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Keystone's keystone

Just like a single block of keystone at the apex of a dome, a keystone species is one 'whose impact on its ecosystem is disproportionately large relative to its abundance'. Studies have long established the honey bee as a keystone species for several plant species. Now, in a Research Article on **page 1379**, researchers cite the discovery of keystone food resources for the bees in Uttara Kannada.

Uttara Kannada is home to both, dense forests and impoverished laterite terrains. But come monsoon, the brown of the infertile laterite soil is blanketed by the green of a rare community of herbs, which flower when the forests do not. The nectar and pollen from this community of herbs is vital for the survival of a whole gamut of insect species who waft in from the forests.

To account for the biodiversity of the laterite terrain, researchers determined the floral wealth and the insect visitations rates at 12 ear marked sampling stations. During summer, the laterite terrain is bare and the insects derive their nutrition from the flowering forests. In the monsoon, however, the fate of the insects, particularly bees, precariously see-saw on the endemic keystone flowering herbs that flourish on the laterite terrain, and a transient explosion of life is observed. Once the monsoon ceases, the moribund brown of the terrain inexorably returns, and insect-life ebbs deep into the flowering forests again.

Today, the ecological niche of the honey bee has been infringed upon by urbanization, pollution and a paucity of food resources. Therefore it is imperative that conservation strategies be implemented to safeguard the local populations of these rare herbs, the loss of which could trigger irreparable collateral damage.

Black gold to green gold

About 120 years ago, Rudolf Diesel invented an engine that was powered by groundnut oil. In the 20th century, however, cheaper mineral oils trumped vegetable oils and were exploited as energy sources to power engines. But, fossil fuels are non-renewable and their reserves are limited. Enter vegetable oils in a new avatar: *Jatropha*. *Jatropha* seeds contain about 35% oil and are touted to produce almost four times the biodiesel extracted from corn per hectare. In a Research Article on **page 1394**, researchers from Central Salt and Marine Chemicals Research Institute present a novel synthesis of biodiesel from *Jatropha* oil using a basic ionic liquid catalyst: choline hydroxide.

Biodiesel is extracted from vegetable oil through transesterification – a chemical reaction in which the oil is broken down into esters, in the presence of a catalyst. Traditional catalysts – alkali and acid – have slow reaction times and demand expensive purification processes. Basic ionic liquid catalysts, however, are eco-friendly and exhibit superior catalytic activity.

The transesterification of *Jatropha* oil is carried out in a conical flask, where the oil, the catalyst and methanol are mixed and stirred. Once the reaction is complete, a biphasic state, analogous to 'oil–water' mixture, is formed – the lower phase contains glycerol, methanol and the catalyst; the upper phase, biodiesel.

This 'one-pot' novel synthesis has several advantages over traditional processes: choline hydroxide boasts of high reusability; the amount of methanol required is considerably less; the biodiesel yield is far superior; and the *Jatropha* biodiesel so extracted does not require a bespoke diesel engine.

A year before his mysterious death, Rudolf Diesel prophesied: '*Vegetable oils for engine fuels may become in the course of time as important as petroleum and the coal tar products.*' Today the widening gap between energy production and energy demand along with the need to reduce the use of fossil fuels has set the stage for biofuels. *Jatropha*, a hardy non-edible carbon fixer, may allow several developing countries to become self-sufficient in fuel, fulfilling Diesel's dream.

The microbiome of a termite mound

Two millennia ago, Aristotle, equipped with only a humble scalpel, first classified animals. Today, scientists armed with the phylogenetic nu-scalpel of 16s rDNA sequencing, continue the tradition. The 16s rDNA is highly conserved within the same genus, and is often exploited to differentiate between microbe species living in the same microbiome.

The microbiome of a termatarium epitomizes symbiotic relationships between microbes in the animal kingdom. Recycling of uric acid waste, sulfate reduction, nitrogen fixation – are only a few of the vital functions carried out by the microbes in the termite's gut. Although several studies have analysed the microbial diversity in a termite's gut, there have been few studies that investigate the diversity of the termatarium as one single entity. A Research Communication (**page 1430**) does so through two different methods: 'culture dependent' and 'culture independent' methods.

In the culture-dependent method, a termatarium sample is dissolved in a buffer, diluted and then cultured on nutrient media to isolate bacteria. Once the bacteria have grown, their DNA is extracted for identification. In the culture-independent approach, however, the DNA is extracted directly from the termatarium sample. To determine the microbe diversity, the 16s rDNA extracted from both the methods is sequenced.

Culture-dependent profiling has limitations since certain microbes cannot be cultured. A greater species richness and homogeneity is observed in the culture-independent profiling. The study, therefore, lends credence to the culture-independent approach as a more comprehensive method to characterize the diversity of the termatarium.

Termatarium diversity studies have far reaching implications: pesticides against termites; isolation of microbes that are known to convert cellulose to alcohol, a biofuel; isolation of microbes that could decrease the amount of methane; and the harvesting of the termatarium as a biofertilizer. The termite, with its complex symbiotic microbial community, is indubitably the apotheosis of a natural bioreactor. And it would not be ludicrous to assume that in the near future, termites could be tapped as a viable natural resource.

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