



16th ANNUAL REPORT 2019-20

TIES – ties Mind and Nature



TROPICAL INSTITUTE OF ECOLOGICAL SCIENCES

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SIXTEENTH ANNUAL REPORT
(2019-20)



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Preface

TIES is stepping to the 16th year of its existence. Sixteen years of age for a voluntary organization is very crucial, because it is the period at which it decides whether it will be sustained or not, especially in environmental sector in Kerala. Incidentally, TIES paved a new path of professionalism over the years among the eco-NGO sector in Kerala and became one among such very few organizations in the country. TIES received recognitions of that level also during these years such as Best Green Institution Award, 2012, Centre of Excellence for Emerging Kerala Projects, 2012, Kerala State Tourism Award for the most innovative project in the tourism sector, 2013, Vanamitra Award from Forests and Wildlife Department, Government of Kerala 2018, and recently, got global environment protection project award from World Malayalee Council 2018-19 and Paristhithi Mitra Award from St. Stephens College. TIES also became one of the leading academic and research support organization for projects in government, corporate and voluntary sector. TIES projects are supported by state, national and international agencies too. The 16th year of TIES is marked with national, international, CSR and governmental grants. We extend our whole hearted thanks for the support and co-operation rendered by all director board members and our well wishers. With great pleasure we submit the 16th annual report before the board of directors, members and well wishers.

Sixteenth Annual Report

Major Projects & Programmes

1. Research and Development

a. Funded Projects

i. River Bank Mapping and Sand Auditing of Periyar River, Ernakulam (Phase II)

River Bank Mapping and Sand Auditing project of Periyar River in Ernakulam District is funded by River Management Centre. It is carried out by Government of Kerala in order to conserve our rivers with wise utilization. TIES have been entrusted with the responsibility of mapping for a phase II assessment of the sand deposits in the river covering an area of 59 km of Periyar River which includes 11 km from the confluence of Deviyar with Periyar near Maniyampara till the hanging bridge near Inchathotty and 48 km from Bhoothathankettu dam upto the Aluva railway bridge. The reconnaissance survey and the sand audit of the river was completed. During the survey 18 panchayats were surveyed among them, 3 panchayats Keerampara, Perumbavoor Municipality and Aluva Municipality has no amount of mineable sand deposit.



Sand Auditing of Muvattupuzha River, Phase II

ii. Sand Auditing of Muvattupuzha River, Ernakulam (Phase II)

On 2nd March 2019, a MoU signed between TIES and Ernakulam District Administration for conducting sand audit of Muvattupuzha River, the second phase sand auditing for the flood affected. TIES was entrusted with the sand auditing of the Muvattupuzha river for a phase II Assessment Of Sand Deposits In The River. A Total Of 52 Km Were Mapped Starting From



Sand Auditing of Muvattupuzha River, Phase II

Thirupurath Check Dam Till Kanjiramattom- Thalapara Road Bridge. The Reconnaissance Survey Of Muvattupuzha River was completed.

iii. Green Islands And Habitats: Developing Model Plots For Ensuring Biodiversity Conservation, Improved Livelihood And Resilience To Climate Change

UNDP High Range Mountain Project

United Nations Development Programme (UNDP), started a project on developing green islands at Munnar. The project was entrusted to TIES. The project aims to restore degraded ecosystems, agriculture land, plantation and other altered areas outside the forest ecosystems through the concept of Pachathuruthu or natural green island through local community involvement in a sustained manner. Pachathuruth is a collection of trees, which grow within a city or in barren land area, in order to protect the biodiversity and promote climate mitigation. Marayoor, Kanthalloor, Mankulam, Adimalai and Chinnakanal Grama Panchayats are selected for implementing the project. The objective of the project is to protect the biodiversity of the High Range Mountain Landscape of the South Western Ghats. Reconnaissance report was prepared and submitted to UNDP. A stakeholder meeting was also held at Marayoor GP. Primary and secondary data collection was done.



UNDP HRML Project; Stakeholders meeting & Site visiting

iv. Eco restoration plan for the Purapuzha Grama Panchayat using Geoinformatics, Purapuzha Grama Panchayat, Idukki

The eco restoration plan for the Purapuzha Grama Panchayat using geoinformatics is an on-going project of TIES. The project aims to find out the decadal changes in the land use pattern, vegetation with the aid of Geoinformatics, the study also focuses on estimation the carbon sequestration potential of the area and a watershed management plan. Geoinformatics is used as tool for the restoration of the degraded area/ land. This tool will aid in identifying habitat problems and needs. The MoU was signed between TIES and the Purapuzha Grama Panchayat on 10th February 2020.

v. The Preparation Of Biodiversity Park at Purachirakulam ,Poothrikka GP

Poothrikka Grama Panchayat, Ernakulam

The project aims to build a biodiversity park at the Panchayat in order to protect the Purachirakulam in the GP. The MoU was signed between TIES and the Poothrikka Grama Panchayat.

b. CSR Projects

i. TVS - CSR Projects

a) Study on sustainability of Apiculture in Javadhu Hills

TVS the motor company who is focusing on sustainable agriculture has also put forward many activities to improve the socio-economic status of the people. As part of its empowerment activities TVS started supporting the apiculture farmers to increase the production rate and also to conserve the traditional knowledge and economy. TVS entrusted TIES with the task of conducting a detailed study on the current status of Apiculture in Javadhu Hills. The project aims explore the interest of farmers in doing apiculture and also to find out the suitable locations for apiculture. Initially a questionnaire survey was conducted among the households in the study area, which was done to collect the data like farmer details, current status of the apiculture units, bee box maintenance, honey extraction, problems faced while marketing, etc. a biodiversity estimation was also conducted in the area.



Javadhu hills are traditionally known for honey through the major livelihood of the community is farming, especially millets. Surveyed community is also engaged in farming, but almost all houses have at least one bee box. Among the surveyed community, many boxes have bees, but about half of the surveyed community's bee boxes were empty. Thus the pre-project study has

given ample information of the area. As a result the project was implemented in the area, which trained the apiculture farmers in bee keeping, feeding during dry season, bee box maintenance, colony division, etc. a technical knowledge on bee keeping was given to the farmers. After the phase I of the project 77 nursery boxes with healthy colonies were maintained among 25 farmers and maintenance activities are still continuing. The study also suggested to decrease the use of pesticides especially in an area of 1.5 – 2km radius where the apiculture project bee boxes are placed.



Sustainable Apiculture at Javadhu Hills

ii. Apollo Tyres Foundation- CSR Projects

TIES is the CSR consulting agency of Apollo Tyres, Thrissur and Ernakulum, Kerala. As a part of the CSR activities of Apollo Foundation, TIES has been implementing various environment conservation programmes such as River and Pond conservation, Eco-friendly Park maintenance, terrace farming for community etc. and projects at Apollo campuses such as Biodiversity Enhancement Programmes, and Zero Budget Natural Farming. This year TIES was entrusted to carryout a project on beeswax and the value added products.

1. Project on Bees Wax & Value Added Products

Beekeeping which is an lucrative income-generating activity, which makes it the reason for promoting it. The best known primary products from beekeeping are honey and beeswax. However, propolis, royal jelly, venom and the bees themselves are also marketable products derived from keeping bees. For increasing its market value some of the products are processed into a suitable form. This project too aims at providing skill and knowledge for making Value added products from beeswax as support for their livelihood of the beekeeping community. The apiculture farms of ATF at Kottayam presently not extracting beeswax systematically. TIES is entrusted to train the beekeepers on beeswax extraction and processing and preparation of

value added products. An initial training on honey processing was given to the community by TIES. The project activities are on-going.

iii. Indian Snake Bite Initiative

In partnership with Indiansnakes.org, TIES has initiated a program to mitigate casualties from snake bites in rural districts of Madhya Pradesh and Chhattisgarh. Support is provided to hospitals in the form of Anti-venom provision, community education and outreach programmes. It is the pioneering project on mitigating the issue on the country that encounter 50,000 snake bites every year.

This year snakebite awareness workshops were conducted. The workshops were conducted across India on reducing death and disability resulting from snakebite envenomation. So far, 18 workshops were conducted in Gujarat, Maharashtra and Odisha and have reached upto more than 2000 people including school students, forestry students, village gathering, etc. The workshops are being conducted by snake rescuers belonging to the Indian Snake Rescue Network (ISRN) and Indiansnakes.org. The 2.5 hour workshop comprises sessions on identifying common venomous and non-venomous snakes in the region, how to avoid unpleasant encounters with snakes, simple safety measures to avoid snakebite and proper first aid and treatment of snakebite. The workshops also emphasize on the negative results of delayed medical treatment of snakebite.



Snakebite Awareness Workshops

c. TIES' Internal Projects

I. TRTP- STUDENT PROJECTS

“Studies on Growth Promoting Activities of Rhizobium Isolates”

Vrenda P. P., B. Sc. Biotechnology, Submitted to Department of Biotechnology, Indira Gandhi College of Arts and Science, Nellikuzhy P. O., Kothamangalam.

A study was conducted in order to isolate and identify different *Rhizobium* species and to investigate the effects of *Rhizobium* sp. inoculation on seeds of *Pueraria phaseoloides*. In vitro screening studies on these isolated microorganisms showed potential production of Indole Acetic Acid (IAA), Gibberillic acid, Ammonia and Siderophore and it may be associated with plant growth and nutrient uptake efficiently. The results revealed that of the inoculation of *Pueraria phaseolides* with isolated *Rhizobium* sp. gave significantly increased root length and weight, shoot length and weight. Inoculation of plant growth promoting (PGP) nitrogen-fixing bacteria was an alternative to the use of nitrogen, phosphorous and potassium fertilizers.

“Study Biocontrol Activity of Endophytic Bacterial Isolates against Plant Fungal Pathogens”

Ashna R. S., B. Sc. Biotechnology, Submitted to Department of Biotechnology, Indira Gandhi College of Arts and Science, Nellikuzhy P. O., Kothamangalam.

The aim of the study is to isolate and identify endophytic bacterial isolates against plant fungal pathogens. Endophytic bacterial strains were isolated from the leaf, stem and roots of *Syzygium cumini* and *Punica granatum* and fungal pathogens were isolated from the infected leaves of *Diploknema butyracea*. The isolated bacterial strains were identified through morphological and biochemical characteristics and the isolated plant fungal pathogen was identified their macroscopic and microscopic characteristics. The efficiency of the isolates in controlling the fungal pathogen was tested by analyzing their ability to produce hydrogen cyanide and salicylic acid. Antagonistic activity of the endophytic isolates against the pathogens was tested by dual culture method. From the results, it was found that root of *Syzygium cumini* and stem of *Punica granatum* contained more different endophytic colonies and the isolates were identified as *Enterobacter* sp., *Proteus* sp. and two different *Serratia* sp. the fungal pathogen was identified as *Corynespora* sp. Results of hydrogen cyanide and salicylic acid revealed that *Proteus* sp. was highly efficient in producing these compounds. Similar result was

found while testing antagonistic activity like *Proteus* sp. showed significant inhibitory activity against *Corynespora* sp. From the results it can be concluded that the endophyte *Proteus* sp. was more effective biocontrol agent in controlling the plant fungal pathogen *Corynespora* sp.

“Antitumor Activity of Leaf Extracts of Different Plants Using Potato Tumour Induction Assay”

Farsana Shirin E. P., B. Sc. Biotechnology, Submitted to Department of Biotechnology, Indira Gandhi College of Arts and Science, Nellikuzhy P. O., Kothamangalam.

Plants were considered to be the main source of biologically active compounds. Keeping this in mind, the present study was carried out to estimate the antitumor potential of aqueous leaf extracts of different plants such as *Azadirachta indica*, *Clerodendrum infortunatum*, *Hibiscus rosasinensis* and *Psidium guajava*. For the study *Agrobacterium tumefaciens* was isolated and identified from collected plant tumours and the inhibitory activity of the extracts were studied using potato disc tumour assay. From the results, it was found that the aqueous extract of *A. indica* exhibited maximum inhibition percent (85%) which was followed by *P. guajava* (83%), *H. rosasinensis* (77%) and *C. infortunatum* (54%). Thus, from the study it can be concluded that the tested aqueous extracts can be used in controlling plant tumour causing *A. tumefaciens*.

“Water quality of Erumely Valiyathodu River during Sabarimala Pilgrimage Season”

Balendu Balachandran., B. Sc. Microbiology, Submitted to Department of Microbiology, P. G. M. College, Devagiri P. O., Kangazha.

The present study was conducted to evaluate the quality of water from Erumeli Valiyathodu river during pettathullal on Sabarilamla pilgrimage season. Samples were collected from different regions of the river and adjacent water resources. The collected water samples were analysed for physical, chemical and biological properties using standard protocols. From the results, it was found that the parameters such as pH, conductivity, total dissolved solids, conductivity, salinity, acidity, alkalinity, chlorinity, total hardness, calcium ions, magnesium ions, iron, sulphate, nitrate, chloride and organic carbon content in the collected samples were within the permissible limit. Fluoride content was exceeded the permissible limit in all the collected samples. The values of organic carbon, oil content, dissolved oxygen and biological oxygen demand were found higher than the permissible limit in the samples collected from the main contamination site and nearby sites including wells. Total coliform bacterial count and faecal coliform count were above the maximum level in all the samples collected. The

pathogenic bacteria such as *E. coli* and *Klebsiella* sp. were also present in the entire collected samples. The main contamination site and nearby sites were contaminated with the pathogenic bacteria such as *Salmonella* sp. and *Vibrio* sp. From the study, it can be concluded that the river Valiyathodu was highly polluted during Sabarimala pilgrimage season and it was recommended that the government should take immediate steps and necessary actions to control the river contaminating anthropogenic activities.

“Isolation and identification of fungal Contaminants from Traditionally Prepared Curd”

Ann Jefri Manual and Archana Shaji, B. Sc. Botany, Submitted to Department of Botany, S.V. R. N. S. S. College, T. P. Puram P. O., Vazhoor.

Curd is one of the most common fermented milk products in the world. As it is a fermentation product, it contains large quantities of lactic acid bacteria and their metabolites, which are beneficial to human health. In previous studies, multistate fungal meningitis outbreak reported in the United States due to the uptake of contaminated curd. Keeping this in mind this study was undertaken with the aim to isolate and identify fungus from contaminated curd. A total of five contaminated curd samples were collected and fungi were isolated using pour plate method. The isolated fungal strains were identified through their microscopic and macroscopic characteristics. Analysis of data confirmed that all of the isolated fungal isolates from the collected curd samples to be *Rhizomucor* sp. and found that it is able to cause food borne disease in humans.

“Isolation and Identification of Phytopathogenic Fungi from Infected Plant”

Archana Satheesh, Amrutha Prathap and Anandalakshmi, B. Sc. Botany, Submitted to Department of Botany, S.V. R. N. S. S. College, T. P. Puram P. O., Vazhoor.

The present study deals with the isolation and identification of phytopathogenic fungi from infected bark. Infected bark samples were collected from different plants. Surface sterilized samples were placed on sterile potato dextrose agar to isolate the fungi. The pure cultures were then identified through their macroscopic and microscopic characteristics as *Alternaria* sp., *Fusarium* sp. and *Collectotricum* sp. The isolated fungal pathogens were found to destruct the plant and found that the production was reduced due to the infection.

“Isolation and Characterization of Phosphate Solubilizing Bacteria from Ponthenpuzha Forest”

Abhirami Kannan, M. Sc. Botany, Submitted to Department of Botany, S.V. R. N. S. S. College, T. P. Puram P. O., Vazhoor.

Phosphate-solubilizing bacteria (PSB) function in soil phosphorus cycle, increasing the bioavailability of soil phosphorus for plants by converting insoluble forms of phosphorus to accessible forms. Nine rhizosphere soil samples were collected from Ponthenpuzha forest and bacterial strains were isolated using pour plate method. The isolated colonies were screened for their phosphate solubilising efficient on apetite agar medium by spot inoculation. 11 morphologically different isolates were showed efficient phosphate solubilisation and among the strains, the most efficient one was characterized by 16S rRNA sequencing. These isolates were identified as *Enterobacter* sp., *Acinetobacter* sp., *Pseudomonas* sp., *Serratia* sp., *Flavobacterium* sp., *Micrococcus* sp., *Alcaligenes* sp., *Thiobacillus* sp., *Chromobacterium* sp., *Arthrobacter* sp. and *Bacillus cereus*. From the results of 16S rRNA sequencing, it was revealed that the most efficient isolate was *B. cereus*. Hence, it can be concluded that application of these isolates to the soil likely to regulate the phosphate transformation process.

“Isolation and Characterization of Biopolymer Producing Microorganisms”

Sayujya S., M. Sc. Microbiology Submitted to Department of Microbiology, St. Xavier's College for Women Aluva.

Dependence on conventional plastics and their boundless usage have resulted in waste accumulation and green house gas emissions. Poly β hydroxybutyrates are biodegradable polyesters synthesized by many bacteria. In this present study, 8 bacterial isolates were isolated and identified from the soil collected from rhizosphere soil near washing area, rhizosphere soil near garden, non rhizosphere soil near pond, non rhizosphere soil near cooking area and non rhizosphere soil near construction site. The four positive isolates were identified by Sudan Black staining method and were further cultured in nutrient broth to study PHB production. The PHB yielding bacterial isolates were further characterized for PHB production with different physical and chemical parameters like temperature, pH, carbon and nitrogen sources. The result presumed that *Micrococcus roseus* isolated from non rhizosphere soil near pond showed high PHB production by using nutrient broth at pH 9 containing lactose as a carbon source and glycine as a nitrogen source when incubated at 30C. The extracted polymers were compared with the standard PHB and were confirmed to be PHB using TLC

analysis. From the study, therefore it can be concluded that *Micrococcus roseus* yield maximum amount of PHB when glycine was used as a nitrogen source and lactose as a carbon source at pH 9 and temperature of 30°C.

“Screening of Bacteriocin Producing Microorganisms for the Bio preservation of Food Products”

Ardra C. O., M. Sc. Microbiology Submitted to Department of Microbiology, St. Xavier's College for Women Aluva.

Bacteriocins are ribosomally-synthesized peptides or proteins with antimicrobial activity, produced by different groups of bacteria. Several LAB bacteriocins offer potential applications in food preservation, and the use of bacteriocins in the food industry can help to reduce the addition of chemical preservatives as well as the intensity of heat treatments, resulting in foods which are more naturally preserved and richer in organoleptic and nutritional properties. The objective of the present study was to isolate, characterize, and identify the bacteriocin producing microorganisms from intestine of domestic animal and fish and the dairy products. The extracted bacteriocin from the isolates (*Lactobacillus paraplantarum*, *Lactobacillus casei*, *Lactobacillus kefir*, *Lactobacillus capillatus*, *Lactobacillus huananensis*, *Lactobacillus mali*, *Lactobacillus acidifarinae*, *Lactobacillus koreensis*, *Lactobacillus ghanensis* and *Lactobacillus aquaticus*) was tested against pathogens *Micrococcus sp*, *Salmonella typhi*, *Clostridium sp*, *Bacillus sp*, *Pseudomonas sp*, *Salmonella paratyphi*, *Klebsiella sp*, *Staphylococcus aureus*, *Vibrio sp*, *Escherichia coli* and *Streptococcus sp*.. The present work was also focused on effect of some physiological conditions like temperature and pH, and enzymes papain. The extracted bacteriocin was also tested for maintaining the decreased CFU during the biopreservation of apple juice and fish. Bacteriocin showed maximum activity at temperature 37°C and at pH 2. All the extracted bacteriocin produced by the lactic acid bacteria were inactivated by papain (proteolytic enzymes), which indicated their proteinaceous nature. The extracted bacteriocin showed the decreased CFU used as bio preservative during the apple juice and fish storages when compared to a without any preservatives. From the results, it can be concluded that the isolated lactic acid bacterial isolates showed potent bacteriocin and antimicrobial properties that exerts in the usage of this compound as a bio preservative in apple juice and fish.

“A Study on Bio control Activity of Phosphate Solubilising Bacteria in Soil”

Arya Mani K. M., M. Sc. Microbiology Submitted to Department of Microbiology, St. Xavier's College for Women Aluva.

Phosphate solubilizing microorganisms is a group form an important part of the microorganisms, which benefit plant growth and development. Microbially mediated solubilization of insoluble phosphates through release of organic acids is often combined with production of other metabolites, which take part in biological control against phytopathogens. The aim of the study was to study the biocontrol activity of phosphate solubilizing bacteria against plant fungal pathogens. For checking the solubilization capacity of different phosphates, Pikovskaya broth medium can be used. Different strains of phosphate solubilizing bacteria (PSB) were isolated from 5 different areas of tropical institute of ecological science (TIES), Kottayam and screened for antagonistic activity against plant pathogenic fungi. The antagonistic potential of eight bacterial isolates (*Bacillus cereus*, *Pseudomonas graminis*, *Bacillus amyloliquefaciens*, *Xanthomonas species*, *Micrococcus species*, *Paenibacillus validus*, *Bacillus mycoides* and *Paenibacillus polymyxa*) was assessed *in vitro* against *Aspergillus quadrilineatus*, *Alternaria spp.*, *Diaporthe pascoei*, *Fusarium equiseti* and *Sclerotinia sclerotiorum*. *In vitro* studies showed the potential of phosphate solubilizing bacteria for the simultaneous synthesis and release of siderophores, hydrolytic enzymes, hydrogen cyanide, volatile compounds and salicylic acid. The result indicated that tested bacterial species exhibited varying degree of antagonistic potential against all pathogenic fungi. *Bacillus amyloliquefaciens* showed maximum inhibitory potential against *Aspergillus quadrilineatus* and *Alternaria spp.* Results also showed antagonistic activity of *Xanthomonas species* against *Sclerotinia sclerotiorum*, *Bacillus mycoides* against *Diaporthe pascoei* and *Paenibacillus polymyxa* against *Fusarium equiseti*. From this study, it can be concluded that all the bacterial isolates were found to have the ability to resist plant fungal pathogens and hence these can be applied as biocontrol agents as well as biofertilizers for plant growth promotion.

“Application of Milk Clotting Enzyme Produced by Microorganisms in Cream Cheese Development”

Vishnupriya M. A., M. Sc. Microbiology Submitted to Department of Microbiology, St. Xavier's College for Women Aluva.

There has been an increasing consumer demand for cheese along with a search for products with new organoleptic parameters, which has resulted in extensive research on alternative milk

coagulants. To date, plant enzymes have largely been used for this purpose, along with traditional enzymes of animal origin, chymosin and pepsin. The use of plant and microbial milk-clotting enzymes as an alternative to animal-derived enzymes allows not only to diversify the assortment of cheeses on the market but also to solve ethical and economic issues. This study aims to study the application of milk clotting enzyme produced by the bacterial isolates from soil samples in cream cheese development. The objectives includes the isolation and identification of milk clotting enzyme producing bacterial isolates, and to extract, assay milk clotting enzyme activity. The effects of various carbon, nitrogen sources, pH, temperature, inoculum size and incubation time on milk clotting activity and protease activity was studied using milk clotting enzyme assay and protease assay respectively. The results indicated that among the bacterial isolates *Bacillus subtilis* was the best alternative for traditional calf rennet and can be used in cream cheese development. The optimum conditions at which *B. subtilis* show highest MCA includes lactose and cellulose as carbon source, urea and peptone as nitrogen sources, at pH range 6-10, temperature 30-40° C, with inoculum size 1% and incubation time of 24 – 96 hours. Thus, from this study it is concluded that, bacteria with milk clotting activity can be used as an alternative for traditional calf rennet for cheese production.

“Synthesis and Characterization of Biogenic Hemetite α -Fe₂O₃ Nanoparticles for Antibacterial Applications.”

Ashin Philip, M. Sc. Chemistry Submitted to Department of Chemistry, St. Thomas College, Kozhencherry.

This work emphasizes a simple method for the synthesis of α -Fe₂O₃ nanoparticles using *Psidium guajava* leaf extract. *P. guajava* was used as a reducing agent. UV-Vis spectroscopy was used to test the optical properties of the sample and gave the characteristic absorption peak of Fe³⁺ ions at 366nm. XRD studies confirmed that the particle belonged to hematite phase and no other phases were present as impurities. SEM and TEM revealed the morphology and topography of the sample. Results of antibacterial effect of synthesized particle revealed that the synthesized particle was effective against *V. cholerae* and *C. Diphtheria*. The synthesized particles showed more activity when compared with standard antibiotic. Thus, it was proven that the iron oxide nanoparticles synthesized from a natural source seems to be promising and effective antimicrobial agent against the multi drug resistant strains of bacteria. This work integrates nanotechnology and microbiology, leading to possible advances in the formulation of new types of bactericides.

“Assessment of Airborne Microbes of Selected Sites at Kottayam District and the Inhibitory Effect of *Mangifera indica* Leaves on Airborne Microorganisms in the Indoor Environment”.

Linta Anna Scariah, M.Sc. Environmental Science Submitted to Department of Geology and Environmental Science, Christ College, Irinjalakuda, Thrissur.

Most people in the urban and rural communities resort to surrounding atmospheric air which are normally of low quality exposing them to air pollution diseases. The present study was carried out to determine the microbial contamination in six areas of Kottayam district and to confirm the effectiveness of leaves of *Mangifera indica* on microorganisms in the air at different sites. During the study, samples were collected from six sites such as Manarcad, Puthuppally, Kodimatha, Kottayam town, Changanassery and Pampady in Kottayam district. The inhibitory effect of *Mangifera indica* leaves on microorganisms in air were studied by collecting the samples from different indoor sites such as Manarcad, Puthuppally, Kodimatha, Kottayam town, Changanassery and Pampady in Kottayam district. Samples were collected at different time intervals such as 1, 3, 20 and 24 hours after the treatment with *Mangifera indica* leaves. The collected samples were immediately transported to the laboratory and incubated at 37°C for 24-48hrs for bacteria and at room temperature for one week for the isolation of fungi. From the results, it was observed that Kodimatha and Manarcad of Kottayam district were highly polluted with microorganisms such as *Staphylococcus sp.*, *Streptococcus sp.*, *Aspergillus sp.*, *Pencillium sp.*, etc. Similarly, Bedroom and hall were highly polluted with microorganisms such as *Pseudomonas sp.*, *Enterobacter sp.*, *Staphylococcus sp.*, *Streptococcus sp.*, *Aspergillus sp.*, *Pencillium sp.*, *Micrococcus sp.*, etc. Treatment with the leaves of *Mangifera indica* found that the microbial count was reduced in the 1 and 3 hour and also observed that the count was increasing from the 20th hour of treatment. From the study it can be concluded that Kodimatha and Manarcad were more polluted with airborne microorganisms and *Mangifera indica* leaves have significant effect in reducing airborne microorganisms. From the study, it is recommended to cultivate *Mangifera indica* trees for air purification where rural and pre urban people living in extreme poverty.

Isolation and Characterization of Pigment Producing Bacteria from Cow Dung and Soil.

K. H. Hazeena Hussain, M. Sc. Microbiology Submitted to Biosciences and Biotechnology, Amity Institute of Microbial Technology, Amity University Uttar Pradesh, Noida.

Cow dung possess abundant prospective for microbial diversity. A total 10 bacteria were isolated from representative cow dung samples collected from different regions through serial dilution method. Out of 10 isolates three were showed pigment production such as deep green, red and yellow pigmentation in nutrient agar medium. The morphological and biochemical characterization confirmed that the pigment producing isolates were belonged to the genus *Pseudomonas* (green), *Serratia* (red) and *Micrococcus* (yellow). It can be concluded that bacteria has the potential to produce different pigments in presence of cheap raw material supplemented to the production medium, that can radically shrink the cost of industrial production.

A Study on the Effect of Bacteriocin Producing *Lactobacillus* sp. on Multi Drug Resistant Bacteria and Their Role in Food Preservation.

Jobins Joseph, M. Sc. Microbiology, Submitted to Department of Microbiology, The Oxford College of Science, Bangalore.

Bacteriocins are ribozomally synthesized peptides that have antibacterial activity towards target strains, produced by various bacteria, including food grade lactic acid bacteria (LAB). LAB isolated from samples like intestine of prawn and fish and batter. The isolates were identified on the basis of their morphological and biochemical characteristics as *L. acidophilus*, *L. plantarum*, *L. fermentum* and *L. delbrueckii*. Their ability to produce bacteriocin was checked by antimicrobial activity against MDR bacteria such as *Escherichia coli*, *Pseudomonas aeruginosa*, *K. pneumoniae* and *Staphylococcus aureus*. Bacteriocin produced from the isolates were partially purified through dialysis and from the data obtained, it was found that the purified bacteriocin was stable only at 37°C temperature, pH 2-7 and was not inhibited by the proteolytic enzyme papain. Maximum amount of bacteriocin was synthesized at 24hrs of incubation and in the medium containing 1% of glucose and peptone as carbon and nitrogen source. The results of antimicrobial activity showed that the extracted bacteriocins have a significant inhibitory effect on MDR bacteria. Incorporation of bacteriocin into apple and grape juice extended their shelf life. Hence, it can be concluded that the extracted bacteriocin from LAB can inhibit the MDR bacteria and can act as a food preservative agent.

II. TRTP – ON THE JOB TRAINING PROGRAMME

“Study on Municipal Solid Waste Management at Two Wards of Pampady Gramapanchayath”

Geethu A. M., Hema Harikumar, Hima M. Hari and Jossiny Johnsey, B. Sc. Botany (ML-II), Submitted to Department of Botany, Devaswom Board Pampa College, Parumala.

A survey on waste management was conducted at two wards, I and IXX of Pampady Gramapachayath of Kottayam in December 2019. A total of 76 houses were surveyed; 22 houses in Ward I and 54 houses in Ward IXX. From the data, it was revealed that there exists a lack of proper waste disposal methods. Almost 50% of house in both wards burn the plastics or dumped it into open places and 22-33% were giving it to scrape dealers.. Also, found that most of them were not concerned about the harmful effects of burning plastics and those who concerned said they have no other alternative. Majority of the people from both wards converting the bio wastes into compost for agricultural purposes. They were using pipe and pit composting methods for this and 6% of them were using biogas plant. Negligible number of houses was throwing it to open areas. Most of them were giving non degradable wastes such as glasses, bulbs and e-wastes to scrape dealers. About 30% of people were store or stack these wastes as they have no idea of what to do with these wastes. More than 80% of the houses from both wards were willing to collect and store the non degradable waste as per the directions if there is a proper collection mechanism. From an overall view, lack of implementation of effective waste disposal methods especially for non degradable wastes was the major problem in both the wards.

“Study on Microbiological Quality of Valiyathodu Stream at Erumely during Sabarimala Season”

Anandu M. S., Akshay Kumar, Anjali B., Athulya A. and Arathy G., B. Sc. Botany (ML-II), Submitted to Department of Botany, Devaswom Board Pampa College, Parumala.

Sabarimala temple is one of the pilgrim centre where large number of pilgrims visit during Mandala Pooja and Makaravilakku festival season. Erumely is the major transit point of Sabarimala pilgrimage and it is compulsory for the devotees to visit Erumely at the time of their first pilgrimage. It is estimated that every year 60% of the total pilgrims visit Erumely. Samples were collected with the objective to evaluate the microbiological quality of the river Valiyathodu, a tributary of Manimala river to suggest remedial measures to allivate the current

problems. A total of 15 water samples were collected from ten different spots of Erumeli Valiyathodu at half kilometre distance and from five adjacent water resources during Sabarimala Pilgrimage Season in sterile bottles. Microbiological analysis were carried out most probable number (MPN) system to enumerate coliform bacteria and faecal coliform bacteria and *E. coli*, *Salmonella sp.*, *Vibrio sp.*, and *Klebsiella sp.* were enumerated by plating the samples on Eosin methylene blue (EMB) agar, Xylulose Lysine Deoxycholate agar, Thiosulphate-citrate-bile-salts-sucrose agar and Macconkey agar medium. From the results, it was found that total coliform bacterial count and faecal coliform bacterial count were at more than maximum level in all the collected samples from the river and adjacent wells. This indicated that water has been contaminated with faecal matter of humans or animals. The pathogenic bacteria such as *E. coli* and *Klebsiella sp.* were found in all the river water and well water samples. *Salmonella sp.* was found in two well water samples and in two sites of river water samples. These sites were near to the main contamination site. *Klebsiella sp.* was found in eleven samples, four were well and remaining were different sites of river. Both *Klebsiella sp.* and *Salmonella sp.* were found in the main contamination spot and the well adjacent to this site. It can be concluded that the presence of pathogenic microorganisms indicated high health risk for the human population.

“Spawn Production and Mushroom Cultivation”

Ajay P. Namboothiri, Ajith V. Kumar, Akhil Raj A. K. and Akhila Suresh, B. Sc. Botany (ML-II), Submitted to Department of Botany, Devaswom Board Pampa College, Parumala.

Pure cultures of oyster mushroom can be obtained by tissue culture from desired mushroom fruiting bodies. The inside tissue of a fruiting body was exposed by pulling apart the mushroom cap to expose the inside uncontaminated tissues. Plucked tiny pieces of inside tissue using sterile fine-tip tweezers and transferred onto the potato dextrose agar medium. This procedure was done inside the laminar flow chamber. The cultures were incubated at room temperature and observed for the hyphal growth. After completing mycelial running, the culture was used to make mother spawn. For that, rice seeds were soaked for about twelve hours in pure water. After draining, the seeds were cooked until the coating gets broken. Drained the water, mixed with 3% percent Calcium carbonate and packed 250g of this into polypropylene covers. Sterilized the seeds inside the autoclave for 2 hrs at 15lbs pressure and temperature at 121°C. The sterilized seeds were inoculated with mycelium from tissue culture under aseptic condition and incubated at room temperature for about one week for the growth of good quality mother spawn. Again the rice seeds were processed in the above manner to produce the spawns for

cultivation. Then the sterilized seeds were inoculated with mycelium from mother spawn under aseptic condition and incubated at room temperature for about one week for the growth of good quality spawns for cultivation. To prepare mushroom bed, soaked clean paddy straw in pure water for 16-20 hrs. Drained off excess water and steam sterilized the straw for 45 minutes. Excess water was drained off and beds were prepared by filling spawns and sterilized straw alternatively in polythene bags. Different species such as *Pleurotus florida*, *P. ostreatus* and *Hipsizygus ulmarius* of oyster mushrooms were cultivated. Spawn running was completed in 20 days and harvested 1Kg from each bed. Among different species, it was found that *H. ulmarius* was the fast growing variety and given more yield.

Comparative Study on Phytochemical Contents in the Aqueous Extracts of *Azadiracta indica*, *Ocimum tenuiflorum* and *Moringa oleifera*

Praveea S., Rahul G., Sindhu P. Mohan and Veena Nair S., B. Sc. Botany (ML-II), Submitted to Department of Botany, Devaswom Board Pampa College, Parumala.

The study was undertaken with the aim to compare the phytochemical contents in the aqueous extracts of three plants *Azadiracta indica*, *Ocimum tenuiflorum* and *Moringa oleifera*. The leaves of these plants were collected and air dried under shade. The dried leaves were powdered and extracts were prepared using sterile distilled water. The prepared extracts were analyzed for flavanoids, terpenoids, alkaloids, protein, carbohydrates, amino acid and free sugars qualitatively and quantitatively. Qualitative estimation revealed that flavanoid, terpenoid and alkaloids were present in all the samples. Carbohydrates were absent in *Ocimum tenuiflorum* and amino acids were absent in *Azadiracta indica*. Protein and free sugars were absent in all the three samples. Quantitative estimation revealed that flavanoid content was high in *Moringa oleifera*, alkaloid content and terpenoid content were high in *Ocimum tenuiflorum*.

A Comparative Study of Native and Exotic Plant Species in TIES Campus

Avinash Viswan, Bhagya, Blesson Baby, Devika P. and Devu Somanath, B. Sc. Botany (ML-II), Submitted to Department of Botany, Devaswom Board Pampa College, Parumala.

Plants are usually recognised as a vital component of the world's biological diversity and an essential resource for the planet. A native species (indigenous) is one that occurs in a particular region, ecosystem or habitat without direct or indirect human action. Exotic species which are also known as alien species, invasive species or non- indigenous species are those which are growing in non-native environment. Alien species have been moved by human to areas outside

of their native ranges. Tropical Institute of Ecological Sciences (TIES) Velloor, Kottayam has a valuable biodiversity of both flora and fauna. The institution was surrounded by shady appearance of these plants. They are varying from trees, shrubs and herbs. Almost all types of valuable medicinal plants were there. Both exotic and native species of plants have been seen with different adaptation. Traditional approach like field visit was used for this study. Descriptive data such as local name, botanical name and common name of each plant was collected using counting method. The plants were identified whether it was native or exotic with the help of books from library. The collected data was tabulated and found that TIES ecological garden contained 200 different plant species. The results revealed that the garden contained 155 different species of native plants and 38 different species of exotic plants.

Comparative Study on the Antimicrobial Activity of Three Different Medicinal Plants.

Jyothy Lekshmi K., Megha Padmakumar, Nithya Sreekumar and Parvathy M., B. Sc. Botany (ML-II), Submitted to Department of Botany, Devaswom Board Pampa College, Parumala.

The study was undertaken with the aim to compare the antimicrobial activity of *Cinnamomum verum*, *Curcuma longa* and *Coriandrum sativum* against the bacteria *Staphylococcus* sp. and *Aspergillus niger*. For the study the leaves of the plants were collected and dried under shade. Aqueous extracts of 500mg/ml of the dried powdered samples were prepared. Antibacterial activity of the samples were analyzed using disc diffusion method on nutrient agar medium and antifungal activity of the samples were analyzed using well diffusion method on Sabouraud's dextrose agar medium. After swabbing and sample inoculation, nutrient agar plates were incubated at 37°C for 24-48 hrs and Sabouraud's dextrose agar plates were incubated at room temperature for about one week. After incubation, all the plates were observed for a zone of clearance around the disc or well and the zone diameter was measured. From the results, it was revealed that all the samples were inhibiting the bacteria *Staphylococcus* sp. Among the samples *Coriandrum sativum* (0.66mm) showed more activity when compare with *Cinnamomum verum* (0.62mm) and *Curcuma longa* (0.62mm). Also revealed that the extracts did not have any effect on *Aspergillus niger* at this concentration.

III. CAMPUS SOLAR LIGHTING PROJECT

Earth is powered by SOLAR ENERGY or simply by SUNS's ENERGY. Likewise, TIES too powered by the extremely powerful source of energy, SUN. The solar cells placed in the campus buildings convert the solar energy to electricity and it is used to power the lights in the campus. The main building as well as the seminar hall of TIES is powered by Solar Energy. As an outdoor application, solar street lights systems were placed in the roads and front area and also in the parking lots of all buildings this year through the project - **Campus Solar Lighting**. 24 solar lights were installed in the campus in order to reduce the dependency over other forms of lighting system. And this system found to be an ideal application for campus street lighting. The lights will automatic ON/OFF with time (that means on during night time and off when during day time). Now the all the lights in the campus are 100% solar powered, which were formerly incandescent, CFL lamps, etc. The main aim in shifting electric power to solar power is that it works on natural light. This is a model project that can be replicated in any similar campuses, or more likely, anywhere. Moreover, the carbon footprint is reduced by using this solar energy, since it is totally green and renewable.



2. Environmental Education and Outreach

a. Ph.D Course Work

Currently, four students are perusing their Ph.D namely S. Sathrumithra, Roshni Susan Elias, Alex John and Vinod Mathew. They have completed their course works. Currently, they are carrying out their research activities.

b. TIES Research Training Program (TRTP)

The prestigious training programme for masters and research students of South Indian and foreign Universities, TRTP continued during this reporting year too. 9 undergraduate students from three colleges and 9 post graduate students from six colleges, have undergone this training along with another 26 undergraduate students as part of their on the job training.

The TRTP students were from four universities, Mahatma Gandhi University, Calicut University, Amity University and Bangalore University respectively.

Table 1: List of student's undergone TRTP training at TIES during 2019-2020.

Sl. No.	Student Name	Topic	Course and College
1	Vrenda P. P.,	Studies on Growth Promoting Activities of <i>Rhizobium</i> sp. Isolates	B. Sc. Biotechnology, Department of Biotechnology, Indira Gandhi College of Arts and Science, Nellikuzhy P. O., Kothamangalam.
2	Ashna R. S.,	Study Biocontrol Activity of Endophytic Bacterial Isolates against Plant Fungal Pathogens	
3	Farsana Shirin E. P.	Antitumor Activity of Leaf Extracts of Different Plants Using Potato Tumour Induction Assay	
4	Balendu Balachandran	Water quality of Erumely Valiyathodu River during Sabarimala Pilgrimage Season	B. Sc. Microbiology, Department of Microbiology, P. G. M. College, Devagiri

			P. O., Kangazha.
5	Ann Jefri Manual	Isolation and identification of fungal Contaminants from Traditionally Prepared Curd	B. Sc. Botany, Department of Botany, S.V. R. N. S. S. College, T. P. Puram P. O., Vazhoor.
6	Archana Shaji		
7	Archana Satheesh	Isolation and Identification of Phytopathogenic Fungi from Infected Plant	
8	Amrutha Prathap		
9	Anandalakshmi		
10	Abhirami Kannan	Isolation and Characterization of Phosphate Solubilizing Bacteria from Ponthenpuzha Forest	M. Sc. Botany, Department of Botany, S.V. R. N. S. S. College, T. P. Puram P. O., Vazhoor.
11	Sayujya S.	Isolation and Characterization of Biopolymer Producing Microorganisms	M. Sc. Microbiology Department of Microbiology, St. Xavier's College for Women Aluva.
12	Ardra C. O.	Screening of Bacteriocin Producing Microorganisms for the Bio preservation of Food Products	
13	Arya Mani K.M.,	A Study on Bio control Activity of Phosphate Solubilising Bacteria in Soil	
14	Vishnupriya M. A.,	Application of Milk Clotting Enzyme Produced by Microorganisms in Cream Cheese Development	
15	Ashin Philip	Synthesis and Characterization of Biogenic Hemetite α -Fe ₂ O ₃ Nanoparticles for Antibacterial Applications.	
			M. Sc. Chemistry Department of Chemistry, St. Thomas College, Kozhencherry

16	Linta Anna Scariah	Assessment of Airborne Microbes of Selected Sites at Kottayam District and the Inhibitory Effect of <i>Mangifera indica</i> Leaves on Airborne Microorganisms in the Indoor Environment”.	M.Sc. Environmental Science Department of Geology and Environmental Science, Christ College, Irinjalakuda, Thrissur.
17	K. H. Hazeena Hussain,	Isolation and Characterization of Pigment Producing Bacteria from Cow Dung and Soil.	M. Sc. Microbiology Department of Biosciences and Biotechnology, Amity Institute of Microbial Technology, Amity University Uttar Pradesh, Noida.
18	Jobins Joseph	A Study on the Effect of Bacteriocin Producing <i>Lactobacillus</i> sp. on Multi Drug Resistant Bacteria and Their Role in Food Preservation.	M. Sc. Microbiology, Department of Microbiology, The Oxford College of Science, Bangalore.

Table 2: List of students undergone TRTP- on the Job Training at TIES during 2019-2020.

Sl. No.	Student Name	Topic	Course and College
1	Geethu A. M.	Study on Municipal Solid Waste Management at Two Wards of Pampady Grama Panchayath, Kottayam.	<i>B. Sc. Botany (ML-II)</i> <i>Department of Botany</i> <i>Devaswom Board Pampa College, Parumala.</i>
2	Hema Harikumar		
3	Hima M. Hari		
4	Jossiny Johnsey		
5	Anandu M. S.	Study on Microbiological Quality of Valiyathodu Stream at Erumely during Sabarimala Season.	
6	Akshay Kumar		
7	Anjali B.		
8	Athulya A.		

9	Arathy G.		
10	Ajay P. Namboothiri	Spawn Production and Mushroom Cultivation	
11	Ajith V. Kumar		
12	Akhil Raj		
13	Akhila Suresh		
14	Praveen A. S.	Comparative Study on Phytochemical Contents in the Aqueous Extracts of <i>Azadiracta indica</i> , <i>Ocimum tenuiflorum</i> and <i>Moringa oleifera</i>	
15	Rahul G.		
16	Sindhu P. Mohan		
17	Veena Nair S		
18	Avinash Viswan	A Comparative Study of Native and Exotic Plant Species in TIES Campus	
19	Bhagya		
20	Blesson Baby		
21	Devika P.		
22	Devu Somanath		
23	Jyothy Lekshmi K.	Comparative Study on the Antimicrobial Activity of Three Different Medicinal Plants.	
24	Megha Padmakumar		
25	Nithya Sreekumar		
26	Parvathy M.		

c. Internship

Students who completed their course benefitted from internship at TIES for varied periods of three months to one year. During the reporting year, four students from four Universities successfully completed internship at TIES on various topics of interest.

Table 3: List of intern's undergone training at TIES during 2019-2020.

Sl. No.	Name	Topic	Institution
1.	Chithralekha K. S.	Field survey of invasive alien plant species in Vijayapuram Village, Kottayam District, Kerala.	M. Sc. Ecology and Environmental Science Central University Pondicherry
2.	Sourav S. Kurian	Various Research and education programmes.	FY-B.Sc. Economics Symbiosis School of Economics, Pune.
3.	Krishnapriya A. B.	Survey on Socio-economic relationship of municipal solid waste (MSW) Management among Urban communities	B. A. L. L. B. Mar Gregorios College of Law, Thiruvananthapuram.
4.	Meera S.	Various Research and Education Programmes.	B.Sc. CBZ (Chemistry, Botany and Zoology) Christ University, Bangalore.
5.	Anjana Harikumar	Various Research and Education Programmes.	M.Sc. Microbiology Dept. of Microbiology P. G. M. College, Devagiri P. O., Kangazha.
6.	Devika Prakash	Various Research and Education Programmes.	M. Sc. Biotechnology MES College, Marampally, Aluva

d. College- NGO Partnership Program

College NGO Partnership Initiative (CNPI) is a mutually benefitting research cum extension project of TIES, involving students and faculty of affiliated colleges in India. CNPI is basically a student capacity building programme, equipping them to meet the challenges and to evolve a socially and environmentally responsible society and to promote environmental awareness among the community. CNPI helps to inculcate research culture among students and faculty of affiliated colleges to empower colleges to take up social and environmental issues and to develop the right scientific temper and outlook. The technical report submitted after the audit contains the recommendations for improving the energy efficiency, biodiversity, waste management and water usage along with the action plans to reduce resource consumption. CNPI program was inaugurated at Christian College, Chengannur in December, 2016. The programme was inaugurated by the College Principal and was attended by the whole college community. The training session was led by Dr. Punnen Kurian and Abraham Samuel. This year two CNPI programmes were completed: Al-Ameen College, Edathala and Mar Baselious College, Peermade and some are on-going: Henry Baker College, Melukkavu; St. Thomas College, Kozhencherry. The green audit was done four major heads: Energy Audit; Water Audit; Waste Audit and Biodiversity Audit. An initial training and tools were provided for the faculties and students of the college, along with a mock test. The green audit report of both colleges was given by TIES by thorough scrutiny and calculation. The report also suggested the essential changes that is to be made to avoid energy, water and biodiversity loss and for the management of waste. All the data's were collected through questionnaire survey, except for biodiversity survey and all were done by students under the supervision of teachers. For the other two colleges the initial training has completed and the auditing part is going. Continuous evaluation is done throughout the auditing process in order to make data more clear and precise. Auditing groups are maintained in social media's in order to evaluate the day-to-day activities and in order to share the data. The pre and post auditing attitude of students and faculties also showed much change in the view of conservation. The knowledge they acquired via the training and auditing process has showed much change in the behavioural pattern and was noted by the teachers and which is a good sign for a better future.



CNPI Programme at Al-Ameen College, Edathala



CNPI Programme at Mar Baselious College, Peermade

e. Enjoy Learning

Enjoy Learning is a customised one day nature education session designed for schools and colleges. Enjoy Learning programme was conducted at TIES for student groups from various colleges, schools and Institutes. Alphonsa College, Pala; Don Bosco School, Puthupally ; S.M.E College, Thalappady and B.A.M. College, Thuruthikkad were the school and colleges participated. The sessions included introduction on nature study, medicinal plants, waste management, building walk, research methodology, studying the flora and fauna inside the campus and eco friendly games. Regardless of Enjoy Learning programme, several other schools and colleges also visited TIES Campus. The list of schools and colleges visited is as follows:



1. Govt. L. P. School, Kaniankunnu, Manarcaud
2. Don Bosco School, Puthupally
3. Students from Carmel Engineering college, along with Foreign students
4. Sophia International School, Mannanam
5. Students of MG University



Enjoy Learning Programme for Schools and Colleges

3. Capacity Building

A. Junior Naturalist Certificate Course

TIES conducted a 15 days course “Junior Naturalist”, a Training Programme for children to make them more passionate about nature and life, through systematic nature studies. The programme includes field studies, theory classes, field trips, etc. Students successfully completed the course are awarded with a certificate of Junior Naturalist. Dr Punnen Kurian, Dr Abraham Samuel, Dr Nelson P Abraham, Shibi Moses, Manoj P, Jose Louise, Dr C P Shaji, Dr Sajith and Sarath N Babu led the sessions. A total of 16 students participated in the camp.





Junior Naturalist Certificate Course (JNC)

B. Training on Mushroom Farming

A total of three training programmes were conducted during this year in which 75 people were participated. Of this one training session was conducted at TIES and rest of them were training given to Members of Manimala RPS and Mushroom growers of Mukkada. The session covered topics such as tissue Culture, Mother Spawn production, Spawn Production, Bed preparation, post harvesting technologies, Mushroom disease management etc. Dr. Punnen Kurian took the introductory session. Mrs. Roshni Susan Elias led the theoretical and practical sessions. The mushroom farm maintained at TIES carried out several experimental farming approaches and attempted a standardised protocol for sustained production in all seasons.





Mushroom Training at TIES

C. Hands on Training on Statistical Analysis using SPSS

As part of the TIES capacity building programmes two rounds of three-day training on SPSS was conducted at TIES. The training was attended by students, researchers and employers from different fields and a total of 53 participants were trained. The training consisted of both theoretical and practical sessions. The classes were taken by Dr. Ramesh Nair, Rtd. Head of the Department of Statistics and Planning Division & Joint Director of Rubber Board.





Hands-on training on Statistical Analysis using SPSS

D. Meenachil River Odonate Survey

The fourth series of TIES Meenachil Odonate Survey was conducted on 7th and 8th of December 2019 along the Meenachil river basin. The survey was in collaboration with the Department of Forests and Wildlife, Kerala (Social Forestry Division). It was a two day programme to monitor and survey the dragonflies and damselflies in the Meenachil River. Over 90 participants from educational and research institutions attended the training session and survey. Dr Punnen Kurian and Dr Abraham Samuel led the training session. The sites were assigned to each team and each site was assigned with an expert. The survey team surveyed dragonfly and damselfly population in their respective sites. The survey was conducted from Adukkam- Pazhukkamalakayal, covering an area of 27km, including 8 teams consisting of 12-15 students.

From the Survey, a total of 55 odonate species including 33 dragonflies and 22 damselflies were found. Social forestry Assistant Conservator Dr. G Prasad, Forest Officer Jayan M and experts like Dr. Abraham Samuel, Dr. Punnen Kurian, Dr. Nelson Abraham, Manoj P, Sathrumitra, Mohammed Haneefa, Sarath N Babu, M N Ajayakumar and Anoopa Mathews

have led the survey. After the survey, valedictory function and publishing report were fulfilled at TIES campus. Participants were provided with Certificates.



Fourth Meenachil Odonate Survey

E. Vembanad Odonate Survey

TIES this year conducted an Odonate Survey along the Vembanad wetland to study the pollution levels of the area. The survey was conducted on 4th and 5th of January 2020. It was done in collaboration with the Department of Forests and Wildlife, Kerala (Social Forestry Division). The two day programme was aimed to monitor and survey the dragonflies and damselflies along Vembanad. 75 participants from educational and research institutions attended the training session and survey. Dr Punnen Kurian and Dr Abraham Samuel led the training session. The sites were assigned to each team and each site was assigned with an expert. The survey team surveyed dragonfly and damselfly population in their respective sites. The survey was conducted at 14 sites along 60 km. There were 12 groups consisting of 8-10 members.

From the Survey, a total of 33 species were identified, including Ditch Jewel, which is a pollution indicator. Social forestry Assistant Conservator Dr. G Prasad, Forest Officer Jayan M

and experts like Dr. Abraham Samuel, Dr. Punnen Kurian, Dr. Nelson Abraham, Manoj P, Sathrumitra, Mohammed Haneefa, Raison Thumboor, Renjith R.V., Sajith Ninan, Geetha Paul, Sr. Sonia, Sarath N Babu, M N Ajayakumar and Anooa Mathews have led the survey. After the survey, valedictory function and publishing report were fulfilled at TIES campus. Participants were provided with Certificates.



Vembanad Odonate Survey

F. Kottayam Urban Bird Survey

TIES has conducted the 3rd urban bird Survey on 4th May 2019, in which about 49 participants were participated. The survey was conducted over 7 locations, civil station Kottayam, Nagampadom stand, PWD gust house, CMS collage, Erayil kadavu. The team has reported the presence of 43 bird species in Kottayam town area. An increase in the bird count was seen this year while considering the previous year data. A number of 30 bird species were identified at CMS college campus. A heronary was seen in the Nagampadom stand area. The nesting's of bird were present in. Indian Cormorant, Little Cormorant, Indian



Pond Heron and Oriental Darter were the species found in the heronary. Darter, white-throated kingfisher, oriental magpie robin, yellow bittern, stork billed kingfisher, lesser whistling duck, streaked weaver, cotton pigmy goose, were some species identified through the survey.



Kottayam Urban Bird Survey

G. Awareness Classes on Birds, Butterflies and Dragonflies.

As part of the TIES Environmental Education and Outreach programme, 5 awareness classes were conducted and trained over 188 participants, including parents of the Excelsior School (50); students of: VHSS, Naduvetom (40); Mahatama Girls School, Chennithala (21); NSS, Mannar (37); Assumption College, Changanassery (40). The sessions were about birds, flora, dragonflies and butterflies. The training was followed by a field survey led by the experts. A bird survey at Naalukodi was also conducted by the students of Assumption college, under the guidance of Sarath N Babu and identified 63 species. The training was led by Dr. Nelson P Abraham, Dr. Abraham Samuel K AND Sarath N Babu.



NSS School, Mannar



Mahatma Girls School, Chennithala



VHSS, Naduvettom



Assumption College, Chanaganassery



Excelsior School

H. Global Strike for Climate Change: Cycle Rally

As part of the Global Climate strike, a cycle rally was conducted by Tropical Institute of Ecological Sciences (TIES), NSS and NCC Units of St. Mary's College Manarcad and Malayala Manorama Fasttrack Magazine on 24th September 2019. The rally was towards the unsustainable development powered by fossil fuels and to generate awareness among the public on climate change. Meetings were also arranged in several schools and colleges. St. Mary's HED Manarcad, BCM College, etc. have participated in the rally.



Global Strike for Climate Change: Cycle Rally

I. Training on Waste Management

A training on waste management was given to the employees of Block Panchayat entitled by “Suchitwa Maalinya Samskkaranam” at TIES on 25th June 2019. The session on bio-waste management was taken by Dr. Punnen Kurian and a session on composting methods were taken Ms. Roshini Susan Elias and was supported by Suchitwa Mission. The training was attended by 40 employees.





Training on Waste Management

J. Training on Cloth Bag Making

A Workshop on Cotton Cloth Bag Making for Kudumabasree workers was conducted at Pension Bhavan, Manarcaud. A Practical training session was conducted to make designer cloth bags such as Purse, Strawberry fruit, cotton roll etc. The women who are trained will be provided with raw materials and the finished bags will be purchased from them to distribute through Super markets and malls. This gives them a leisure time income, which will be certainly a livelihood support. The designer bags will be made available to the Malls, Shops, etc. at a subsidised price. This training is part of the NO DISPOSABLE CAMPAIGN and 25 woman's from various Kudumabasrees of Manarcad Grama Panchayath were trained. Dr. Jiji Thomas, co-ordinator women cell St. Mary's College, Manarcaud, Smt. Manjusha C.G. and Saneej M. Salu, NSS Programme Officers St. Mary's College, led the programme. Mr. Biju Thomas, Member Ward 19 of Manarcad GP and Dr. Punnen Kurian, Principal St. Mary's College, Manarcad and Secretary Tropical Institute of Ecological Sciences (TIES) spoke on the occasion.





Training on Cloth Bag Making

K. Training for the Students at State Level NSS Camp

A one day awareness programme to the students of state level NSS Camp was give by TIES. The session was attended by 170 students from several colleges in Kerala. Awareness classes was on Waste Management led by Dr. Punnen Kurian, Different composting models by Ms. Roshini Susan Elias, TIES biodiversity by Sarath N Babu and brief about TIES by Anoop Mathews.



Awareness class to the students of State Level NSS Camp

L. Training on Eco-friendly Life Style

Sri. Srinivasa Chowdary Alluri, the Founder and President of Manavata, shared his vision and mission to the research students of TIES. The session on Eco-friendly lifestyle was held at TIES on 4th December 2019. His mission is called 3H World: to make World Healthy, Happy and Harmonious. He has dedicated his life for humanity to work for welfare of all beings & Mother Nature with unselfish motto and to lead sustainable development with eco-friendly living and right use of science and technology. His works strive to reach all humanity through voluntary initiatives aimed at the individual, family, village, society and global levels that improve human values and quality of living through simple, natural and eco-friendly lifestyles and livelihoods. This is the second visit of Sri. Alluri and 45 research fellows of TIES interacted with him.



Session on eco-friendly Lifestyle

M. TIES Jalaraksha Campaign

Jalaraksha Campaign is a unique campaign of TIES to ensure clean water for all. This is an community initiative started by TIES this year. Good water will ensure good health, so in this respect the water sample of household are tested. Samples are collected in number of 30 or above and tested for its MPN Count, conductivity and pH .The results will be given Through a meeting along with an awareness session and also remedial measure that shouldbe taken will also be taken. Each campaign is conducted under residence association or any other community groups. The first of this was conducted on 16th June 2019 and till now 5 campaign were completed, viz Puzhayoram Residence Association, Kidangoor; Sangamam Residence Association, Parambuzha; Senior Citizen Forum, Pampady; Vattakunne Residence Association, Meenadom; and Thiruvanchoor Public Library and tested over 400 samples. The sessions are led by Dr. Punnen Kurian and Ms. Roshini Susan Elias



TIES Jalaraksha Campaigns



N. TIES Green Corporate Training Programme

Tropical Institute of Ecological Sciences (TIES) offers scientifically designed customized training packages for all cadres of staff of corporates which will imbibe sustainable practices among the corporate community. The principal aim of the Green Corporate Training is to aware, sensitize and equip the corporate community to adopt sustainable practices at individual and institutional levels in order to adapt and mitigate climate change. As part of this a training was given to the 22 Managerial employees of MRF, Kottayam on 22nd January 2020. The session were about, waste management, energy conservation, water conservation and biodiversity conservation. The pre and post evaluation showed a great change in the attitude as well as knowledge of the participants. The sessions were headed by Dr Nelson P Abraham and Dr.Punnen Kurian. Sarath Babu and Anoop Mathews also accompanied. The programme successfully transacted the tips and solutions for a eco-friendly lifestyle that should be practiced as an individual and for the institution.



0. KSCSTE- World Environment Day – 2019

The World Environment Day, 2019 was celebrated by TIES by conducting an awareness campaign titled “*Indoor Air Pollution: A Burning Health Issue*”. The programme was supported by the Kerala State Council of Science, Technology and Environment and it was conducted on 29th June, 2019. Dr. Punnen Kurian, Secretary, TIES had led the session by taking sessions on Indoor Air pollution, its causes, pros and cons and measures that is to be taken to mitigate it along with examples from the present day scenario. The session was participated by 70 students and 5 faculties. A quiz competition on the Indoor air pollution was also conducted along with the programme. The programme was co-ordinated by Ms. Roshini Susan Elias and M N Ajayakumar .

Along with the awareness programme 30 wild trees were planted by TIES staff around the TIES campus as part of WED on 5th June and medicinal plants were distributed to the District Legal Service Authority, Muttambalam, Kottayam.



Awareness Class at TIES as part of World Environment Day-2019



Tree Planting at TIES Campus as part of World Environment Day-2019



Medicinal Plant Distribution at District Legal Service Authority

P. DoECC- Paaristhithikam 2019

A one day awareness programme was conducted at TIES as part of the Paaristhithikam supported by Directorate of Environment and Climate Change (DoECC), Govt. of Kerala on 12th December 2019. The theme of the awareness campaign was “Air Pollution: Fight for Life and Earth”. A Pamphlet on “Nammuku Venam Sudhavau (We Need Fresh Air)” was released by Dr. A P Thomas (Director, ACESSED M. G. University) as part of the campaign. Sessions were based on Indoor Air Pollution led by Dr. A P Thomas and Air Pollution and Climate change by Mr. John Richard (Research Scholar, MG University). The campaign highlighted the need to fight against air pollution and also the ways and measures that are to be taken to mitigate air pollution. The awareness classes were attended by 45 students and 15 community members.



Q. EMC- Urja Kiran- 2020

With the support of Energy Management Centre (EMC), TIES conducted energy conservation awareness campaigns for the employees of Govt. Institutions. The focal theme of campaign was “Energy Efficiency and Conservation”. The campaigns were conducted at 6 institutions, viz: Kottayam East and West Police Station; Pampady Police Station; Pampady Taluk Head Quarters Hospital; Pampady Grama Panchayat and KSEB Pampady and a total of 257 Government employees attended the programme . A pamphlet on energy conservation measure was given to the participants. Jayamol Jacob and Subash, Resource person of EMC, led the sessions and co-ordinated by Ms Roshini Susan Elias. The campaign also collection energy data, regarding number of electric equipments, usage hours, waste amount, etc. Were collected to suggest measures to reduce them.



Taluk Head Quarters Hospital, Pampady



Grama Panchayat, Pampady



KSEB, Pampady



Police Station, Pampady



East Police Station, Kottayam



West Police Station, Kottayam

R. River conservation and Restoration Activities

a. Water Quality Analysis of Manimala River

TIES was called out to investigate the presence of green sludge in the Manimala area of the Manimala river in Kottayam, Kerala. The sludge was first noticed by the residents of the area and suspected to be industrial waste. The thick viscous green sludge was found floating on the river covering an area of 1 lakh sq m (about 2 km. stretch of the river). The pre monsoon showers has washed the sludge downstream and it can no longer be seen; but the original location of the sludge is marked by extensive algal bloom. Microbiologists from TIES collected samples of water from this point and two other points further downstream to identify the contaminant and extent of contamination. Samples were also taken from a well in a nearby house to check if the pollutant had seeped into it. Water from the Manimala river is pumped into homes and is freely used by residents for bathing, cleaning, and washing clothes etc., but now they are complaining of itchy skin and a foul smell in the water and have complained to the administration about it. The collected samples were analysed for its physical and biological properties including pH, conductivity, TDS, salinity, chlorine levels, total hardness, Ca, Mg, Fe levels, dissolved oxygen, presence of E. coli, etc. The results showed excess level of Iron, fluoride, etc. And also presence of septic waste and higher levels of BOD, etc. Were observed during the analysis



Sample Collection at Manimala River

b. Meenachil Rivulet Cleaning

As part of the TIES Adopt a River Project, Paalamuri Thodu of the Meenachil River was rejuvenated. This was jointly done by TIES and Paadasamrakshana Samathi, Thiruvanchoor. And also the Sasthamkadavu Thodu was also rejuvenated as part of this.



Meenachil Rivulet



Sasthamkadavu Restoration

c. **Water Sample collection and Analysis of Erumely Valiyathodu**

A water sample collection and analysis drive was conducted by TIES at Manimala. The reason behind is the toilet waste pollution faced by the Valiyathodu. A number of toilets were established for the pilgrims at Erumely is posing this threat to the Manimala River and the Erumely Valiyathodu. A huge amount of human waste is flowing to the river from this. As a result of this a complaint was raised by the local community and the water quality analysis was done by TIES. 15 water samples were collected from 15 spots along the river course. The analysis showed the presence of *E.coli*, *Klebseilla*, etc and also Flouride in levels higher than the limit. The collection was done by Roshini Susan Elias, Sarath Babu and Pradeep Thomas from TIES.

d. **Manimala River Restoration**

A great initiative has been begun to clean and green Manimala River under the aegis of Ente Manimalayar Peoples Collective was started on 5th December 2019. Plastic and other non-degradable wastes clogged near Pazhayidom Check dam, near Manimala were removed. The Student volunteers collected the plastic wastes that were trapped in tree branches along the river bank. Above 500 bamboo saplings were planted on the riverbank in order to improve the riparian vegetation and will prevent

soil erosion. A Completed rehabilitation which was needed for the river was done. TIES' being the technical partner of the Manimala River Conservation partnered with Haritha Keralam Mission, Division of Social Forestry, Kerala State. In order to revive the river, TIES jointly worked with Haritha Kerala Mission, Department of Forest & Wildlife (Social Forestry Division), Govt. of Kerala, Manimala GP, Kanjirappally GP, Erumely GP, Kanjirappally Block Panchayath took the initiative. MNRGE workers, Haritha Karmasena Workers, NSS volunteers from St. Dominics College, Kanjirappally, St. Mary's College, Manarcaud and SPC students from NSS School, Manimala were participated in the cleaning and greening drive. The programme was inaugurated by Dr. N. Jayaraj, MLA., Dr. Punnen Kurian (Secretary, TIES). Dr.G. Prasad, DFO, Ramesh P., (District Coordinator of Haritha Keralam Mission, Kottayam), Ms. Litha Shaji, President of Manimala GP, were also present during the programme. Vipin Choradan (Haritha Keralam Mission) co-ordinated the programme



Manimala River Restoration

S. TIES DRC Testing Laboratory

The Dry Rubber Content (DRC) of the rubber latex is important for certification, research experiments, in the field of chemical modification of rubber, etc. In this context, TIES started DRC testing lamp at its Campus on 11th January 2020 and till now over 70 samples were tested. Dr. Ramesh B Nair, former Head and Director of Statistics and Joint Director of Rubber Board inaugurated the lab.



DRC Lab at TIES

4. TIES Publications

BOOKLETS & PAMPHLETS :

1. “നമുക്ക് വേണം ശുദ്ധവായു” by Dr. Punnen Kurian and Roshini Susan Elias
(Pamphlet on Air Pollution (Malayalam). Script: Roshini Susan Elias, Editor: Dr. Punnen Kurian.
Published by: Tropical Institute of Ecological Sciences (TIES) and Supported by Directorate of Environment and Climate Change Government of Kerala, Thiruvananthapuram in connection with Paaristhithikam in December 2019.)

PAPER PUBLICATIONS :

- Elias R.S., Balasundaran M., Samuel, A. K. and Kurian P. 2019. Enhancement of biodegradation of kitchen waste through the development of microbial consortium. *Asian Journal of Microbiology Biotechnology and Environmental Science*.21(2): 149-156.
- Annliya Sajan, Parvathy V., Roshini Susan Elias, Sosamma Oommen and Punnen Kurian presented a paper on “Isolation and identification of gut bacteria from cockroach and its application in organic waste degradation,” 10th International Conference on Environmental Research at Bangalore and have got best poster presentation award.

5. TIES Achievements

TIES entering into its 15 years of success are getting more achievements through its continuous efforts and hard works. This year TIES got Paristhithi Mitra Award for the best Environmental Institution in Kerala. Paristhithi Mitra Award is an award instituted by Centre for Environmental Education and Rural Development (CEERD), St. Stephens College, Uzhavoor. TIES President, Dr. Abraham Samuel and Secretary, Dr. Punnen Kurian received the award from Prof. (Dr). Sabu Thomas, Honourable Vice Chancellor of MG University.



6. TIES Visitors

1. **Loretta Andrade** (Sr. Administrative Assistant, f5) **from Hyderabad** 🍀 *June 13*
2. **Paristhithimitra Award Committee Visit** 🍀 *July 4*
3. **Don Bosco Students Visit** 🍀 *July 25*
4. **IISAC, Pravasi Think Tank Meeting and Visit** 🍀 *September 4*
5. **Praveen Pie, Representing World Malayalee Council** 🍀 *September 20*
6. **Zina from France** 🍀 *November 6*
7. **Faculties from St. Xaviers College, Piravom** 🍀 *November 15*
8. **Henry and Dorine from Germany and Carribean Island** 🍀 *December 12*
9. **Prabhakara Reddy, MRF GM** 🍀 *January 18*
10. **8 Students from Carmel Engineering College and faculties along with 4 Australian Students** 🍀 *February 1*
11. **Students from Sophia International Public School, Managanam** 🍀 *March 4*
12. **Haritha Kerala Mission Intern** 🍀 *March 11*





7. Conclusion

All members of TIES have enough reasons to be proud of its growth since its establishment in 2004. Over the past years, TIES has been recognized as the most active environmental research organization in the state.

In the reporting year, TIES have witnessed significant growth in national and Government funded projects. The inputs from the implemented projects are very impressive and are highly appreciated by other organizations. Besides, a number of flagship programmes have been successfully launched. TIES have also witnessed a hike in the number of research projects, awareness and training programmes. As a part of these programmes, eminent persons and foreigners were the guest of TIES. We have achieved immense progress in working as a professionally functioning organization. We have increased the staff strength working for various projects. Further, the support from governmental and non-governmental organizations for various programmes and projects had increased in the last year.

We would like to extend heartfelt thanks to each and everyone for the help, support and guidance rendered in all programmes.

We submit the sixteenth annual report for the approval of the general body.

Dr. Abraham Samuel
President

Dr. Punnen Kurian
Secretary



of Committed Service to our Mother Nature



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