Current Science Reports

Atrazine Affecting Amphibians

Larval skipper frogs

In his autobiography, the Mughal emperor, Babur, describes a peculiar Indian frog. The eyes of the frog were visible above the water. When approached, the frog jumped on the surface of water as if it were skipping on stones.

Image Balaram Mahalder, Wikimedia Commons

The skipper frog, aptly named, is one of the most common frogs in the subcontinent and acts as a health indicator for the freshwater ecosystem. But industrial waste and pesticides seem to affect the growth of the skipper frog.

Swapnil Chandrakant Supekar and Narahari Gramapurohit from the Savitribai Phule Pune University study the physiological and behavioural traits of skipper frogs, *Euphlyctis cyanophlyctis*. Recently, they investigated the impact of atrazine, a weedicide, on the morphological and behavioural traits of the frog.

Tadpoles from four pairs of male and female skipper frogs were reared under laboratory conditions. They were exposed to different concentrations of atrazine throughout larval development.

The researchers observed that all the tadpoles completed metamorphosis and there was no increased mortality. But atrazine altered the body and tail morphology of larval *E. cyanophlyctis*. Lower concentrations of atrazine induced wider bodies and longer tails with wider tail muscles. In contrast, a higher concentration of atrazine induced narrower bodies and tail muscles. Tadpoles exposed to a medium concentration of atrazine had greater body mass than those exposed to a low or high concentration.

Higher concentrations of atrazine also increased the duration of the larval phase of *E. cyanophlyctis*.

To assess the ability to perceive chemical alarm cues released by damaged tissues of conspecific tadpoles during a predatory attack and to assay the anti-predator behaviour of tadpoles exposed to atrazine, the researchers released conspecific chemical signals into the aquarium. The tadpoles did not reduce their activity as they normally do to escape predators.

Delay in development as well as alterations in morphology and behaviour can impact the survival of the species in natural environments contaminated by atrazine, say the researchers.

Do the benefits of the weedicide really outweigh the harm to frogs?

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Drugs Degrade in Space

Radiations impact formulations

Medicines carried during space flights, are exposed to ionising particles such as protons, neutrons and gamma ray radiation. These radiations may degrade the medicines that are carried on board during space missions. Researchers from Nirma University, Ahmedabad recently collaborated with IUAC, New Delhi and BARC, Mumbai to test the stability of some common drugs under radiation.

They took the tablet, liquid and injection forms of an anti-inflammatory, an antibiotic and a medicine to treat high BP: diclofenac, ciprofloxacin and metoprolol.

The drugs were irradiated with UV and visible rays to test photostability. Diclofenac, ciprofloxacin and metoprolol were sensitive to UV and visible irradiation.

At the Folded Tandem Ion Accelerator at BARC, the researchers irradiated the drugs with protons, thermal and fast neutrons, radioactive ferrous ions and high-energy gamma rays at different temperatures and different doses.

To check for changes in physical appearance before and after radiation exposure, the researchers analysed chemical stability using high-performance liquid chromatography. They found variations in the chromatographic profiles after different doses of irradiation.

Proton radiation affected the drugs, but no changes in the injectables were observed after neutron, radioactive ferrous ion or gamma irradiation. However, in tablet formulations, all drugs showed low or negligible degradation.

Space agencies can use this information for manned missions. However, the researchers used lower energy radiation than often encountered in space. So further research with higher doses is required.

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Treating Ringworm

Using turmeric and ginger oils

Ringworm, a fungal infection transmitted by domestic animals, manifests as a red-coloured ring-shaped itching rash. Common antifungals are used for treatment. However, many fungi have started showing resistance against these antifungals.

Image: Asurnipal via Wikimedia Commons

Antifungal compounds are present in turmeric and ginger as bioactive volatile oils. Can a mixture of turmeric and ginger essential oils be used to treat ringworm?

Recently, researchers from the Mahatma Gandhi University of Medical Science and Technology, MPS International, Jaipur and Invertis University, Bareilly investigated the possibility. They extracted essential oils from turmeric and ginger by hydrolysing them using Clevenger's apparatus.

The team examined skin samples from pet owners with possible ringworm infection under a microscope. They found two types of fungi: *Trichophyton verrucosum* and *Microsporum canis*.

The team screened the antifungal effect of the essential oils using a filter paper disc to introduce the oils into the fungal culture. The oils inhibited the fungal growth.

The researchers also measured inhibition-zone-diameters and compared them with clotrimazole and ketoconazole, common antifungal drugs. The inhibition-zone-diameter produced by the essential oils was larger than that of the drugs.

Pharmaceutical companies can develop antifungal topical medicines using these essential oils to combat antifungal resistance. However, the safety and efficacy of the essential oils should be validated through clinical trials.

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Cancer Survivor Health

Longitudinal ageing study

Cancer risk is higher in older people. The availability of methods for detecting and treating cancer is increasing the number of cancer survivors in India.

Recently, researchers from the International Institute for Population Sciences, Mumbai, in collaboration with researchers from the UK, analysed the health status of Indian adults over 45 who had survived cancer.

They took data from a recently released longitudinal ageing study. The survey conducted in 2017 and 2018 covered a nationally representative sample of 72,000 people. Statistical analyses using this sample suggested that, overall, there are 2.1 million cancer survivors in India.

The researchers removed data of people under 45 years of age. Now, they had a sample population of more than 65,500. An analysis of this data showed that there were more than 2000 cancer survivors per lakh of population in Himachal Pradesh, Uttarakhand, Gujarat, Kerala and the Andaman Nicobar Islands. In Andhra Pradesh, Bihar, Meghalaya and Nagaland, there were less than 300 per lakh. The national average was 641 cancer survivors per lakh population.

The proportion of female survivors was higher. Most of the survivors were Hindus, followed by Muslims. There were more cancer survivors among castes that do not face much discrimination.

Cancer survivors had poor self-rated health, depressive symptoms, functional limitations in their daily life, sleep problems and higher hospitalisations.

'These results can be used to develop education and training programmes for the oncology workforce,' says T. R. Dilip, IIPS Mumbai.

To avoid fragmented health care after diagnosis or treatment, India requires an improved integrated cancer care pathway.

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Silicene for Flexible Electronics

Possible silicon alternative

Silicene, the thinnest possible form of silicon, has electronic properties similar to two-dimensional graphene. Can silicene be used for straintronics applications, where materials are exposed to physical strain to control electronics at the nanoscale?

Researchers from IIT Bombay and the Indo-Korea Science and Technology Centre, Bengaluru, collaborated to investigate the electrical response of silicene to mechanical strain.

Two-dimensional silicene is not completely planar. Like two-dimensional graphene, it has atoms in a hexagonal pattern. But, in silicene, the parallel layers of hexagonal rings buckle into each other, distorting configuration. It is this distortion which enhances the electrical properties of silicene.

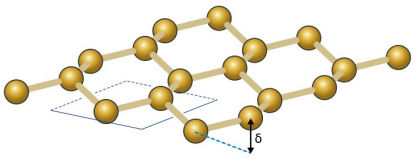

Image: Jozef Sivek via Wikimedia Commons

To map the energy levels of silicene, the researchers visualised its electronic band structure. Silicene had linear energy levels, allowing faster conduction of electrons within the semiconductor.

When a uniaxial strain was applied on silicene, they observed a shift in electron transfer points in silicene. The researchers examined the electrical parameters of silicene at different levels of applied strain. They found that, when silicene is further twisted, transmission reduces due to the reduction in electron density. There was also an increase in current values with an increase in twisting angle. The physical strain did not change the resistivity of silicene.

The researchers infer that silicene resists changes in resistance due to strain, demonstrating a robust electronic characteristic. Furthermore, silicene, which has high conductivity and a high elastic limit, is potentially useful for electronics in cramped spaces.

As electronic circuits become smaller and denser, semiconductors like silicene offer flexible alternatives to packing more processing power into a smaller and smaller area.

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