STOP CHOKING THE EARTH. SAY NO TO PLASTIC BAGS.

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NESA

NATIONAL ENVIRONMENTAL SCIENCE ACADEMY

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TRC Sinha Lifetime Achievement Award was presented to Dr. Alok Adholeya, Programme Director, Sustainable Agriculture Division, IHC, TERI, New Delhi and Director, TERI Deakin Nanobiotechnology Centre, TERI Gurgugram by Honourable Shri Arjun Ram Meghwal Ji in the NESA 31st Annual Conference at Conference Centre, University of Delhi, Delhi on 15-16 December, 2018.

NESA Award 2019 Notification No. 3

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(3) NESA SCIENTIST OF THE YEAR AWARD

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AGE : Below 35. The recipients shall get Citation, Certificate, Memento and a Gold plated medal.a Gold plated medal.

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MECHANISM OF NITRATE POLLUTION IN THE GROUNDWATER & ITS HEALTH IMPLICATIONS

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Occurrence of nitrate in groundwater is normally of anthropogenic nature due to the contact of soil cover with contaminants like nitrate fertilizers. Factors which contribute to the aquifer contamination comprise the secondary porosity of aquifer and the porous and permeable soil cover. Aquifer could contaminate by leaching source, Point source and Biochemical source.

Leaching Mechanism

The use of nitrogen (N)-fertilizer in agriculture has significantly increased over the past 30 years to meet the food and living requirements of the speedily growing population. Therefore, the use of nitrate in fertilizers causes a foremost predicament in groundwater contamination. Some of the fertilizers infiltrate with the irrigation and/or rainwater to recharge the aquifer. The increased uses of nitrate fertilizers in the villages enhance the contamination of groundwater. The local farmers of the study area admitted the use of excessive nitrate fertilizers and believe that it is necessary to have better agricultural productivity.

Point Source Mechanism

Wastewater in the upper soil layer either from the cesspools or the disposal ponds could infiltrate to the groundwater aquifer. The absence of a sewage system encourages such types of contamination by nitrate. Thus, the level of nitrate in groundwater will continue to increase as the sources of contamination. These sources are more dangerous than the leaching ones, because of the daily use of water, which then recharges the aquifer.

Biochemical Mechanism

The interaction of nitrogen compounds with the surrounding media leads to oxidation of nitrogen compounds, which finally contaminate the aquifer. Generally, organic matter -nitrate bearing- is distributed on the surface or near surface of the ground (sewage water, cesspools and drainage) produces nitrate. Oxidation of ammonia (from waste water, e.g. cesspools, sewage water and disposal ponds) into nitrite by bacteria (Nitrosomonas) follows the reaction below: $_2NH_4 + _4O_2 = _2NO_2 + _4H_2O$

Nitrite is then oxidized to nitrate by another type of bacteria (Nitrobacteria)

$_2NO_2 + O_2 = _2NO_3$

This conversion of ammonia in to nitrates is called nitrification. The nitrification rate increases in the presence of oxidation conditions and in the case of a high population of nitrifying bacteria.

Impact of Agriculture on Groundwater

Major Sources of Nitrate Pollution:

There are number of sources of nitrate contamination of groundwater such as, human and animal waste, industrial wastes from food processing, fertilizer processing industries and septic tanks; the major source of nitrate pollution in the densely populated areas is the septic systems of that area. Another major reason for the nitrate pollution may be taken as the disturbances in the natural systems due to the changes made by the mankind for its facilities; one example of this is the effect of forested areas on

the leaching of nitrate to the groundwater. Natural, dense forests conserve nitrogen but cutting of such forests by the human causes lesser conservation of nitrogen, which in turn leads to nitrate pollution of the groundwater. Another major source of nitrogen pollution of groundwater is the application of nitrogen-rich fertilizers to the agricultural land areas. The nitrogen provided to such areas in the form of fertilizers can be consumed in number of ways such as; it may be: taken up by plants; stored in soil; lost to atmosphere and it may be lost to groundwater. There are number of reasons or factors that could lead to more of the nitrogen leaching to the groundwater. Some of them are summarized here under:

- **Nitrogen content**
- **Nitrogen source**
- **Irrigation practices**
- **Soil texture**

Nitrates as a Health Hazard

Problems Associated With High Nitrate Levels

Nitrate incorporation in humans takes place via drinking water and food. The water used for drinking and cooking in the rural areas is high in nitrate content. Although there have been studies performed attempting to link nitrate consumption to various illnesses, a few are stated here under:

Methemoglobinemia

Cases of *Blue-Baby Syndrome* usually occur in rural areas which rely on wells as their primary source of drinking water. Often these wells become contaminated when they are located close to cultivated fields, feedlots and septic tanks. *Methemoglobinemia* is the condition in the blood which causes *Infant Cyanosis* or Blue-Baby Syndrome. In the GIT of an infant certain bacteria converts the nitrate ion to nitrite ion, which then reacts with two molecules of hemoglobin to form methemoglobin; In acid mediums, such as the stomach, the reaction occurs quite rapidly. This altered form of blood protein (hemoglobin) prevents the blood cells from transporting oxygen, which leads to the oxygen deprivation in the infant; due to which infant often take on a blue or purple tinge in the lips and extremities, hence named as, BlueBaby Syndrome. Other signs of *Methemoglobinemia* are gastrointestinal disturbances, vomiting, diarrhea and relative absence of distress when severely cyanotic but irritable when mildly cyanotic. *Methemoglobinemia* most often affects infants of less than six months in age; the primary reason is that infants possess much less oxidize-able hemoglobin than adults, so a greater percentage of their hemoglobin is converted to methemoglobin which greatly decreases the blood's ability to carry oxygen.

Stomach and Gastrointestinal Cancer Scientists claim that nitrate represents a potential risk because of nitrosation reactions which, with appropriate substrates present in the body Nitrates form N-nitroso compounds which are strongly carcinogenic in animals.

There is still no concrete evidence to support this theory of carcinogenicity of nitrates. This inconsistency suggests that nitrate alone cannot be the only cause of elevated regional gastric cancer mortality rates, but these could result from a number of other factors, such as high pesticide levels, presence of coli form bacteria and/or other groundwater contaminants.

Thyroid Problems
Histo-morphological changesin thyroidare observed due to 250 and 500 mg/l of Nitrates. Number of experimental studies or data suggests that Nitrates impairs thyroid function involving the hypothalamo–hypophysio–thyroid axis.

Reproductive Problems:
Few studies have been published regarding water nitrate and the outcomes of spontaneous abortions, stillbirths, premature birth, or intrauterine growth retardation. Results of these studies have been inconsistent, possibly indicating no true effect of water nitrate on reproductive outcomes at the levels evaluated in these studies.

Alternatively, the inconsistencies may be due to the differing periods over which exposure was assessed, differing levels of water nitrate across studies, or differences in exposure to other cofactors.

Livestock Health
Nitrate intake by dairy cattle is related to the levels found in forage and drinking water. According to research conducted on dairy cattle (nitrate-nitrogen in drinking water at levels under 10 mg/l is safe for animals. Between 10-20 mg/l nitrate-nitrogen, water is safe for livestock unless their feed has high nitrate levels. Problems for livestock can occur between 20 – 40 mg/l nitrate-nitrogen if feed contains more than 1,000 ppm. If well water is between 40-100 mg/l nitrate-nitrogen, feed should be low in nitrate, well balanced and fortified with vitamin A. At levels between 100 - 200 mg/l nitrate-nitrogen in water, studies report decreased appetite.

Aquatic Life
Nitrate does not appear to be acutely toxic to adult fish except at extremely high concentrations where mortality is due to salinity effects. However, available research indicates that nitrate concentrations lower than the drinking water standard cause substantial egg and fry mortality in some salmonid fish species.

FERMENTED FOODS: SUPER FOODS FOR SUPER HEALTH

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Introduction
India is traditionally rich in fermented foods. In the Indian sub-continent, fermented food using local food crops and other biological resources are very common. But the nature of the products and base material varies from region to region. Fermented foods such as idli and dahi were described as early as 700 BC. At present, there are hundreds of fermented foods with different base materials and preparation methodology. Each fermented food is associated with a unique group of microbiota, which increases the level of proteins, vitamins, However, fermented foods are still produced traditionally by spontaneous fermentation and only limited knowledge has been obtained regarding the microbiota of these products.

Fermentation is the process of using microorganisms, such as bacteria or yeast, to convert carbohydrates to alcohol or organic acids under anaerobic conditions.

There are two types of fermentation
1. Alcoholic fermentation/ Ethanol fermentation: where pyruvate (from glucose metabolism) is broken down into carbon dioxide and ethanol by bacteria and yeast. Alcohol fermentation has been used to produce beer, bread and wine.

2. Lactic acid fermentation: Pyruvate molecules from glucose glycolysis may be further fermented into lactic acid. Lactic acid fermentation converts lactose into lactic acid.

Fermented foods
Yogurt: Yogurt is usually an accompaniment to every meal, in some form or the other. Whether it is thick lassi in the north, or curd rice in the south, there are benefits to consuming yogurt, which is made by fermenting milk. Curd can contain upto 100 million probiotics cultures per gram, and help cleanse your gut, soothe inflammation and irritable bowel syndrome, boost the immune system and generally promote a healthy digestive tract. What's more, it contains the added benefits of milk (calcium, vitamin D, protein and vitamin B12), that even lactose-intolerant people can enjoy.

Idli/ Dosa/ Paniyaram: The fermentation process increases the bioavailability of proteins, and also enriches the idli with vitamin B. They are light and balanced, with carbohydrate, fibre, protein and vitamins being available in one food.

Kimchi: The dish of fermented cabbage can boost heart health, prevent cancer, fight free radicals in the body, and of course, boost gut health. This versatile dish can be consumed with something, or even on its own. Try to eat it raw, for optimum benefits. The probiotics found in this fermented food contain anti-ageing benefits as well, keeping your skin and hair looking younger and more supple. It is also a good detox dish, and a rich source of vitamin A.

Cheese: During the fermentation process, just like in the case of idlis, vitamin B develops, which is a vital nutrient that keeps the body functioning smoothly. It also contains the added benefits of protein, calcium and D vitamins that keep bones, joints and teeth in shipshape. Avoid processed cheeses and opt for those that are fermented naturally.

Miso: This Japanese staple is found everywhere – in soups, mains and even on salads. It is a natural source of vitamins E, K and folic acid. Made by fermenting soyabeans, barley, brown rice and other grains with Aspergillus oryzae, it adds flavour to your dish, and boosts gut health

Kombucha Tea: Kombucha Tea has been consumed in China as an elixir of health! This unique drink combines all the benefits of tea, along with healthy probiotics that are a result of the fermentation process. The enzymes that cause the fermentation aid digestion, nutrient-absorption, overall immunity and increased metabolism for weight-loss. It detoxifies the body and has antioxidants.

Dhokla: Made with gram flour (for protein and vitamins), then fermented and steamed, it has significantly less calorie content than other yummy snacks. The fermentation of the flour, again increases the nutritive value, just like it does in idlis.

Sauerkraut: Made from simple cabbage and salt, this European staple is the western counterpart to the Korean kimchi. Sauerkraut is not just probiotics, but is also fibre-rich, ensuring that blood sugar and cholesterol levels remain balanced. However, cooking it destroys its benefits, so be sure to have it raw.

Miso

Yoghurt

Cheese

Dhokla

Saucerkraut

Kimchi

Kombucha tea

Idli-Dosa

Examples of some Indian fermented foods

Fermented food	Ingredients	Place of origin	Related Microorganisms
Rabdi	Flour of barley, pearl millet, corn or soybean and country buttermilk	Rajasthan	*Bacillus and Micrococcus* sp
Kulu	Wheat flour, buttermilk	Himachal Pradesh	*Lactobacillus* sp.
Idli	Rice, black gram dhal, table salt, fenugreek seeds	South India	*L. mesenteroides, E. faecalis P. cerevisiae*
Dosa	Rice, black gram dhal (either raw or parboiled rice), table salt	South India	*L. mesenteroides, E. faecalis*
Dhokla	Bengal gram dhal, rice and leafy vegetables	Gujrat	*L. fermentum, L. mesenteroides E. faecalis*
Sinki	Radish root	North-east India	*L. casei, L. brevis, L. plantarum L. fallax, L. fermentum*
Kinema	Soybeans	Darjeeling, Sikkim	*E. faecium*
Kanji	Carrot or beet root, rice, mustard	North India	*L. pentosus, L. paraplantarum, L. plantarum*
Curd (Dahi)	Milk	India	*S. cremoris, S. lactis, S.thermophilus, L. bulgaricus, L. acidophilus, L. helveticus, L. cremoris, Lactobacillus delbrueckii subsp. indicus*
Gundruk	Leaves of mustard/radish /cauliflower	Arunachal Pradesh	*P.pentasaceous,L. fermentum, L. casei*

ANTIBIOTIC RESISTANCE IN URINARY TRACT INFECTIONS

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Urinary tract infection (UTI) remains one of the most common infectious bacterial diseases in the routine outdoor patient. Generally more than 150 million people are diagnosed with UTI each year.[1] UTI are associated with multiplication of causal pathogen, Gram- negative bacteria and is the second most common infection diagnosed in human. Urine formed in the kidney, is a sterile fluid that serves as a good culture medium for the growth of bacteria.

It is a serious health problem affecting millions of people each year and is leading cause of Gram-negative bacteremia. The pathology of UTI and the antibiotic resistance of uropathogens have been changing over the years due to non-judicious administration of antibiotics [2, 3]. The common uropathogens identified in the patients with UTI include enteric Gram-negative bacteria, such as *Escherichia coli*, *Pseudomonas aeroginosa*, *Klebsiellla, pneumonia*, *Shigella* sp., *Proteus* sp. including fungus, Candida albicans. *E. coli* expresses a voculating cytotoxin, which results in damage to kidney epithelium [4].The distribution of urinary tract infection in population varies with age, sexual activity and longer duration of catheterization. Women are more prone to UTIs than men as per anatomical structure of the genitourinary tract. UTI has become the most common nosocomial infection that accounts 35% of the hospital acquired infections. A major percent of women experience UTI at some point in their life and almost one third pass through recurrent infection[5]. Improper intake of broad spectrum antibiotics, insufficient health care, immuno-suppression and prolonged hospitalization are some of the major factors that increase the chances of resistance among patient [6,7]. Urinary tract infection is manifested by- abdominal pain, blood in the urine, cloudy urine, lower back pain, painful urination with burning sensation.

In the present scenario, antimicrobial drug resistance of major uropathogens has posed a global problem. Antimicrobial resistance has been increased five fold for the last ten years. [8].Poor patient compliance and non-judicious intake of proper antibiotic therapy have resulted in the resistance to many antibiotics. Now a days flouroquinolones resistance has developed among uropathogens i.e., *E. coli* and Klebsiella and other uropathogens because of Extended Spectrum Beta Lactamase (ESBL) and Amp C enzymes[9].The genetic elements such as plasmids, integrons, transposons play an important role to increase the degree of resistance. As antimicrobial resistance continues to increase, remaining antimicrobial drugs have a higher likelihood of causing unwanted side effects such as gastrointestinal distress, kidney related problems, nausea and vomiting. Uropathogens are detected through Gram staining, Eosin methylene blue test.,SIM agar test.,Triple sugar iron test, Methyl red & Vogesproskauer test

It has been argued that there is direct relation among susceptibility and specific medium for detection. As per susceptibility of different pathogens towards antibiotics indicated increasing resistance among fluoroquinolones, this has been occurred due to non-judicious administration of prescribed regimen and quantity. Some under diagnosed samples for O157:H7 strain of *E.coli* may conclude catastrophic outcome of the treatment. Major presence of *E.coli* (O157:H7) and resistance towards generally recommended fluoroquinolones posed a major challenge to public health system. In our record of administration of antibiotics (aminoglycosides, flouroquinolones, cephalosporins, penicillin and many more) had shown complete resistance for most of the samples tested in our laboratory. Therefore it can be stated that disease control centers/primary care providers will have to look into the strategy again to combat increasing resistance pattern.

As we know that *E.coli is* a major threat in UTIs, we will have to control increasing resistance through surveillance and following cultural practices of samples of patients protecting our general health and economy (treatment) for resource limiting countries like India.

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A NOVEL AND UNIQUE GIFT OF NATURE FROM BASTAR: THE BODA

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Bastar is the southernmost district of Chhattisgarh in central India which has escaped excessive human interference and exploitation of its forests. Bastar is endowed with a unique blend of traditional knowledge and rich floral diversity. The region is well known as the island of Shorea robusta tree forest which is a key source for white and black truffle called Boda. It is also known as black gold of sal forest. It is found 1-4 cm near sal tree and is hard from outside and soft from inside. It is mainly of two types viz., black pulp truffle (Jatha boda) and white pulp truffle (Rakhadi boda). It sets underground with the onset of early monsoon in the soft and elevated soil. It is a small round fruiting body of a fungus that grows underground (Fig. 1). It is an edible mushroom with high protein, vitamin and fiber with low calorific value used by the local inhabitants as delicious food. Tribal community of Bastar uses it as food and medicine to heal several ailments.

The boda is an important source of nutritive food and is easily digestible. It is consumed not only for its innate flavor and taste but also for its immense nutritional value. It is rich sources of protein, lipids, amino acids, glycogen, vitamins, minerals, polysaccharide, glycoprotein and proteoglycans. It is an excellent source of protein and contains all the essential amino acid required by an adult. Tryptophan and lysine are present in high concentrations as compared to cystein and methionine. It is an excellent source of riboflavin, nicotinic acid, pantothenic acid and ascorbic acid. Its mineral salt content is superior to that of meat, fish and nearly twice that of the most common vegetables. The minerals such as iron, potassium, phosphorus, calcium and copper along with carbohydrate, protein, fat and ash are present abundantly in boda. They are also rich in vitamin B and vitamin D. On fresh weight basis the boda is superior in protein content to the vegetables and fruits which are generally conventional protein sources. It has high moisture content as compared to that of beef and fresh vegetables. The boda possess a high protein and low caloric diet and can thus be recommended to heart patients. The carbohydrate and fat contents are quite low. The absence of starch makes it an ideal food for diabetic patients and for persons who wants to shed excess fat. It is a cardiovascular, anticancer, antiviral, antibacterial, antiparasitic, anti-inflammatory, hepatoprotective, antidiabetic, immunomodulatory and inhibits tumor growth. Currently, several extracts have been used in Japan, Korea and China as adjuncts to radiation treatments and chemotherapy.

Market price of Boda in Jagdalpur is 500-3000 / kg. Thus, in light of vast potentiality of boda as a rich source of protein and essential nutrients for dietary source among local tribal inhabitants of Bastar. The present study was a focused endeavor on the assessment of fungi associated with boda as well as the protein and moisture content analysis of boda sample viz., white boda and black boda collected from the sal forest area of Jagdalpur, Bastar, Chhattisgarh. The fungus isolated from the pulp of white boda and black boda samples were identified on the basis of its morphological and microscopic characterization as Rhizopus sp., Mucor sp., Aspergillus sp. and Penicillium sp. (Fig. 2). In nut shell, findings revealed the presence of fungi associated with boda and the wide array of nutrient availability in the boda especially the high protein and moisture content makes it a good food of choice. Moreover, this is the first report of its kind depicting the presence of novel array of fungal association and the unique nutritive value of boda from Bastar region. All the fungal isolates were preserved in the form of slants for further investigation. However, the molecular characterization using 18s r-RNA sequencing of all the isolated fungi from boda sample and to study the molecular mechanism of boda nodule formation, its fungal association in natural habitat and its lab cultivation techniques along with the protein isolation from the boda its purification and characterization is the future prospect of the present investigation. However, further isolation and characterization of the bioactive compound from boda for novel drug discovery can also be targeted for future research prospects.

Fig. 1: Sample of boda and isolation of fungi

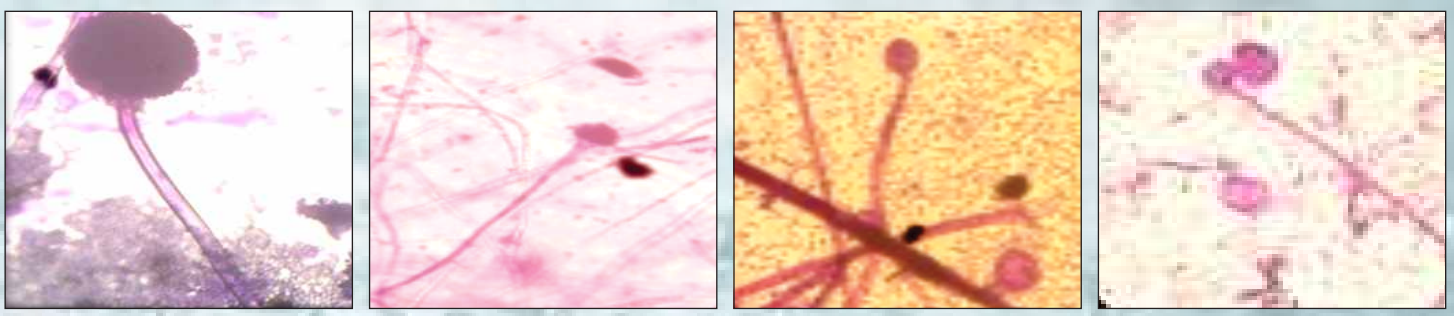

Fig. 2: Microscopic view of the fungi associated with Boda

THE IMPORTANCE OF THE USE OF AUTHORIZED CHEMICALS FOR THE CONTROL OF THE MITE VARROA DESTRUCTOR TO REDUCE THE PROBLEMS OF CONTAMINATION OF HONEY IN MEXICO

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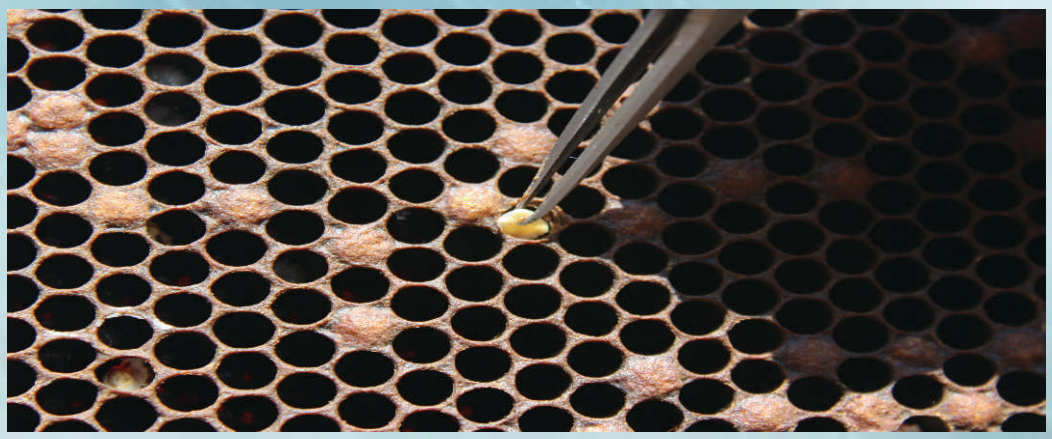
At present, the mite Varroa destructor is considered the main health problem facing apiculture industry worldwide. This mite was first reported in Mexico in 1992; and in 1996 the bee colonies throughout the national territory were already infested with this parasite, with the exception of Baja California. Among the main damages caused by the mite, they range from the reduction of the life span of infested bees to the total loss of the colony. When the mite arrived in the state of Yucatán, beekeepers reported a mortality of 30-70% of infested colonies. Likewise, it was observed that infested colonies reduce honey production by up to 65% when compared to colonies free of this parasitosis. In this sense, the Yucatan Peninsula, one of the most important honey producing regions nationwide and worldwide, due to the quality of the honey that is produced, and because more than 90% of the production is destined for the international market. There were already several local bee diseases but they were considered of minor importance. However, when the mite was registered, it was observed that the infested colonies were susceptible to other diseases. For this reason, the Mexican beekeepers were in need of applying various chemical products authorized for the control of this mite. But the application of these chemicals in the colonies presents a series of drawbacks that limit their use, because the risk of contaminating the honey and wax from the treated colonies is increased.

In Mexico, there are two common chemicals made from pyrethroids, known commercially as flumethrin and fluvalinate, which have demonstrated high efficacy in the control of the mite and are also quite easy to apply. However, improper use of these products using doses lower than those recommended or using the product for a prolonged period of time and continuously has caused the emergence of populations of pyrethroid resistant mites. Resistance has been monitored in different local mite populations where some individuals are capable of tolerating toxic doses that would be fatal to the remaining members of the same population. It is important to mention that resistance can be successfully reversed by early detection via specially designed sensitive tests to identify the presence of resistant mites in a population. The phenomenon of pyrethroid resistance by the mite is mainly due to two mechanisms: an increase in detoxification levels by means of the P-450 monooxygenase enzyme and a reduction in the sensitivity at the target site of the sodium channel. Therefore, it is important to find new options for the treatment of diseases to rotate the application of active ingredients, thus reducing the probability of the development of resistant mites and reducing the danger of contaminating the honey and wax of the colony treated. Photo credit: Authors



APPEAL TO LIFE MEMBERS

NESA Life Members are requested to submit short articles for the NESA e-Newsletter that are consistent with NESA's objectives to improve environment. The articles should focus on topics related to environment and facilitate communication and discussion among researchers, academicians and students. The articles for September edition can be submitted to nesapublications@gmail.com before **25th September, 2019**.

Dr. R.S.S. Tomar, Editor, NESA E-newsletter

From the Editor's

Dear Readers,

I wish my warm wishes on auspicious occasion of Ganesh Chaturthi and Muharram.

In September issue, we recount the various projects and popular articles. This issue also includes seven Annual awards by Academy for its members actively involved in their field or events and activities organised by the Academy. NESA is well known for its environmental awareness activities.

I humbly request to all the members of the Academy to please plant a single tree on his/her birthday or any member of the family, friends and relatives and share the memorable pictures with us. We would like to include in our Newsletter and it will serve as an inspiration and motivation to many for making our Planet with the motto "Green and Clean Environment".

Once again, I express sincere and huge thank to all the persons who contributed writing the wonderful and inspiring articles, without which there wouldn't have been this newsletter issue. Please continue sharing such articles and share with your friends 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. R. S. Tomar
Editor-in-Chief

Dr. Sushma Tiwari
Associate Editor

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To,

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