petals and gulkand

Hibiscus

Hibiscus plants produce large, ornate blossoms that usually grow in tropical and subtropical climates around the world. Although sometimes grown for strictly ornamental purposes, hibiscus is also well known for its culinary and medicinal applications. You can eat the flower straight from the plant, but it is usually used for tea, relishes, jam or salads. Many cultures drink hibiscus tea for its medicinal properties. Some studies indicate that hibiscus may help reduce blood pressure and cholesterol levels, although more research is needed to better understand how hibiscus can support heart health. The tea is bright red and has a tart, somewhat sour flavour. It may be served hot but is particularly refreshing over ice on a hot summer day.



Fig. 3: Hibiscus flower

Nasturtium

It is a culinary favourite because of its brightly coloured blossoms and unique, savoury flavour. Both the leaves and flowers of nasturtium are edible and may be enjoyed cooked or raw. They feature a peppery, slightly spicy flavour profile, although the blossoms themselves are milder than the leaves. The funnel-shaped flowers are typically bright orange, red or yellow. They make a beautiful garnish for cakes, pastries and salads. The leaves are round and resemble small lily pads. They're tender enough to be used as salad greens or blended into pesto. Nasturtium is



Fig. 4: Nasturtium flower

not only a versatile and eye-catching ingredient but also nutritious containing a variety of minerals and health-promoting compounds with antioxidant and anti-inflammatory effects. These gorgeous flowers have a slightly peppery taste, almost like watercress, which makes them

perfect for summer rice paper rolls like these.

Dandelion

Dandelions are best known as stubborn garden weeds. However, they happen to double as a highly nutritious edible flower. Dandelions have small blossom roughly 1-1.5 inches (2-4 cm) in diameter with many tiny, bright-yellow petals. They supply various plant compounds known to have powerful antioxidant properties. Interestingly, the flowers are not the only part of dandelion that can be eaten. In fact, every part of this so-called weed can be enjoyed including its roots, stems and leaves. There are endless options for eating dandelion. The flowers can be eaten raw, either alone or tossed into a salad. They may be breaded and fried or used to make jelly and wine. The roots are often steeped to make tea, while the greens may be consumed raw as a salad or a sandwich topping. They can also be cooked in stews, casseroles or any other dish that calls for hearty greens.



Fig. 5: Dandelion flower

Lavender

It is a woody, floral herb originally grown in parts of northern Africa and the Mediterranean. The violet flowers are very small but plentiful. Lavender is probably best known for its distinctive fragrance, which is acclaimed for its calming effects. The combination of colour and aroma make lavender a particularly desirable

addition to a variety of foods, including baked goods, infused syrups, liqueurs, herbal teas, dry spice rubs and herb mixtures. Its flavour pairs well with both sweet and savoury ingredients, including citrus, berries, rosemary, sage, thyme and chocolate. When cooking with lavender, it's best to start with a small amount and increase slowly until you achieve the desired flavour, as it can quickly become overpowering.



Fig. 6: Lavender flower

Honeysuckle

Almost 200 honeysuckle species exist, but the most common are the Japanese and woodbine varieties. The fragrant blossoms, typically light yellow or white, hold nectar that can be eaten straight from the flower. Honeysuckle has been vital to traditional Chinese medicine practices for centuries. The flowers and their extracts are ingested or applied to the skin to treat various inflammatory conditions. However, its efficacy as medicinal therapy for humans remains scientifically unproven. In the culinary world, honeysuckle is most often used to make tea or fragrant flavourful syrup. You can use the syrup to sweeten iced tea, lemonade, yogurt and sorbet or as a sugar replacement in quick bread recipes. While the honeysuckle flower and its nectar are perfectly safe to eat, note that the berries of some varieties may be toxic if ingested in large quantities.



Fig. 7: Honeysuckle flower

Starflower

It is an herb that produces delicate, star-shaped flowers. The blossoms are usually blue but may also be white or pink. In herbal medicine, borage is used to treat minor ailments, such as sore throat or cough. However, human research to support its efficacy as a medical therapy is scarce. In the kitchen, there is no shortage of ways to put borage to use, as both the flowers and leaves are edible. The flowers are often described as having a slightly sweet flavour that is reminiscent of cucumber and honey. The flowers may be eaten fresh in a salad or as a garnish for desserts and cocktail or they may be cooked and added to soups, sauces or stuffed pasta fillings. Borage can also be served as a stand-alone vegetable side dish.



Fig. 8: Star flower

Purslane

It is a succulent that produces tiny, yellow flowers and thick, fleshy leaves, both of which are edible and may be eaten cooked or raw. Historically, purslane was considered no more valuable than a garden weed. However, this little plant has recently soared in popularity due to its rich nutrient content. It's filled with vitamins, minerals and antioxidants, but its biggest claim to nutritional fame is its omega-3 fat content. In fact, purslane provides more omega-3s than almost any other vegetable of its kind. The flowers and leaves of purslane can be served raw in many salads and sandwiches. They may also be sautéed or steamed with other vegetables as a side dish or added to your favourite soups. One may even consider trying this plant battered and fried.



Fig. 9: Purslane flower

Squash Blossom

Although these blossoms form on all types of summer squash, the most popular come from zucchini. Zucchini flowers are bright yellow with a long, rounded bell shape. These flowers can be eaten raw as a garnish or chopped and added to salads. If you're feeling indulgent, another delicious option is to stuff the blossoms with herbed cheeses and fry or bake them until the delicate petals become crispy. Only the female blossoms can turn into squash, so stick to eating the male flowers to ensure a full harvest. The male flowers have a long,

thin stem and typically grow around the outer edges of the plant. Female flowers tend to grow closer to the plant's centre and have a small, bulbous fruit at the base of the blossom where it meets the stem.



Fig. 10: Squash blossom

Pansy

Already quite pleasant to look at, pansies are equally pleasant to eat. Pansies have small blossoms, measuring about 2-3 inches (5-8 cm) in diameter. They exist in many colours, but hues of purple, blue and yellow are most common. They have five overlapping petals with a dark area in the centre that resembles an ink stain. Typically, pansies have a mild, fresh and lightly floral flavour, although there is some flavour variation depending on the type. Because pansies can have so many colour variations, they make an excellent decorative addition to desserts, such as pastries, cakes and cookies. For a simpler preparation, pansies can be finely chopped and added to a simple green salad for a pop of colour and texture. Aside from being a unique addition to a meal, pansies are also a rich source of several potent plant compounds known to have antioxidant and anti-inflammatory properties. It also has a slightly grassy even minty flavour, so they work well in herb-flavoured summer cocktails and fruit salad.



Fig. 11: Pansy flower

Chamomile

It is a floral herb used in cooking and traditional medicine for centuries. Medicinally, chamomile is often consumed to reduce anxiety and improve sleep quality. The flowers closely resemble daisies, albeit much smaller. They lend a slightly sweet, earthy flavour to the foods they're cooked with. The leaves and flowers are usually dried first but can be used fresh. While most often utilized for chamomile tea, the blossoms can also make syrups or other infusions for baked goods, smoothies or desserts. The sweet flavours of chamomile flowers add a cheerful, summery flavour to far more than your morning tea.



Fig. 12: Chamomile flower

Calendula

Known as the "poor man's saffron," the sunset-hued marigold flower really does

taste like saffron when it's sautéed in olive oil to release its flavour.



Fig. 13: Calendula flower

Marigolds

Marigolds are vibrant, all-purpose flowers that offer a splash of colourful sunshine for summer salads. Lutein extracted from the marigold is used as poultry feed to enhance the Vitamin A content of the egg yolk.



Fig. 14: Marigold flower

Marketing and Market Outlook

Edible flowers can complement a cut flower or herb business, providing additional opportunities for value-added products. However, they require a specialized niche market that may take some time to develop. Flowers intended for human consumption must be grown without pesticides, providing organic growers a production edge. Plant material obtained from most commercial florists, garden centres, and nurseries is not pesticide-free and, therefore, is NOT suitable for consumption. Flowers may be

marketed fresh, dried, candied, or in pre-packaged salads. Market research conducted in Michigan indicates that packaging different colours and varieties of fresh edible flowers in the same container appeals the most to consumers. Including varieties with more appealing fragrances in the mix also encourages positive consumer reaction. Value-added products that feature edible flowers offer additional marketing opportunities. Minced flowers make a colourful and flavourful addition to herbal butters, cheese spreads, jellies, and jams. Dried flowers could be used in teas or to add flavour to wines.

Potential growers could talk to upscale restaurant chefs and caterers. Because edible flowers are highly perishable, growers must be willing to frequently (usually daily) deliver smaller quantities to restaurants. Fine bakeries may be interested in candied flowers. Growers will need to be able to demonstrate an ability to provide a dependable supply of consistently high quality product to meet buyer demand. Expanding to a colourful and diverse range of edible flower varieties is a way for a producer to increase offerings to existing customers. Retail marketing through farmers markets is also a viable option. Fresh edible flowers or value-added edible flower products have the potential to perform quite well in some markets. Interested growers should visit local farmers markets and consult with their County Extension Service to determine the market potential of edible flowers in their area.

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Seed collection, processing and nursery techniques for *Sterculia urens* Roxb. – An important NTFP tree in central India

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About the species

Sterculia urens Roxb. belongs to the family Sterculiaceae. It is also known as 'Kullu'. *Sterculia urens* is a moderate-sized to large deciduous tree attaining a height of 9 m and a girth of 2.4 m where it is usually found at elevations from 300 - 750 m. It usually grows in areas with a distinct dry season. *S. urens* is distributed in the northern and southern tropical dry deciduous forests. It prefers a pH in the range 6 - 7, but tolerates 5.5 - 7.8. It extends from the Ganges eastward to West Bengal while in the South it mainly occurs in the dry hills of Western Ghats and to the limited extent in Eastern Ghats. *S. urens* is resistant to drought and can grow in rocky stones, as well as shallow and ferruginous well-drained soil (Kumar, 2016; Kumar and Desai, 2016).

Sterculia urens is commercially important and valued for its gum called 'gum-karaya' or 'Indian tragacanth', a complex carbohydrate used in petroleum, paper and pulp, leather, printing, textile, cosmetics, confectionary, food and dairy industries. It is also used in preparation of varnishes, inks, rubber, oil cloth, polishes and engraving processes. In pharmaceutical industries, it is used as an ingredient in emulsions, lotions, denture fixative powders, medical adhesive tapes. Gum karaya used in foodstuffs as emulsifiers, stabilizers and thickeners. Seeds are eaten after roasting. Seeds and young tender roots are eaten in times of famine. The

bark can be stripped off easily and yields a useful fibre suitable for making coarse cloth and bud ropes (Kumar et al., 2013).

S. urens is also source of income for tribes and forest-dwellers. Its wood can be used for furniture, frames and other products after proper seasoning. India is the main producer of gum-karaya, most of which is exported. The trees can be tapped for their gum about 5 times during their lifetime (Yesodharan and Sujana, 2007).

Flowering and fruiting habit

Trees shed leaves in November-December and remain leafless till about May. New leaves appear from April-June. The flowers appear from December to March, the panicles borne at the ends of leafless branches. The follicles ripen about April-May and split in hot and dry weather dispersing the seeds in rocky hill slopes causing the collection difficult.

Seed collection

Fresh fruits are collected from the trees. Pods should be collected at 53-57 days after a thesis in last week of April and 1st week of May, when the pod colour is yellowish green and pod colour is mostly black and grey. The collection method is to spread a tarpaulin under the tree and collect the fruits by lopping the branches or plucking. After collection seeds should be extracted from the pods and white and brown seeds should be discarded just after collection, as some may turn gray under ambient condition and therefore become indistinguishable from high quality gray

seeds. After collection, black and gray seeds should be dried under shade to attain maximum quality. There is about 5300 seeds kg⁻¹ (Chacko et al., 2002).

Processing and storage

Seeds are extracted from the pods manually before drying in shade. Seeds of *S. urens* can tolerate desiccation to 4-5% moisture content; hence seeds are of orthodox type. Seeds will remain viable at least for 2 years, if stored 4-8%. In moisture content 10% and above, seed germination decreased if stored above 15°C. Seed viability can be maintained up to 3 years at 15, 5 and 0° C (Subhashini Devi et al, 2012).

Nursery Technique

Germination can be improved by removing two layers of seed coat (grey and white). Seeds are filled in cloth bag and rubbed to remove the two layers, and then the seeds are washed and dried in shade. The best temperature for germination was 35° C. Germination was reduced at 40° C. No germination was observed at 45° C. The seeds germinate in all light conditions. However germination is slightly reduced in dark condition. The seeds germinated well in clayey and mixed soil. Germination is prevented in sandy soil. The seeds germinated best on surface of the soil. Seeds sown at depth of 4 cm had reduced germination capacity.

The species can be raised by direct sowing in lines 30 cm wide and 1.8 m apart. One or two-rows of seeds may be put along the centre of each line. Seeds may be sown in patches at an escapement of 1.8 m x 1.8 m with about 3 seeds in each patch. Sowing is done soon after collection in May-June at the break of rains. Germination takes place in 10 – 15 days. The species can be best raised by planting nursery raised entire plants with

balls of earth or bagged plants. In Jabalpur, 4 month seedlings having a height of 4.5 cm were successfully raised in trial plantations with high survival percentage.

The seedlings should be planted during the onset of rains in June-July in well-drained pits or on berms of contour trenches. Water logging conditions should not be created, as the species is intolerant of even temporary water-logging. Seedlings may die-back for 2-3 years under adverse conditions until a stout shoot is thrown out. The period of establishment in the field can be reduced by applying chemical fertilizers, 25 gm of a mixture of ammonium sulphate and superphosphate per plant applied in 2 dosages, the first after 10 days of planting and the second after one month after the first application in rainy season (Anon, 1981).

The seedlings and saplings are damaged by fire, so clear weeding around the plants is desirable. The seedlings are also liable to damage by cattle, sambhar, chital and rodents therefore protection is necessary.

Propagation

Matured Seeds have been collected and dried in the month of May. These seeds were sown in the nursery. Around 4 kg of seeds were sown on 22 primary beds. After the 4th day of sowing seed, sprouting was observed. In the species, radicle emergence was noticed within 5 days period, and plumule emergence was noticed within 6-7 days period. Germination starts after 8 days. Seedlings of 3 weeks old were transplanted into the polythene bags. It was found that few days old seedlings transplanted into polythene bags resulted in 80% percentage of survival.

Regular watering, providing thatched shade helped for the above 80% of

survival rate both in primary beds and secondary beds. During the radical emergence a small bulb like structure is formed on the radicle. These bulbs become a tuber when the species growth increases. The tuber is developed just below the collar region. It has been observed that

the *Sterculia urens* seedlings did not tolerate water-logged conditions. However, two to three months old seedlings can withstand drought conditions. It is suggested that, about 150 g seeds sown in 1x1 m bed will give better seedling growth in the nursery.

Sterculia urens



S. urens flower



S. urens bark



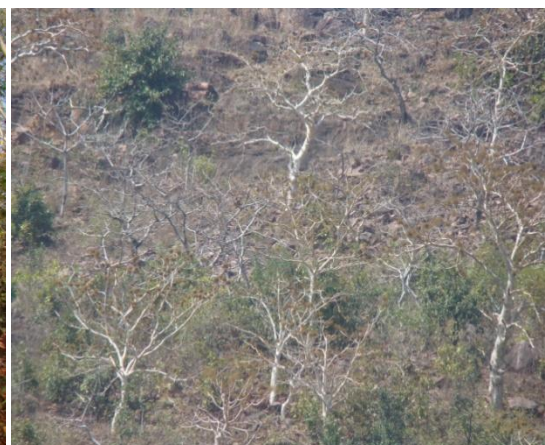
S. urens seeds at different maturation stage



Flowering branch of *S. urens*



S. urens plantation



S. urens in natural forest

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गेहूँ फसल के प्रमुख रोग एवं प्रबंधन

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गेहूँ दुनिया में सबसे ज्यादा उगाये जाने वाला फसल है। भारत में यह धान के बाद दूसरा सबसे ज्यादा उगाये जाने वाला फसल है। गेहूँ कार्बोहायड्रेट का महत्वपूर्ण स्रोत है, इसमें प्रोटीन की मात्रा 13 % है, इसमें विटामिन - ए, सी, सेलेनियम, मैंगनीज के अतिरिक्त डाइट्री फाइबर भी पाए जाते हैं जो इसे सुपाच्य बनाते हैं। शोध के अनुसार यह पाया गया है कि गेहूँ में रोग लगने से उसकी उत्पादकता 20 से 25 % की कमी हो जाती है। जिस तरह मनुष्य में रोग होने से उनके काम करने की क्षमता घट जाती है उसी तरह पौधों में रोग होने से उसकी उत्पादकता और गुणवत्ता में कमी हो जाती है और अगर रोग का सही समय पर प्रबंधन ना किया जाये तो इससे होने वाली छति और बढ़ जाती है। रोग ग्रस्त पौधे टेड़े - मेढ़े और छोटे होते हैं, पत्तिया झुलसी हुयी होती है और अनाज की बालियां टेड़े - मेढ़े होते हैं जिसके फलस्वरूप इनकी उत्पादकता काफी कम हो जाती है।

गेहूँ के प्रमुख रोग एवं उनके प्रबंधन

आल्टानेरिया पत्ती अंगमारी / आल्टानेरिया पर्ण झुलसन

यह रोग बहुत ही महत्वपूर्ण है। यह रोग आल्टानेरिया ट्राईटीसाइना (*Alternaria triticina*) नामक फफूंद से होता है। आरंभ में पत्तियों के ऊपरी हिस्से पर गोल धब्बे दिखाई पड़ते हैं। ये धब्बे अनियमित रूप से फैले होते हैं। धब्बे भूरे से काले रंग के होते हैं। ऊतकक्षयी क्षेत्र

चमकीले पीले रंग से घिरा रहता है। धब्बे बड़े होकर मिल जाते हैं और बड़े धब्बे बन जाते हैं। काला चूर्ण पदार्थ कॉनीडिया और कॉनीडिया फॉर विकसित हो जाते हैं। इसी तरह के लक्षण बाली एवं पत्तियों पर भी दिखाई पड़ते हैं।

प्रबंधन

फसल में 25 % बाल निकलने पर मैकोजेब 0.25 % का घोल बनाकर छिड़काव करें। 0.25 % की दर से ज़ीनेब या मेनेब या कॉपर आक्सीक्लोराइड का 10-15 दिन के अन्तराल में छिड़काव करें। प्रमाणित बीजों का उपयोग करें। रोग प्रभावित पौधे उखाड़कर नष्ट कर दें। प्रतिरोधक किस्में जैसे एन.पी. 4, एन.पी.-52, एन.पी. -100, एन.पी.-824 को बोये। खेत की साफ-सफाई पर ध्यान दें। देर से बोनी न करें। मई-जून के महीनों में जब तेज धूप हो, बीज को सुबह 4 घंटे तक पानी में भिगोने के बाद धूप में अच्छी प्रकार से सुखा लें।

पर्ण धब्बा / झुलसा रोग

यह रोग में बहुत ही महत्वपूर्ण है। यह रोग बायपोलरिस सोरिकिनियाना (*Bipolaris sorokiniana*) नामक फफूंद से होता है। पर्णच्छद पर गोल अलग अलग धब्बे दिखाई पड़ते हैं। धब्बे बढ़कर हल्के भूरे से गहरे भूरे हो जाते हैं और पत्तिया निर्जीव हो जाते हैं। ये धब्बे मिलकर बड़े अनियमित धब्बे हो जाते हैं। दाना भरने के



दौरान संक्रमण होने पर छोटे, सिकुड़े हुये बदरंग दाने बनते हैं।



प्रबंधन

फसल में 25 % बाल निकलने पर मैंकोजेब 0.25 % का घोल बनाकर छिड़काव करें। 0.25 % की दर से ज़ीनेब या मेनेब या कॉपर आक्सीक्लोराइड का 10-15 दिन के अन्तराल में छिड़काव करें। प्रमाणित बीजों का उपयोग करें। रोग प्रभावित पौधे उखाड़कर नष्ट कर दें। खेत की साफ-सफाई पर ध्यान दें। देर से बोनी न करें। मई-जून के महीनों में जब तेज धूप हो, बीज को सुबह 4 घंटे तक पानी में भिगोने के बाद धूप में अच्छी प्रकार से सुखा लें। वीटावेक्स 2 ग्राम प्रति कि.ग्रा. से बीज उपचारित करें।

पीला किट / स्ट्राइप जंग

यह गेहूँ का महत्वपूर्ण रोगों में से एक है। यह रोग पाक्सिनिया ग्रामिनिस स्ट्रीफॉर्मिस (*Puccinia striiformis*) नामक फफूंद से होता है। स्ट्राइप जंग दुनिया भर में होता है और संभवतः पत्ती की जंग और स्टेम जंग की तुलना में सबसे हानिकारक अनाज जंग है। पीले-नारंगी बीजाणुओं वाले लम्बी धावों की उपस्थिति स्ट्रीप जंग का सबसे स्पष्ट लक्षण है। पौधे के सभी विकास चरण संक्रमण के लिए अतिसंवेदनशील होते हैं। स्ट्रीप जंग के शुरुआती लक्षण संक्रमण के 7-10 के भीतर दिखाई देते हैं जैसे कि संक्रमण स्थलों के आसपास छोटे, पीले धब्बे या । अतिसंवेदनशील किस्मों पर, बीजाणु पुस्टुल्स (सोरी) में विकसित होते हैं, जिसमें पीले रंग के

युरिडेनिया होते हैं। युरिडेनिया आमतौर पर के रूप पौधों की पत्तियों पर बिखरे हुए हैं, लेकिन

पुराने पौधों की पत्तियों पर लम्बी धारियों में होते हैं



प्रबंधन

इस रोग के प्रबंधन के लिए हमें प्रोपिकोनाज़ोल जो के बाज़ारों में टिल्ट नाम से उपलब्ध है इसका छिड़काव करते हैं। प्रोपिकोनाज़ोल का 0.1 % का घोल बनाकर 15 दिनों के अंतराल में इसका छिड़काव करने से इसका प्रबंधन किया जा सकता है।

भूरा किट / पत्ती जंग

जंग गेहूँ की सबसे महत्वपूर्ण बीमारी है। स्ट्राइप और स्टेम रस्ट की तुलना में लीफ रस्ट संभावित रूप से कम से कम हानिकारक है। यह रोग

पाक्सिनिया ग्रामिनिस रेकॉन्डिता (*Puccinia recondita*) नामक फफूंद से होता है। लीफ रस्ट रोग का निदान करने के लिए एक अपेक्षाकृत आसान बीमारी है क्योंकि यह नारंगी-भूरे रंग के गुच्छे बनाती है जो पत्ती की सतह से ऊपर उठते हैं। उंगली पर नारंगी-भूरे रंग का निशान छोड़ते हुए इन गुच्छों को पत्ती से रगड़ा जा सकता है। पत्ती की सतह के पार बिखरे हुए धब्बे कणिकाकार, अंडाकार आकार में होते हैं, और मुख्य रूप से पत्ती की ऊपरी सतह तक सीमित होते हैं।



प्रबंधन

इस रोग के प्रबंधन के लिए हमें प्रोपिकोनाज़ोल जो के बाज़ारो में टिल्ट नाम से उपलब्ध है इसका छिड़काव करते हैं। प्रोपिकोनाज़ोल का 0.1 % का घोल बनाकर 15 दिनों के अंतराल में इसका छिड़काव करने से इसका प्रबंधन किया जा सकता है।

करनाल बट

यह रोग टिल्लेसिआ इंडिका (*Tilleta indica*) नामक फफूंद से होता है। स्मट फंगस टिल्लेटिया इंडिका मित्रा, करनाल बट का कारण बनता है,

जिसे ब्रेड गेहूँ , ज्यूरम गेहूँ और ट्रिटिकल के इंडियन बंट या आंशिक बंट के रूप में भी जाना जाता है। रोग आमतौर पर केवल तब देखा जाता है जब थोड़े से अनाज में आंशिक रूप से मुंहतोड़ और टूटी हुई गुठली देखी जाती है। संक्रमित गेहूँ मनुष्यों या जानवरों के लिए विषाक्त है, 3 % से अधिक गुठली वाले गेहूँ के अनाज को आमतौर पर मानव उपभोग के लिए अयोग्य माना जाता है। इसका कारण यह है कि गेहूँ के उत्पादों में गंध एक अप्रिय गंध, रंग और स्वाद का कारण बनता है।

**प्रबंधन**

खेत की साफ-सफाई का ध्यान रखें। प्रतिरोधक किस्मों का उपयोग करें। फूल आने के पहले सिंचाई करने से रोग का परिमाण घट जाता है। स्वस्थ खेत में रोग रहित बीजों का उपयोग करें। बीज शोधन कर। खड़ी बीज के फसल में 25 % बाल निकलने पर मैकोजेब 0.25 % अथवा

प्रोपिकोनाज़ोल का 0.2 % का घोल बनाकर छिड़काव करें।

अनावृत कण्ड / लूज़ स्मट

यह रोग उस्टिलगो नूडा ट्रिटिसि (*Ustilago nuda tritici*) नामक फफूंद से होता है। इसमें पौधे के बालियों के दाने कडुआ, कालेरंग के गांठ

मबदल जाते है। ठन्डा व नमी वाला मौसम इस रोग के लिए अनुकूल है। कलियों के गुच्छों पर प्रभाव पड़ता है। यह रोग पौधे की किसी भी अवस्था में लग सकता है। यह बीज जनित रोग

है। कलियों का पूरा गुच्छा रोग से प्रभावित रहता है। रेचीस को छोड़कर पूरा गुच्छा काले बारीक पाउडरी पदार्थ में बदल जाता है।



प्रबंधन

रोग मुक्त बीजों को उपयोग करें। प्रतिरोधक किस्मों जैसे पी.डब्लू.डी.-233, पी.डब्लू.डी. 34, पी.डब्लू.डी.-438, टी.एल. 1210 का उपयोग करें। बीज को छः घंटे तक 50 से 54 डि. सेन्टीग्रेट तापमान पर पानी से उपचारित करें। भिगे हुए बीजों को सीधे धूप में करीब चार घंटे तक सुखाए। 2.5 से 3 ग्राम वीटावेक्स या बेनलेट प्रति किलो की दर से उपचारित करें। खेत की साफ सफाई पर ध्यान दें। प्रमाणित बीजों का उपयोग करें। देर से बोनी न करें। प्रभावित पौधों के अवशेषों को खेत से निकाल कर नष्ट कर दें। मई-जून के महीनों में जब तेज धूप हो, बीज को

सुबह 4 घंटे तक पानी में भिगोने के बाद धूप में अच्छी प्रकार से सुखा लें। बीज शोधन कर।

सेहू रोग

है। यह रोग इनग्वाना ट्राइटीसी (*Angina tritici*) नामक सूत्रकृमि से होता है। बुआई के 20 से 25 दिन बाद पौधे के निचले हिस्से पर सूजन दिखाई देती है। पौधा आने पर पत्तियां बाहर अन्दर की तरफ मुड़ जाती है। रोगी पौधा बौना रह जाता है। प्रभावित पौधे पर निष्फल बालियां उत्पन्न होती है। रोगी बालियां में दानों की जगह फफोले होते है जो काफी दिनों तक हरे रहते है। कटाई के समय ये फफोले अगर मिट्टी में गिर जाए

तो ये अगली फसल को भी प्रभावित करते हैं। इस रोग का प्रकोप बहुत अधिक होता है और यह 80

प्रतिशत तक उपज में कमी ला सकता है।



प्रबंधन

पिटिका से मुक्त बीजों का उपयोग करें। प्रमाणित या रजिस्टर्ड बीजों का उपयोग करें। फसल चक्र के सिंघात अपनाएं। एक ही किस्म का उपयोग बार बार न करें। प्रभावित पौधा उखाड़ दें। रोगग्रस्त फसल के बीज को बोनी के लिए उपयोग में न लाये। खेत की साफ-सफाई पर ध्यान दें। देर से बोनी न करें। मई-जून के महीनों में जब तेज धूप हो, बीज को सुबह 4 घंटे तक पानी में भिगोने के बाद धूप में अच्छी प्रकार से सुखा लें। यदि रोगग्रस्त फसल के बीजों को अगर उपयोग में लाना है तो उन्हें साधारण पानी में डुबायें, रोगग्रस्त बीज हल्के होने के कारण तैर जाते हैं और उन्हें अलग कर लें।

काला किट (हरदा रोग)

यह गेहूँ का एक बहुत ही महत्वपूर्ण रोग है। यह रोग पाक्सिनिया ग्रामिनिस ट्रिटिसि (*Puccinia graminis tritici*) नामक फफूंद से होता है। यह रोग लगभग हर देश में गेहूँ को प्रभावित करते हैं इसके संक्रामक बीजाणु हवा के माध्यम से प्रसारित होते हैं। संक्रमण के सात से 15 दिनों के बाद, युरिडेनिआ नामक बीजाणु, छोटे लाल डॉट्स पत्ती या तने की सतह पर बनने लगते हैं। इस रोग में गेहूँ के पत्तियों और तनों में काले काले लम्बे धब्बे पाए जाते हैं। ये धब्बे बाद में फट जाते हैं। इन धब्बों से काले रंग के बीजाणु बाहर निकलते हैं। इस रोग में पत्तियों और तनों में संक्रमण होने से पौधे असामान्य दिखते हैं और प्रकाश संश्लेषण क्रिया में छति होती है फलस्वरूप इसकी उत्पादकता में कमी हो जाती है।



प्रबंधन

इस रोग के प्रबंधन के लिए हमें प्रोपिकोनाज़ोल जो के बाज़ारो में टिल्ट नाम से उपलब्ध है इसका छिड़काव करते हैं। प्रोपिकोनाज़ोल का 0.1 %

का घोल बनाकर 15 दिनों के अंतराल में इसका छिड़काव करने से इसका प्रबंधन किया जा सकता है।

Grewia Optiva Drummond: An autobiography

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Dear reader, myself *Grewia optiva*, locally known *Beul* or *Bhimal*, and I belong to family Tiliaceae. Your livestock productivity depends on the fodder quality and availability, besides their genetic makeup/breed. In the Northwestern Himalayan region, there are many forage genetic resources including grasses, legumes, cereal crop residues and we fodder trees. During the winter, our farmers face fodder scarcity and they have to on tree based fodder especially on me (*Grewia optiva*), Maggar (*Dendrocalamus hamiltonii*), Banj (*D. strictus*), Kachnar (*Bauhinia variegata*), Shahtoot (*Morus alba*), Ban Oak (*Quercus leucotrichophora*), Kharsu oak (*Q. semecarpifolia*), Black locust (*Robinia pseudoacacia*), etc. But Negi (1986) has reported that I excel all these aforesaid fodder trees/bamboos in overall nutritive value and very well compared with cultivated leguminous fodders.

I am a multipurpose tree species, especially known for fodder among the farmers of the Sub Himalayan tract from Jammu to Nepal along Himachal Pradesh and Uttarakhand. I am common on bunds in the agricultural fields of the region as an agroforestry species. My branches with big tender leaves are pruned by farmers for their livestock, as my leaves are highly preferred by their livestock and are having better digestibility and fodder quality. Besides that, my small wood is used for

agricultural implements, wherever strength and elasticity is required. My bark yields fibre but unfortunately is of inferior quality. Still you can use that fibre for cordage and clothing. You can use my elastic branches for making baskets. I have observed that some people remove the bark of my branches and use my dry twigs as excellent torches.

Though I am a moderate sized tree, but I am an ideal agroforestry tree species as I am frost and drought hardy and can coppice well with good number of shoots. Mighty frost could not kill me even I was a seedling, but I had to undergo dieback and in the spring season, I had a good flush of shoots. My wood is hard, tough and elastic. You will be surprised that I can grow well on a variety of soils, but like others, I like sandy loam with adequate moisture content.

Besides the tangible benefits like fodder and wood and bark products, I also perform different environmental functions. These include carbon sequestration and mitigation of climate change, providing habitat to birds and wild animals, soil and water conservation and checking pollution. Dear, I remain leafless for a very short period during March and April and my new leaves sprout during May, when I flower also. Being mainly a cross pollinated species, I am highly thankful to insects like Honeybees, hover's flies and dipterian flies who help me in cross

pollinating. My berries either solitarily or in groups of up to four seeds ripen from October to December. You should collect the seed when it turns black. Birds and monkeys are fond of my fruit and they help me in seed dispersal.

My nursery and plantation management

Dear reader, now I am hopeful that you would be interested in raising me in nursery. There are two methods you can adopt in raising my planting stock. Your first option is seed, wherein you will know my one parent only, i.e, the female, from where you collected my seed. Your second option is through cuttings, and you must adopt this method when you want to replicate me based on my quantitative and qualitative fodder traits.

For propagation through seed, you should know that the testa of my seeds is hard, so you need to go for their pre-treatment. You can simply soak my seeds in warm water for 24 hours or use moist gunny bags for 24-36 hours or even use concentrated sulphuric acids for 10-15 minutes, followed by washing or soaking in water for my pre-treatment. Then after, you can sow my seed during May, 2 cm deep in lines 15-20 cm apart and irrigate me regularly so that my seeds germinate well. Germination of my seeds will be complete within a month.

My clonal propagation through cuttings will give you best results in June, if you soak my cuttings for 24 hr in Indole Acetic Acid or Indole Butyric Acid (100-250 mg/l). I can also be propagated through air layering during the pre monsoon period or through stump planting at the onset of monsoons.

The best way to raise my plantation is to dig pits 30-45 cm³ at a spacing of 3m x 3 m for block planting and 4m to 5 m apart for single row planting along the field

bunds and plant my seedlings during the onset of monsoons. Like your other plants, I love if you feed me with vermin-compost or farmyard manure @1-1.5 kg per seedling. It nourishes me well and I gain height and girth at my early stages. You must take my care at the seedling stage against defoliators, against whom you should apply insecticides. Not only that, during my early days my plantations were to be protected from fire, grazing and browsing by cattle.

Genetic improvement work on me

I am highly thankful to all those who have chosen me for carrying out their research work. From conventional evaluation methods to the advanced molecular characterization, cytology and floral biology, I have been used for research work, more specifically for fodder traits.

Days back to 1965, Sidhu and his colleagues collected my leaves at the late maturity stage and reported 16.97 per cent crude protein, 5.39 per cent ether extract, 19.73 per cent crude fibre, 52.63 per cent nitrogen free extract and 9.18 per cent total ash after analyzing them. Khosla *et al.* (1982) reported to the public that seasonal differences in dry matter content of fresh forage between early and late winters indicated significant drop in the succulence with advancement of winter season. My crude protein and crude fibre content were found significantly higher and nitrogen free extract significantly lower in early winter. They also observed inter and intra provenance variation in my fodder traits.

Tewari *et al.* (2008) studied my seed germination and seedling growth. Observations indicated that acid treatment (H₂SO₄) for 15 minutes and then soaking in water for 24 hr gave maximum (44%) germination, which was significantly

higher than other treatments. This treatment produced maximum seedling growth and biomass yield followed by 24 hr seed soaking in ordinary water treatment. My seedlings produced 4.76 to 7.01 g plant⁻¹ biomass within 120 days of seed sowing.

Dear, since my importance to public is more because of my fodder traits, thankfully Khosla and his team in 1982 found higher estimates of heritability of phosphorus and crude protein in me which indicate that these characters are least influenced by the site/environment. Many other workers also found that my fodder quality traits are highly heritable, which include results of Sankhyan *et al.* (2010).

In Himachal Pradesh, Department of Tree Improvement and Genetic Resources, College of Forestry, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan has shown great interest on my genetic improvement. They have also established my open pollinated seed orchard, a way forward for the production of my better quality seed. They collected my germplasm (60 half sib progenies) from different districts of Himachal Pradesh, which included Sirmour, Solan, Chamba, Bilaspur, Mandi, Hamirpur, Kangra and Shimla. Bhat and his team have evaluated all the half sib progenies present in the orchard during the period 2008-10 for morphometric, fodder, seed and seedling traits.

My morphometric and quantitative fodder traits studied included height (m), diameter (cm), leaf area (cm²), estimated number of leaves (current year), fresh weight of 100 leaves (g), dry weight of 100 leaves (g), leaf dry matter content (%). As all the half sib progenies had different seed sources distributed all over the state of Himachal Pradesh over a variety of sites differing

with regard to locality factors like altitude, climate and edaphic conditions, but then we were growing at one site in the same environmental conditions in the seed orchard, so the differences in the performance of all of us were due to genetic factors (Sankhyan *et al.* 2011).

They found that the percentage of proximate fodder analysis, viz., crude protein, crude fibre ash content, ether extract, and nitrogen free extract in my siblings ranged from 18.01-22.03, 18.33-21.75, 10.32-13.26, 4.30-5.74 and 39.42-45.63, respectively. They observed upon us that higher variability estimates were aided by high heritability, which implied that the variations noticed in my foliar nutrients were genetically controlled, and thus selection of the family for the desired contents may prove to be of immense value for my genetic improvement (Sankhyan *et al.* 2010). They even studied association analysis between my different traits besides genetic divergence among my different half sib progenies (Bhat *et al.* 2012, Bhat and Ahmad 2012). My progenies from Patta Balakar, Balu, Dotliji, Sarpadol, Adgu and Kasholi were best with respect to morphometric traits while as Deothal, Amberkothi, Bharari and Deoltikkeri excelled for seed and seedling traits (Bhat *et al.* 2018). As per their study, variability and divergence studies suggested that my variability can be exploited for my breeding programme to obtain heterotic vigour through hybridization. Improvement in my fodder quality and production of my higher quality planting stock is the need of the hour, which can be fulfilled through selection and breeding programmes on me. Many others have also worked on different aspects related to me using different approaches and suggested new things

based on their results, which have helped the scientific and farm community to increase my productivity of quality fodder, for which I am highly indebted to them. Hopefully, such work shall continue in future also so that the livestock industry flourishes well and raise the socio-economic profile of all those who own me on their land.

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Pate 1: **See how I look...**

Impact of the weather pattern on population growth of insect pests of Teak (*Tectona grandis*) and potential damage of the host in central India

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Abstract

Climate plays very important role in the insect behavior including growth and development. Temperature, rainfall and humidity manage the life cycle of the insect up to certain extent and any variation in these weather parameters fluctuate the life span of the different stages of the life cycle of any insect. These climatic variations have direct impact on the feeding potential of the insect thus control the damage to the host. Insect's life cycle is effected by minute changes in the abiotic and biotic factors. These factors also control the duration of life cycle of the particular insect. *Eutectona meacheralis* (Teak skeletonizer) and *Hyblea parea* (Teak defoliator) are the two serious lepidopteron pests of Teak in Central India. Both these insect species feed on teak leaves which sometimes lead to complete defoliation of the tree causing serious damage to the tree growth. Abiotic factors like rainfall, temperature and humidity affects the insect longevity, larval growth and feeding potential which in turn will affect the extent of damage on the host. Erratic behavior of monsoon rains during the year 2019 in Madhya Pradesh, which continued from mid June to mid October has greatly influenced the emergence and potential of damage by the causative insect defoliator and skeletonizer to the host i.e. Teak. Short term studies

were carried out to analyze the effect of erratic weather on the behavior of insect defoliator and skeletonizer and extent of damage on the host plant.

Introduction

Teak (*Tectona grandis*) also called as Sagwan, Sagon etc. being the important timber species of the Central India including the state of Madhya Pradesh has found to be effected by variety of insect pests attack. Insect defoliators are major pests attacking the young plantations causing considerable damage to the growth of the tree. A lot of management practices have been developed to control this menace in the past also. Uses of synthetic chemical pesticides have proven to be very harmful to the environment including local flora and fauna. In recent, plenty of awareness has been generated on the conservation of biodiversity through various modes. It is evident that there has been significant decline in the status of biodiversity which is mainly due to human activities and climatic disturbances. Once the diversity is lost, it cannot be recreated and is permanent damage to human society. Human society is solely dependent on biodiversity since, it provides various requirements of human needs. Efforts are therefore required to conserve this biodiversity at all levels, to identify the hot spots and to create proper environment for their survival. Forests in countries like

India owing to its climatic conditions & environment, suffer severe losses due to pests. There is a great need of effective tools to fight against these pests especially in tropical forests of Central India. Forest is a treasure house of diverse flora and fauna. Opportunities for bioprospecting of forest resources are enormous.

Climate plays very important role in the insect behavior including growth and development. Temperature, rainfall and humidity manage the life cycle of the insect up to certain extent and any variation in these weather parameters fluctuate the life span of the different stages of the life cycle of any insect. These climatic variations have direct impact on the feeding potential of the insect thus control the damage to the host. Habitat is very important requisite for proliferation and conservation of lepidopteron (New, 1990-1992). The cold deserts ecoregion is very fragile ecosystem and will be affected most due to the impacts of changing climatic conditions and other environmental hazards. Besides the prevalent climate change phenomenon is changing the distribution and migration of biodiversity in this region. Bishop *et. al.* (2016) explored about how plant-pollinator interactions are modified by extreme weather and climate change. Insects, including bees, hoverflies, butterflies and moths, are essential for the pollination of many wild plants and crops (Vanbergen, 2013). Unfortunately multiple factors are threatening pollinating insects. In India at least two species of butterflies have shown change in their distribution range, recently. The Red Pierrot, *Talicauda nyseus nuseus* (Lycaenidae) a species restricted to Peninsular India has now colonized the lower West

Himalayan foothills and Shiwaliks in northern India (Singh, 2005). While another species, the Brown Gorgon, *Meandrusa lachinus* (Fruhstorfer) Syn. *M. gyas* (Papilionidae), which had distribution restricted to north-east India and eastern Himalayas up to Sikkim has also now established itself in Kedarnath Musk Deer Reserve in Garhwal, the western Himalayas (Singh, 2006). Bishop *et. al.* (2016) also explored how plant-pollinator interactions are modified by extreme weather and climate change.

Insect's life cycle is effected by minute changes in the abiotic and biotic factors. These factors also control the duration of life cycle of the particular insect. *Eutectona meacheralis* (Teak skeltonizer) and *Hyblea purea* (Teak defoliator) are the two serious lepidopteron pests of Teak in Central India. The present study was based on annual observations on the damage status of teak due to the attack of *Eutectona meacheralis* (Teak Skeltonizer) and *Hyblea purea* (Teak Defoliator).

Observations and Results

Eutectona meacheralis (Teak skeltonizer) and *Hyblea purea* (Teak defoliator) are the two serious lepidopteron pests of Teak in Central India. Both these insect species feed on teak leaves which sometimes lead to complete defoliation of the tree causing serious damage to the tree growth. Abiotic factors like rainfall, temperature and humidity affects the larval growth and feeding potential which in turn will affect the extent of damage on the host. Erratic behavior of monsoon rains during the year 2019 in Madhya Pradesh, which continued from mid June to mid October has greatly influenced the emergence and potential of damage by the causative insect defoliator and skeletonizer to the host i.e. Teak.

Reiners and Petzoldt (2005) stated that timely planting becomes more uncertain under climate change. Study on management of onion thrips by Reiners and Petzoldt (2005) revealed that some insects are sensitive to precipitation leading to killing or removal from crops by heavy rains and this consideration is important when choosing management options for a crop. Sharma (2010) stated that during the rainy season of the year 2009, delay in onset of monsoons by 45 days resulted in delayed plantings of Pigeonpea that are prone to damage by *Helicoverpa armigera* and lead to heavy damage to Pigeonpea. As with temperature, precipitation changes can impact insect pest predators, parasites, and diseases resulting in a complex dynamic. Fungal pathogens of insects are favored by high humidity and their incidence would be increased by climate changes that lengthen periods of high humidity and reduced by those that result in drier conditions.

Earlier studies of Lewis (1997) stated that temperature may change gender ratios of some pest species such as thrips potentially affecting reproduction rates. Bale *et al.*, (2002) concluded that insects that live most of the time in the soil are gradually affected by temperature changes than those which live above ground because of the simple fact that soil provides them an insulating medium allowing buffer temperature changes more than the air. Lower winter mortality of insects due to warmer winter temperatures could be important in increasing insect populations (Harrington *et al.*, 2001). Andrew and Hughes (2005) reported that insect species diversity per area tends to decrease with higher latitude and altitude, meaning that rising temperatures could

result in more insect species attacking more hosts in temperate climates (Bale *et al.*, 2002).

Short term studies were carried out to analyze the effect of erratic weather during the monsoon season on the behavior of insect defoliator and skeletonizer and extent of damage on the host plant. The symptoms of attack of *Eutectona meacheralis* (Teak skeletonizer) and *Hyblea parea* (Teak defoliator) on teak can be distinguished easily by the pattern of damage of leaf, as the skeleton of veins of leaves is visible due to the attack of former and leaves are eaten by the Teak defoliator. During the month of June 2019, it was noticed that heavy attack of *Hyblea parea* (Teak defoliator) was prevalent on the teak thorough the region. But at the end of the month of June and beginning of monsoon rains the attack started decreasing and as the monsoon progressed the attack become very minor. The rains continued upto the month of October, 2019. As the attack of the *Eutectona meacheralis* (Teak skeletonizer) starts during the month of August or September and lot of damage to the foliage used to be clearly visible in the forest, the same was not the condition during the year 2019. The reasons for the lesser damage can be attributed to the fact that insect activity is greatly affected by the climatic factors (Bishop *et al.*, 2016). Reiners and Petzoldt (2005) revealed that some insects are sensitive to precipitation leading to killing or removal from crops by heavy rains. Keeping in view the pattern of the prolonged monsoon which continued from mid June to Mid October, 2019 may have affected the egg hatching, feeding behavior, life cycle and longevity of both the pest species i.e. *Eutectona meacheralis* (Teak skeletonizer) and *Hyblea parea* (Teak

defoliator) in teak forests. It was noticed that the teak forests were giving greenish appearances even in the month of the December which is not a usual seen during this part of the year. The damage of both the pest species i.e. *Eutectona meacheralis* (Teak skeltonizer) and *Hyblea purea* (Teak

defoliator) was very minor in some of the teak forests. Long time monitoring is required to establish the climatic impacts on damage potential of both the pest species i.e. *Eutectona meacheralis* (Teak skeltonizer) and *Hyblea purea* (Teak defoliator)



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6

Figs. 1-6: Damage Status of Teak by *E. meacheralis* (Teak skeltonizer) and *H. purea* (Teak defoliator) during monsoon season (flowering period) at different plantation sites

**Fig.7****Fig.8**

Figs. 7-8: Damage Status of Teak by *E. meacherlis* (Teak skeltonizer) Post Monsoon (Seed setting period) at different plantation sites

Conclusions

It has been estimated that with a 2^oC temperature increase insects might experience one to five additional life cycles per season (Yamamura and Kiritani, 1998). Williams *et al.*, (2003) reported that elevated temperatures increase gypsy moth performance, both decreasing its development time and increasing its survival rate. As, Reiners and Petzoldt (2005) stated that some insects are sensitive to precipitation leading to killing or removal from crops by heavy rains, so such factors needs to be monitored to establish the climatic impacts on life cycle and damage potential of both the pest species i.e. *Eutectona meacherlis* (Teak skeltonizer) and *Hyblea purea* (Teak defoliator) on teak. So, it is pertinent that the study on insect species life history and

adaptations to changing climatic condition may obscure our ability to detect species response to climate change and accordingly, examine how species responds differently to changes in thermal environments. This type of study can help in control the population of *Eutectona meacherlis* (Teak skeltonizer) and *Hyblea purea* (Teak defoliator) on teak with effectiveness by utilizing natural resources or biocontrol agents.

There are many biotic and abiotic interactions with the species, and it is extremely difficult to predict the impact of climate change on insect pests in the future, but conclusive study on these parameters can help in determining the increase of certain major pests as well as minor pests and invasive species. Some of the potential adaptation strategies that can

be applied to control the population of *Eutectona meacheralis* (Teak skeltonizer) and *Hyblea purea* (Teak defoliator) on teak could be by developing IPM involving natural biological control agents (Parasites, parasitoids, Predators etc.), pest forecasting using recent techniques like simulation modeling.

As stated, insects are sensitive to precipitation leading to killing or removal from crops by heavy rains and this consideration is important while assessing the feeding and damage of the *Eutectona meacheralis* (Teak skeltonizer) (fig.7-8) and *Hyblea purea* (Teak defoliator) on teak (fig.1-6). It may be concluded that the continuous heavy rains either don't allow the insect larvae to feed or reduce the larval vigor thus inhibiting the larva to feed on the host. Lesser attacks during the season may also contribute to other consequences like serious outbreaks of the insect species due to continuous diapauses during unfavorable conditions leading to simultaneous emergence of different populations during the favorable season. Long time monitoring is required to substantiate the climatic impacts on larval emergence, insect longevity and damage potential of both the pest species i.e. *Eutectona meacheralis* (Teak skeltonizer) and *Hyblea purea* (Teak defoliator) so as to develop forecast system to predict the outbreak of both the pests during the year.

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मोबाइल टॉवर विकिरण एवं पर्यावरण

राजेश कुमार मिश्रा

उष्णकटिबंधीय वन अनुसंधान संस्थान

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जबलपुर

आज के इस आधुनिक युग में इलेक्ट्रॉनिक्स उपकरणों का उपयोग बहुत भारी मात्रा में बढ़ गया है। आज के इस टेक्नोलॉजी के युग हम वायरलेस तकनीकी का उपयोग बहुत अधिक मात्रा में कर रहे हैं। इनके इतने चलन के कारण इनका दुष्प्रभाव बहुत तेजी से बढ़ रहा है।

रेडियेशन एक प्रकार की ऊर्जा है जो अंतरिक्ष में तरंगों या कणों के रूप में यात्रा कर रही है और यह नियमित रूप से हमारे आसपास रहता है। हम इसी के साथ विकसित हुए हैं और यहाँ तक की हम रोजाना इसके सम्पर्क में ही रहते हैं। हम एक रेडियोधर्मी ग्रह पर हैं और सभी रेडियोधर्मी होते हैं। हम यह जानते हैं कि विकिरण के बिना यह जीवन अस्तित्व में नहीं होगा।

हमारे मोबाइल फोन से विद्युत चुम्बकीय (इलेक्ट्रो मैग्नेटिक्स) रेडियेशन उत्पन्न होता है। यह मोबाइल में मौजूद है क्योंकि यह कॉल करने और कॉल प्राप्त करने के लिए रेडियो फ्रीक्वेंसी (आरएफ) तरंगों का उपयोग करते हैं। मोबाइल फोन के रेडियेशन क्षमता को बहुत छोटा माना जाता है क्योंकि उत्सर्जन की सीमा कम है लेकिन दुनिया भर में मोबाइल फोन के उपयोग में भारी वृद्धि के परिणामस्वरूप मानव स्वास्थ्य पर मोबाइल फोन रेडियेशन का प्रभाव लगातार

बढ़ता जा रहा है। आजकल लगभग सभी मोबाइल कंपनियों अपने नेटवर्क के विस्तार के लिए नए नए मोबाइल टावर लगातार लगा रही



है जो कि मोबाइल रेडियेशन बढ़ने का अहम कारण है। मोबाइल फोन का नियमित उपयोग से मानव मस्तिष्क के ऊतकों को गर्मी और कोशिकाओं पर बुरा प्रभाव पड़ता है। मोबाइल फोन माइक्रोवेव सीमा (450-2100 मेगाहर्ट्ज) में इलेक्ट्रो मैग्नेटिक्स रेडियेशन का उपयोग करते हैं। अन्य डिजिटल वायरलेस सिस्टम, जैसे डेटा संचार नेटवर्क, समान विकिरण का उत्पादन करते हैं, संभावित रेडिएशन के उपभोक्ताओं को चेतावनी देने के लिए मोबाइल फोन कंपनियों ने पहले ही फोन मैनुअल का उपयोग किया है। अधिकांश प्रदाता वर्षों से ऐसा कर रहे हैं। वे कम

से कम विकिरण स्तर रखने के लिए सुझाव और संकेत देते हैं।

एक शोध के मुताबिक वर्ष 2015 तक, दुनिया भर में 7.4 बिलियन सदस्यताएं थीं और अकेले भारत में वर्ष 2016 तक 1.127 बिलियन सदस्यताएं थीं जो दुनिया भर में सबसे ज्यादा है हालांकि उपयोगकर्ताओं की वास्तविक संख्या कम है क्योंकि कई उपयोगकर्ता एक से अधिक मोबाइल फोन के मालिक हैं। डॉक्टर डेविड कार्पेन्टर, स्कूल ऑफ पब्लिक हेल्थ स्टेट यूनिवर्सिटी ऑफ न्यूयॉर्क में डीन का कहना है कि सभी बचपन के कैंसर का 30% ईएमएफ एक्सपोजर के साथ जुड़ा हुआ है। यूनाइटेड किंगडम के डॉक्टरों ने चेतावनी जारी की है कि 16 साल से कम उम्र के बच्चों को सेल फोन का इस्तेमाल न करने की चेतावनी दी गई है। तीव्र क्षमता वाली तरंगों से मानव में ब्लड प्रेशर बढ़ जाता है, जिसके कारण मस्तिष्क में तनाव के कारण नई नई बीमारियां होने लगती है। मोबाइल फोन के अधिक उपयोग से मस्तिष्क कैंसर या अन्य सिर ट्यूमर होने का खतरा बढ़ जाता है।

शोधकर्ताओं ने यह पाया है कि कुछ धरती खनिजों में रेडिएशन को कम करने और मोबाइल फोन के तापमान को कम करने की क्षमता है। आजकल कई कंपनियों ने कई एंटी रेडिएशन चिप (एंटी रेडिएशन डिवाइस) बना रही है अब ये कितना मददगार होता है इसका तो परिणाम बाद में ही पता चलेगा। विश्व प्रसिद्ध

इलेक्ट्रॉनिक मापन और उपकरणों परीक्षण प्रयोगशाला कैलिफोर्निया संस्थान के इलेक्ट्रॉनिक्स और सामग्री विज्ञान (इम्स) कैलिफोर्निया, USA द्वारा प्रमाणित है 9.95% की आवृत्ति 9.375 GHZ पर परीक्षण के दौरान 99.95% की विद्युतचुंबकीय परिरक्षण प्रभावशीलता रखने के लिए है, वर्तमान में नवीनतम जीएसएम और सीडीएमए फोन 2100 मेगाहर्ट्ज (2.1 गीगाहर्ट्ज) के अधिकतम आवृत्ति पर काम कर रहे हैं, जबकि Radisafe (एंटी रेडिएशन चिप) को 9.375 GHZ की आवृत्ति पर भी रेडिएशन का परीक्षण करने के लिए परीक्षण किया गया है। जब RADISAFE मोबाइल फोन के पीछे की तरफ लगाने से यह तुरंत शील्ड रेडिएशन शुरू होता है और मोबाइल फोन के तापमान को कम करता है।

मोबाइल टावर से निकलने वाले रेडिएशन पर दुनिया भर में बहस चल रही है। लगातार शोध किए जा रहे हैं। रेडिएशन से होने वाले नुकसान को देखते हुए मोबाइल टावर्स को हटाने की मांग तेज हो गई है। हाल ही में ऑल इंडिया इंस्टिट्यूट ऑफ मेडिकल साइंसेज ने अपने शोधों का विश्लेषण किया। जिसमें पाया गया कि सरकार की तरफ से कराए गए शोध और अध्ययनों में मोबाइल रेडिएशन से ब्रेन ट्यूमर होने की आशंका ज्यादा है, जबकि मोबाइल इंडस्ट्री से जुड़ी कंपनियों जब ऐसे अध्ययन करती हैं तो शोध के नतीजों में आशंका को कम बताया जाता है। ये विश्लेषण 22 अध्ययनों का किया गया। ये

अध्ययन दुनियाभर में 1996 से 2016 के बीच किए गए। 48,452 लोगों पर किए गए अध्ययनों को आधार बनाया गया था।

2004 में इजराइली शोधकर्ताओं ने एक शोध किया। जिसके बाद उन्होंने बताया कि जो लोग लंबे समय से स्थापित मोबाइल टावर के 350 मीटर के दायरे में रहते हैं, उन्हें कैंसर होने की आशंका चार गुना बढ़ जाती है। 2004 में जर्मन शोधकर्ताओं के अनुसार मोबाइल टावरों के 400 मीटर के दायरे में एक दशक से रह रहे लोगों में अन्य लोगों के मुकाबले कैंसर होने का अनुपात ज्यादा पाया जाता है। जानकारों का कहना है कि मोबाइल से अधिक परेशानी उसके टॉवर्स से है। क्योंकि मोबाइल का इस्तेमाल हम लगातार नहीं करते, लेकिन टावर लगातार चौबीसों घंटे रेडिएशन फैलाते हैं। मोबाइल पर अगर हम घंटे भर बात करते हैं तो उससे हुए नुकसान की भरपाई के लिए हमें 23 घंटे मिल जाते हैं, जबकि टावर के पास रहने वाले उससे लगातार निकलने वाली तरंगों की जद में रहते हैं। विशेषज्ञ दावा करते हैं कि अगर घर के समाने टावर लगा है तो उसमें रहने वाले लोगों को 2-3 साल के अंदर सेहत से जुड़ी समस्याएं शुरू हो सकती हैं।

वर्ष 2017 में ऐसा पहली बार हुआ था जब एक व्यक्ति की शिकायत पर हानिकारक रेडिएशन को आधार बना कोई मोबाइल टावर बंद किया गया हो। कैंसर पीड़ित की याचिका पर सुप्रीम कोर्ट ने 7 दिनों के भीतर एक मोबाइल टावर को बंद करने का आदेश दिया था। ग्वालियर के हरीश

चंद्र तिवारी ऐसे पहले शख्स बने जिन्होंने सुप्रीम कोर्ट को इस बात के लिए मना लिया था कि मोबाइल फोन टावर के इलेक्ट्रोमैग्नेटिक रेडिएशन से उन्हें कैंसर हुआ। दूरसंचार मंत्रालय ने 2016 में सुप्रीम कोर्ट में एक हलफनामा दाखिल कर बताया था कि इस समय देश में 12 लाख से अधिक मोबाइल फोन टावर हैं। जिनमें से मात्र 212 टावरों में रेडिएशन तय सीमा से अधिक पाया गया। जिसके बाद कोर्ट ने सभी टावरों पर 10 लाख रुपये का जुर्माना लगाया था। सुप्रीम कोर्ट ने सरकार को निर्देश दिए थे कि मोबाइल सर्विस प्रोवाइडर को पूरे तरीके से नियमों का पालन कराने के लिए समय सीमा निर्धारित की जाए। उल्लेखनीय है कि गत वर्ष दूरसंचार विभाग ने 'तरंग संचार' पोर्टल लॉन्च किया। जिसके माध्यम से आप पता लगा सकते हैं कि आप के इलाके में कितना रेडिएशन फैला हुआ है। मोबाइल फोन के टावर से पैदा होने वाले विकिरण से जो बीमारियां हो सकती हैं उनमें सिरदर्द के अलावा थकान, याददाश्त में कमी और दिल व फेफड़ों की बीमारियां शामिल हैं। यह अध्ययन कोलकाता के नेताजी सुभाष चंद्र बोस कैंसर रिसर्च इंस्टीट्यूट ने किया है। शोधकर्ताओं का दावा है कि इन इलेक्ट्रोमैग्नेटिक तरंगों से कैंसर तक हो सकता है। शोधकर्ताओं ने इन टावरों के आसपास रहने वाले सैकड़ों लोगों से बातचीत के आधार पर यह रिपोर्ट तैयार की है। इनमें से कुछ लोग तो उन इमारतों में रहते हैं जिनकी छतों पर ऐसे टावर लगे हैं। एक

शोधकर्ता के अनुसार "ज्यादातर लोगों का कहना था कि अपने घर से दूर जाने पर उनकी बीमारियों का असर कम हो जाता है लेकिन घर आते ही वे पहले जैसी हालत में लौट आते हैं". शोधकर्ताओं का कहना है कि इस रिपोर्ट के नतीजों की पुष्टि के लिए और तकनीकी सबूत जरूरी हैं लेकिन इस मामले पर गंभीरता से ध्यान देना होगा । टावर से निकलने वाली इलेक्ट्रोमैग्नेटिक तरंगों कोशिकाओं को नष्ट कर कैंसर पैदा करने में सक्षम हैं । इससे दिल की बीमारियां भी पैदा हो सकती हैं ।

टावर के आसपास रहने वाले लोग चौबीसों घंटे विकिरण की जद में रहते हैं । इससे उन लोगों को खासकर बहरापन, अंधापन और मेमोरी लॉस होने की आशंका ज्यादा है । विकिरण का ब्रेन ट्यूमर से कोई सीधा संबंध है या नहीं, इसकी पुष्टि के लिए अभी और विस्तृत अध्ययन जरूरी है । ऐसे अध्ययनों के होने तक मोबाइल फोन के टावरों को ज्यादा आबादी वाले इलाकों में लगाने की अनुमति नहीं दी जानी चाहिए ।

कोलकाता के केंद्रीय इलाके में ऐसे टावरों का घनत्व बहुत ज्यादा है । इन सबका कहना था कि उनको किसी न किसी बीमारी से जूझना पड़ रहा है । इस अध्ययन रिपोर्ट में कहा गया है कि विकिरण की वजह से टावर के पास रहने वाले ज्यादातर लोग किसी चीज पर ध्यान केंद्रित नहीं कर पाते । बहुत से लोगों को रात को ठीक से नींद भी नहीं आती ।

चौबीसों घंटे इलेक्ट्रोमैग्नेटिक तरंगों की जद में रहने का स्वास्थ्य पर प्रतिकूल असर पड़ना लाजिमी है । इससे ब्रेन ट्यूमर भले नहीं हो, कई दूसरी बीमारियां हो सकती हैं । ऐसा माना जाता है कि छह मिनट तक विकिरण की जद में रहने पर शरीर को उसके कुप्रभाव से मुक्त होने में 23 घंटे 54 मिनट लगते हैं लेकिन जिन इलाकों में टावरों का घनत्व ज्यादा है वहां ऐसा संभव नहीं होता ।

एक मोबाइल स्टेशन एंटेना उदहारण के लिए मान लें (GSM900 मॉडल एंटेना) 935 से 960 मेगा हर्ट्ज़ तक के तरंग आवृत्ति प्रक्षेपित करती है । ये तरंग आवृत्ति पट्टिका, 25 – 25 मेगा हर्ट्ज़ के तरंग आवृत्ति पट्टी और फिर 1.2 मेगा हर्ट्ज़ के 20 सब तरंग आवृत्ति पट्टि में विभाजित कर विभिन्न ऑपरटरों को बाँट दिए जाते हैं । प्रत्येक ऑपरटरों को अनेकों धारक तरंग आवृत्ति (1 से 5) अधिकतम 6.2 मेगा हर्ट्ज़ बैंडविड्थ बाँट दिए जाते हैं । प्रत्येक धारक तरंग आवृत्ति 10 से 20 वाट की ऊर्जा उत्पन्न कर सकते हैं । इस तरह प्रत्येक ऑपरटर लगभग 50 से 100 वाट की ऊर्जा उत्पन्न करता है और इतनी ही ऊर्जा एक छत पर लगे टावर लगभग 200 से 400 वाट ऊर्जा प्रक्षेपित करते हैं । निश्चित दिशावर एंटेना का प्रचलन है जो अनेको किलो वाट की ऊर्जा एक ही दिशा में मुख्य किरण के रूप में प्रक्षेपित करती है ।

आज के समय में लगभग 60 करोड़ से ऊपर लोग मोबाइल फोन का उपयोग कर रहे हैं और लगभग

6 लाख मोबाइल टावर द्वारा संचार के जरूरतों को पूरा किया जा रहा है। मोबाइल फोन और मोबाइल टावरों की संख्या में भारी बढ़ोतरी हो रही है परन्तु इसके दुष्प्रभाव को बिलकुल अहमियत नहीं दी जा रही है।

पूरे विश्व में मोबाइल और मोबाइल टावरों से होने वाली समस्याओं की परिचर्चा जोर पर है। विकिरण के प्रभाव दो तरह के होते हैं: ऊष्मीय प्रभाव और अऊष्मीय प्रभाव। ऊष्मीय प्रभाव की तुलना माइक्रोवेव ओवन की ऊष्मा से की जा सकती है; परन्तु विकिरण के अऊष्मीय प्रभाव के बारे में पर्याप्त जानकारी उपलब्ध नहीं है परन्तु यह कहा जाता है कि विकिरण के अऊष्मीय प्रभाव इसके ऊष्मीय प्रभाव की तुलना में 3 से 4 गुना ज्यादा हानिकारक है।

भारत में फिलहाल चार लाख टेलिकॉम टावर हैं लेकिन इनकी वृद्धि की दर सालाना सिर्फ 3 फीसदी है जो इस उद्योग के साथ हर साल जुड़े रहे 1.2 करोड़ ग्राहकों की तुलना में बहुत ही कम है। दूरसंचार सेवा प्रदाताओं का कहना है कि लोगों में इससे सेहत पर होने वाले दुष्प्रभाव से भय का माहौल है। लिहाजा, अधिक संख्या में अतिरिक्त टावर नहीं लगाए जा सकते।

बाँयो-एनिशिएटिव की 2012 की एक रिपोर्ट में इस ओर संकेत किया गया था कि सेलफोन टावरों से होने वाले विकिरण से सेहत को खतरा है। इनमें सबसे आम दुष्प्रभाव हैं नींद न आना, सिरदर्द, खीझ, एकाग्रता में दिक्कत, स्मृतिलोप, अवसाद, सुनने में दिक्कत और जोड़ों की समस्या।

इनमें ज्यादा गंभीर बीमारियों में दौरे पड़ना, लकवा, गर्भपात, स्थायी नपुंसकता और कैंसर वगैरह के खतरे बताए जाते हैं। अधिकतर देशों में विकिरण के मानक बहुत निम्न हैं। ऑस्ट्रिया में विकिरण की सीमा 1 मिलिवाॅट प्रति वर्ग मीटर है। रूस, चीन, इटली और पोलैंड जैसे देशों में इसकी स्वीकृत सीमा 100 मिलिवाॅट प्रति वर्ग मीटर है। इन देशों में मोबाइल की कवरेज मुमकिन है तो कोई वजह नहीं हम अपने देश में विकिरण के स्तर को कम नहीं रख सकते।

मुंबई में सेलफोन टावरों से होने वाले विकिरण के दुष्प्रभावों के खिलाफ विरोध प्रदर्शनों का एक सिलसिला चला था। ये प्रदर्शन तब भड़के थे जब फिल्म अभिनेत्री जुही चावला ने मुंबई के मालाबार हिल स्थित अपने मकान के ठीक सामने लगे मोबाइल टावर को हटवाने का कदम उठाया और इसे लेकर उन्हें लोगों का समर्थन प्राप्त हुआ जिसके बाद राजनैतिक कार्यकर्ताओं की मदद से सेलफोन टावरों के दुष्प्रभावों के खिलाफ एक आंदोलन ही उठ खड़ा हुआ। उनकी मांग थी कि दूरसंचार कंपनियां रिहाइशी इलाकों के निकट विकिरण के स्तर को कम रखें, एंटीना की संख्या की एक सीमा तय करें और टावरों को इमारतों से दूर लगाएं। इसी दौरान विकिरण के दुष्प्रभावों पर एक रिपोर्ट आ गई। मसलन, दादर की पारसी कॉलोनी स्थित श्री समर्थ बिल्डिंग के निवासियों ने दावा किया कि उन्होंने सिर्फ तीन साल के भीतर वहां कैंसर के छह मामले देखे हैं

जो कथित तौर पर उस इलाके में लगे दूरसंचार टावरों के विकिरण से पैदा हुए थे.

किसी भी मामले में कैंसर और टावर के बीच के रिश्ते को स्थापित नहीं किया जा सका था लेकिन इससे सरकारी हलकों में अचानक सनसनी फैल गई. दूरसंचार विभाग ने 2014 में मुंबई स्थित अपने दूरसंचार प्रवर्तन संसाधन और निगरानी प्रकोष्ठ के माध्यम से विकिरण के स्तर पर एक अध्ययन करवाया। इसने जनता की शिकायतों को संबोधित किया और उसे आश्चस्त किया कि टेलीकॉम ऑपरेटर वास्तव में विकिरण पर प्रस्तावित मानकों का पालन कर रहे हैं। केंद्रीय दूरसंचार मंत्री रविशंकर प्रसाद ने भी इंडिया टुडे को बताया कि ऐसे कोई निर्णायक अध्ययन मौजूद नहीं हैं जो साबित कर सकें कि इन टावरों से होने वाले विकिरण से सेहत को खतरा होता है।

एक गैर-मुनाफा संगठन अमेरिकन कैंसर सोसायटी का कहना है कि सेलफोन टावरों से होने वाले विकिरण का स्तर कम होता है क्योंकि टावर जमीन से काफी ऊंचाई पर लगाए जाते हैं और इनसे निकलने वाले सिग्नल आवधिक तरीके से संप्रेषित होते हैं. सोसायटी का कहना है कि जब तक कोई सीधे एंटीना के सामने न आ जाए, उस पर विकिरण का दुष्प्रभाव बहुत सीमित होगा।

मोबाइल फोन के रेडिएशन को कम करने के प्रमुख उपाय

1. एक शोध में यह पाया गया है की अगर आप अपने फ़ोन को अपने सिर से 20 सेंटीमीटर दूर करने से फोन में लगभग 9 8% तक रेडिएशन की मात्रा में कमी आती है। तो आज से बिस्तर पर जाने के दौरान मोबाइल फोन को अपने तकिया के नीचे रखने की बजाय, एक बेडसाइड टेबल पर फोन रखे।
2. अपने फ़ोन से सीधा कान से लगाकर बात करने के तरीके को बदले अगर आप तार (वायर) वाली इयर लीड से बात करते हो तो ये काफी अच्छा साबित होगा।
3. लिफ्ट, कार, गाड़ियों या विमानों में अपने मोबाइल फोन का उपयोग न करें। मोबाइल फ़ोन अधिक शक्ति लेते हैं, और साथ लगी धातु स्थानों में अधिक विकिरण का रेडिएशन करते हैं।
4. जितना भी संभव हो कॉल करने के बजाय टेक्स्ट करे जो की आपके शरीर के लिए बेहतर है।
5. अगर आपके घर या अपार्टमेंट में एक वायरलेस राउटर,वाई-फाई है, तो इसे थोड़ा-प्रयोग वाले कमरे और बेडरूम से बाहर रखें (या इसे पूरी तरह से रात में बंद कर दें)। यथासंभव अपने बेडरूम को इलेक्ट्रॉनिक विकिरण से मुक्त रखने का प्रयास करें। रूटर के अलावा, सेल फोन, वायरलेस फोन और कंप्यूटर को हटा दें।

6. अगर आप अपने मोबाइल फोन से ज्यादा लम्बी अवधि तक बातें करते हैं तो कृपया करके जितना हो सके कम करने की कोशिश करें यदि उपलब्ध हो तो एक कॉर्डेड लैंडलाइन फोन का उपयोग करें और लंबी बातचीत के लिए ताररहित फोन का उपयोग न करें।
7. बच्चों के साथ फोन का उपयोग कम से कम करें क्योंकि एक बच्चे का शरीर अभी से ही विकसित हो रहा है और सेल फोन रेडिएशन एक वयस्क के मस्तिष्क की तुलना में अधिक गहराई से एक बच्चे के मस्तिष्क में प्रवेश करती है।
8. जब आप कॉल करते हो तो कान से लगाने के लिए तक प्रतीक्षा करें जब तक की आपका कॉल शुरू हो जाये, क्योंकि प्रारंभिक कनेक्शन के दौरान फोन सबसे तीव्र रेडिएशन का उत्सर्जन करता है, फिर कॉल शुरू के बाद अपनी शक्ति को कम करता है।
9. अगर सम्भव हो तो जब आप फोन का उपयोग नहीं कर रहे हो तो हवाई जहाज मोड का उपयोग करें या अपने सेल फोन को बंद करें।
10. इसके साथ साथ और भी कई ऐसे उपाय हैं जिनसे की आप अपने आप और अपने चाहनेवालो को सुरक्षित कर सकते हो



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