

In this issue

Early Universe

Experiments unveil

In the beginning, about 13.8 billion years ago, there was quark–gluon plasma. And the quarks and gluons went around unconstrained, free in hot dense matter.

But that was not to be for long. Within about a nonillionth of a second or less, gluons and quarks were constrained in the kind of particles that we now see around us.

This mythology of the beginnings of our universe is not a result of the unconstrained imagination of inventive minds. Unlike religious, cultural and literary mythologies, scientific ideas have to go through the touchstones of logic and evidence. And evidence has indeed started accumulating.

At the Large Hadron Collider, hadrons can now be accelerated to almost the speed of light by using more than 10 tera-electron volts. And typical signatures of quark–gluon plasma have started showing up. When the Future Circular Collider is set up, the energies are expected to go up many folds, promising to lay bare the conditions of the early universe to the human mind.

The General Article on **page 1403** by researchers at IIT Indore, NISER Bhubaneswar and CERN Geneva provides a brief overview of the exciting findings so far.

Tree Phenology in India

A citizen science project

SeasonWatch is an Indian citizen science initiative to document changes in the phenology of trees – flowering, fruiting, ripening, shedding leaves or sprouting new ones. The initiative aims to examine changing patterns in tree phenology with changes in climate.

Starting in 2010, the initiative has been slowly picking up pace. Hundreds of volunteers, from school children to retired botany professors, keep a regular watch on common trees in India and enter data in prescribed formats. Besides these regular observations, campaign-mode observations are also done to record seasonal changes.

A Research Article in this issue examines the data entered in SeasonWatch to understand the behaviour of the contributors – an essential parameter that influences the success of any citizen science initiative. Kerala had the maximum participation. The lowest observations were during the school vacation period in South India.

They also extracted the phenological patterns of the most observed trees over time. Besides latitudinal variations, the researchers detect a drift in the timing of flowering of *Cassia fistula* from the traditionally expected time.

Researchers interested in tree phenology, as well as citizen science enthusiasts, must read the Research Article on **page 1409**.

Pondering on Past Pandemics

To prepare for the future

Researchers from IIT Mandi examined the spatio-temporal patterns of the influenza epidemic that swept through India a century ago and the H1N1 epidemics of the last decade. And they found a spatial pattern that is similar to that of COVID-19: the same states accounted for most of the infections. They decided to explore further.

They analysed the time series data of daily SARS-CoV-2 infected cases in 640 Indian districts from 1 April to 25 December 2020. Using the *k*-means clustering algorithm, they identified the districts most affected by the pandemic during the monsoon and post-monsoon. They also studied the potential roles of factors such as temperature and humidity as well as the presence of water bodies in the spread of COVID-19.

A Research Article in this issue presents their results: states with high international migration get hit first; regions with comparatively lower temperature, especially those with water bodies, were found to have high rates of transmission. These findings can help create a targeted approach to tackling pandemics of the future, say the researchers. For details, turn to **page 1425**.

Wheat Threshers

Threat to respiration

Threshing wheat raises agricultural dust. How does it impact the health of the operators and those who are nearby?

Researchers from the Maharana Pratap University of Agriculture and Technology examined the case of three commercial threshers of different capacities in different locations and at different times. They measured the amount of particulate matter of different sizes within the microenvironment of operating wheat threshers. Particulate matter of sizes 1, 2.5, 4, and 10 microns and total suspended particles, implicated in respiratory issues, were higher than the safe limits declared by the WHO Air Quality Guidelines.

The results from the Research Communication on **page 1480** pose a challenge not only to public health authorities, but also to innovators who need to tackle this problem posed by wheat threshers.

Fall Armyworm

Fall in farmers' income

May 2018. The fall armyworm, *Spodoptera frugiperda*, was reported for the first time in India from Karnataka. The invasive agricultural pest spread fast and was soon reported from other states. The farmers responded by increasing the use of chemical pesticides.

Karnataka has about 300,000 hectares under maize and the reduction in maize yield varied between 20% and 60%. The loss in yield and increase in expenses on pesticides by 10–12 times has affected farmers' incomes. Besides, there is also the threat of increasing environmental pollution by chemical pesticides.

There is an urgent need to popularise biopesticides, biocontrol methods and integrated pest management among farmers, say the researchers.

Turn to the Research Communication on **page 1487** for details.

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