In this issue

Protecting Stratospheric Ozone
How has India fared?

The Montreal protocol demanded the phasing out of the production and consumption of ozone-depleting substances including chlorofluorocarbons, carbon tetrachloride, halons, methyl chloroform and a few others to protect the stratospheric ozone layer. India responded quickly by collaborating with the Chinese delegation to draft an agreement in 1990 to protect the interests of developing countries. This included funding requirements, a commitment to make the technologies needed available to all countries and a few tweaks to the timeline to enable other countries to join the effort.

By 1993, the country had a detailed plan to phase out ozone depleting substances with due consideration to the industrial development in the country. The plan was revised and updated in 2006 to adjust to the amendments of the Montreal protocol. And the Ozone Cell was set up for monitoring and timely execution.

In a General Article on **page 635** in this issue, Garima from the Delhi Technological University provides us a bird's eye view of the efforts and progress India has made to reach and, in some cases, surpass the requirements for protecting the ozone layer.

Arsenic Stress in Plants
Alleviation by nanoparticles

Arsenic in various forms – inorganic arsenite and arsenate as well as the organic monomethylarsonic and dimethylarsinic acids – induce various levels of toxicity in plants. A Review Article in this issue examines the different transporters involved in the uptake and transportation of the compounds, the biochemical and morphological changes as well as the genetic aspects of arsenic toxicity in plants.

Since arsenic toxicity not only affects plants, but also human health through the food chain, there is a need to counteract this phenomenon. The Review Article also examines the various nanoparticles that may provide relief – zinc oxide, iron oxide, titanium, silicon, silicon oxide, etc.

The nanoparticles seem to act through various mechanisms including interfering with uptake by roots, transportation to other tissues, eliciting defence against stress through the production of antioxidants, etc. There is a need for more scientific explorations in this direction to evolve mechanisms to reduce arsenic toxicity in plants and the impact on human populations. Read on from **page 642**.

Weaver Ant Volatiles
To deter oriental fruit fly

The oriental fruit fly, *Bactrocera dorsalis*, is a very destructive pest of fruit crops. The females of the species lay eggs after penetrating the fruits with their ovipositor. Infection by microbes at the ovipositional site, as well as the larvae that develop inside the fruit, reduce the marketability of the infected fruits. The use of insecticides on fruits to deter the insect is harmful to consumers. Besides, it has environmental implications, including the impact on pollinators. So there is a need to find alternatives.

Researchers from the ICAR-IIHR realised that the insect avoids fruits visited by the weaver ant, *Oecophylla smaragdina*. The weaver ant, a natural predator of the oriental fruit fly, deters the insect from laying eggs in fruits. The oriental fruit fly detects and avoids the volatiles emitted by the predator.

The researchers collected the volatiles from the weaver ants and found three candidate compounds among the headspace volatiles: *n*-undecane, *n*-dodecane and *n*-tridecane. Experiments showed that the oriental fruit fly avoided visiting *n*-tridecane treated areas. Treatment with *n*-undecane also had an effect: it reduced the number of eggs laid.

The researchers mixed and matched the three compounds and their synthetic versions and confirmed their findings: these volatiles do indeed deter the oriental fruit fly from spoiling fruits.

The researchers suggest that volatiles from weaver ants (often found on mango trees in large numbers) can help protect guavas and other fruits. The volatile and harmless nature of these compounds to humans makes them a better alternative than using chemical pesticides. Read on from **page 694**.

Farm Mechanisation
In the lower Shivalik range

Seed-cum-fertilizer drills and zero tillage implements are used by many small and marginal farmers in India and this has demonstrably improved the efficiency of seeds, fertilizers and water, reduced the costs of cultivation including labour, power and time, while increasing yield. Yet, in the Lower Shivalik Range of Uttarakhand, which has the lowest agricultural productivity, most farmers have not adopted these technologies.

Why? What are the factors that hold the farmers back from using farm mechanisation and high yielding varieties of wheat? What can be done to improve the situation? Researchers from the Indian Council of Agricultural Research did an extensive study of the problem from 2016 to 2019.

In a Research Article in this issue, they provide the results. Small and scattered land holdings, low levels of awareness, lack of conviction about the usefulness of these technologies to improve economy and livelihood as well as inadequate capital were some of the major limiting factors. The researchers recommend increased mass media coverage on farm mechanisation and its benefits, and wider outreach by the Krishi Vigyan Kendras and other actors in agricultural extension services to improve awareness and the knowledge base of the farmers. Government subsidies and easier loans from banks and financial institutions can help overcome the lack of capital. Equipment manufacturers and agricultural entrepreneurs can also think of providing custom hiring services. Training farmers in operations, maintenance and repair as well as easier availability of spare parts will reduce the other bottlenecks in farm mechanisation in the region. Read for more from **page 667**.

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