



*Newly constructed Eco-friendly Conference Hall "The Grove "*

# 14<sup>th</sup> ANNUAL REPORT 2017-18

**TIES – ties Mind and Nature**



TROPICAL INSTITUTE OF ECOLOGICAL SCIENCES  
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# Preface

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**TIES** is stepping to the 14th year of its existence. Fourteen 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, and Kerala State Tourism Award for the most innovative project in the tourism sector, 2013. 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 14<sup>th</sup> 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 14<sup>th</sup> annual report before the board of directors, members and well wishers.

# Fourteenth Annual Report

## Major Projects & Programmes

### 1. Research and Development

#### *a. Funded Projects*

##### **i. Participatory Forest Management**

Forest supports a wide variety of life forms and provides invaluable ecosystem services for healthy survival of humankind on earth. Forests all over the world are in peril due to a multitude of anthropogenic causes and demands urgent measures for protection. Participatory Forest Management (PFM) is an attempt to co-manage natural resources with the participation of forest dependent community. PFM was adopted as a national policy in India in 1988, and a decade later in Kerala. It marked a drastic policy change compared to earlier policies and practices.

State Forest Development Agency (SFDA), Kerala, entrusted Tropical Institute of Ecological Sciences (TIES) with the task of evaluating the institutional strength and weaknesses, identifying the gaps in the functioning and training needs and to develop training process for various stakeholders in PFM process of the state. In order to discharge the responsibility entrusted with, TIES carried out desktop research, extensive consultation with Forest Dept. officials and other stake holders, questionnaire surveys, focus group discussion (FGD), situational analysis (SA), field visits and one to one interaction in a time bound manner. The objectives were: - to find out the strength and weakness of PFMI in Kerala, suggest measures for enhancing structural and functional efficiency of PFMI, identify issues and suggest measures for quality Micro plan preparation and practice of Participatory Rural Appraisal (PRA), identifying the gaps in capacity building and prepare a training manual for the highly heterogeneous stakeholder groups.

TIES has identified the gaps in the functioning of PFM and PFMI and framed a set of recommendations for rejuvenating the structural and functional aspects of PFMI in Kerala in tune with the “5C Framework”. In the year 2017-18, the project was wrapped up with the training of presidents and secretaries of VSS and EDC on PFM manual introduction. The trainings were conducted at Trivandrum, Kottayam and Palakkadu.

The project team includes Mrs. Ashly Thomas (Principal Investigator), Dr. Shaju Thomas (Co-investigator), Dr. Punnen Kurian (Co-investigator), Mr. Jacob Mathew, Mr. Dileep Kumar K.G, Mr. Gopinatha Pillai and Mr. Rajendra Babu (PFM related resource

persons, Kerala Forest Dept.) and Sarath N Babu (Project Officer, TIES). We specially thank Dr. Shaju Thomas, who took all the pain for ensuring that the project get completed in an excellent manner.

### **ii. KSCSTE- National Technology Day 2017**

With the support of Kerala State Council of Science, Technology and Environment and in association with Kottayam District Residents Associations TIES has celebrated National Technology Day by conducting a one day workshop on “Simple Water Treatment Techniques for Domestic Use” on 12<sup>th</sup> May at St.Mary’s College Auditorium, Manarcaud. The programme was inaugurated by Rev. Fr. Kuriyakose Karukayil Cor-episcopa (Manager, St. Mary’s College, Manarcaud). Dr Punnen Kurian, Secretary of TIES gave the presidential address, covering details about the harmful side of water pollution and the scarcity of fresh water. He suggested promoting household practices for overcoming the current frenzy. Followed by that, Mrs. Roshini Susan Elias demonstrated various water purification methods for domestic use. TIES has also published a booklet, “*Kudivellam*”, on simple water purification techniques for households. Mr. Biju Kurian, Manarcaud Grama Panchayath Member, and Mr M.A. Kuriakose, Manager of St. Mary’s College Manarcaud, have facilitated the program.



### **iii. River Bank Mapping and Sand Auditing of Shiriya and Yalkkana Rivers, Kasaragod**

River Bank Mapping and Sand Auditing project of Shiriya and Yalkkana Rivers in Kasaragod District is funded by River Management Centre. is carried out by Government of Kerala in order to conserve our rivers with wise



utilization. TIES has been entrusted with the responsibility of mapping 16 km of Shiriya River (Shiriya dam to Bombrana Dam) and 21 km of Yalkanna River (Yethadka Bridge to the confluence with Shiriya River). The project was started in November 2017 and is expected to complete in September 2018.

The reconnaissance survey of both rivers were completed in November, and the field work was started in December 2017. The river bank mapping of Shiriya River was completed in April. The sand auditing of Shiriya is nearly completed. The sand auditing and river bank mapping of Yalkanna is under progress.



#### **iv. National Science Day 2017**

With the support of Kerala State Council for Science Technology and Environment (KSCSTE), TIES conducted one day training for Anganawadi Teachers about green protocols for green institution. The session was led by Dr. Punnen Kurian (Principal, St. Mary's College, Manarcaud), Dr Abraham Samuel (President, TIES) and Dr. Nelson Abraham (Vice President, TIES).

#### **v. Environmental Poisoning from Pineapple Farms in Kerala: A Preliminary Study**

Kerala State Biodiversity Board (KSBB) entrusted TIES to conduct a short term study on pineapple cultivation in three districts of Kerala in order to find out the

impact of indiscriminately used poisons on soil, water, fish and pineapple. In view of developing a project proposal TIES conducted a flash visit to selected farms in three districts, Pathanamthitta, Kottayam and Idukki, covering 12 active plots. Field observations were conducted and through stakeholder interactions information regarding pineapple cultivation practices were collected. The proximity of such field to water bodies and their topographical features also were recorded. A summary report of the flash visit was submitted on 7h March 2018 and KSBB has accorded sanction to conduct a detailed study of pesticides residue in pineapple farms in its 46th board meeting held on 16th March 2018 to Tropical Institute of Ecological Sciences (TIES) , by utilizing the State Biodiversity Fund. An MoU was signed between TIES and KSBB and the work started on 16<sup>th</sup> April 2018 and completed in September 2018.

## *b. CSR Projects*

### **i. Apollo Tyre Foundation- CSR Projects**

TIES is the CSR consulting agency of Apollo Tyres, Thrissur and Ernakulam, Kerala. As a part of the CSR activities of Apollo Foundation, TIES has been implementing various environment conservation programmes and projects at Apollo campuses such as Biodiversity Enhancement Program and Zero Budget Natural Farming. TIES project coordinators carry out continuous monitoring of these projects and our expert team conduct periodical field visits to Apollo campuses for evaluating the conservation programmes.

The rejuvenation activities of Kothakkulam Pond, Peringankulam Pond and Marathampilly Pond at Kodakara Panchayath were completed. Also, Kallankulam Pond at Kodakara Grama Panchayat and Therikkulam Pond at Kalamassery Municipality were restored. The ponds were cleaned, restored and a boundary was constructed with community participation. Also, TIES continuous to maintain Peringankulam Pond, Marathmpilly Pond and Kothakkulam Pond of Kodakara, Cochin Children's Science Park, Kalamassery and Chalakkudy Municipal Park.



Terrace farming projects are successfully implemented at Kodakara Panchayath and Kalamassery Municipality. 52 beneficiaries are selected at each site and special provisions are provided for doing organic farming with the space constraint households of the beneficiaries. The project has achieved 90% success at Kodakara and 70% success at Kalamassery.

Also, TIES has implemented the 2<sup>nd</sup> phase of Chalakkudy River Conservation project at Thrissur. In light of this, multiple awareness programs were conducted for river bank community on river protection. Also, several practices include rain water harvesting soak pits and composting was given for them. Moreover, bamboo and riparian vegetation planting was carried out all across the stretch of the river area that is selected for the conservation activities.

For that an inauguration program was conducted for schools among the river bank community. Teachers and students were trained to prepare a school level biodiversity register on Chalakkudy River. A Road Show was conducted at Koodappuzha- South Chalakkudy, as a part of awareness programme. Rejuvenation of rivulets and watershed areas of Chalakudi River were also running successfully to conserve the river.



**Road Show conducted as part of Chalakydy River Conservation Project**

### **ii. Hindustan Unilever Ltd- Greening the Campus Project**

TIES has initiated a biodiversity enhancement and green cover improvement project with Hindustan Unilever Ltd, Pondicherry. TIES has successfully implemented three projects, butterfly garden, green cover enhancement and composting at HUL campus.

### **iii. World House Sparrow Day**

World House Sparrow Day celebration was organized by TIES in coordination with Indian Oil Corporation Ltd, Greater Cochin Development Authority (GCDA) at Marine Drive, Kochi, and Kottayam Market. The population survey of house sparrows was conducted at both the sites and the study findings were compared with past data and was published in the media. About 150 pot nests and 50 wooden nests placed on buildings and trees at Marine Drive and Kottayam Rice Market. Tree naming was conducted at Marine Drive where name boards with scientific name, common name and English name was placed on the trees.



**TIES team placing nesting pot at Marine Drive, Cochin**

A public meeting was conducted at Marine Drive where Mr Bose Joseph, CSR Head- IOCL, Mr N. Devanarayana, CSR Executive- IOCL, Dr Punnen Kurian, Secretary- TIES lead the sessions. Also, Shri. R. Lalu (Secretary, GCDA) and Shri. James (Secretary, Shop Owners Association), and Project Officers of TIES spoke on the occasion. The shopkeepers who have taken outstanding initiatives towards house sparrow conservation were given a token of appreciation in the meeting. Pamphlets and brochures on house sparrow conservation was distributed to visitors and shopkeepers of Marine Drive. Information boards stating the importance of nature conservation and protecting house sparrows were placed all across Marine Drive. Shopkeepers who are actively involved in feeding house sparrows were presented with millets for

feeding these passerines. A similar public meeting was conducted at Kottayam Rice Market as well.

### *c. TIES' Own Projects*

#### **i. TRTP Projects**

*i. A Comparative study on the activity of curcuminoids extracted from different rhizomes of turmeric*

Curcumin is the main yellow bioactive component of turmeric has been shown to have a wide spectrum of biological actions. In this study, curcumin was purified from *C. longa* and *C. aromatica* through Soxhlet extraction using the solvents acetone, chloroform and water. The antimicrobial activity of the extracted curcuminoid was studied against *S. aureus*, *B. subtilis*, *A. niger*, *A. flavus* and *P. citrinum* through well diffusion method. Among the extracts, acetone was showed increased antimicrobial activity followed by chloroform and there was no activity was found with the aqueous extracts. It was also found that the concentration of curcumin was high in *C. longa* therefore, it possess higher antimicrobial activity than *C. aromatica*.

*ii. A study on the bacterial quality of cold snacks*

Cold storage of food items for a prolonged period of time causes microbial contamination. In this study cold snacks such as ice creams, kulfi, cheese and cream bars were collected and enriched in BHI broth. The samples were then streaked on

to selective medias like nutrient agar, Mac- conkey agar and TCBS agar. The isolates were identified through their morphological and biochemical characteristics and found the bacterial pathogens such as *S. aureus* (50%), *Klebsiella* sp. (28.3%), *E. coli* (4.5%), *Vibrio* sp. (4.6%) and *Streptococcus* sp (12.6%). Among the samples, icecreams, cream bars and kulfi was heavily contaminated with microbes than cheese.

### *iii. Study on the effect of fish amino acid on plant growth and disease control*

This study was carried out to determine the effect of fish amino acid on growth promotion and disease control in *Pisum sativum* plants. Fish amino acid was prepared by fermenting *Sardinella longiceps* with jiggery. After fermentation, it was filtered and its protein content amino acid content and enzyme activity was studied. Poly bag study was also conducted with *Pisum sativum* to study the effect of fish amino acid. The data obtained from this study was showed that it was rich source of proteins and amino acids such as leucine and tryptophan. Enzyme assays showed that, it contains protease, cellulose, chitinase, pectinase and amylase enzymes. It was also revealed that the treatment with fish amino acid has a great influence on growth promotion and disease control when compared with the control. It can be concluded that fish amino acid can be used as an effective organic fertilizer to reduce the use of chemical fertilizers.

### *iv. A Comparitive study on the bioactive compounds between Ganoderma sp. and Calocybe sp.*

This study was undertaken to compare the bioactive compounds produced by *Gnoderema lucidum* and *Calocybe* sp. extracts were prepared in acetone, ethanol and petroleum ether and analyzed moisture content, dry matter content, ash content, lipid content, crude fiber content, phytochemicals such as alakaloids, flavanoids, tannins, saponins, antioxidant activity and antimicrobial activity. From the results, it was found that the phytochemical content was more in *Ganoderma* sp. than *Calocybe* sp. both the species were rich in their nutritional contents and the mushroom extracts showed antibacterial and antifungal properties against *Bacillus* sp., *Staphylococcus* sp. *A. niger*, *A. flavus* and *P. citrinum*. Among the solvents petroleum ether showed increased nutritional properties than other solvents. From the results, it can be concluded that the consumption of mushrooms might be beneficial to protect human body against oxidative damage, microbial activity and malnutrition.

### *v. Isolation and characterization of the bacteria Entrobacter aerogens for the production of biopolymer*

Development of biopolymer is a remedy towards harmful effect caused by synthetic polymer. This study was aimed to isolate and characterize biopolymer from *Enterobacter aerogens*. Soil samples were collected from paddy field, river side and other plastic contaminated areas. The isolates were subjected to Sudan black staining to detect their ability to produce PHB. The amount of PHB production was quantified and confirmed by TLC analysis. The strain was identified as *Enterobacter aerogens* through morphological and biochemical characteristics. The PHB production by the isolate was optimized for maximum production under temperature, pH, carbon and nitrogen sources. It was found that maximum production of PHB occurred at pH 9, at 28°C temperature and in the presence of sucrose as carbon source and ammonium chloride as nitrogen source.

*vi Study on pink pigmented facultative methylotropic bacteria (PPFM) to enhance seed germination through the production of growth hormones in tomato (Solanum lycopersicum)*

Many microbes living on the surface of the plants lead to saprophytic life style, feeding on materials leached from the leaf such as PPFM bacteria. They are able to promote plant growth and yield under dried conditions too. In this study, PPFM bacteria were isolated from the leaves of *Hibiscus rosasinensis*, *Gossipium* sp. and *A. Esculentus* in AMS medium and mineral salt medium by enrichment technique. The isolate was characterized morphologically and biochemically and identified as *Methylobacterium* sp. The optimum conditions for pigment production were determined and found that maximum pigment was produced by the bacteria at a pH of 7.5 and at temperature 27°C with 0.5% methanol concentration. Analysis of plant growth hormone production by the isolate revealed that they are rich sources of Indole acetic acid and cytokinin. Studies with *S. lycopersicum* revealed that it fasten the seed germination rate and seedling growth, accelerate vegetative growth, increase leaf area index, chlorophyll content, earliness in flowering, fruiting and maturation and improves fruit weight.

*vii. Bio ethanol production from sweet potato (Ipomea batatas L.) flour using co-culture of Trichoderma sp. and Saccharomyces cerevisiae in solid state fermentation.*

The aim of this work is to study the optimum conditions for the production of bioethanol from sweet potato flour by co culturing *Trichoderma* sp. and *Saccharomyces cerevisiae*. The data obtained from the study revealed that maximum ethanol was produced when incubated for 72hrs under optimum conditions like 70% moisture, 0.2% ammonium sulphate at a pH of 5.0 with a temperature of 30°C. The yield was found maximum when the flour was co cultured with *Trichoderma* sp. and *Saccharomyces cerevisiae* than individual inoculation of the cultures.

### *viii. Synthesis of aspirin using acetic acid and natural catalysts*

This study was undertaken to compare the production of aspirin between synthetic and natural catalysts. For this purpose, sulphuric acid, different concentrations of citric acid and pineapple juice were taken. The synthesized aspirin was characterized by the determination of its melting point, TLC and FTIR spectroscopy. The study revealed that aspirin can be synthesized by natural organic acids and the concentration of synthesized aspirin was more in synthetic catalysts.

### *ix. Biosynthesis of nanosilver.*

This study was focused on the biosynthesis of silver nano particles using different plant extracts. For this purpose *Ocimum tenuiflorum*, *Centelle asiatica* and peels of *Citrus sinensis* were collected. The leaf extracts were subjected to silver nanoparticle production under various conditions like incubation period and pH and the synthesized AgNP's were characterized by UV-Vis spectroscopy. It was found that maximum AgNP's were produced when the extracts were incubated at 24hrs and maximum absorption was found at a wave length of 200nm and also found that all the extracts were good source of silver nanoparticles.

### *x A study on the effect of bacteriocin producing Lactobacillus sp. on multi drug resistant bacteria and their role in food preservation*

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.

### *xi. A study on mosquito larvicidal efficiency of different microorganisms*

Mosquitoes are potential vectors of many diseases including malaria, filariasis, dengue, brain fever. Because of this, there is an urgent need to control vector mosquitoes in order to reduce the diseases. In the present study, soil samples were collected to isolate bacteria and fungi showing the larvicidal activity. Among the isolates 100% mordacity rate of larvae shown by the isolates, *B. subtilis*, *Anterobacter aerogens*, *Penicillium sp.* and *Candida albicans*.

*xii. A study on the isolation of biosurfactant producing microorganisms and their role in the degradation of kerosene.*

This study was undertaken to identify biosurfactant producing microorganisms for their effective degradation ability of the isolates to produce biosurfactant was determined by emulsification test. Based on the emulsification index the isolates were screened and subjected to kerosene degradation. The isolates were identified as *M. luteus*, *B. subtilis* and *S. odorifera*. The results revealed that 52% of the kerosene was degraded by the isolates and TLC analysis of the degraded kerosene confirmed that kerosene was broken down into glycolipids and lipopeptides.

*xiii. A study on antimicrobial activity of silver nanoparticles.*

Silver nanoparticles were chemically synthesized and their antimicrobial activity against *A. faecalis*, *M. luteus*, *E. aerogens* and *S. aureus* was determined at different concentrations such as 50,100, 150, 200µg/ml. the effect of temperature also determined at 25<sup>o</sup>, 37<sup>o</sup> and 44<sup>o</sup>C. Their effect on protein leakage from the bacterial cells was determined spectrophotometrically. *E. aerogens* and *S. aureus* were effective at temperature 44<sup>o</sup>C and *A. faecalis* and *M. luteus* were effective at 37<sup>o</sup>C. The protein leakage from the cells was observed from 6hrs of incubation and the minimum inhibitory concentration was found as 50µg/ml. Hence, the synthesized silver nanoparticle has great inhibitory spectrum on all bacterial pathogens.

*xiv. A study on the antibacterial and enzymatic activity of Actinomycetes*

This study was aimed to isolate and identify Actinomycetes having antimicrobial activity with the production of different enzymes. Actinomycetes were isolated from different soil samples and identified that *Micromonospora sp.*, *Streptomyces sp.* and *Nocardia sp.* enzymatic screening of the isolates revealed that all the isolates were able to synthesize the enzymes such as amylase, cellulose, protease and pectinase. The data generated from the antimicrobial activity showed that the isolates were able to inhibit the tested *B. subtilis*, *M. luteus*, *Streptococcus sp.*, *A. flevipes*, *A. flavus* and *A. terreus*.

*xv. Isolation, characterization and industrial application of microbial pectinase.*

Microbial pectinases act on pectin, the major component of middle lamella in plant cell wall. Soil samples were collected from different dump sites to isolate pectinase producing microorganisms and the isolates were identified as *Rhizopus stolonifer*, *Aspergillus fumigates*, *A. niger*, *A. ustus*, *A. flavus* and one bacterium *Bacillus subtilis*. To optimize the conditions for maximum production the isolates were subjected to different temperature and pH. Maximum enzyme production was observed at a temperature range of 40-50°C and at a pH of 6. Application of pectinase in apple juice clarification revealed that, the turbidity of the juice was significantly reduced by 3hrs of incubation and *A. niger* showed more effect when compared with other isolates.

*xvi. Comparison of pollution rate of temple ponds with respect to normal ponds*

The quality of the temple pond water is deteriorating at an alarming rate due to careless management. In this study three temple pond waters were collated and their quality was compared with fresh water. The samples were tested for pH, acidity, alkalinity, salinity, DO, BOD, Hardness, chlorinity, TDS, conductivity, total coli forms, fecal coli forms and presence or absence of *E. coli*. From the data generated, it was revealed that the temple ponds were heavily contaminated with coli form bacteria when compared with the normal water.

*xvi. Studies on growth promoting and biocontrol activities of plant growth promoting rhizobacteria (PGPR) on Solanum lycopersicum.*

*Solanum lycopersicum* (tomato) is a common vegetable crop with worldwide consumption; however, its cultivation has been limited by an abundant attack of pathogens. Biological control of the pathogens using plant growth promoting rhizobacteria (PGPR) has gained a considerable attention. So this study was undertaken to isolate and identify effective PGPR bacteria and rhizosphere soil samples were collected to isolate them. To determine the efficiency of rhizobacterial isolates production of various metabolites were analysed. The isolates were tested against the pathogens *Pythium splendens*, *Phytophthora* sp., and *Cylindrocladium camellia* and found that the isolates *Pseudomonas fluorescense*, *P. aeruginosa*, *P. putida*, *Bacillus subtilis* and *Azotobacter chroococcum* were effective against the fungal pathogens with the production of metabolites. *Pseudomonas* sp. showed significantly high bio control activity followed by *Bacillus* sp. and *Azotobacter* sp. Therefore, these findings showed that the rhizobacterial isolates were act as efficient biological control agents by promoting plant growth and yield.

*xvii. Application of microbial enzymes in biodegradation*

This study was aimed to isolate bacteria, fungi and actinomycete able to degrade protein, cellulose, starch, oil, pectin and keratin. For the isolation, 148 samples were collected from various dump sites. Screening tests with selective media demonstrated the ability of isolates to produce protease, cellulase, amylase, polyphenolase, pectinase and keratinase. Isolated 70 species of bacteria, 30 species of fungus and 27 species of actinomycetes and identified through their morphological and biochemical characteristics. Bacterial isolates were in the genus *Bacillus*, *Alcaligenes*, *Pseudomonas*, *Lactobacillus*, *Clostridium*, *Thermus*, *Flavobacterium*, *Chromatium*, fungal isolates were in the genus *Aspergillus*, *Mucor*, *Humicola*, *Papulospora*, *Sporotrichum*, *Pecilomyces*, *Malbranchea*, *Candida*, *Microsporum* and actinomycete isolates were in the genus *Streptomyces*, *Actinobifida*, *Nocardia*, *Microbiospora* and *Actinomyces*. The degradation ability was varying with the isolates and was able to degrade about 90% of blood stain, 60% of egg white, 60% of coir, 70% of cotton, and 70% of feather and 60% of kerosene. Therefore, it can be concluded that the inoculation of these enzyme producing microbial isolates on complex substrates like protein, cellulose, starch, oil, pectin and keratin.

*xix. Antibacterial activity of garlic extracts on microbial pathogens from ready to eat food items*

The aim of this study was to determine the antibacterial activity of garlic extract on bacterial pathogens isolated from ready to eat food items. For the isolation of bacteria sweetna, cream bun and vada were collected and the isolates were identified based on their morphological and biochemical characteristics. Antimicrobial activity was determined by crude garlic extract and methanolic extract of garlic. The isolates from the food items were identified as *Staphylococcus aureus*, *Streptococcus lactis*, *Salmonella typhi*, *Enterobacter aerogens*, *Shigella dysenteriae*, *S. bacilli*, *Proteus mirabilis*, *Klebsiella oxytica* and *K. pneumoniae*. Minimum inhibitory concentration of the extracts was found to be 2.5% for both the extracts and also found that the crude extract was more effective than the methanolic extract.

*xx. Effect of heavy metals on the growth attributes of pathogenic fungi.*

Heavy metals are potentially harmful to most microorganisms at certain levels of exposure and absorption. In the present study effect of heavy metals such as mercuric chloride, lead acetate and copper sulphate at different concentrations such as 0.6, 1.3, and 3.3mg/ml on the growth of fungus such as *Aspergillus flavipes*, *A. Flavus*, *A. Terreus*, *Penicillium chrysogenum* and *P. citrinum* were analysed. From the results, it was found that mercuric chloride inhibited all the tested fungus in all the

concentrations. Lead acetate has less effect when compared with mercuric chloride whereas; copper sulphate inhibits only *Pencillium* sp. at higher concentrations. Thus from this study, it was concluded that the tested heavy metals affect the growth attributes of microorganisms.

*xxi. A study on dyeing of cotton cloths with pigment extracted from bacterial isolates.*

The use of synthetic dyes was harmful to human health and causes environmental pollution. The present study was undertaken to extract natural pigments from microorganisms and their use in textile dyeing. Pigment producing bacteria were isolated from different rhizosphere soil samples and identified as *Pseudomonas aeruginosa*, *Serratia marcenas* and *Staphylococcus aureus*. The parameters such as incubation period, pH, carbon source and nitrogen source were optimized for maximum pigment production. Antimicrobial activity of the pigments was also analysed and the effect of pigments on dyeing of cotton cloths was also determined. From the results it was confirmed that maximum pigment was produced when the isolates were incubated up to 72hrs at pH 9 in medium containing glucose and glycine as energy sources. TLC analysis of the pigments revealed that the Rf values were closely related to prodigiosin, staphyloxanthin and pyoverdine. Spectrophotometric analysis revealed that the intensity of colour was significantly high in *P. aeruginosa* followed by *S. marcenas* and *S. aureus*. The pigment shown antimicrobial activity against *Bacilus* sp., *E. coli* and *Klebsiella* sp. The dyed cloths couldn't lose their colour when exposed to sunlight and washing and skin allergic tests doesn't have any allergic reactions.

*xxii. Effect of medicinal plants on dandruff causing fungal pathogens*

Dandruff is the most common problem that affects many people leading to an embarrassing condition. In this study, antidandruff activity of medicinal plants such as *Lawsonia inermis*, *Azadirachta indica*, *Ricinus communis* and *Vernonia cinereae* were studied. Plants extracts were prepared in distilled water, chloroform and petroleum ether. Phytochemical analysis of these extracts revealed that the aqueous extract was rich in flavanoids, tannins, terpenoids, saponins and steroids. *Malassezia furfur* was isolated and identified from dandruff samples. Antimicrobial activity of tested plant extracts found to be very effective and the MIC was 250mg/ml. Among the solvents, aqueous extract was found to be more effective than other solvents and among the plant extracts *L. inermis* and *R. communis* were more effective than *A. indica* and *Vernonia cinereae*.

*xxiii. A study on effective microorganisms (EM) Technology in home waste engagement and in unfertile soil*

The present study was conducted to evaluate the effects of effective microorganisms (EM) on home waste, management and thereby in unfertile soil. EM solution was prepared by the fermentation of natural substances like banana, papaya, pumpkin, eggs and jiggery. After fermentation, the contents were filtered and organic waste kitchen was treated with EM solution. This was turned into fine compost within 20 days and its physical, chemical and biological properties were analyzed. From the results it was found that the compost was a rich source of microbial community and NPK. This compost was applied to *Capsicum annum* to study the effect of compost in plant growth promotion and disease control. The plants were uprooted after 45 days and from the data generated it was concluded that the compost treated plants showed increased biomass with less disease incidence.

### **Industrial Application of Microbial Pectinase Enzyme**

*Noel N. Mathew, B. Sc. Biotechnology, C. M. S. College, Kottayam.*

Pectinase is a group of enzymes that breakdown pectic polysaccharides into simpler molecules like galactouronic acids. Pectinase producing microorganisms were isolated from soil, different composts and decayed fruits. Production of pectinase enzyme was confirmed by the development of zone of clearance around the colony on pectin agar medium. Pectinase producing microorganisms were identified as *Citrobacterfreundii*, *Lactobacillus delbrueckii*, *Pseudomonas mallei*, *Enterobacteraerogens*, *Escherichia coli*, *Moraxella sp.*, *Micrococcus luteus*, *Branchamella sp.* and *Klebsiellaozaenae* on the basis of biochemical and morphological characteristics. The enzyme from the microorganisms were partially purified through ammonium sulphate precipitation and dialysis and the results of the study showed that all the partially purified enzymes were efficient to clarify the fruit juice extracted from pineapple and grape.

### **Antitumor Activity of Different Plant Leaf Extracts Using Potato Disc Tumor Assay**

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*Vishnupriya C. B., M. Sc. Zoology, C. M. S. College, Kottayam.*

*Agrobacterium tumefaciens* a soil borne Gram-negative bacterium which has a unique type of Ti plasmid containing T-DNA region. By transferring T-DNA region into plant cell through type IV secretion system *A. tumefaciens* produces crown gall disease in plants. *A. tumefaciens* was isolated from infected crown galls of plants and identified on the basis of morphological and biochemical characteristics. Aqueous

and methanolic extracts for the assay was prepared from the leaves of *Chrysanthemum indicum*, *Azadirachta indica*, *Vincetoxicum*, *Wedelia trilobata*, *Hibiscus rosasinensis*, *Cleodendrum paniculatum*, *Tagetes erecta*, *Gomphrenaglobosa*, *Euphorbia cotinifolia*, *Citrus lemon*, *Achyranthes aspera*, *Adiantum trapeziforme*, *Selaginella selaginoides*, *Codiaeum variegatum*, *Vitex negundo*, *Catharanthus roseus* and *Psidium guajava*. Initial screening for antitumour activity of the extracts was done by agar well diffusion method and maximum zone of inhibition was produced by the methanolic extracts of *W. trilobata* and *A. aspera* (22mm). Antitumour activity was done by potato disc assay and highest percentage of tumour inhibition was found by methanolic extracts of *W. trilobata* and *A. aspera* (97.08%). Aqueous extracts have less activity when compared with methanolic extracts. From the results it can be concluded that the methanolic extracts of *W. trilobata* and *A. aspera* were effective in controlling the crown gall disease of plants.

### **A Comparative Study between the Effect of Shampoos and Oils on Dandruff Causing Fungal Isolates**

*Greeshma S. Prasad, M. Sc. Zoology, C. M. S. College, Kottayam.*

*Amrutha Anil, B. Sc. Zoology, C. M. S. College, Kottayam.*

*Diana Varghese, B. Sc. Industrial Microbiology and Zoology, S. B. College, Changanacherry.*

Dandruff is common scalp problem associated with flaky and inflamed skin, causes hair fall. Dandruff causing fungal isolates were isolated on Sabouraud's dextrose agar from the samples collected from children and adults. The fungal isolates were identified as *Malassezia furfur*, *Aspergillus* sp. and *Penicillium* sp. Crude extracts of *Acmella uliginosa*, *Aerva lanata*, *Azadirachta indica*, *Chromolaena odorata*, *Hibiscus sinensis*, *Lavosonia inermis*, *Phyllanthus niruri* and *Sida rhombifolia* was prepared and their antidandruff activity was compared with shampoos of four different companies using agar well diffusion methods. On the basis of zone of inhibition around the well it can be concluded that both shampoos and extracts have antifungal activity, but superior effect was exerted by the shampoo.

### **Cytotoxic Effect of Soft Drinks on *Allium cepa***

*Suryamol K. S., B. Sc. Biotechnology, C. M. S. College, Kottayam*

Researchers found that consumption of soft drinks, particularly cola based can cause dental problems and developed carcinogenic activity. Thus this study was

undertaken with the objectives to compare the cytotoxic effect of three soft drinks on *Allium cepa* with respect to time. Chromosomal aberrations were studied based on microscopic observation at 6hrs and 24hrs. From the results the cytological aberrations found in the root tip cells are, disoriented metaphase, *unequal* segregation, strap nucleus with lesion, multiple Anaphase Bridge, cell wall shrinkage, enlarged nucleus and vacuole, binucleate cell and finally resulted in cell death. The third soft drink showed more cytotoxic effect when compared with other two. With respect to time the chromosomal aberrations started at six hours of treatment and at 24hrs, aberrations decreased due to cell death.

### **Optimization of Milk Clotting Enzyme Production by Microbial Activity for the Production of Cheese**

*SreejithaRadhakrishnan, B. Sc. Biotechnology, C. M. S. College, Kottayam.*

Microbial sources of bioagents are coinciding with the attempts to find cheap alternative substrates for high production. Rennet is the golden element in the dairy industry, particularly in cheese making. The present study adopted for Milk Clotting Enzyme (MCE) production by microorganisms isolated from rhizosphere soil samples. The enzyme producing bacterial isolates were identified on the basis of morphological and biochemical characteristics as *Bacillus subtilis*, *B. calidolactis*, *Proteus vulgaris*, *Lactobacillus brevis*, *Streptococcus lactis* and *Staphylococcus aureus*. Liquid state fermentation was carried out to extract the milk clotting enzyme and *L. brevis* showed high milk clotting activity. Cheese was manufactured using the enzymes extracted from the isolates and the cheese obtained have good aroma with milky color.

### **Isolation of Pigment Producing Microorganisms from Soil and Extraction of Pigments to Study Their Application in Dyeing.**

*ReshmaMadhukumar, B. Sc. Biotechnology, C. M. S. College, Kottayam.*

Natural dyes are non-toxic, non-polluting and less health hazardous and are obtained from various sources like plants, animals and microbes. Microbial dyes have some advantages over plant and animal based dyes as microbes are fast growing and have the potential of being standardized commercially. The pigment producing bacterial isolates were isolated from different soil samples and identified on the basis of morphological and biochemical characteristics as *Chromobacterium* sp., *Micrococcus* sp., *Pseudomonas* sp. and *Bacillus* sp. pigments from the isolates were extracted using the solvent methanol and identified as violacein, carotene, pyocyanin and pyoverdine by thin layer chromatography. The

results have shown that the extracted can act as natural colorants and have great potential in the dyeing of cotton cloths.

### **Bio control of Plant Pathogens by Endophytic Bacteria**

*Ramzana Rasheed, B. Sc. Biotechnology, C. M. S. College, Kottayam.*

Endophytes are beneficial microorganisms that colonize the internal tissues of their host plants. Plants derive several advantages from endophytic colonization, such as the biocontrol of phytopathogens and growth-promoting factors. Endophytic bacteria were isolated from the roots and stem of *P. guajava* and *B. acuminata* and are identified as *Bacillus subtilis*, *Bacillus* sp., *Staphylococcus aureus* and *Corynebacterium* sp. antagonistic studies were carried out to determine the biocontrol activity of the isolates against *Pythiumsplendens* and *Phytophthora* sp. from the results, it can be concluded that the endophytic bacteria *Bacillus* sp. have the potential effect on controlling the diseases caused by *P. splendens* and *Phytophthora* sp.

### **Isolation, Identification and Characterization of Cellulose Degrading Microorganisms from Three Different Termite Species**

*Tiffy Mariam John, M. Sc. Zoology, C. M. S. College, Kottayam.*

This study was carried out to isolate cellulose degrading bacteria from the gut of three different termite species, *Odontotermesredemanni*, *O. anamensis* and *Microcerotermescameroni*. The microorganisms present in the gut of the termite produce cellulase enzymes which are able to degrade complex cellulose molecules. Bacteria from the gut of the collected termites were isolated by serial dilution method and cellulase producing activity of the isolates were determined by Congo red assay on carboxy methyl cellulose agar. The enzyme producing bacterial isolates were identified as *Brevibacillusbrevis*, *Bacillus licheniformis*, *B. lentus*, *Enterobacter cloacae*, *B. cereus*, *B. subtilis*, *B. circulans*, *Micrococcus luteus*, *Clostridium bifermentans*, *C. septicum* and *Pseudomonas corrugata*. Production of cellulase enzyme was optimized at different pH, temperature, incubation time, carbon and nitrogen sources and found that the enzyme activity was high at pH 6, temperature 50°C, at 72hrs of incubation, in the presence of glucose and glycine as carbon and nitrogen sources. The production of cellulase enzyme by different microorganisms were quantified by dinitrosalysilic acid method and maximum amount was produced from *B. licheniformis*. The efficiency of cellulose degradation by the bacterial isolates was determined by filter paper degradation assay and found that more than 60% of the filter paper was degraded by *B. licheniformis*, *B. brevis*, *C. bifermentans* and *C. septicum*. Thus, it can be concluded that the cellulase enzyme

obtained from the microorganisms was efficient in degrading complex cellulose molecules into simpler units and it would be useful in the field of waste management in future studies.

### **Study on Biosynthesis of Silver Nanoparticles: Its Antimicrobial Activity and Toxicity Assay on Seed Germination**

*Hartitha Prasad, M. Sc. Zoology, C. M. S. College, Kottayam.*

*Anu Thomas, B. Sc. Biotechnology, C. M. S. College, Kottayam.*

This study was aimed to synthesize silver nanoparticles (AgNPs) from the leaves of *Azadiractaindica*, *Centellaasiatica* and *Aloevera*, peels of *Citrus sinensis*, *Musa paradisaca* and *Punicagranatum* to determine their antibacterial activity. Synthesized AgNPs were characterized by UV-Vis spectrophotometer and found that rapid bio reduction was achieved using all plant extracts except *A. vera* leaf extract. Also, the synthesized AgNPs remained stable after 48 hours of reaction. Antibacterial activity was determined by agar well diffusion method against *Escherichia coli*, *Pseudomonas aeruginosa* and *Bacillus subtilis*. The results revealed that all the extracts were able to inhibit the tested bacterial pathogens and among the extracts *A. vera* showed less effect. 10% concentration was found to be the MIC of all the extract and for *A. vera* it was 50%. Additionally, the toxicity evaluation of AgNP was carried out by seed germination test on *Vignaradiata*. Seeds treated with the AgNPs from *P. granatum* and *M. paradisaca* showed better seed germination rate than other extracts. Hence, it can be concluded that the AgNPs from plant origin is safe to be discharged into the environment and can be utilized in process of pollution remediation.

### **A study on the effect of bacteriocin producing *Lactobacillus* sp. on multi drug resistant bacteria**

*Leena Elizabeth Varghese, B. Sc. Biotechnology, C. M. S. College, Kottayam*

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 the results of antimicrobial activity

showed that the extracted bacteriocins have a significant inhibitory effect on MDR bacteria. Hence, it can be concluded that the extracted bacteriocin from LAB is an alternative to drugs against MDR bacteria.

### **Effect of mercuric chloride on the growth attributes of pathogenic fungi.**

*Surya S. Nair, B. Sc. Microbiology and Biochemistry, S. B. College, Changanacherry.*

Heavy metals are potentially harmful to most microorganisms at certain levels of exposure and absorption. In the present study effect of heavy metal mercuric chloride at different concentrations such as 0.6, 1.3 and 3.3mg/ml on the growth of fungus such as *Aspergillusflavipes*, *A. Flavus*, *A. Terreus*, *Penicilliumchrysogenum* and *P. citrinum* were analysed. From the results, it was found that mercuric chloride inhibited all the tested fungus in all the concentrations. Thus from this study, it was concluded that the tested heavy metals affect the growth attributes of microorganisms.

### **A Comparative Study on the Efficiency of Different Natural Filters in Water Purification**

*Michelle Mary Varghese, B. Sc. Industrial Microbiology and Zoology, S. B. College, Changanacherry.*

Today, water is getting polluted by various microorganisms. Throwing garbage into water bodies and eutrophication are the major causes of water pollution. People use modern sophisticated techniques for water purification, but these are not eco-friendly. This study was undertaken with the aim to determine the efficiency of natural filters in water purification for household use. Polluted water samples were collected and subjected to purification through the filters containing fine sand, coarse sand, charcoal and pebbles, *Vetiveriazizanioides*, *Moringaoleifera*, copper and ceramic pot along with control. Coliform bacterial count was determined by MPN method before and after treatment to compare the efficiency of different methods. The results revealed that all the filters used in the study were able to reduce the coliform count the treatment with *M. oleifera* was completely removed the coliform count. Thus, it can be concluded that *M. oleifera* was more efficient than other filters in water purification.

### **Biodegradation of Synthetic Dyes by Microorganisms**

*Merin Mathew, B. Sc. Biotechnology, C. M. S. College, Kottayam*

The textile industries use different types of dyes in their processing units which are liberated in natural water bodies through wastewater. Disposal of these dyes into

the environment causes serious damage. Thus, there is the need of era to investigate new bacterial dye degraders that have potential for use in a various textile industries to treat effluents. The present study deals with the degradation of Congo red and bromophenol blue by bacterial isolates isolated from different textile effluents. Three different bacterial species were isolated and subjected to dye decolourization assay. The isolated bacteria were identified as *Proteus sp.*, *Pseudomonas sp.* and *Acinetobacter sp.* based on their morphological and biochemical characteristics. Dye decolourization efficiency of the isolates was analysed on the basis of zone of clearance around the colony. Quantitative assay revealed that above 90% of the incorporated dyes were degraded by microorganisms within 24hrs. It can be concluded that the microorganism could successfully be employed in the treatment of textile effluent.

### **A Study on the Efficiency of Disinfectants against Bacterial Laboratory Contaminants**

*Nowfira Mohammad, B. Sc. Biotechnology, C. M. S. College, Kottayam*

Frequent environmental contaminants within microbiology laboratory create not only diagnostic dilemmas but also poses major risk for laboratory technicians. Hence, the main objective of this study was to isolate and identify the common laboratory contaminant bacteria and to determine the effect of commonly used disinfectants on the contaminants with an ultimate goal to reduce false positive culture reports as well as laboratory acquired infections. The study was conducted in the Microbiology laboratory of Tropical Institute of Ecological Sciences (TIES). Contaminants were isolated from different areas of laboratory by exposing sterile nutrient agar plates. After incubation, the developed colonies were identified based on morphological and biochemical characteristics as *Micrococcus luteus*, *Bacillus subtilis*, *Staphylococcus epidermidis* and *S. aureus*. Antibacterial activity was determined by agar well diffusion method using the disinfectants such as Dettol, phenol and alcohol. The results revealed that phenol was highly effective against all the contaminants followed by alcohol and Dettol. Hence, it can be concluded that precaution should be taken to get rid of these organisms from laboratory by means of proper laboratory disinfection and sterilization as well as personal hygiene of laboratory workers.

## 2. Environmental Education and Outreach

### *a. Ph.D Course Work*

TIES proudly announce that our first Ph.D candidate, Abin Varghese, has been awarded with a doctorate in Environmental Sciences. The rest of the five students S. Sathrumithra, Roshni Susan Elias, Rejani Rajan, Alex John, Vinod Mathew has



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 continued during the reporting year. 24 postgraduate students from seven colleges and 13 undergraduate students from three colleges have undergone this training.

Table 1. List of students undergone TRTP training at TIES during 2017-18

S. No.	Student Name	Topic	Course & College
1	Rinta Ann Samuel	A comparative study on the activity of curcuminoids extracted from different rhizomes of turmeric.	

2	Arya G. S	Study on the effect of fish amino acid on plant growth and disease control	<i>MSc Biochemistry</i> St. Mary's College for Women, Thiruvalla
3	Sumayya M.	A comparative study on the bioactive compounds between <i>Ganoderma</i> sp. and <i>Calocybe</i> sp.	
4	Vrinda A.	A comparative study on the bioactive compounds between <i>Ganoderma</i> sp. and <i>Calocybe</i> sp.	
5	Sangeetha O.	Isolation, characterization and industrial application of microbial pectinase.	<i>MSc Microbiology</i> St. Mary's College for Women, Thiruvalla.
6	Salini S.	A comparative study on the activity of curcuminoids extracted from different rhizomes of turmeric.	
7	Angela Ann Philip	Studies on growth promoting and biocontrol activities of plant growth promoting rhizobacteria (PGPR) on <i>Solanum lycopersicum</i> .	
8	Veena Viswanathan	Application of microbial enzymes in biodegradation	
9	Akhila K. Subhash	Isolation and characterization of the bacteria <i>Enterobacter aerogens</i> for the production of biopolymer	<i>MSc Biotechnology</i> Sree Narayana Arts and Science College, Kumarakom, Kottayam.
10	Ambily V. S.	Study on pink pigmented facultative methylotropic bacteria (PPFM) to enhance seed germination through the production of growth hormones in tomato ( <i>Solanum lycopersicum</i> )	
11	Vandana G.	Bio ethanol production from sweet potato ( <i>Ipomea batatas</i> L.) flour using co-culture of <i>Trichoderma</i> sp. and <i>Saccharomyces cerevisiae</i> in solid state fermentation.	
12	Nusaiba Naseer	Isolation and characterization of the bacteria <i>Enterobacter aerogens</i> for the production of biopolymer	<i>MSc Microbiology</i> M. E. S. College, Marampally, Aluva.
13	Megha Mary Mathew	Synthesis of aspirin using acetic acid and natural catalysts	<i>BSc Chemistry</i> K. G. College, Pampady.
14	Athira Santhosh	Biosynthesis of nanosilver.	<i>BSc Food Science &amp; quality control</i> St. George's College, Aruvithura
15	Archana K. Satheesh	A study on the effect of bacteriocin producing <i>Lactobacillus</i> sp. on multi drug resistant bacteria and their role in food preservation	
16	Anju K. A.		
17	Christin Thomas	Antibacterial activity of garlic extracts on microbial pathogens from ready to eat food items	
18	Jasna Aliyar	A study on mosquito larvicidal efficiency of different microorganisms	<i>MSc Biotechnology</i>
19	Minumol M. M.	A study on the isolation of biosurfactant producing	

		microorganisms and their role in the degradation of kerosene.	Indira Gandhi College of arts and Science, Nellikuzhy.
20	Aleema Kamar A. K.	A study on antimicrobial activity of silver nanoparticles.	
21	Digna Sekhar	A study on the antibacterial and enzymatic activity of Actinomycetes	
22	Anna Simon	A study on antimicrobial activity of silver nanoparticles.	<i>MSc Microbiology</i> Indira Gandhi College of arts and Science, Nellikuzhy
23	Amalamol Rose Baby	Effect of heavy metals on the growth attributes of pathogenic fungi.	<i>MSc Microbiology</i> P. G. M. College, Kangazha
24	Treesa Jose	A study on dyeing of cotton cloths with pigment extracted from bacterial isolates.	
25	Sreeprabha S.	Bio ethanol production from sweet potato ( <i>Ipomea batatas</i> L.) flour using co-culture of <i>Trichoderma</i> sp. and <i>Saccharomyces cerevisiae</i> in solid state fermentation.	
26	Sona V. Johnson	A study on the bacterial quality of cold snacks	
27	Thasni Bhanu		
28	Babini Fathima	Isolation, characterization and industrial application of microbial pectinase.	<i>BSc Microbiology</i> P. G. M. College, Kangazha
29	Neenu P. Raju		
30	Jojo Thankachan		
31	Selsher Sebastian		
32	Meenu Mahadevan	Comparison of pollution rate of temple ponds with respect to normal ponds	
33	Tessa Anna Varghese		
34	Anjana Mohan		
35	Kavya C. Ravi	A study on the effect of bacteriocin producing <i>Lactobacillus</i> sp. on multi drug resistant bacteria and their role in food preservation	<i>MSc Applied Microbiology</i> St. Thomas College, Palai.
36	Greeshma R.	A study on effective microorganisms (EM) Technology in home waste engagement and in unfertile soil	
37	Sruthy Sadan	Effect of medicinal plants on dandruff causing fungal pathogens	<i>MSc Microbiology</i> SNGIST arts and Science College, North Paravoor.

### *c. Internship*

Students who completed their courses benefitted from internship at TIES for varied periods of 3 months to one year. During the reporting year, three students successfully completed internship at TIES on various topics of interest.

Table 2. Interns undergone training at TIES during 2017-18

Srl No.	Name	Topic
1	Akhila	Waste management studies
2	Priyanka	Plant growth promotion studies
3	Soumya Sadananthan	Water quality analysis

#### *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 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.



Inauguration of Green Audit Session at Christian College, Chengannur

#### *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. Some of them where; Alphonsa Collage, Pala; New man college,Thodupuzha; BMM School, Pampadi and Young Men Association, Mundiapally. The sessions included introduction on nature study, different laboratory sessions, mushroom cultivation, building walk, studying the flora and fauna inside the campus and eco friendly games.



Enjoy Learning Session for Schools Conducted at TIES Campus

### 3. Capacity Building

#### A. Junior Naturalist Certificate Course

TIES conducted a 15 days course of “Junior Naturalist” Training Programme for children to making them more passionate about nature and life through systematic nature studies. Students successfully completed the course awarded with a certificate of Junior Naturalist.



**Field study as a part of Junior Naturalist Training Programme**

## **B. Training on Mushroom Farming**

Four training programmes were conducted during this year in which 69 people participated. 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.



**Introduction session on Mushroom Farming**

### **C. Hands on training on Basic microbiology techniques**

TIES conducted two day training programme on basic microbiology techniques for biology undergraduate students. Students of botany and zoology departments from Nirmala College, Moovattupuzha were participated.



**Training session on Microbiology Techniques**

### **D. Class on Organic Farming for new beneficiaries**

TIES provided organic farming class for new beneficiaries and distributed booklet on 'Organic Farming Techniques' and 'Composting Method.' 29 beneficiaries attended the meeting. Dr. Punnen Kurian took class on 'Organic Farming.'

### **E. Class on Butterfly**

One day class was conducted by TIES for school and college students to provide information and build awareness about butterflies. Sarath N Babu led the session. A total of 300 students were participated in this programme.

### **F. Hands on Training on Statistical Analysis using SPSS**

TIES conducted two rounds of SPSS training workshop at TIES for students, researchers and employers from different fields. The classes were taken by Dr.

Ramesh Nair, Joint Director, Statistics and Planning Department, Rubber Board, Kottayam.

### **G. Exhibition**

TIES conducted Laurie Baker Centenary Celebration by installing a stall in Kottayam for exhibiting TIES products.

### **H. World Environment Day - 2017**

The World Environment Day was celebrated at TIES financially supported by Indian Oil Corporation Ltd. The music therapy event “Laya: Connecting People to Nature through Music” was conducted in connection with World Environment Day 2017. The renowned music therapist, Smita Pisharady organized the event. About 50 people were present to attend the event.

### **I. International Day for Biological Diversity -2017**

International Day for Biodiversity was celebrated by TIES in collaboration with Apollo Tyres Foundation Ltd. at Apollo Tyres, Kalamasseri.

### **J. World Water Day Celebration-2017**

One day workshop was conducted by TIES on World Water Day in collaboration with Apollo Tyres on “Simple Techniques for Water Purification at Households”. Classes taken by Mrs. Roshini Susan Elias. Sixty three people were participated in this programme.

### **K. Meenachil River Dragonfly Survey**

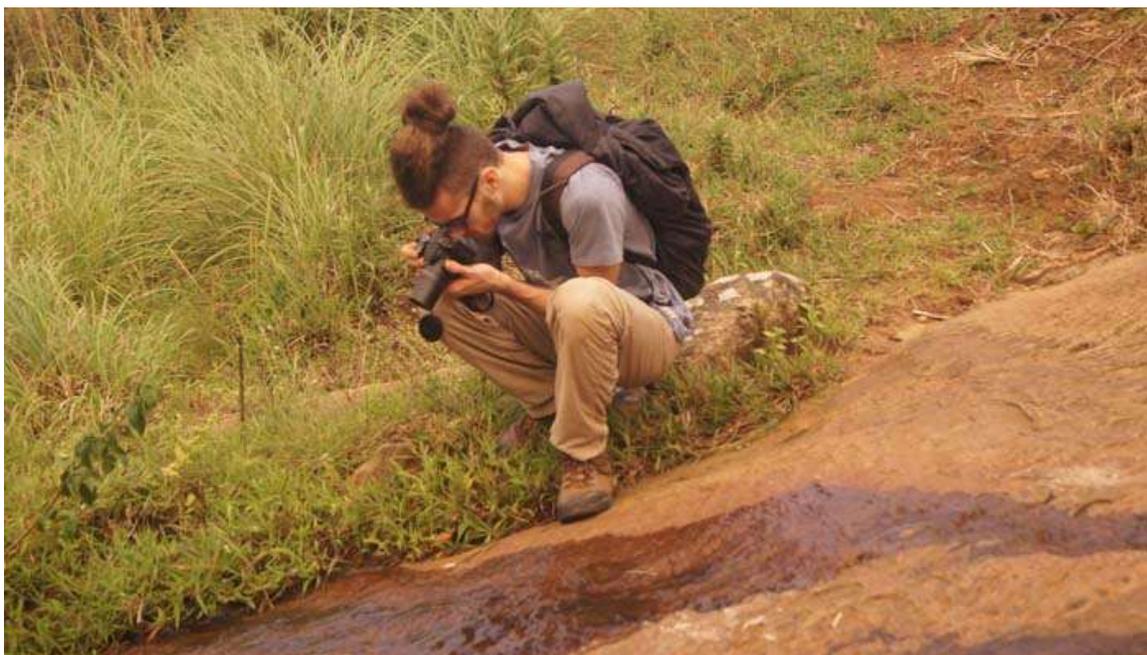
Two day programme was conducted by TIES to monitor and survey the dragonflies in Meenachil River. Over 90 participants from 18 educational and research institutions attended the training session. Dr Punnen Kurian and Dr Abraham Samuel led the training session. The sites where assigned to each team and each site was assigned with an expert. The survey team surveyed dragonfly population in their respective sites. The study findings and water quality analysis reports were published.



**Dragonfly Survey: Conducted by TIES**

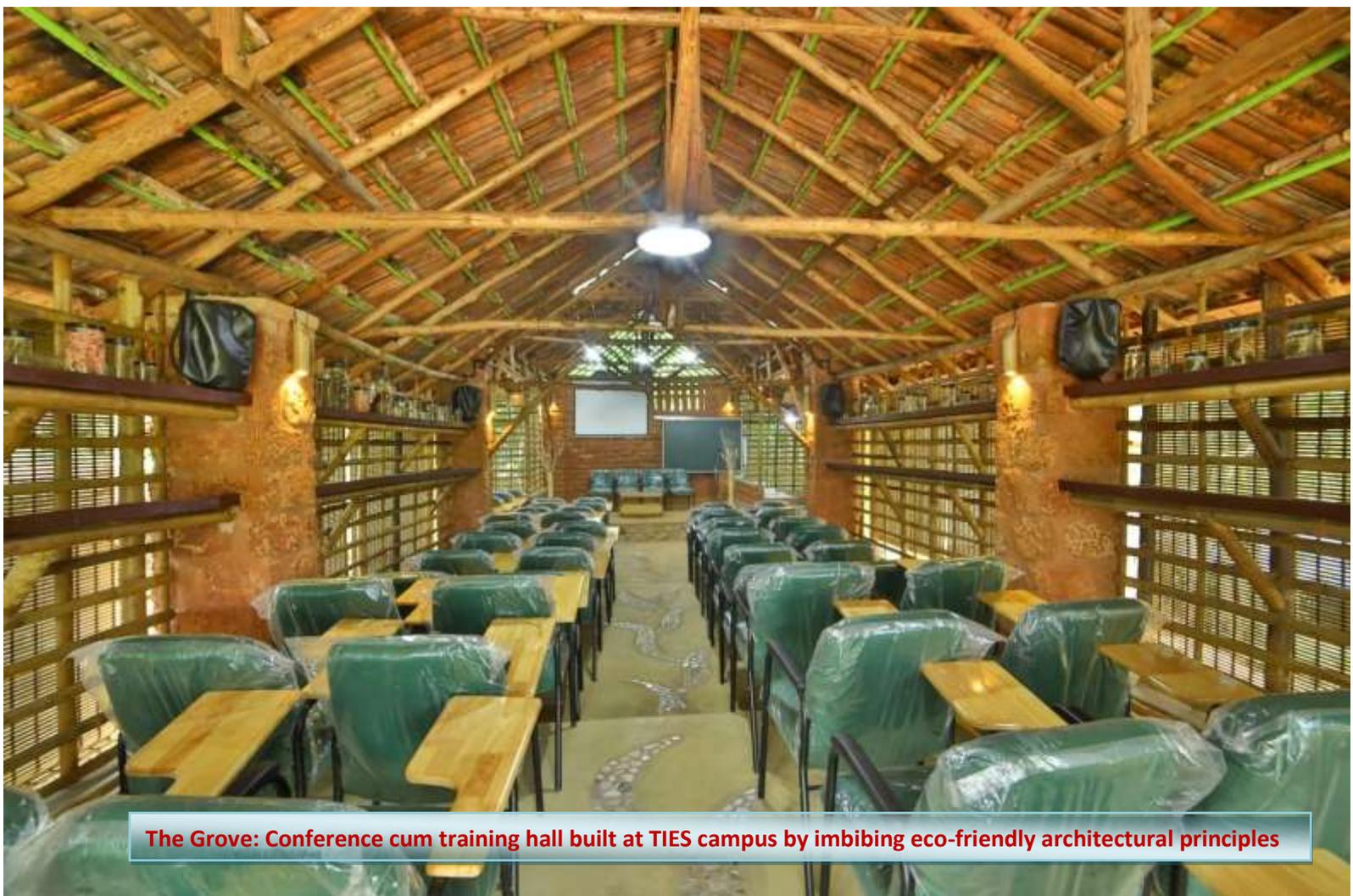
### **L. Tropical Explorer Programme**

TIES has launched Tropical Explorer Tourism Program. Edwin Zargar from Belgium was taken for a 3-day long nature exploration trip to Aramanakkadu near Udumpanchola. Tropical Explorer is the educational tourism program of TIES which aims at evoking the spirit of nature conservation through unique experiences of exploring the nature at its pristine form.



## M. Inauguration of the Grove

The Grove in the groves: A new meeting cum exhibition hall built at the TIES campus was inaugurated. The hall built using the sustainable architecture philosophies is gaining more public attention. The grove that is built inside a bamboo grove and has a seating capacity of 100 people. Also, it boasts an open air theatre type seating facility, natural air conditioning and a biological specimen exhibition unit. COSTFORD, a green architectural firm, has turned this eco-friendly idea of Dr Punnen Kurian , Director of TIES, into reality. It was featured in the architecture magazine, Designer + Builder.



**The Grove: Conference cum training hall built at TIES campus by imbibing eco-friendly architectural principles**

## Visitors:

1. Smt. Shanthakumari, Honourable District Judge.
2. Smt. Jyothi Ben, Chief Judicial Magistrate.
3. Mrs. Rema Devi, Representative from Azim Premji University.
4. Alam Marshall, Researcher from Australia.
5. Edwin Zargar from Belgium.
6. Tuesday Club, an association of retired teachers.
7. NSS student group from Kothala.
8. Architectural students from Trichi.
9. Florian Rameir, from Thailand.

## 4. 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 has 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.

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

I submit the fourteenth annual report for the approval of the general body.



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