



ONLY NEWS PAPER PUBLISHED IN INDIA FOR SCIENTIFIC COMMUNITIES

NESA NEWSLETTER

NATIONAL ENVIRONMENTAL SCIENCE ACADEMY

Vol. 24 Issue - 10 (MONTHLY)

October 2021

From the Editor's

Dear Readers,

I wish my warm wishes on auspicious occasions of Gandhi Jayanti which marked the culmination of the 'Swachhta Hi Sewa' in our lives.

In October issue, we recount the eight popular articles from various themes and day to day life. I express sincere thank to all the authors who contributed articles and shared with us to get published. Please continue sending such articles and share the published NESA Newsletter with your friends and colleagues also.

I would like to thank President and General Secretary, NESA, New Delhi, and the Editorial team including Print, Designer and Publication committee for their nonstop support and efforts throughout this edition.

Hope this edition makes an interesting read. Please feel free to offer any suggestions for improvement.

Dr. Sushma Tiwari

Associate Editor

Dr. R. S. Tomar

Editor-in-Chief

Editorial Board Members

Dr. S.K. Basu

PS, Lethbridge AB Canada

E-mail: saikat.basu@alumni.uleth.ca

Dr Syed Shabih Hassan

Scientist (Fisheries) & NSS Programme Officer, Department of Fisheries Resource Management, College of Fisheries, GADV & AS University, Ludhiana

E-mail: fish_ab@rediffmail.com

Dr. Deeksha Dave

Assistant Professor (Environmental Studies), School of Inter Disciplinary and Trans Disciplinary Studies, IGNOU, New Delhi

E-mail: deekshadave@ignou.ac.in

Dr. Ashok K. Dhakad

Scientist (Tree Breeding), Dept. of Forestry & Natural Resources Punjab Agricultural University, Ludhiana, Punjab

E-mail: ashokdhakad@pau.edu

Dr. Prabha Singh

Scientist, ICAR-IGFRI, Jhansi, Uttar Pradesh, India

E-mail: prabhahadauriya72@gmail.com

Dr. Pawan Kumar

Assistant Professor, College of Horticulture and Forestry RLB Central Agricultural University, Jhansi, U.P.

E-mail: pawan2607@gmail.com

FORESTS AND LIVELIHOODS: SUSTAINING PEOPLE AND PLANET

Pavan Kumar*, R.S. Tomar, P. Lavania, G. Gupta, B.S. Pavithra, A. Kale, M. Dobriyal and A.K. Pandey

College of Horticulture and Forestry

Rani Lakshmi Bai Central Agricultural University, Jhansi

*Correspondence Author: pawan2607@gmail.com

Every year, from 2nd to 8th October, all over the country Wildlife Week is celebrated with an aim to protect and preserve the country's fauna. In 2021, the Wildlife week is celebrated under the theme "Forests and Livelihoods: Sustaining People and Planet", as a way to highlight the central role of forests, forest species and ecosystems services in sustaining the livelihoods of hundreds of millions of people globally, and particularly of indigenous and local communities with historic ties to forested and forest-adjacent areas. The role played by wildlife in maintaining the ecological balance of nature is undeniable. Any harm to the wilderness can pose a threat to the entire ecosystem. Thus, it is very crucial to preserve flora and fauna. During this week, experts organised workshop to make people understand the importance of wildlife conservation. Besides, several awareness-building activities are organized on different levels to make people more aware about wildlife. India is a biological hotspot, supporting a number of animal species. With only 2.5% of the earth's surface, India is home to over 7% of the world's biodiversity. India's faunal wealth is incredibly diverse, constituting around 7.4% of the world's fauna. Wildlife week was first started in the year 1952 with the great vision of saving the life of the Indian animals by taking some critical steps. It involves the planning to save animal extinction of any species from the planet.

The inauguration function was scheduled on 4th October of wildlife week. The Chief Guest of the event was Vice Chancellor of RLB Central Agricultural University, Jhansi (Fig.1). The program was inaugurated by Dr. A. Arunachalam, Director, ICAR-CAFRI, Jhansi. Dr. A.K. Pandey, Dean College of Horticulture & Forestry, RLBCAU, Jhansi delivered the lecture on Wildlife Conservation and its Consequences. Dr. Pawan Kumar was the Organizer of the whole wildlife week program. Inter departmental quiz competition was organized on 5th Oct through Virtual mode. On 6th Oct there was Essay competition through online entry submission. Photography competition was held on 7th Oct under the pre decided theme of Wildlife week. Some other activities like Poster competition was also organized on 8th Oct. At the end of week i.e 9th Oct there was closing ceremony of Wildlife week. The program was closed by lighting the lamp in the dignified presence of Hon'ble former Education Minister (Uttar Pradesh Government), Ravindra Shukla and, Special Guest Smt. Meena Mishra, Divisional Forest Officer, Shivpuri, Madhya Pradesh.



Fig. 1: Dr. A. Arunachalam (Director of CAFRI, Jhansi) facilitate by Prof. Arvind Kumar, Vice Chancellor of RLB Central Agricultural University, Jhansi, Uttar Pradesh on the occasion of Celebration of Wildlife Week as he was the Chief Guest.

Dr. S. S. Singh, Director, Extension Education, present in the program, threw light on the topics mentioned in the protection of wildlife and various religions of India and emphasized on the protection of the ecosystem. Special guest Smt. Meena Mishra explained the provisions of the punishments fall under protection of wildlife, the Forest Act 1927 of the Government of India and the Wildlife Protection Act 1972. In the presidential speech of the program, Hon'ble Shukla Ji told that while connecting the wildlife with Hindu deities, the importance of wildlife in human life and their protection is inspired to give small measures in daily life like grains for birds, water for fishes, etc. During the program Dr. Pavan Kumar announced the results of the various competitions including Quiz, Essay, Photography and Poster which was conducted throughout the week. In the quiz competition Gayatri

Kumari (B.Sc. Horticulture-II Sem) got first position (Fig. 2), Chinmaya Pradhan (M.Sc Forestry-II Sem) second and Aishwarya (B.Sc Agriculture V-Sem) got third position. In the essay competition, Aishwarya (B.Sc Agriculture V-Sem) got first place, Shreya Verma ((B.Sc Agriculture V-Sem) second and Fatima Vasir (B.Sc Forestry V-Sem) got third place. In photography competition Aishwarya (B.Sc Agriculture V-Sem) (Fig. 3) occupied first position, Divyansh (B.Sc Forestry VII-Sem) second and Akshay Sajeew occupied third. In the poster competition, Shatrughan stood first, Reena Maurya second and Anshima Maheshwari third. During the program Dr. Anil Kumar, Director Education, Dr. SK Chaturvedi, Dean Agriculture, Dr. SS Kushwaha, Librarian, Dr. RP Yadav, and all the scientists as well as faculties of RLBCAU were present.



Miss Gayatri Kumari
Winner (Quiz)



Miss Aishwarya
Winner (Essay)



Miss Aishwarya
Winner (Photography)



Mr. Shatrughan
Winner (Poster)

Fig. 2: Winner of students in various event organized by RLBCAU.

Invitation was sent to more than 250 students from different colleges such as College of Horticulture and Forestry and College of Agriculture and students from different colleges actively participated in different events in Wildlife Week 2021. Dr.

Manmohan Dobriyal proposed the vote of thanks to all the dignitaries who have made it convenient to attend this wildlife week and successfully organized by College of Horticulture and Forestry on behalf of SPARSH in the memory of RLBCAU.

हर घर में पेड़ लगे और हरियाली चारों ओर हो।



EACH ONE PLANT ONE





Fig. 3: Online painting by student (Mr. Shatrughan, Forestry- II sem.) and Photography by Miss Aishwarya (B.Sc Agriculture V-sem).

GOOD AGRICULTURAL PRACTICES FOR *ANDROGRAPHIS PANICULATA*: A MEDICINAL PLANT OF HIGH VALUE

Raviraja Shetty G.

Agricultural & Horticultural Research Station
Ullal, Mangalore

(University of Agricultural & Horticultural Sciences, Shimoga
Corresponding author: rrshetty2059@gmail.com)

Ayurvedic name	: Kalmegh, Bhunimba
Unani name	: Kalmegh, Chirayita Desi
Hindi name	: Kalmegh
English name	: Creat
Trade name	: Kalmegh
Parts used	: Dried Leaves and Tender Shoots

Morphological Characteristics

It is an erect, annual herb and 30-90 cm tall with upper part of stem quadrangular while the lower part nearly rounded stem. Leaves are opposite sessile or subsessile, linear-lanceolate or lanceolate, 3-8 cm long, acute, glabrous or minutely puberulous beneath and base cuneate, margin slightly undulate.



Andrographis paniculata

Floral Characteristics

Flowers are pedicelled, bilipid, white purple or spotted purple and solitary. Pedicel is 2.5-10 mm in

size, slender and glandular pubescent. Bracts are acicular and 2.5 mm long. Calyx lobes are subacute, 2.5-3.7 mm long and glandular. Corolla is 7.5-12.5 mm in size, tube about half as long as the corolla. Filaments are hairy and anthers are purple beared at base. Fruit is a capsule, oblong, 18-20X4.5-5.0 mm, young ones sparsely glandular and hairy; when mature it is glabrous. Seeds are subquadrate, yellow to brownish in colour and rugose. Flowering and fruiting occurs in October – December (North India).

Distribution

The species is a native of tropical South-East Asia and occurs throughout hotter parts of India.

Climate and Soil

The plant comes up well in tropical and subtropical regions all over India. It is a hardy species, therefore, can be grown in medium fertile sandy loam to clay-loam soils, possibly with irrigation. It can withstand partial shade of trees, say few hours, but it is cultivated in open fields.

Propagation Material

It can be easily raised through seed and vegetative methods. But in commercial cultivation, propagation through seed is easy and economical.

Agro-technique

This crop is grown during cooler climate and it remains for 120 days in field; usually, ratoon crop is also taken all over north India. Cooler climate helps plants in synthesizing more bitter ingredients.

Nursery Technique

- **Raising of Nursery:** Seeds are soaked in water for 24 hours and sown in the nursery beds in early September. About 650-750 gm seeds are required for raising nursery for one hectare of land. Nursery is prepared with soil, sand and organic matter in 1:1:1 ratio and sown in early September at 5 cm spacing in rows and it takes 8-10 days



Andrographis paniculata in field

for germination to commence. Six weeks old seedlings are planted in field at 30X15 cm or 15X15 cm spacing. Direct sown crop is broadcasted thinly and has a seed rate of 1.5 kg/ha. It matures early, but nursery raising is preferred. For nursery beds, FYM @ 20 kg per square meter as basal dose is mixed in the soil.

Planting in the Field

- **Land Preparation and Fertilizer Application:** The land should be prepared well by repeated ploughing to make soil pulverized. For main field, FYM @ 20 t/ha is given as basal application. It is given NPK (75:75:50 kg/ha) in two split doses *i.e.* first at planting stage and second 40 days after plantation. Use of 5 kg *Azospirillum* + 5 kg Phosphobacteria per hectare has also given good results.
- **Transplanting and Optimum Spacing:** 10-25 cm long seedlings raised in the nursery beds during September are transplanted in the main field (after 6 weeks of sowing) at a distance of 30X15 cm between plant to plant and row to row.
- **Irrigation:** 4-6 light irrigations are required till harvesting the crop.
- **Weeding:** Since it is an herbaceous plant, the field should be free from weeds. Two to three weedings are essential during the crop season *viz.* at 20 days and 60 days after transplantation.
- **Disease and Pest Control:** It is a hardy plant and not attacked by any pest and disease.

Harvest Management

- **Crop Maturity and Harvesting:** The crop matures after 120 days of sowing. It is harvested when most plants are in bloom. It is at this stage, the plants should be uprooted. However, a small lot of healthy plants should be left in the field for seed production. When the fruits

become mature, these should be picked up and dried in the sun and seeds are collected. The seeds should be kept in open sun for complete drying. After this, these are stored in air-tight containers for next sowing.

- **Post-harvest Management:** After uprooting the plant, first it should be dried in the sun for two days and afterwards in the shade. This properly dried material should be packed in laminated gunny bags, lest it absorbs moisture. The harvested dry material should be stored in dark, airy and moisture-free places.
- **Viability of Seed:** One year of storage from the time of harvest.
- **Chemical Constituents:** The leaves contain three bitter principles; deoxyandrographolide, andrographolide and neoandrographolide. These are also present in whole plant. The leaves should yield 2.5% chemical constituents on analysis.
- **Yield and Cost of Cultivation:** The yield (whole plant) is 2.5 t/ha. It has sizeable demand and yields a reasonable profit to the growers. It is commercially cultivated in several States of India. Rs. 25000/- is the cost of cultivation for one hectare.

Therapeutic Uses

The whole herb is bitter in taste and is source of several diterpenoids of which a bitter water soluble lactone "andrographolide" is important. The plant is bitter, acrid, cooling, laxative, antipyretic, antiperiodic, anti-inflammatory, expectorant, sudorific, anthelmintic, digestive and stomachic. It is useful in burning sensation, chronic fever, malaria and intermittent fever, inflammation, cough, bronchitis, skin diseases, intestinal worm, dyspepsia, flatulence, colic, diarrhoea, dysentery, haemorrhoids and vitiated condition of *pitta*. The plant is often used as a substitute for Chirayita (*Swertia chirayita*).

BIOART-INSPIRED BY NATURE: A NEW EMERGENT ART FORM ON THE SOCIAL MEDIA PLATFORMS

S. K. Basu

PFC, Lethbridge Alberta Canada

Corresponding Author: saikat.basu@alumni.uleth.ca



Art is an expression of human mind and soul and a manifestation of inner self expression. It is defined and perceived according to both the artist as well as his or her audience, readers, translators, reviewers, fans and/or admirers, museologists, curators, collectors, critics and art historians. Art prevails in various forms and platforms like literature, dance, drama,

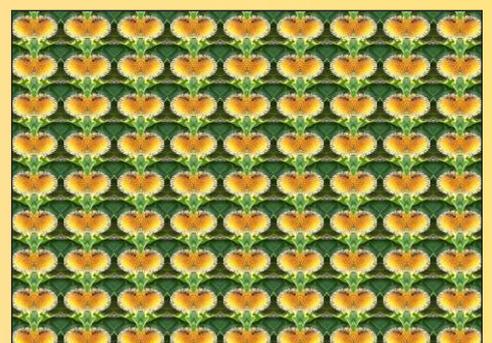
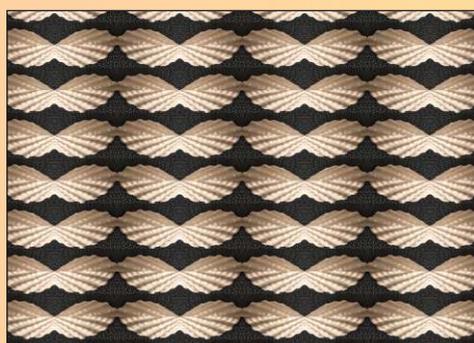
music, acting, recitation, sketches, paintings, sculptures, handicrafts, folk arts, ethnic arts as well as prehistoric art left on rock faces and caves by our long forgotten humanoid ancestors.

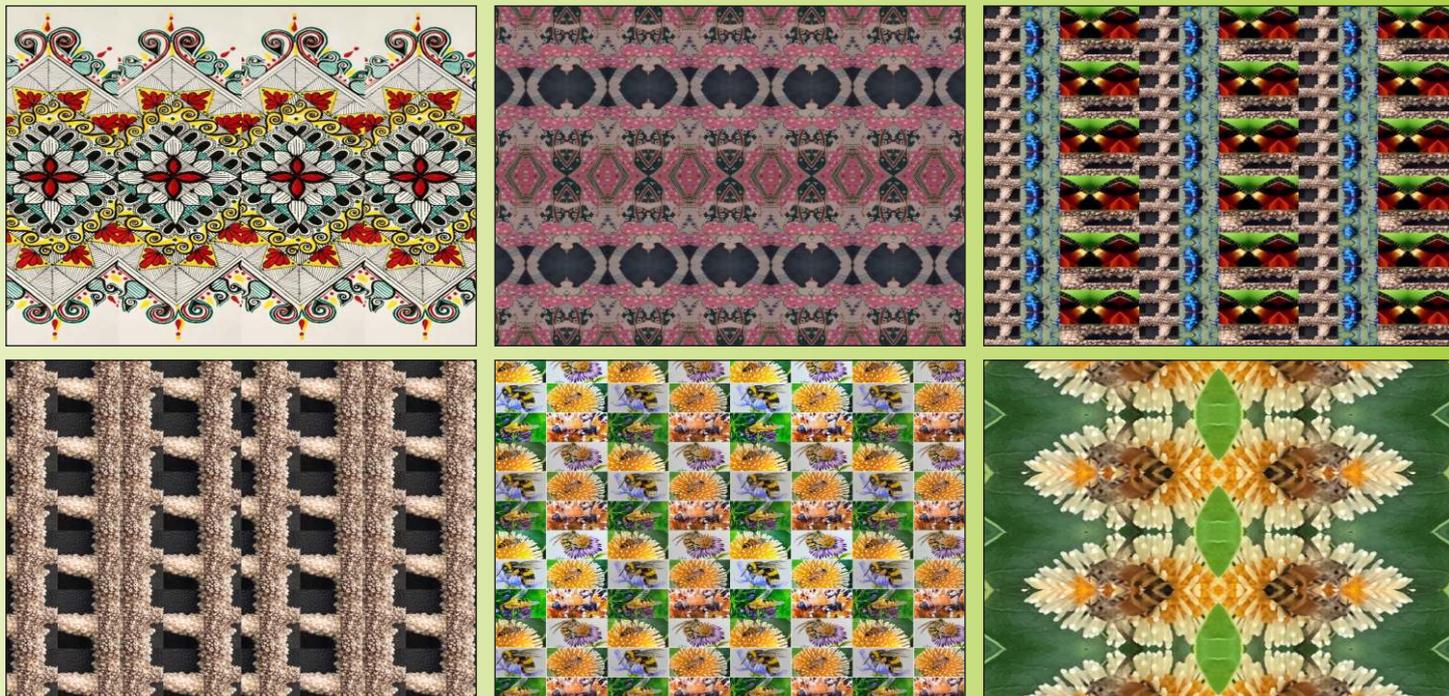
Art therefore has been associated with human society even before

the formal initiation of human civilizations across all the major continents. It has evolved over several millennia and acquired various styles, formats, motifs, fragrance, ethnicity, language, heritage and branding in different parts of the world. From modern art to Renaissance classics; and from tribal/aboriginal art forms to abstract art, the diverse world of arts and culture is a mesmerizing platform that deserves our sincere appreciation and support to further excel and evolve over time.



The recent boom of information technology, internet and the rise of social media as a major communication platform around the planet has also impacted the diverse field of arts in various forms like any other realms of human life. Some critics consider these widespread and rapid changes in the arts as positive; while others mark them as negative to the conventional art practices. However, none can ignore the importance of social media in our lives and it's unimaginable deep penetration into our minds and thoughts.





Hence, it is quite natural that this is certainly going to impact arts too; whether positive or negative is an entirely different area of discussion.

Under these circumstances and with the COVID-19 pandemic restrictions confining people indoors; new art forms have emerged and are booming in various social media platforms. One of them I have named as BioArt. Now you may ask what is BioArt and do you mean by it? Well to me BioArt as the name chosen by me is an amalgamation of two diverse disciplines of arts and sciences. In simple terms, BioArt encompasses any form of artistic expression by an artist that has central theme of Biology or Biological Sciences (Life Sciences) consciously or unconsciously in the final artistic output. It could be anything from real life sketch of plants or animals or figurines or wood/ clay/ glass/ polymer models to unique designs made from subjects that are biological in both theme and origin.

To further illustrate, BioArt could be anything from a Japanese origami defining an animal or plant to models, figurine and even abstract with biological subjects of themes. But the best application of the term BioArt is applicable in designs or patterns or abstract art made or prepared from biological subjects or themes. This art form has been rapidly evolving in the social media providing an open platform for professional artists trained in art softwares or even those who are art amateurs. The new initiatives and possibly the free time available due to being confined at home as a result of the COVID-19 pandemic has been stimulating the development as well as rapid evolution into unique art forms strongly biological in theme and origin.

For me biological subjects such as images forms the basis of my BioArt initiatives. I like using pics of images of nature and wildlife and use softwares to develop unique and creative designs that can be used for commercial and industrial design purposes. These bio-imprinted designs are useful for designs to be used on furnitures, curtains, paper, plastic and ceramic containers, kid, male and female clothings, toilet items and gardening accessories,

wall paper, tiles and floorings. Such designs could be used in the interior decorations of offices, chambers, laboratories, clinics, hospitals, diagnostic centres, gymnasium, shops, kiosks, malls, recreational centres, washrooms and toilets, beauty parlours, spas, pools, pubs and restaurants, hotels, motels, guesthouses, bungalows, meditation, religious and worship centres, movie theatres, interiors of public transport like tube rails, mono rails, railway carriages, trams, buses, cars, autos, totos, vanos and rickshaws. New and creative biological designs can have positive impacts on the consumers and customers and will further add to the artistic glories and uniqueness of a municipality, city, town or a metro.

The BioArt adds to the aesthetics of our daily life in a new and innovative form. The social media platforms are to be acknowledged at this point for their help in providing a portal as well as a diversified wide platform empowering and Eva long both professional and amateur artists to post and display their innovative artistic enterprises. Also due to the reach of the social media even to the farthest and remotest corners of our planets, BioArt has been booming exponentially as more people are being able to see, review, comment and provide constructive feedbacks in further improving or modifying the work of the artists involved.

This could easily transform into a new revenue source and provide self employment opportunities for several talented individuals over safe and recognized online money transaction portals and apps. Buyers and sellers could thus interact online maintaining social distancing norms and carry their trades forward during the pandemic. For amateur artists engaged in other professions this is a window of opportunity to both explore their available recreation time to enjoy their hobby as well intellectually contributing to the society through their innovative BioArt projects and in turn earn some revenues from their work as an additional income.

Artistic work: Saikat Kumar Basu

INDIA: MAKING PLANS FOR A DISASTER-RESILIENT COUNTRY

V. Sunitha

Department of Geology, Yogi Vemana University
Kadapa, Andhra Pradesh-516005

*Corresponding author: Vangalasunitha@gmail.com

On October 13, the International Day for Natural Disaster Reduction is commemorated around the world. The International Day for Natural Catastrophe Reduction, observed by the United Nations (UN), aims to increase awareness about disaster risk reduction.

The Covid-19 disasters have already taught us the most basic lesson: any country's health infrastructure must be prepared on a massive scale to deal with disasters that strike without warning and affect a large number of people regardless of geographic boundaries, wealth, caste, creed, or religion with tremendous speed and virulence. Adequate readiness in such health and related infrastructure is never a waste because it can be used in the future for any form of disaster – whether natural or caused by humans – or for any future health epidemic. Apart from earthquakes, other common natural catastrophes such as cyclones, floods, droughts, and tsunamis also have a varying lead time, which means that early warning systems are already in place in India for all of these kinds of disasters.

The respective nodal agencies and National/ State Disaster Management Agencies have well institutionalized the issuance and dissemination of such early warnings in India, and a standard protocol exists for all such disasters in terms of preparedness and mitigation, and the same are definitely on alert mode as usual. Due to gaps in historical data, predicting the time of occurrence of landslides is challenging, which is why India has yet to develop an operational temporal prediction model for landslides that can be used for early warning.

However, India currently knows the geographical regions where future landslides are expected to occur due to the presence of a trigger, which in most cases is higher monsoon rainfall, for 60 percent of landslide-prone areas (2.55 lakh km²). As the nodal agency for landslides, GSI has already created and posted such geoinformation on landslide susceptibility maps on its Bhukosh web platform for use by everyone in the 17 landslide-prone states. It is one of the most vulnerable countries in the planet. Infrastructure is required to reduce socioeconomic damage. The rising frequency of natural disasters is due to India's unique geoclimatic circumstances and high socio-economic vulnerability to calamities. This has a huge impact across the United States. Floods, cyclones, avalanches, heat/cold waves, landslides, lightning, earthquakes, and droughts all pose serious threats to India.

According to the National Disaster Management Authority, around 40 million hectares of land in India are vulnerable to floods (roughly 12% of total land area), 68 percent of land is vulnerable to droughts, landslides, and avalanches, 58.6% of landmass is earthquake-prone, and tsunamis and cyclones are a regular occurrence for 5,700 kilometers of the 7,516-kilometer long coastal line. As a result of these fragile conditions, India is now one of the most disaster-prone countries on the planet.

India is the 14th most vulnerable country in the world owing to catastrophic weather-related occurrences, according to the Global Climate Risk Index report 2019. Floods are the most common natural disaster in India, accounting for 52 percent of all disasters,

followed by cyclones (30 percent), landslides (10 percent), earthquakes (5 percent), and droughts (5 percent) (2 per cent). Floods are the most expensive disaster in terms of damage to infrastructure, agriculture, and livelihood, accounting for 63% of all damages, followed by cyclones (19%), earthquakes (10%), and droughts (3%). (5 per cent). In terms of human casualties, the earthquake is the most deadly disaster in India, accounting for 33% of all deaths, followed by floods (32%), cyclones (32%), and landslides (2%). (World Bank, 2012).

Lightning is the most dangerous natural catastrophe, accounting for 35% of all disaster deaths over time, followed by cold waves (17%), heat strokes (14%), landslides (12%), floods (11%), and cyclones (10 per cent). Furthermore, six major natural disasters killed 65 persons per 10 million people in India each year.

Natural disasters have varying impacts throughout Indian states, particularly in terms of disaster mortality, due to varying geoclimatic variables and socio-economic susceptibility (see Table). For example, between 1969 and 2016, 90 persons were killed per 10 million inhabitants in Chhattisgarh, the state with the highest rate of lightning deaths among the states. Madhya Pradesh and Odisha came in second and third, respectively. The state with the fewest lightning deaths was Manipur.

Punjab had the largest number of deaths due to heat strokes (20), followed by Tripura (14), Jharkhand and Andhra Pradesh (13 apiece), and Odisha (13). (12). The number of people who die from heat stroke is lowest in Uttaranchal. The increase in temperature and humidity throughout Indian states is one of the reasons for the increase in mortality due to lightning and heat waves. Landslides are more common in hilly areas. Similarly, cold wave disasters are more likely in central and northern India, while cyclones are more likely in coastal states like Andhra Pradesh, Odisha, Gujarat, and West Bengal. Due to the geo-spatial distribution of rainfall, higher flood-prone areas, higher socio-economic vulnerability, and inadequate resilient infrastructure across States to avoid flood risk, a large number of Indian states are vulnerable to floods.

Though it is critical to endeavour to limit disaster losses on all fronts, current trends indicate that strong and rapid legislative measures are required to protect human losses due to lightning deaths. To help states mitigate natural catastrophe mortality, we propose a few methods that can help to reduce fatalities to some extent.

First, as per the literature survey on Environment and Development Economics, not only more per capita income but also improved Central and State political collaboration can help to reduce catastrophe mortality. Second, increased public spending on disaster-resistant infrastructure, such as dams and drainage systems, as well as river embankment and canal protection, is critical.

Third, sophisticated catastrophe warning systems that are accurate in predicting rainfall in coastal areas are required, particularly in low-lying places. Fourth, public actions such as palm tree planting and disaster awareness programs through the media during high heat and humidity months must be implemented to reduce death due to heat waves and lightning. Bangladesh is planting five million palm palms to reduce lightning deaths, according to a recent World Economic Forum report. India may take a similar path to reduce the number of people killed by lightning storms. To reduce catastrophe mortality across States, effective pre- and post-disaster cooperation between the federal and state governments, as well as a better disaster management policy, are required.

Disaster preparedness

Disaster preparedness saves numerous lives, expedites recovery, and saves money.

The need to be prepared for a world full of unexpected surprises has never been more apparent. Epidemics, floods, storms, droughts, and wildfires are all anticipated to grow more common and severe in the next years, affecting hundreds of millions of people annually.

Preparedness for Effective Response (PER)

Preparedness for Effective Response (PER) is a cyclical technique that may be used to assess a National Society's response system's capacities, strengths, and shortcomings. It is based on our global network's decades of cumulative experience in disaster preparedness and response.

The five phases of the PER method are as follows: Orientation, **Assessment, Prioritization & analysis, Work Plan, Action & Accountability**

Currently, numerous national agencies are attempting to strengthen their catastrophe readiness. This includes the following:

- Coordination with national authorities and partners to determine what risks and dangers to anticipate

- Training and equipping millions of volunteers to serve as first responders to a variety of threats.
- Working with communities to understand the needs of people most at risk
- Establishing early warning systems so communities may take action before a disaster strikes

It's not just the proper thing to do to be prepared for a disaster; it's also the smart thing to do. Rather than waiting for the next crisis to strike, we must take action and invest in preparedness now.

References

1. <https://www.hindustantimes.com/analysis/disaster-management-india-is-not-completely-ready/story-WQ7TEVdfWibfohDQXSCnzO.html>
2. <https://www.thehindubusinessline.com/opinion/india-is-not-prepared-for-natural-disasters/article30463153.ece>
3. <https://www.unisdr.org/2005/mdgs-drr/national-reports/India-report.pdf>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4317986/>

BIOFILMS: ITS FORMATION, DEVELOPMENT, FUNCTION, PROPERTIES AND ROLE IN AQUACULTURE

Nikhat Equbal¹ and Syed Shabih Hassan²

¹Partap College of Education, Ludhiana
Department of Fisheries Resource management, College of Fisheries, Guru Angad Dev Veterinary and Animal Sciences University, Distt.- Ludhiana (Punjab) India
**Corresponding author: equbal2011@gmail.com*

A biofilm is a clump of bacteria encased in a self-developed polymeric matrix that adheres to a live or inert surface. Surface adhesion, structural heterogeneity, genetic diversity, complex community connections, and an extracellular matrix of polymeric substances are all common characteristics of biofilms.

A biofilm is a collection of microorganisms encased in a complex three-dimensional gelatinous matrix of extracellular material secreted by the organisms that live there. Biofilm is a microbial community in which cells adhere to one another on a surface and are encased in a matrix of extracellular polymeric substance produced by bacteria. Antoni van Leeuwenhoek, a Dutch researcher, was the first to identify 'animalcule' on teeth surfaces using a basic microscope, and this was considered the first microbial biofilm finding. Biofilms are not only persistent, but also resistant to disinfectants (chlorine), according to William G. Characklis, who published his findings in 1973. In 1978, Costerton developed the term "biofilm" and made the world aware of its importance. Biofilms can be found in industrial settings, hotels, waste water channels, toilets, labs, and medical settings, and they most typically form on hard surfaces that are submerged in or exposed to an aqueous solution. It can also be shaped into floating mats on liquid surfaces. It can form on living as well as non-living surfaces.

Biofilms are populations of microorganisms that are adherent to a surface. Microorganisms clearly undergo significant modifications throughout their transformation from planktonic (free-swimming) organisms to cells that are part of a sophisticated, surface attached community. These changes are reflected in biofilm bacteria's new

phenotypic characteristics, which occur in response to a variety of environmental signals. Genes and regulatory circuits important for initial cell-surface interactions, biofilm maturation, and the return of biofilm microorganisms to a planktonic mode of growth have been identified using recent genetic and molecular approaches used to study bacterial and fungal biofilms. The planktonic-biofilm transition appears to be a complex and tightly regulated process, according to research so far.

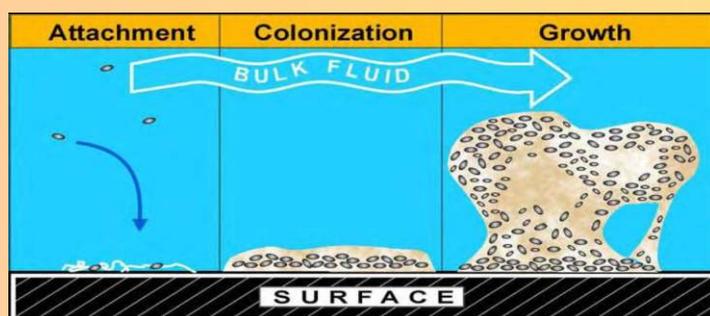
In general, single-celled organisms have two unique forms of behaviour. The first is the well-known free-floating, or planktonic, form, in which single cells float or swim in a liquid medium autonomously. The connected state is one in which cells are tightly packed and firmly bonded to one another, forming a solid surface. Many factors, including quorum sensing and other systems that differ between species, can cause a shift in behaviour. When a cell switches modes, it undergoes a phenotypic shift in behaviour that involves the up- and down-regulation of a large number of genes.

Biofilms are a type of microorganism in which microbes produce extracellular polymeric substances (EPS) such as proteins (1-2%), including enzymes, DNA (1%), polysaccharides (1-2%), and RNA (1%). In addition to these components, water (up to 97%) is the most important component of biofilm, allowing nutrients to flow through the matrix. Biofilm-forming microorganisms have a greater ability to tolerate and neutralize antimicrobial medications, resulting in a longer treatment time. Due to changes in cell density, nutritional status, or temperature, cell density, pH and osmolarity, biofilm-forming bacteria turn on some genes that trigger the expression of stress genes, which then convert to resistant phenotypes.

Formation of Biofilms

Formation of a biofilm begins with the attachment of free-floating microorganisms to a surface. These first colonists adhere to the surface initially through weak, reversible van der Waals forces. If the colonists are not immediately separated from the surface, they can anchor themselves more permanently using cell adhesion structures such as pili. Biofilm formation begins with a transition of bacteria from the planktonic (free swimming) form to its genetically distinct attached form. The genetic transition happens seven times during the biofilm's life cycle: viz; (i) conditioning, (ii) contact, (iii) adsorption, (iv) growth, (v) production of extracellular products, (vi) attachment, and (vii) re-entrainment.

The first colonists facilitate the arrival of other cells by providing more diverse adhesion sites and beginning to build the matrix that holds the biofilm together. Some species are not able to attach to a surface on their own but are often able to anchor themselves to the matrix or directly to earlier colonists. The cells are able to communicate via quorum sensing during this colonization. The biofilm grows through a combination of cell division and recruitment once colonization has begun. Development is the final stage of biofilm formation, during which the biofilm has become established and can only change shape and size. This biofilm development allows for the cells to become more antibiotic resistant.



Development

There are five phases to the creation of a biofilm. A photomicrograph of a developing *P. aeruginosa* biofilm is shown for each stage of growth in the diagram. The photomicrographs are all displayed at the same scale.

There are five stages of biofilm development

1. initial attachment
2. irreversible attachment
3. maturation I
4. maturation II
5. dispersion

Dispersal of biofilms

The biofilm lifecycle requires the dispersal of cells from the biofilm colony. Biofilms can spread and colonize new surfaces thanks to dispersal. Biofilm dispersal may be aided by enzymes that destroy the extracellular matrix of biofilms, such as dispersin B and deoxyribonuclease. Anti-biofilm agents that degrade biofilm matrix could be useful.

Properties

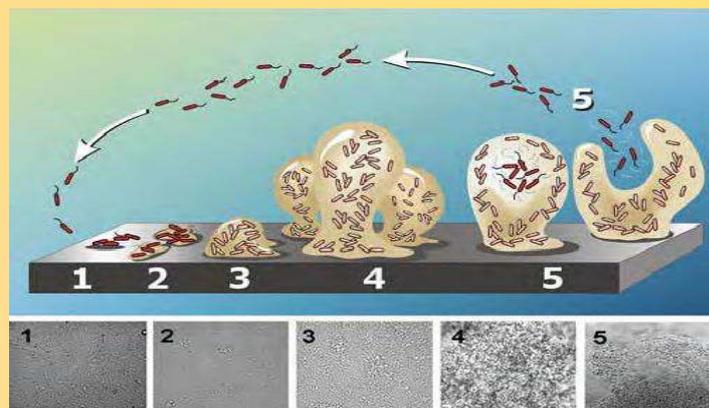
Biofilms are primarily found on solid substrates that have been submerged in or exposed to an aqueous solution, but they can also form as floating mats on liquid surfaces and on the surface of leaves, especially in humid areas. A biofilm will soon develop to be macroscopic if given enough materials for growth. Biofilms can contain a wide range of microorganisms, including bacteria, archaea, protozoa, fungi, and algae, all of which conduct diverse metabolic tasks. Under specific conditions, however, some organisms will build mono-species films.

Biofilm techniques were studied by researchers at the Helmholtz Center for Infection Research. Biofilm bacteria use chemical weapons to defend themselves against disinfectants, antibiotics, phagocytes, and our immune system, according to the researchers.

Biofilms, according to the study, could be a source of new bioactive chemicals. When bacteria form biofilms, they create chemicals that individual bacteria are unable to make on their own.

Matrix extracellular

A matrix of excreted polymeric molecules known as EPS holds the biofilm together and protects it. Either extracellular polymeric substance or exopolysaccharide is abbreviated as EPS. This matrix protects the cells within it while also allowing them to communicate



with one another via biochemical signals. Water channels have been discovered in some biofilms, which aid in the distribution of nutrients and signalling molecules. Biofilms can become fossilized due to the strength of this matrix under certain conditions.

The dense and protective habitat of a biofilm allows bacteria to cooperate and interact in a variety of ways, allowing them to have dramatically different qualities than free-floating bacteria of the same species. One advantage of this habitat is that the strong extracellular matrix and outer layer of cells protect the community's innards, making it more resistant to detergents and antibiotics. Antibiotic resistance can rise by 1000 times in some circumstances. Examples:

Biofilms are everywhere. Not only bacteria and archaea, but nearly every kind of microorganism has methods for adhering to surfaces and to each other.

- Biofilms can be found on rocks and pebbles at the bottom of most streams and rivers, and they frequently form on the surface of stagnant water pools. Biofilms are key components of food chains in rivers and streams, and they are grazed by aquatic invertebrates, which are consumed by numerous fish.
- Biofilms grow in hot, acidic pools in Yellowstone National Park (USA) and on Antarctica's glaciers.
- Biofilms can easily grow in showers because they provide a wet and warm environment for them to thrive in.
- Biofilms can form on the insides of pipes, causing blockage and corrosion. In food preparation areas, biofilms on floors and counters can make sanitation difficult. It is well known that biofilms in cooling water systems hinder heat transfer.
- Bacterial adherence to boat hulls is the foundation for seagoing vessel biofouling. Other marine species, such as barnacles, find it easier to attach once a coating of bacteria has formed. Fouling can reduce vessel speed by up to 20%, lengthening journeys and necessitating additional fuel. Due to corrosion and mechanical removal (scraping) of marine creatures from ships' hulls, time spent in dry dock for refitting and repainting affects the productivity of shipping assets, and the usable life of ships is also shortened.
- Biofilms can be used for beneficial reasons as well. Many sewage treatment plants, for example, have a stage where waste water travels through biofilms formed on filters, which collect and breakdown organic substances. Bacteria are primarily responsible for the removal of organic matter (BOD) in such biofilms, whereas protozoa and rotifers are mostly responsible for the removal of suspended solids (SS), which includes pathogens and other microbes. Slow sand filters, like those used to filter surface water from lakes, springs, and rivers for drinking, rely on biofilm formation. Because these microcellular organisms are unaffected by pollution, to these microcellular creatures, what we consider clean water is a waste product since they are unable to take any further nutrients from it.
- Biofilms can aid in the removal of petroleum oil from polluted oceans and marine systems. The oil is removed by microbial communities' hydrocarbon-degrading activities, particularly by

a spectacular newly discovered group of experts known as hydrocarbonoclastic bacteria (HCB).

- Biofilms can also be found as dental plaque on the teeth of most mammals, where they can cause tooth decay and gum disease.
- Biofilms can be found on the surface of plants as well as inside them. They can cause crop disease or, in the case of nitrogen-fixing *Rhizobium* on roots, coexist with the plant in a symbiotic relationship. Citrus Canker, Pierce's Disease of grapes, and Bacterial Spot of plants like peppers and tomatoes are examples of crop diseases linked to biofilms.

Biofilms and infectious diseases

Biofilms have been recognized to be involved in a wide range of microbial illnesses in the body, accounting for up to 80% of all infections, according to one estimate. Infectious processes in which biofilms have been implicated include common problems like urinary tract infections, catheter infections, middle-ear infections, formation of dental plaque, gingivitis, and coating contact lenses, as well as less common but more lethal infections like endocarditis, infections in cystic fibrosis, and infections of permanent indwelling devices like joint prostheses and hearing tubes. To distinguish bacterial cells developing in living animals, such as tissues with allergy inflammations, new staining techniques are being developed.

Pseudomonas aeruginosa biofilms

Chronic opportunistic infections of *Pseudomonas aeruginosa*, which have become increasingly common in immuno compromised patients and the ageing population, have severely hampered medical progress in industrialized societies. Chronic infections continue to be a major medical challenge, as well as a significant economic concern, because traditional antibiotic therapy is often insufficient to eradicate these infections.

Phototrophic biofilms

Phototrophic biofilms are found on contact surfaces in a variety of terrestrial and aquatic habitats. Phototrophic biofilms are surface-attached microbial communities that are primarily powered by light as an energy source and contain phototrophic organisms. Eukaryotic algae and cyanobacteria provide organic substrates and oxygen while generating energy and reducing carbon dioxide. The complete biofilm community, including the heterotrophic percentage, is powered by photosynthetic activity, which drives activities and conversions.

Microbial mats or phototrophic mats are thick laminated multilayered phototrophic biofilms that are commonly referred to as microbial mats or phototrophic mats (see also Bacterial mat). Thermal springs, hypersaline ponds, desert soil crusts, and lake ice covers in Antarctica have all been reported as having phototrophic biofilms and microbial mats. Benthic phototrophic communities, including as microbial mats and stromatolites, have a 3.4 billion year fossil record, indicating that they are the Earth's oldest known ecosystems. These early ecosystems are assumed to have played a vital role in the build-up of oxygen in the Earth's atmosphere. The use of phototrophic biofilm is gaining popularity as for example in wastewater treatment in constructed wetlands, bioremediation, aquaculture, and biohydrogen production.

Biofilm factory

The term "biofilm factory" was used in 2006 to characterize the use of microbial biofilms in the synthesis of chemicals. Natural microorganisms can manufacture a wide range of compounds through fermentation or biocatalysis. These biological manufacturing procedures, as compared to standard chemical manufacturing processes, utilize less energy and produce less wastes/by-products, and are therefore considered natural and sustainable chemical production alternatives. One of the most significant issues in biological production processes is that many substances are toxic to microorganisms (at high concentrations), killing them and hence halting production processes. Biological

manufacturing processes are frequently rendered economically unviable as a result of this. Many microbes can naturally aggregate on surfaces to produce biofilms, which are complex aggregations. Biofilm microorganisms are frequently much tougher and recalcitrant than individual bacteria, which is a distinguishing feature of biofilm formation. This feature of increased resistance could be useful in commercial chemical production, as bacteria in biofilms could tolerate larger chemical concentrations and operate as reliable manufacturing "factories" for a variety of goods.

The role of biofilms in aquaculture

The colonization of bacteria on substrates in the form of biofilm is the first step in heterotrophic food production. In addition to its direct use by fish, this microbial biofilm has a lot of potential to support fish food organisms. Many planktonic fish such as silver carp, rohu, catla, mullets, and milkfish may harvest biofilms of microbial communities that exist in blocks of 20-60 μ in water and sediment. Organic and mineral fractions of organic manure serve as a source of energy and nutrients for the microbial community. Fish have the ability to directly gather these creatures in large quantities. The microbial film coating is digested, but the comparatively indigestible substrate of the detritus goes through the fish gut largely undisturbed, where it is recolonized by microorganisms and reharvested by fish.

Biofilm development substrate types

Sugarcane bagasse, paddy straw, dried Eichhornia leaves, coffee leftovers, banana wastes, rice husks, and other low-value agricultural wastes can be utilized as substrates in fish ponds, either alone or in combination with manures and inorganic fertilizers. Microbial protein can be made from a wide range of carbon and carbohydrate basic resources.

Biofilm Development Protocol is a step-by-step guide to creating a biofilm

1. Cement cisterns with a 15-cm-thick soil layer for biofilm formation.
2. Prior to filling with water, the soil bed should be dried for a week.
3. Allow the substrate to dry completely in the sun before using it.
4. Using a bamboo pole put horizontally on the cement cistern, suspend the substrate vertically in the water column. The substrate dosage is 2000kg/ha.
5. Apply cow dung@ 3000kg/ha.
6. After 8-10 days, microbial biofilm development can be observed.
7. Stock the biofilm-grown ponds with 10,000 fingerlings per hectare of fish.

Biofilm enumeration

Total Plate Count

By collecting substrate samples in sterile physiological saline (0.85 percent), the total plate count of bacteria on substrates can be calculated. To remove free bacterial cells, thoroughly wash the substrate with saline. Then, to dislodge biofilm microorganisms, pour 1.0 g (wet weight) of substrate into 9 ml of physiological saline and vortex for 4 minutes. After preparing adequate serial dilutions with physiological saline (0.85 percent), inoculate the homogenate in triplicate using the surface spread method on plate count agar. Then, after 24 hours of room temperature incubation, calculate the viable bacterial count on the substrate as No./g.

On the substrate, quantitative measurement of attached algae and associated fish food organisms

Mark a 1 cm² area on the substrate and scrape it onto a glass slide, then cover with a cover slip. Under a microscope, look for algae and fish food creatures clinging to the slide. Calculate the number of plankton per cm² area of substrate.

In fact, biofilm is a complex community of autotrophic and heterotrophic organisms such as bacteria, protozoans, fungus, and algae encased in an extracellular polysaccharide matrix released by bacteria that forms on submerged surfaces of substrates.

CORONAVIRUS HETEROLOGOUS VACCINATION AND BOOSTER DOSE: IMPORTANCE & IMPLICATION

Sajid Hussain

Department of Microbiology

Ch. Bansi Lal University, Bhiwani, Haryana

*Corresponding author: professorshusain@gmail.com

Let me introduce about heterologous vaccination, that is 1st. shot of a vaccine followed by a second shot of a different vaccine. The most common coronavirus vaccines administered all over the globe in most influential countries and the accountability towards underprivileged nations (which can't afford vaccination to their countrymen). These countries like USA, UK and many more are thinking to provide booster dose after 2 shots for immunologically compromised patients. Mostly Pfizer, Moderna and Johnson& Johnson (Janssen) vaccines were administered in most advanced nations, and scientists have data analysis of the homologous and heterologous priming & boosting doses. One should not be confused with the word boosting; this is the administration of one more dose of the vaccine after recommended doses acceptability that is: a single dose (Janssen) or two doses (Pfizer/Moderna). It has been observed that heterologous vaccination may be proved better than homologous vaccination or two doses are more effective than a single dose (Janssen). A booster dose in half quantity may be given to people of age above 65 years, immunocompromised or suffering from chronic diseases like

cancer, tuberculosis, asthma and obstructive pulmonary diseases. The data analysis on vaccination revealed protective antibodies and the duration of effective functionalities. It was revealed that two doses proved to be better than a single dose (where applicable) also heterologous vaccination is better than homologous vaccination. It was also revealed that a booster dose must be given to chronic patients above 65 years also to front line warriors like treating physicians, paramedical staff and policing personnel. In our country, mostly covishield and covaxin were given and lastly, Sputnik V came into the picture, administered to a limited region of the country. We don't have cross vaccination data analysis accessible to the scientific domain by now in our country. However, a point has been confirmed through vaccination that two doses of vaccine control coronavirus infection among families whose single member or more than two members have been vaccinated. It has also been proved that vaccinated family members have protected growing kids and nascent.

Therefore with the available data of corona vaccination, it can be said that mRNA vaccination may be exploited for making vaccines against some chronic pathogens or future emerging pandemics.

It is real fact that most developed nations are not contributing their vaccine share towards less privileged nations, therefore, four per cent of vaccination has been achieved in those nations only. If we want to control coronavirus from the globe, it is imperative to donate the vaccine generously otherwise unvaccinated will act as carriers of the coronavirus.

ACTIVITIES AND SPECIAL DAYS AT A GLANCE IN THE MONTH OF OCTOBER 2021

V. Sunitha

Department of Geology

Yogi Vemana University, Kadapa, Andhra Pradesh

*Corresponding author: Vangalasunitha@gmail.com



1 October - International Day of the Older Persons

The International Day of Older Persons is one of the most important days in October, commemorating and appreciating the contributions of older people in society. On 14 December 1990, the United Nations General Assembly designated October 1 as International Day of Older Persons.

1 October - International Coffee Day

The International Day of Older Persons is one of the most important days in October, commemorating and appreciating the

contributions of older people in society. On 14 December 1990, the United Nations General Assembly designated October 1 as International Day of Older Persons.



1 October - World Vegetarian Day

The first of October is World Vegetarian Day. It is observed to emphasise the benefits of vegetarianism and to demonstrate that a meatless lifestyle can also be quite tasty.

2 October - Gandhi Jayanti

October 2 is one of India's most important days. Gandhi Jayanti is a national holiday commemorating Gandhi's birthday. Mohandas Karamchand Gandhi, also known as Mahatma Gandhi, was born on this day. People commemorate the day by praying, holding commemorative rituals, and paying honour to the Nation's Father.



4 October - World Animal Welfare Day

World Animal Welfare Day is observed on October 4th. Because



this day unites the animal welfare movement, mobilising it into a global force to make the world a better place for all animals, it is commemorated every year

5 October World Teacher's Day

Teachers' Day is observed on October 5th to show respect for them. The day is observed around the world, but no public holiday has been designated. For the first time, World Teacher's Day was commemorated in 1994.



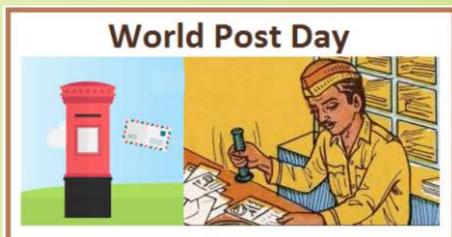
8 October - Indian Air Force Day



The Indian Air Force Day is observed on October 8. On this day in 1932, the force had served in numerous conflicts and missions. As a result, the day is commemorated as an anniversary. Every year, the IAF plans the day ahead of time.

9 October - World Post Day or World Post Office Day

Every year on October 9th, World Post Day commemorates the founding of the Universal Postal Union in Bern, Switzerland, in 1874. The day was named World Post Day by the UPU Congress in Tokyo in 1969. Since then, countries all across the world have joined in the annual festivities.



11 October - International Day of the Girl Child



The International Day of the Girl Child is celebrated on October 11th. The day is dedicated to highlighting and addressing women's empowerment, as well as the demands and obstacles that girls confront, such as the realisation of their

rights.

13 October - World Calamity Control Day (UN) or UN International Day for Natural Disaster Reduction

On October 13, the International Day for Natural Disaster Reduction is commemorated around the world. The International Day for Natural Catastrophe Reduction, observed by the United Nations (UN), aims to increase awareness about disaster risk reduction.



15 October - Global Hand Washing Day

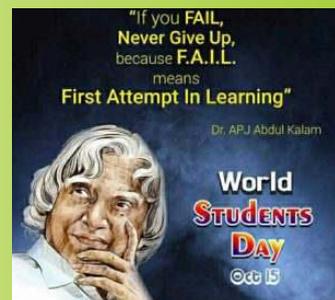


GLOBAL HANDWASHING DAY

The 15th of October is World Handwashing Day. The purpose of the day is to raise hygiene awareness. The goal of the day is to raise awareness about the necessity of soap-based handwashing as a cost-effective and low-cost strategy to prevent disease and save lives.

15 October - World Students' Day

World Students' Day is a worldwide celebration of student diversity, multiculturalism, and collaboration. Students hold events on campus to display and celebrate their actions of social responsibility.



16 October - World Food Day



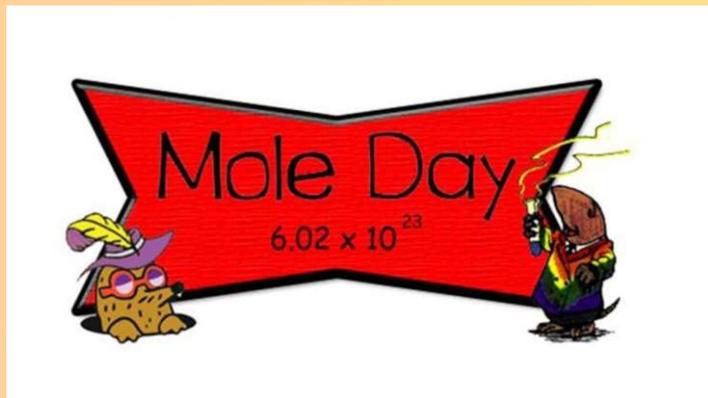
Every year on October 16, World Food Day commemorates the creation of the United Nations' Food and Agriculture Organization (FAO). Three abstract human figures distributing, harvesting, and exchanging food make up the official

World Food Day symbol.

17 October - International Poverty Eradication Day

The 17th of October is designated as International Poverty Eradication Day. One of the keys to reducing child poverty, according to UN Secretary-General António Guterres, is addressing poverty in the home, from which it typically emanates. The availability of high-quality social services must be prioritised.





23 October - Mole Day

On National Mole Day, a particular number in chemistry is honoured. We'll put an end to any visions of a burrowing creature party right now. Every year on October 23, chemists and chemical students commemorate the occasion.

जलवायु परिवर्तन का कीट-पतंगों पर संभावित प्रभाव

¹सुनील, ²नमिता दास साहा, ³रमेश चंद हरित, ⁴अर्चना शर्मा
¹एम.एस. स्वामीनाथन कृषि विद्यालय, संचुरियन प्रौद्योगिकी और प्रबंधन विश्वविद्यालय, परलाखेमुंडी, गजपति, ओडिशा-761211
²भारतीय कृषि अनुसंधान संस्थान पूसा, नई दिल्ली-110012
³सहायक प्रोफेसर, कीटविज्ञान विभाग, एम.एस. स्वामीनाथन कृषि विद्यालय, संचुरियन प्रौद्योगिकी और प्रबंधन विश्वविद्यालय, परलाखेमुंडी, गजपति, ओडिशा-761211
⁴Corresponding author: rathodsunil915@gmail.com

सार

विश्व में प्राकृतिक एवं मानवकेंद्रित अवधि से वातावरण के बदलते परिवेश में कठिनाई जा रही है। वर्तमान में मानव गतिविधियों के फलस्वरूप भविष्य के वातावरण की इस नई परिस्थिति में कार्बन डाइऑक्साइड, ओजोन की बढ़ती सांद्रता एवं बढ़ता तापमान और वर्षा पद्धति में बदलाव का वैश्विक जलवायु, पौधों को सहन करना पड़ता है। आधी जैव विविधता और मध्य खंड परिस्थितिकी तंत्र एवं क्रिया को कीट-पतंगों की उपस्थिति दर्शाते हैं। क्योंकि उनकी मजबूत संबंधिकरण को होस्ट पौधे, घातक किट पतंगों पर जलवायु परिवर्तन का प्रत्यक्ष या अप्रत्यक्ष रूप से उनको प्रभावित करते हैं और अपनी सहशुणुता के अनुरूप इनमें बदलाव होते हैं। तापमान बढ़ने का किट समुदाय पर विषम प्रभाव भी पड़ता है। क्योंकि यह कीट के जीवन वृत्त कारक जैसे जन्म दर, वृद्धि दर, जीवन काल को गंभीर रूप से प्रभावित करते हैं। जलवायु की बढ़ती गर्माहट के कारण फाइटोफागोस प्रजाति पलायन कर जाती हैं और अपने नए मूल पौधे से अपने कार्यवाहक पौधे के अनुरूप परिवर्तन कर लेते हैं। बढ़ती कार्बन डाइऑक्साइड की सांद्रता एवं तापमान की गर्माहट से भूरे प्लांटहोपर की बढ़ती और घटती जीवांकल का धन के परिस्थितिकी तंत्र के फलस्वरूप इसकी घाट जाती है। इसलिए जलवायु परिवर्तन के प्रभाव से फसलों का अनुरूपता तथा खाद्य सुरक्षा का सुरक्षित बचाव करना होगा।

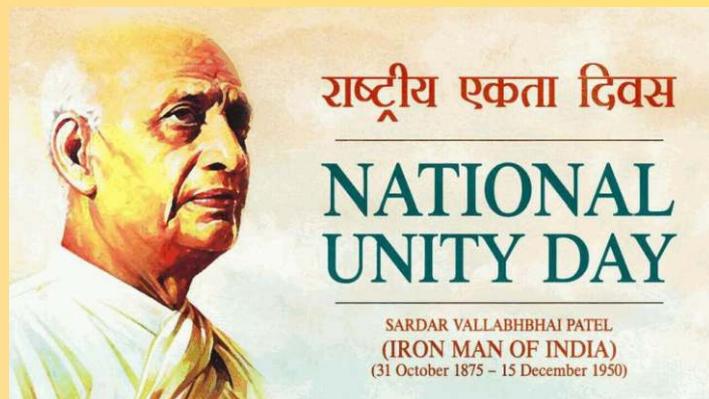
प्रमुखशब्द: कीट, कीटजीवनचक्र, जलवायुपरिवर्तन

प्रस्तावना

आज वैश्विक गर्माहट ६ जलवायु परिवर्तन प्रमुख ज्वलंत वैश्विक वातावरण के लिए मुद्दा बना हुआ है। हरित गृह गैसों एवं जलवायु परिवर्तन के बहुत सारे प्रमाण जैसे तापमान का बढ़ना, वर्तमान में सूखा, असामयिक वर्षा, बाढ़ का आना या जलमग्न होना आदि। उत्तरी गोलार्ध पर इस शताब्दी के दौरान अधिकतम तापमान 1.5 से 5.8°C सेल्सियस तक बढ़ाने की संभावना है। जलवायु कारक जैसे तापमान एवं वर्षा का बहुत अधिक प्रभाव कीट-पतंगों के विकास, प्रजनन क्षमता, जीवन यापन क्षमता पर कुप्रभाव पड़ता है। प्रजातियों के अनुमानित निजी प्रतिक्रिया के फलस्वरूप इनके आकर्षण, प्रतियोगी क्षमता, पूर्वानुमान एवं परजीवी, पहले के सामुदायिक आकार की बढ़ोतरी, संयोजनधरचरणा एवं कार्य में बदलाव होते हैं। फैलाव को प्रभावित करता है। तापमान बढ़ने से मुख्य रूप से कीट समुदाय को प्रभावित करता है क्योंकि यह इनके जीवन वृत्त के सभी कारको जन्म, वृद्धि दर और अंत काल तक को कुप्रभावित करता है। एक फील्ड आधारित प्रयोग में विभिन्न कारक (तापमान, कार्बन डाइऑक्साइड और पानी) देखने पर तापमान कीट

31 October - Rashtriya Ekta Diwas or National Unity Day

The National Unity Day, or Rashtriya Ekta Diwas, is observed on October 31 in India. Sardar Vallabhbhai Patel's birth anniversary is today. During India's independence, Patel was instrumental in persuading numerous princely states to join the Indian Union.



समुदाय की संरचना को प्रभावित करता है। एवं इसके फलस्वरूप इनकी रचनाध्आकार को विशेष रूप से प्रजाति और खाने के तरीको में भिन्न प्रतिक्रिया देखी गई। वर्तमान कारकों को जानने के लिए जलवायु के निरंतर बदलाव से पौधे-कीट समुदाय की बनावट में कैसे परिवर्तन होते हैं। पौधे-कीट समुदाय की बनावट एवं संरचना पर बाहरी कारक कैसे प्रभावित करते हैं। फाइटोफेगोस समुदाय के मुख्य चलन परपोषी पौधे के शारीरिक एवं रसायनिक लक्षणों में परिवर्तन हो सकते हैं। इस अध्ययन में, जलवायु कारको का पोषक पौधे एवं पौधे-कीट समुदाय पर होने वाले प्रभाव वर्तमान एवं वातावरण के होने की स्थिति का परीक्षण किया गया है।

बढ़ता तापमान एवं कीट आबादी

तापमान कीट-पतंगों के जीवन वृत्त को नियंत्रित करने वाला एक प्रमुख कारक है। क्योंकि कीटों को पोइकिलोथर्मिक (ठंडा-खून) जीव होते हैं, वातावरण का तापमान इनके शरीर के अनुसार होता है। इसलिए, इनकी जीवन अवस्था की विकास दर मुख्यतौर से तापमान पर निर्भर करती है। कुछ डिग्री तापमान का बदलाव लगभग सभी कीटों को कुप्रभावित एवं कीटों के जीवन वृत्त को कई रूप में प्रभावित करता है। प्रयोगशाला और मॉडलिंग के प्रयोग से समर्थन से धारणा है कि तापमान बढ़ने से कृषि कीट-पतंगों के जीवन भी प्रतिक्रिया होती।

भूमंडल की बढ़ते तापमान की प्रत्येक डिग्री के साथ-साथ कीट-पतंगों का जीवन काल घटता जाता है। जिंदगी की तीव्रता बढ़ने से, कीटों की आबादी तेजी से बढ़ती है। शीतोष्ण क्षेत्रों में, अधिकतर कीट एवं उनके विकास की अवधि सालभर में गर्म मौसम के दरम्यान ही होती है क्योंकि कौन से जलवायु कारको में मौसम को अधिक जगह परिभाषित किया जा सकता है, जलवायु परिवर्तन के प्रभाव को अधिक अनुमानित कर सकते हैं पूर्वानुमान के लिए जैविक और अजैविक कारको का सीमित संसाधन होने के कारण कम अनुमानित होते हैं (बाले एट अल, 2002)। पहले उदाहरण में, सामान्य पूर्वानुमान में तापमान बढ़ रहा है, कीट प्रजातियाँ भौगोलिक स्थान बदल कर गोलार्ध के नजदीक आ रही हैं या अधिक उचाई से इनकी आबादी एवं आकार बढ़ रहे हैं (बाले एट अल, 2002)।

जलवायु परिवर्तन के साथ बढ़ते तापमान में, फसल कीट-पतंगों की आबादी पर जटिल प्रभाव इस प्रकार है (दुप) भौगोलिक सीमा का परिचालन (पप) बढ़ती अधिक ठंड (पपप) आबादी विकास दर में बदलाव (पअ) बढ़ते पीढ़ी क्रमांक (अ) विकसित मौसम परिचलन (अप) फसलीय कीट-पतंगों में परिवर्तन का समकाल (अपप) आकर्षण बदलाव में भिन्नता (अपपप) प्रवासी कीट-पतंगों के बढ़ते जोखिम की स्थिरता (अप) परपोषी पौधे की वैकल्पिक जानकारी एवं अधिक ठंड के परपोषी पौधे। लेकिन ये सभी प्रभाव अधिकतर अन्य वातावरणीय कारको के साथ-साथ तापमान का प्रभाव कीट को प्रभावित करते हैं (बाले एट अल, 2002)।

तापमान बढ़ने के कारण पहले से ही कीट प्रजाति विविधता और वितरण में बदलाव होते रहे हैं। विभिन्न पौधों की प्रजातियों के वितरण में अनेक परिवर्तन होते रहे हैं (हिकलिंग एट अल, 2005)। यह माना गया है कि वैश्विक गर्माहट के कुप्रभाव से कोई विशिष्ट प्रजाति और समुदाय के प्रवर्तित सीमित आकार में बदलाव होते रहते हैं। एक कीट प्रजाति की विकास की स्थिति उपलब्ध तापमान की भिन्नता पर निर्भर करती है (बाले एट अल,



चित्र: कृषि फसल के कीट (संदर्भ: राजस्थान कृषि प्रताप, अगस्त, 2017)

2002)। कीट कार्यिकी एवं मौजूदा परपोषी पौधे पर प्रत्यक्ष और तापमान अप्रत्यक्ष रूप से प्रभावित करता है। कुछ कीटों को अपना एक जीवन वृत्त पूरा करने में कई वर्ष लग जाते हैं। ये कीटोंकी प्रवृत्ति के लिए इनके जीवन वृत्त की प्रक्रिया में संतुलित तापमान विविधता की आवश्यकता होती है। कुछ फसल कीटों (रुको और जाओ) तापमान से संबंधित विकसितहोते हैं, सुरक्षित तापमान अवधि के दौरान ही इनका तेजी के साथ विकास होता है। अगर अनुमानित तापमान 20 सेल्सियस बढ़ेगा तो प्रत्येक मौसम में कीटों की लगभग 1 से 5 अतिरिक्त जीवन वृत्त होंगे। गर्माहट अधिक ठंड के विस्तार को घटा देता है। कीट-पतंग अपने विस्तार के लिए शीतकालिक क्षेत्रों की ओर लौट जाते हैं। वर्ष के दरम्यान संभावित अतिरिक्त प्रजनन सहित, मौसम की गर्माहट के अनुसार संभावित विकास एवं भरण-पोषण का स्तर भी बढ़ जाता है (कैनन, 1998)।

जहां संयमित शरद ऋतु लंबी होती है उस क्षेत्र में प्रवासी कीट जल्दी आने की संभावना होती है। तापमान परिवर्तित होने से परपोषी कीट आबादी के प्राकृतिक शत्रुओं की प्रतिक्रिया में बदलाव होने लगते हैं। जब परजीवी घटने लगते हैं तो परपोषी आबादी बढ़ने लगेगी, और जीवन अवस्था खत्म होने से पहले परजीवी बढ़ने शुरू हो जाते हैं। तापमान की बढ़ोतरी से परपोषी पौधों की जीवन अवधि तेजी से समाप्त होने लगती है तो परजीवियों के लिए अवसर घटने लगते हैं। तापमान के कारण कीट-पतंगों की कुछ प्रजातियों के लिंग अनुपात में बदलाव होने लगते हैं, इनकी प्रजनन क्षमता भी कुप्रभावित होती है। इसलिए, तापमान परिवर्तन बाह्य (वातावरणीय) कीटों की अपेक्षा मृदा कीटों एवं उनके अपने जीवन वृत्त के महत्वपूर्ण भाग को अधिक प्रभावित कर सकते हैं। हैं क्योंकि यह वायु में तापमान परिवर्तित रोधक क्षमता की अपेक्षाकृत मृदा तापमान प्रतिरोधक क्षमता तीव्रता से फैलती है (बाले एट अल, 2002)। हल्की सर्दी में कीटों की मृत्यु होती है जबकि संतुलित उष्णाय सर्द तापमान इनकी आबादी बढ़ने के लिए उचित होता है (हररिंगटोन एट अल, 2001)। अधिक तापमान होने पर, माहु (अफीड) की सबसे कम प्रतिक्रिया देखी गयी फेरोमोन माहु पर संकट की चेतावनी होने से परजीवियों और परभक्षी का हमला के परिणाम स्वरूप परभक्षियों की तादाद बढ़ती है। विशिष्ट औसत तापमान बढ़ने पर, सरक्षित सर्दी और लंबी गर्मिया, माहु की आबादी बढ़ने और अनेक कीट-पतंगों के भूमंडलीय सीमा बढ़ाने, हमले की सीमा बढ़ाने के लिए सबसे उपयुक्त होता है। जहाँ पर नए कीट पतंगों के आने की संभावना रहती है, संभवतः यह वैश्विक गर्माहट से तापमान बढ़ने के कारण यहाँ आना संभव लगता है। ये परिणाम दर्शाते हैं कि जलवायु गर्माहट, कीट समुदाय कि संरचना एवं आवास में सार्थक अंतर, लेकिन शाकभक्षी प्रजाति संरचना को कम से कम समय में तेजी से विघटित बदलाव कर समान भरण-पोषण नए स्थान पर विचरण कराते हैं।

बढ़ती कार्बन डाइऑक्साइड और कीट आबादी जलवायु परिवर्तन के एक महत्वपूर्ण पहलू कार्बन डाइऑक्साइड की बढ़ती सांद्रता का पौधों पर प्रभाव अध्ययन है। पौधों की प्राथमिक आवश्यकता कार्बन है, बढ़ती कार्बन डाइऑक्साइड का स्तर के कारण कार्बन समावेश बढ़ने से वृद्धि बहुत तेजी से होती है। इस दशक में हरित गृह में उगाने वाले जानते हैं और कार्बन डाइऑक्साइड बढ़ाने से पौधे कि वृद्धि में बढ़ोतरी होती है। समान्यतः, क्योंकि कार्बन डाइऑक्साइड अधिकतर फसल के पौधों कि प्रकाश-संश्लेषण क्रिया दर में बढ़ोतरी कर देता है, वैज्ञानिकों कि प्रथम सोच होती है कि कार्बन डाइऑक्साइड बढ़ाना ही विश्व को खाधान आपूर्ति का समाधान है। कार्बन डाइऑक्साइड बढ़ाने से सूखा सहनशील कई फसलों के पौधों की वृद्धि में बढ़ोतरी होती है। क्योंकि जब कार्बन डाइऑक्साइड मिलने से इसके पतियों के रंध (स्टोमेटा) खुलते हैं तो पानी भाप बन कर उड़ जाता है और पति के आसपास कार्बन डाइऑक्साइड

की बढ़ने से उसके रंध अधिक खुलने के आवश्यकता नहीं होती है। कार्बन डाइऑक्साइड बढ़ाने की परिस्थिति में सुझाव दिया था की, पौधे खराब दशा होने पर भी अधिक पैदावार देते हैं। अनपेक्षित, इस अनुमान को आशानुरूप सिद्ध नहीं किया जा सकता है। इसका एक कारण यह भी है की बढ़ते कार्बन डाइऑक्साइड का स्तर में उगाये पौधों को कीट अधिक खाते हैं परंतु उनमें पोषक तत्व के गुणवत्ता में कमी होती है।

समान्यतः कार्बन डाइऑक्साइड बढ़ाने से पौधे के ऊतकों में कार्बन से नाइट्रोजन का अनुपात बढ़ने से उनमें पोषक तत्व की गुणवत्ता घटने से कीटों के लिए प्रोटीन सीमित मात्रा में होने से ऊतकों में नाइट्रोजन तत्व घट जाते हैं। खाने में कार्बन से नाइट्रोजन अनुपात बढ़ने से शाकभक्षी कीटों की प्रतिक्रिया में उम्मीद के अनुसार आपूर्ति नहीं होती, पौधों में सुरक्षित रसायनों की सांद्रता और कीट-पतंगों के प्रजातियों के बीच प्रतियोगिता होती है। पतियों में नाइट्रोजन तत्व घटने से कीटों के खाने की आपूर्ति क्षमता बढ़ सकती है (होल्टोन एट अल, 2003), हालाँकि यह घटना हमेशा नहीं कभी-कभी होती है। इसलिए, पौधों में कार्बन डाइऑक्साइड बढ़ने से प्रजातियों के बीच-बीच में प्रतिक्रिया होती है।

कार्बन से नाइट्रोजन अनुपात बढ़ने से कीटों के ऊतकों का विकास धीमा हो जाता है और पतियों की अवस्था बड़ी होने से परपोषी, फाइटोफेगास कीटों की हमलावर प्रतिकूलता बढ़ने से अधिककार्बन से नाइट्रोजन अनुपात होने के साथ-साथ इनके विकास की अनुकूलता आ जाती है, उदाहरणतः पाइन सॉपलाइ (नेओडिप्रिओन लेकोण्टी), दर्शाते हैं की अधिक कार्बन डाइऑक्साइड सांद्रता के साथ उगाये गए पौधे से नाइट्रोजन उपयोगी क्षमता बढ़ जाती है। इसलिए, कम पोषक तत्व गुणवत्ता वाले पौधों के कारण अन्य कीट प्रजातियों में पोषण उपयोगी क्षमता बढ़ जाती है।

प्रपातीधबाद कीट-पतंगों की आबादी एवं इनके विकास पर पानी से प्रभावित होने के कुछ वैज्ञानिक प्रमाण भी मिले हैं। भारी बरसात के पानी कुछ कीट इसके प्रति संवेदनशील और मर जाते हैं या फसल बदल लेते हैं। उत्तरपूर्व अमेरिका के कुछ प्रदेशों में, प्याज थ्रिप्स प्रबंधन के वैकल्पिक चुनाव का विचार होना महत्वपूर्ण है। इसलिए, सर्द ऋतु में कुछ कीट मृदा में रहते हैं, कुछ क्रान्बेरी फल कृमि और अन्य क्रानबेरी कीट-पतंगों, बाढ़ से नियंत्रित आकलन के लिए मृदा का उपयोग किया गया था। जलवायु परिवर्तन होने के अनुमान से यह पूर्वानुमान है की अधिक तेजी एवं मात्रा में वर्षा होने का कीट-पतंगों की आबादी पर इसका ऋणात्मक प्रभाव होगा। तापमान, वर्षा परिवर्तन कासमान प्रभाव से परभक्षी कीट, परपोषी और रोगाणु के परिणाम स्वरूप आचरण में त्वरित गंभीर बदलाव हो सकते हैं। जलवायु परिवर्तन के लंबी अवधि के दौरान अधिक नमी और उनके विस्तार से कीटों की संख्या बढ़ाने में कवकीय रोगजनक सहायक होते हैं और शुष्क अवधि में घटती है।

कीट पर कुप्रभाव और वैश्विक गर्माहट वैश्विक गर्माहट परिणाम का कीटों पर कुप्रभाव होता है। स्ट्रेस पौधों पर कीटों का कुप्रभाव अधिक होता है सुरक्षित पद्धति के परिणाम स्वरूप कमजोर पौधे होते हैं और इस प्रकार कीट-पतंगों की संवेदनशील के स्तर में बढ़ोतरी होती है। उत्तर भारत में वैश्विक गर्माहट के प्रभाव से एच. अर्मिगेरा के शीघ्र आने, इसके परिणाम के रूप में उपज घाट जाती है। जलवायु परिवर्तन के परिणाम से शरद ऋतु के दरम्यान कीट-पतंग की तीव्रता बढ़ जाती है, अन्य मौसम की तुलना में बसंत ऋतु में बड़ी संख्या में आबादी बढ़ती है। अनेक कीटों जैसे हेलिकोवेर्पा स्प. परवासी कीट है, और इसलिए जलवायु परिवर्तन के परिणाम स्वरूप नए क्षेत्र में जाने के बाद तेजी से वहाँ के मौसम के अनुसार अनुकूलन कर लेते हैं।

जलवायु परिवर्तन का कीट-पतंगों पर सहनशक्ति की अभिव्यक्ति स्वयंपोषी पौधों की कीटों से प्रतिरोधक क्षमता ही एक पर्यावरण मित्रता का कीट प्रबंधन महत्वपूर्ण भाग है। इसलिए, कीट-पतंगों एवं उनके स्वयंपोषी पौधे के बीच जलवायु परिवर्तन एक परिवर्तित आकर्षण की कड़ी हो सकती है। भारत में उच्च नमी आर्द्रता पर ज्वार मिडगे की प्रतिरोधी क्षमता का आकलन, और केन्या का उपयुक्त तापमान में यह बढ़नी शुरू होती है। इस लाभ से वहाँ कीट-पतंगों के प्रभाव में बढ़ोतरी होती है और स्वयंपोषी पौधे के प्रतिरोधक क्षमता घट जाती है दबाव बढ़ने के कारण जलवायु अनुलन सहनशील उपलब्धता में कमी आ जाती है। जलवायु परिवर्तन भी बिना प्रतिरोधी फसल या प्रजाति पर कीट-पतंगों के आने की समस्या में सहायक होती है। नई फसल एवं प्रजातियों की जानकारी होने का लाभ मिलना चाहिए, नई वातावरण परिस्थिति के लिए एक संभव जलवायु परिवर्तन की प्रतिक्रिया अनुकूलन पद्धति का सुझाव होना चाहिए।

प्राकृतिक गतिविधियों पर जलवायु परिवर्तन का प्रभाव वैश्विक गर्माहट के परिणाम स्वरूप कीट-पतंगों एवं स्वयंपोषी पौधे उनके बीच प्राकृतिक गतिविधियों में सापेक्षिक बदलाव होते हैं इसके फलस्वरूप कीटों की विशिष्ट प्रजातियों में दोनों उतार एवं चढ़ाव की स्थिति बनी रहती है। तापमान के बदलाव से विभिन्न वर्ग कीटों के दैनिक गतिविधियों की प्रणाली के समय में भी परिवर्तन होता है, कीट की प्राकृतिक आपदाओं के लिए प्रबंधन में प्रतिदिन की पारस्परिक क्रियाओं में बदलाव हो सकता है। भविष्य के कीट प्रबंधन में कार्यक्रम जलवायु परिवर्तन की गतिविधि एवं प्रभावशाली के विश्लेषण करने पर प्राकृतिक शत्रु एक महत्वपूर्ण मसला हो सकता है। अधिकतर कीटों की शुरुआत कृषि-परिस्थितिकी तंत्र से होती है, और इनके बहुत से सुझावों के प्रमाण के अनुसार कीट-पतंगों और प्राकृतिक शत्रुओं (रोगजनक, परजीवी और परभक्षी) की पारस्परिक क्रियाओं से जनसंख्या नियंत्रित हो जाती है। भरी बरसात के बाद सूखे की बढ़ती अवधि के दौरान पूर्वी असंख्यकृमि माइथिन्मा सेपरटा(वॉक) की जनसंख्या बढ़ती है। तापमान और कार्बन डाइऑक्साइड बढ़ने से माहू(अफीड) की संभावना बढ़ जाती है, इसलिए कार्बन डाइऑक्साइड बढ़ने से परपोषी दरों में कोई बदलाव नहीं होता है। तापमान केवल कीटों के विकास को ही प्रभावित नहीं करता, अपितु परपोषी की प्रजनन क्षमता और इनके लिंग अनुपात को भी गंभीर रूप से प्रभावित करते हैं (दिललॉ और शर्मा, 2009)। कीट-पतंगों और उनके प्राकृतिक शत्रुओं के बीच आकर्षण का ध्यानपूर्वक अध्ययन और कीट प्रबंधन में प्राकृतिक शत्रुओं का उपयोग कराते हुए उपयुक्त पद्धति का विकास करना होगा।

जैविक और कृत्रिम कीटनाशकों पर जलवायु परिवर्तन का प्रभाव जलवायु परिवर्तन के परिणाम स्वरूप कीट क्षति की विविधता में बढ़ोतरी होती है। उच्च तापमान से शुष्क मौसम को और अधिक सूखा बनाता है और वर्षा की तीव्रता और मात्रा में परिवर्तन, आर्द्र मौसम को वर्तमान में और अधिक नमी बढ़ाता है। वर्तमान वातावरण प्रदूषण, मानवीय स्वास्थ्य जोखिम, और कीट पुनरुत्थान की संवेदनशील तीव्रता पर कृत्रिम कीटनाशकों के अनुयुक्त उपयोग का प्रभाव होता है। पौधे के प्राकृतिक उत्पादन, कीटरोगकारी (एंटीमोपैथोजेनिक) विषाणुओं, कवकों, जीवाणुओं एवं सूत्रकृमियों और कृत्रिम कीटनाशकों के प्रति वातावरण अधिक संवेदनशील होता है। तापमान और पराबैंगनी किरणों बढ़ने से और सापेक्षिक आर्द्रता घटने से इनके नियंत्रण करने की प्राकृतिक पौधे उत्पादकता एवं जैविक कीटनाशक की क्षमता को तीव्रता से प्रभावित करती है। इसलिए भविष्य में वैश्विक गर्माहट परिस्थिति की कीट प्रबंधन उपयुक्त एवं प्रभावशाली नीति विकसित करनी होगी। किसानों को जरूरत है एक प्रभावशाली नीति की जिससे वह उपयुक्त पैदावार प्राप्त करते रहे।

कीट-पौधे के आकर्षण से परिणाम बदलने से निवेश लागत और लाभ के बीच का सापेक्षिक संबंध भी परिवर्तित हो जाता है। जलवायु लम्बी विविधता के परिणाम स्वरूप फसल उत्पादन पर कीट हानि विभिन्नता बढ़ने का असर इस की आर्थिक व्यवस्था पर भी महत्वपूर्ण प्रभावित होती है। तापमान और पराबैंगनी किरणों बढ़ने से, और सापेक्षिक आर्द्रता कम होने से इनके नियंत्रण नीति भी कमजोर हो जाती है और इसलिए, फसल उत्पादन एवं खाद्य सुरक्षा की समस्या को एक त्वरित आधारित दीर्घकालीन समाधान करना होगा।

जलवायु परिवर्तन के प्रभाव को कम करने की नीतिध्वोजना सस्य क्रियाएँ, प्राकृतिक शत्रु, स्वयंपोषी पौधों की सहनशीलता, जैविक कीटनाशक और कृत्रिम कीट नाशक को अब कीट प्रबंधन के लिए अधिकतर उपयोग करते हैं। फिर भी

इनमें से कई कीट प्रबंधन पद्धति पर्यावरण के प्रति अति संवेदनशील है। भविष्य में वैश्विक गर्माहट की परिस्थितियों के अनुसार कीट प्रबंधन की असरदार नीतियाँ विकसित करने की आवश्यकता है।

स्वयंपोषी पौधों की संवेदनशीलता कीट प्रबंधन के लिए एक प्राकृतिक मित्र कारक महत्वपूर्ण होता है। जलवायु विविधता एवं कीट प्रबंधन के लिए सुरक्षित प्रजातियों में संवेदनशील की पहचान कर सहनशीलता का स्थिर समाधान करना पड़ेगा।

संक्रमित पौधे को कुछ प्रमुख कीट समस्या को नियंत्रण का विकास करना होगा। संयुक्त स्वयंपोषी पौधों का सुरक्षित पर्यावरण एवं स्थान का निपटारा करना पड़ेगा।

वातावरण शत्रुओं की बढ़ती गतिविधियों से बचने के लिए फसल विविधता एक प्रमुख प्रभावी पद्धति हो सकती है। वहाँ फसल प्रजातियों को वातावरण शत्रुओं के खाने से बचने की विकास की जरूरत है, कीट प्रबंधन के लिए फसल पद्धति को विविधता के अनुसार वातावरण शत्रुओं की पहचान करनी होगी।

जलवायु परिवर्तन के प्रभाव के अनुसार वहाँ के पर्यावरण में कृत्रिम कीटनाशकों की उचित जानकारी होना जरूरी होता है। इसलिए, जलवायु परिवर्तन के कुप्रभाव को कम से कम करने की रणनीति के तहत कीटनाशक उपयोग की योजना का विकास करना जरूरी है। अंततः, कीट प्रबंधन पद्धति समावेश का उपयोग करते हुए हमें टिकाऊ फसल उत्पादन के लिए कीट प्रबंधन के प्रभावी विभिन्न कारकों और कीट वर्णक्रम, फसल पद्धति में बदलाव करना होगा।

संदर्भ

1. बाले, जे., मास्टर्स, जी., होडिकंसन, आई., अमक, सी., बेजमेर टी., ब्राउन, वी., बटरफील्ड, जे., बुसे, ए., कौल्सोन, जे. और फरर, जे. (2002) हेर्बिवोरी इन ग्लोबल क्लाइमेट चेंज रिसर्च: डाइरैक्ट इफैक्ट्स ऑफ राइजिंग टेम्परेचर ऑन इनसेक्ट हेर्बिवोरस। ग्लोबल चेंज बयोलॉजी। 8:1-16।
2. बाले, जे. एस., मास्टर्स, जी., होडिकंसन, आई. डी., अमक, सी. और बेजमेर टी. (2002) हेर्बिवोरी इन ग्लोबल क्लाइमेट चेंज रिसर्च: डाइरैक्ट इफैक्ट्स ऑफ राइजिंग टेम्परेचर ऑन इनसेक्ट हेर्बिवोरस। ग्लोबल चेंज बयोलॉजी। 8:1-16।
3. बाले, जे. एस. डी., मास्टर्स, जी. जे., होडिकंसन, आई. डी., अमक, सी., बेजमेर टी. एम., ब्राउन, वी. के., बटरफील्ड, जे., बुसे, ए., कौल्सोन, जे. सी., फरर, जे., गुड, जे. ई. जी., हरिंगटोन, आर., हार्टले, ए. एस., जोस, टी. एच., लिंडरोह, आर. एल., प्रैस, एम. सी., सिम्निऑडिस, आई., वाट., ए. डी., और व्हीटकर, जे. बी. (2002) हेर्बिवोरी इन ग्लोबल क्लाइमेट चेंज रिसर्च: डाइरैक्ट इफैक्ट्स ऑफ राइजिंग टेम्परेचर ऑन इनसेक्ट हेर्बिवोरस। ग्लोबल चेंज बयोलॉजी। 8:1-16।
4. कैन्नन, आर. जे. सी. (1998) दी इम्प्लीकेंस ऑफ प्रेडिकटेड क्लाइमेट चेंज फॉर इनसेक्ट पेस्ट्स इन दी यूके, विद एम्फेसिस ऑन नॉन-इंडिजेनौस स्पेसिस। ग्लोबल चेंज बाओलोजी। 4:785-96।
5. दिललॉ, एम. के. और शर्मा, एच. सी. (2009) टेंपरेचर इंफ्लुएंस दे दी परफॉर्मंस अंड इफेक्टिवानेस ऑफ फील्ड अंड लैबोरेटरी स्ट्रेन्स ऑफ दी इन्फेकमोनिड परासीटोइड, कंपोलेटिस क्लोरीडी। बायोलोजिकल कंट्रोल। 54:743-750।
6. हररिंगटन, आर., फ्लेमिंग, आर. अंड वोइवोद, आइ. (2001) क्लाइमेट चेंज इम्पैक्ट्स ऑन इनसेक्ट मैनेजमेंट अंड कंजर्वेशन इन टेम्परेट रिजन्स: कान दे बे प्रिडिकटेड? एग्रिकल्चर फोरेस्ट्स एण्टोमोलोजी। 3: 233-240।
7. हिक्कालिंग, आर., रॉय, डी. बी., हिल, जे., के. और थॉमस, सी., डी. (2005) ए नॉर्थवार्ड शिफ्ट ऑफ रेंज मार्जिन्स इन ब्रिटिश ओइडोनाटा। ग्लोबल चेंज बाओलोजी। 11: 502-506।
8. होलटन, एम., के., लिण्ड्ज़ेथ, आर. एल. और नोर्थम, इ., वी. (2003) फोलियर क्वालिटी इंफ्लुएंस ट्री-हेर्बिवोर-पैरासीटोइड इंटरैक्शन: एफफेक्ट्स ऑफ एलेवेटेड कार्बन डाइऑक्साइड, ओजोन अंड प्लांट जीनोटाइप। ओएकोलोजिया। 137:233-244।
9. राजस्थान कृषि प्रताप, अगस्त, 2017

International Conference on
**Promoting Environmental Technologies for
 Waste Management and Sustainable Development
 (WMSD-2021)**

12-13 December, 2021

Venue: Hybrid mode (Online & at
 Auditorium, Campus-11,
 Kalinga Institute of Industrial
 Technology, Bhubaneswar, Odisha*)



ORGANIZED BY

IN COLLABORATION WITH



National Environmental
 Science Academy (New Delhi)



BCKIC
 Bhubaneswar City
 Knowledge Innovation
 Cluster
 (An initiative by the Office of the Principal
 Scientific Adviser to the Government of India)

IN ASSOCIATION WITH



KALINGA INSTITUTE OF
 INDUSTRIAL TECHNOLOGY



CSIR-INSTITUTE OF
 MINERALS AND MATERIALS
 TECHNOLOGY



CENTRAL INSTITUTE OF
 PETROCHEMICALS
 ENGINEERING & TECHNOLOGY



ENVIRONMENT & SOCIAL
 DEVELOPMENT ASSOCIATION

ABOUT THE CONFERENCE

Environmental and economic implications have compelled proper eco-friendly disposal of modern day wastes and also made it essential to come up with alternative waste management practices that reduce the environmental burden resulting from unwise waste disposal habits. Increasingly vigilant environmental regulators are imposing austere regulations for waste treatment prior to discharge coupled with escalation in the costs for direct disposal present two interrelated problems such as traditional practice of disposing waste loaded with pollutants need to be either discontinued or upgraded and incremental improvement in the waste management technologies, which has always been a game of playing catch-up with the regulations, have inflated infrastructure requirement and treatment cost significantly. Therefore, rather than continuing slow evolution, adaptation of a leapfrogging strategy could be more effective. Although a great deal of research in carried out in various academic and research institutions, their practical applications is rather slow. Additionally, proliferating global population coupled with high demand of commodities are depleting the natural resources in an alarming rate. Therefore, there is an urgent need not only to develop suitable waste disposal strategy but also to augment the waste recycling technologies for resource recovery in a circular economy model. International Conference on Promoting Environmental Technologies for **Waste Management and Sustainable Development (WMSD-2021)** aims to bring together leading academicians, scientists, researchers, industry experts and policy makers to exchange and share their experiences and on various aspects of Waste Management and Sustainable Development. It also provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of waste management and resource recycling. Selected

INVITATION OF RESEARCH ARTICLES for PUBLICATION in NESA Journals

INTERNATIONAL JOURNAL ON AGRICULTURAL SCIENCES

ISSN NO. 0976-450X | NAAS RATING 2.60

INTERNATIONAL JOURNAL ON ENVIRONMENTAL SCIENCES

ISSN NO. 0976-4534

INTERNATIONAL JOURNAL ON BIOLOGICAL SCIENCES

ISSN NO. 0976-4518

INDIAN JOURNAL OF UNANI MEDICINE

ISSN NO. 0974-6056

These JOURNALS ON DIFFERENT SUBJECTS are being published by this Academy. Send your manuscripts for peer-review by e-mail. THE AUTHORS MUST MENTION ADDRESS, Contact Nos. and E-MAIL ID in their forwarding letter. Proof will be sent for correction before publishing. A pledge of originality will be signed by the authors. Five sets of reprints will be dispatched within 30 days after the receipt of the PROCESSING FEE. along with a press print soft copy of final version of manuscript.

For further details and NOTES FOR AUTHORS,
 please contact Academy at
nesapublications@gmail.com infonesa88@gmail.com

**EACH ONE PLANT ONE
 STAY SAFE WEAR MASK**

papers presented in the conference will be published in journals published by NESA or other suitable publishing houses. The conference will feature renowned speakers representing both academia and industry who are renowned experts in various thematic areas. Conference will include a start-up track session, providing opportunity to innovators to showcase new technologies.

SUB THEMES OF THE CONFERENCE

HYBRID WMSD-2021 (offers both also In-Person* or virtual mode) WMSD 2021 invites papers with the following sub themes

- Agro-waste management
- Burning of the waste and Air Pollution
- Environmental Pollution and Public Health
- Plastic & Polymer recycling and reuse
- Start-up ecosystem in WMSD
- Polar and Marine Science
- Industrial waste management and Resource recycling
- Soil Pollution and Treatment
- Climate Change
- Waste water treatment and reuse

The participants may send their abstracts by **30th November 2021** and full length papers by **6th December 2021** online to 2021wmsd@gmail.com The participants may present their papers in the Conference by oral/poster.

Interested applicants can register at www.bckic.in/wmsd2021

*** Individuals to follow COVID-19 Safety Protocol and should have certificates of both doses of COVID-19 Vaccine.**