

## Current Science Reports

### Fruiting Intensity in Lantana *Effects of canopy cover*

Lantana, an invasive shrub, outcompetes native plants and disturbs their habitat. Lantana's invasion is influenced by fruiting intensity, the assembly and frequency of visitation by seed dispersers and the number of seeds dispersed.

How do these factors vary across a forest with varying densities of tree canopy cover? Yukti Taneja and a team from the Wildlife Institute of India, Dehradun, and the Nature Conservation Foundation, Mysuru, collaborated to investigate.

They selected an area around the Wildlife Institute of India campus in Dehradun. In the interior of the forest with high overstory canopy cover, the forest edges with intermediate overstory canopy cover and a grassland–shrubland with low overstory canopy cover, the researchers identified 15 shrubs in each location.

The team counted the number of ripe fruits on selected shrubs every two weeks. To find the influence of shrub volume and overstory canopy cover on fruiting intensity, they calculated the shrub's volume and mean percentage of overstory canopy cover from values taken along the edges of the shrub using CanopyApp, a freely available application. They found that lantana fruits more frequently in open habitats and is negatively affected by overstory canopy cover.

The researchers watched the focal shrubs once a day for three hours in the morning and/or afternoon using binoculars. They recorded all visitors noting the species, number, and arrival and departure times. A total of 14 species of frugivores visited lantana shrubs, 12 species visited open habitats and 9 visited forest habitats.

Red-vented bulbuls, Himalayan bulbuls and Indian white eyes were frequent visitors in open habitats, whereas the Indian white eye, the grey-breasted prinia, and the Himalayan bulbul frequently visited forest habitats. Visits by three species of bulbuls and a yellow-eyed babbler on fruiting lantana shrubs were negatively influenced by overstory

canopy cover. But the Indian white eye was positively associated with canopy cover. The team also observed that grey-breasted prinia responded positively to understory height.

The frugivore's visitation depends not only on habitat and shrub characteristics but also on fruit availability. The yellow-eyed babbler was positively associated with the ripe fruit crop size of the neighbourhood of selected shrubs.

The researchers measured how many fruits were swallowed, pecked, dropped, or carried away by frugivores. Out of the 14 frugivore species, 11 swallowed fruits and were, therefore, considered seed dispersers. The red-vented bulbul, the Himalayan bulbul, and the Indian white-eye were the most effective seed dispersers of the lantana shrub.

Lantana with low canopy cover produces more fruits and has a greater number of seed dispersers. This poses the threat of further lantana invasions in open habitats. These findings will aid management strategies to restrict the spread of lantana.

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### Wheat with Carotenoids *Tackling vitamin A deficiency*

Vitamin A deficiency leads to blindness, developmental disorders and even death. If genes producing carotenoids, the precursors of vitamin A, are introduced into wheat, one of the four major nutritional deficiencies worldwide could be addressed to a large extent. Recently, researchers from the Punjab Agricultural University, Ludhiana, and the NIPGR, New Delhi, collaborated to develop such a wheat variety.

The team selected a high-yielding wheat variety and crossed it with a variety having a gene, *PsyE1*, for the carotenoid biosynthesis. From more than 3000 progenies, the researchers short-listed the best lineages based on agronomic traits and the presence of a carotenoid-producing gene, indicated by specific DNA sequences that act as molecular markers. From the backcrossing population developed with the high yielding variety, they selected five lines with high carotenoid content. Repeated selection for four more genera-

tions gave a variety with four-fold more carotenoid content.

Normally, selection over seven generations takes seven years. To reduce the time needed, the researchers grew the selected lines in a high altitude location off season, thus producing two crops per year. The continuous hard work of five years from 2015 to 2020 ultimately paid off. Besides having high carotenoid content, the variety has better resistance against leaf and stem rust diseases in wheat.

Wheat is a staple for a large population in India. So, by promoting such varieties, the agriculture ministry can not only address the issue of vitamin A deficiency but also ensure crop resistance to diseases.

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### Clove Cures *Metabolic disorders*



Image: Peripitum via Wikimedia Commons

To treat various metabolic disorders like cardiovascular diseases, and type 2 diabetes, increasing glutathione, an antioxidant naturally present in the body, is an effective strategy. Synthetic glutathione is unstable and has poor bioavailability.

Clove is known to naturally alleviate metabolic disorders. But can it increase natural glutathione levels?

Recently, researchers from the St Thomas College, Pala, Kerala, evaluated and compared the potential of clovinol, the putative active ingredient in the water extract of clove, and synthetic glutathione to increase glutathione levels among patients with metabolic disorders.

They screened 70 individuals from the Anand Multi-speciality Hospital, Vadodara, Gujarat, diagnosed with pre-diabetic conditions and some metabolic disorders, for a comparative analysis.

They divided the volunteers randomly into two groups. One group was instructed to consume synthetic glutathione capsules while the other had to take the clovinal capsule for 12 weeks. Both groups received food-grade capsules of 250 milligrams each of synthetic glutathione and clovinal.

After 12 weeks, the volunteers underwent 10 hours of fasting. In the blood samples collected from the volunteers, the researchers estimated the amounts of antioxidant markers using antioxidant assay kits. A significant elevation of antioxidant levels was observed in the group that consumed clovinal capsules, compared to the levels in the group taking synthetic glutathione.

'The antioxidant levels were almost 46% higher in clovinal-treated volunteers,' says Ratheesh Mohanan, St Thomas College, Kerala.

The team also analysed various other parameters, including fasting blood sugar, insulin levels and lipid profile, using an automated biochemical analyser. Clovinal consumption at 250 milligrams per day remarkably reduced total cholesterol levels and regulated blood glucose. However, synthetic glutathione consumption had no significant impact on blood sugar and lipid metabolism.

Patients with metabolic disorders can try out the strategy of consuming clovinal to speed up treatment. However, it is advisable to always consult a doctor before consumption and also to standardise the amount.

Clove is an important ingredient in many Indian dishes. Perhaps people with metabolic disorders can increase the intake of such nutraceutical food to maintain antioxidant levels and to remain healthy. However, high amounts of clove can interfere with iron absorption and could lead to anaemia.

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### DNA Repair Mechanisms

#### *Involvement of RecG protein*

Before cells divide, DNA starts unwinding. A replication fork forms in the twisted ladder-like structure of DNA. If the DNA gets damaged or there are

any complications, the replication fork is reversed and then the replication process resumes.

DNA repair, including replication fork regression, is associated with an enzyme, RecG. Though the RecG protein has been known for nearly three decades, we do not know the exact mechanisms involved in this process.

Recently, Debolina Bandyopadhyay and Padmaja Prasad Mishra from the Homi Bhabha National Institute, Mumbai, reported the dynamic stages of the RecG-protein's involvement in DNA replication.

They isolated the RecG protein from *Mycobacterium tuberculosis*, cloned it into *E. coli* bacterial cells, and grew it in a growth medium. Using ultracentrifugal filters, they separated the RecG-concentrated samples.

The researchers bought commercial DNA samples, labelled biomolecules, and performed smFRET – single molecule Förster resonance energy transfer, a biophysical technique to measure distances below the 10 nanometre scale in biomolecules. This technique is capable of identifying the intermolecular dynamics of biomolecules such as DNA and proteins.

The researchers found that, depending on the degree of DNA damage, the morphological features of the replication fork are likely to be modified, and the RecG protein is manipulating the functional activity.

'RecG seems to adopt an asymmetric mode of locomotion to unwind the daughter strands and to reverse the action during DNA replication,' says Debolina Bandyopadhyay.

'RecG works in "sliding back" mode to wind the daughter strands,' says Padmaja Prasad Mishra.

The mechanism gives an insight into the process for reducing errors during DNA replication.

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### Biocrude Production

#### *Using spirulina and biomass*

Renewable biodiesel fuels from microalgae are mooted to be a replacement

for diesel fuel. Some argue that biofuels from agro-waste or waste high-density polyethylene may be a more economical option.

Saral and Ranganatan from NIT Calicut recently reported the possibility of a via media: benchmarking the yield of biocrude from various combinations of plant waste, plastic waste and the microalga, *Spirulina platensis*.

The researchers made fine powders of rice husk, coconut shell and high-density polyethylene. They mixed spirulina with rice husk, coconut shell and high-density polyethylene in different proportions for hydrothermal liquefaction as a thermochemical conversion process for biocrude production.

The maximum yield of biocrude from hydrothermal liquefaction for 30 minutes by mixing equal quantities of spirulina and rice husk powder was 20%. With spirulina and coconut shell, it was 12%. With an equal mixture of high density polyethylene and spirulina, the biocrude was 29% at 350°C. When blending ratios or heating temperatures were changed, the reaction was reversed and biocrude yield diminished.

Biocrude has several advantages as it is a renewable liquid fuel with negligible nitrogen, sulphur and carbon emissions. Established practices for culturing spirulina and the abundant availability of waste biomass and high-density polyethylene as raw material makes it an attractive possibility. The team plans to address the gaps in implementing a continuous hydrothermal liquefaction plug-flow reactor for producing biocrude at an industrial scale.

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