



*Newly constructed Eco-friendly Conference Hall The Grove*

# 13<sup>th</sup> Annual Report 2016-17

TIES – ties Mind and Nature



TROPICAL INSTITUTE OF ECOLOGICAL SCIENCES  
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# Preface

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**TIES** is stepping to the 13th year of its existence. Thirteen 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 13<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 13<sup>th</sup> annual report before the board of directors, members and well wishers.



# Thirteenth 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. Unfortunately the same forests are under threat from multitude of anthropogenic causes. Forests all over the world are in peril 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. It is an approach towards better conservation of forests and wildlife, protecting livelihood of the forest dependent people. PFM was adopted as a national policy in India in 1988, with a vision to involve people in the conservation and livelihood enhancement. Kerala too, introduced it, but as late as 1998. 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.



**Handing over PFM manual to Kerala Forest Department**

TIES in consultation with experts within and outside the Department and taking into confidence all the stakeholders, completed the consultancy in time. It 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”.

The major gaps identified are pertaining to (1) Governance, (2) Man Power Management (3) Forest Protection (4) Community Participation (5) Micro plan preparation and PRA process (6) Capacity Development (7) Livelihood Improvements and (8) Democratization of PFM. A structured syllabus and training manual for capacity building was also developed. Training was given to a selected group of secretaries/coordinators and Presidents/ Ex. Com. Members of PFMI (50 +50) as “Master Trainers” for expanding capacity building and implementing PFM effectively in the face of emerging opportunities and threats. Also, TIES provided specific recommendations under four heads; (1) Administrative Improvements, (2) Livelihood Improvements, (3) Community Participation –Micro plan and PRA and (4) Training Needs and Training Manual.

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

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 programme on Organic Farming. The programme was inaugurated by Sri. Korah Thomas (Deputy Director, Department of Agriculture, Kottayam). The programme was attended by Dr. Punnen Kurian (Secretary, TIES), Sri. K.M. Radhakrishna Pillai (President, District Residents Association), and Sri. George Mathew (Assistant Coordinator, Suchitwa Mission, Kottayam). The classes were taken by Sr. John Sherry (Agricultural Officer, Choornikkara). He gave a good account on the importance of organic farming and the need to adopting sustainable farming methods. He inspired the participants to do adopt natural farming technologies. He also stressed on the need of coming together of farmers and Scientists for an effective solution. The booklet named “*Growbagil Jaivakrishi*” (Malayalam), detailing steps to be adopted in the farming technique, was published by TIES in the programme. Participants from various residents association of Kottayam were in attendance.

## iii. Kerala Rural Water Supply and Sanitation Agency (KRWSA- Jalanidhi), Meenadom Grama Panchayath, Kottayam District

Jalanidhi, Kerala Rural water Supply and Sanitation Agency (KRWSA), the World Bank supported project has been implemented by TIES at Meenadom Grama Panchayath. There are 15 drinking water projects and 5 ground water recharging projects proposed for the Meenadom Panchayath, among which 9 drinking water projects are



Review staff meeting at Jalanidhi office Meenadom



One of the Project Sites of Jananidhi at Meenadom

new projects and 6 are rehabilitation projects of either KWA or Panchayath. The work is progressing and the program include baseline data preparation, identification of water scarcity areas and needy community through a participatory appraisal activity, formulation of Beneficiary groups, federation of Beneficiary groups and several sub committees. The projects are implemented with 75% aid from Jananidhi, 15% by the Panchayath and 10% as beneficiary contribution.

As per the current status available, our team stands at the front in the Phase II, Batch II projects. TIES-Jananidhi team includes a team leader, senior engineer, 4 junior engineers, 4 community facilitators, one community development officer and one accountant. The day to day work is monitored by a Project commissioner appointed by Jananidhi. All projects are completed and only the exit process remains.

#### **iv. Urja Kiran- Energy Awareness Campaign**

With the support of Energy Management Centre (EMC) TIES conducted a one day seminar for women of 9<sup>th</sup> ward of Manarcadu Grama Panchayath. The session was led by Dr. Sankararaman (Associate Professor & Research guide, Department of Physics, Nirmala College) and was attended by Dr. Punnen Kurian (Secretary, TIES).

#### ***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



**Peringankulam Rejuvenation: A CSR initiative of Apollo Tyres in Technical Collaboration with TIES**

environment conservation programmes and projects at Apollo campuses such as Biodiversity Enhancement Program and Zero Budget Natural Farming. and different wards of Ernakulam and Thrissur districts. TIES is making periodical field visits to Apollo campuses for evaluating the conservation programmes.

TIES has rejuvenated Peringankulam Pond as part of Apollo's eco-conservation effort in collaboration with Kodakara Grama Panchayat. The pond was cleaned, restored and a boundary was constructed with community participation. The project was inaugurated by Mr. Satheesh sharma, President, Apollo Tyres Foundation in the presence of various Apollo officials, Kodakara Grama Panchayat authority, Dr. Punnen Kurian, Secretary, Tropical Institute of Ecological Sciences and community members. The pond is being cleaned, restored and maintained periodically. As part of the Pond rejuvenation program, rejuvenation activity of Kallamkulam and Marathampilly ponds were also initiated. Also, TIES continuous to maintain Cochin Children's Science Park, Kalamassery and Chalakkudy Municipal Park.

A one day summer camp was conducted by Dr. Punnen Kurian, Dr. Abraham Samuel and Dr Nelson Abraham for the children of employees of Apollo, Perambra, Thrissur. Also, terrace farming projects are successfully implemented at Kodakara Panchayath and Kalamassery Municipality. 100 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 45% success at Kodakara and 40% success at Kalamassery.



**River walk conducted at Chalakkudy as part of the Chalakkudy River Conservation Project**

Under the CSR wing of Apollo Tyres, TIES has initiated Chalakkudy River 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.

**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**

*a. 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*.

*b. 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.

*c. 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.

*d. 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.

*e. Isolation and characterization of the bacteria Enterobacter 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.

*f. 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.

*g. 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.

#### *h. 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.

#### *i. 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.

#### *j. 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.

*k. 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% mortality rate of larvae shown by the isolates, *B. subtilis*, *Anterobacter aerogens*, *Penicillium sp.* and *Candida albicans*.

*l. 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.

*m. 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.

*n. 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*.

*o. 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.

*p. 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.

*q. 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.

#### *r. 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.

#### *s. 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 foos 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.

*t. 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 3.3 mg/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 *Penicillium* sp. at higher concentrations. Thus from this study, it was concluded that the tested heavy metals affect the growth attributes of microorganisms.

*u. 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 marcescens* 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 72 hrs at pH 9 in medium containing glucose and glycine as energy sources. TLC analysis of the pigments revealed that the R<sub>f</sub> 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. marcescens* and *S. aureus*. The pigment shown antimicrobial activity against *Bacillus* 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.

*v. 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 cinerea* 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 cinerea*.

*w. 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.

## 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 2016-17

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.	MSc Biochemistry St. Mary's College for Women, Thiruvalla
2	Arya G. S	Study on the effect of fish amino acid on plant growth and disease control	
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.	MSc Microbiology St. Mary's College for Women, Thiruvalla.
5	Sangeetha O.	Isolation, characterization and industrial application of microbial pectinase.	
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	MSc Biotechnology 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>Entrobacter 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.	
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	<i>BSc Food Science &amp; quality control</i> St. George's College, Aruvithura
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> Indira Gandhi College of arts and Science, Nellikuzhy.
19	Minumol M. M.	A study on the isolation of biosurfactant producing microorganisms and their role in the degradation of kerosene.	
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.	
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	<i>BSc Microbiology</i> P. G. M. College, Kangazha
27	Thasni Bhanu		
28	Babini Fathima	Isolation, characterization and industrial application of microbial pectinase.	
29	Neenu P. Raju		
30	Jojo Thankachan	Comparison of pollution rate of temple ponds with respect to normal ponds	
31	Selsher Sebastian		
32	Meenu Mahadevan		
33	Tessa Anna Varghese		

34	Anjana Mohan	Studies on growth promoting and biocontrol activities of plant growth promoting rhizobacteria (PGPR) on <i>Solanum lycopersicum</i> .	<i>MSc Applied Microbiology</i> St. Thomas College, Palai.
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	
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 2016-17

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*



Inauguration of Green Audit Session at Christian College, Chengannur

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.

#### *e. Greening Minds- Summer Camp*

TIES organized a one day summer camp at Govt. U.P. School, Adoor. The Greening Minds, a one day nature orientation programme for children, was organised for children of 10 to 13 years. The program started with an ice-breaking session by Dr. Nelson P. Abraham and that was followed by "Total Quality Child", another session by Dr. Nelson P. Abraham. In the afternoon, Dr. Punnen Kurian led a session on "Learn from Nature."

#### *f. 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, Palai; St. Dominic's College, Kanjirappally; St. Jude Global School & Junior College, Thalappady; K.G College, Pampady and School of Applied Sciences and Technology, M.G University. 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.



### **3. Capacity Building**

#### **a. Training on Mushroom Farming**

Three training programme were conducted during this year in which 69 people were. Dr. Punnen Kurian took the introductory session. Mrs. Roshni Susan Elias lead 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.

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

TIES organised three rounds of SPSS training workshop at TIES for students, researchers and employers from different fields. The classes were conducted by Dr. Ramesh Nair, Joint Director, Statistics and Planning Department, Rubber Board, Kottayam.

#### **C. Plastic Waste Management Drive**

TIES has conducted a consultation meeting on plastic waste management drive at TIES. Shri. Roy Paul IAS has inaugurated the program and many residents association representatives were in attendance of the program.

#### **D. Exhibition**

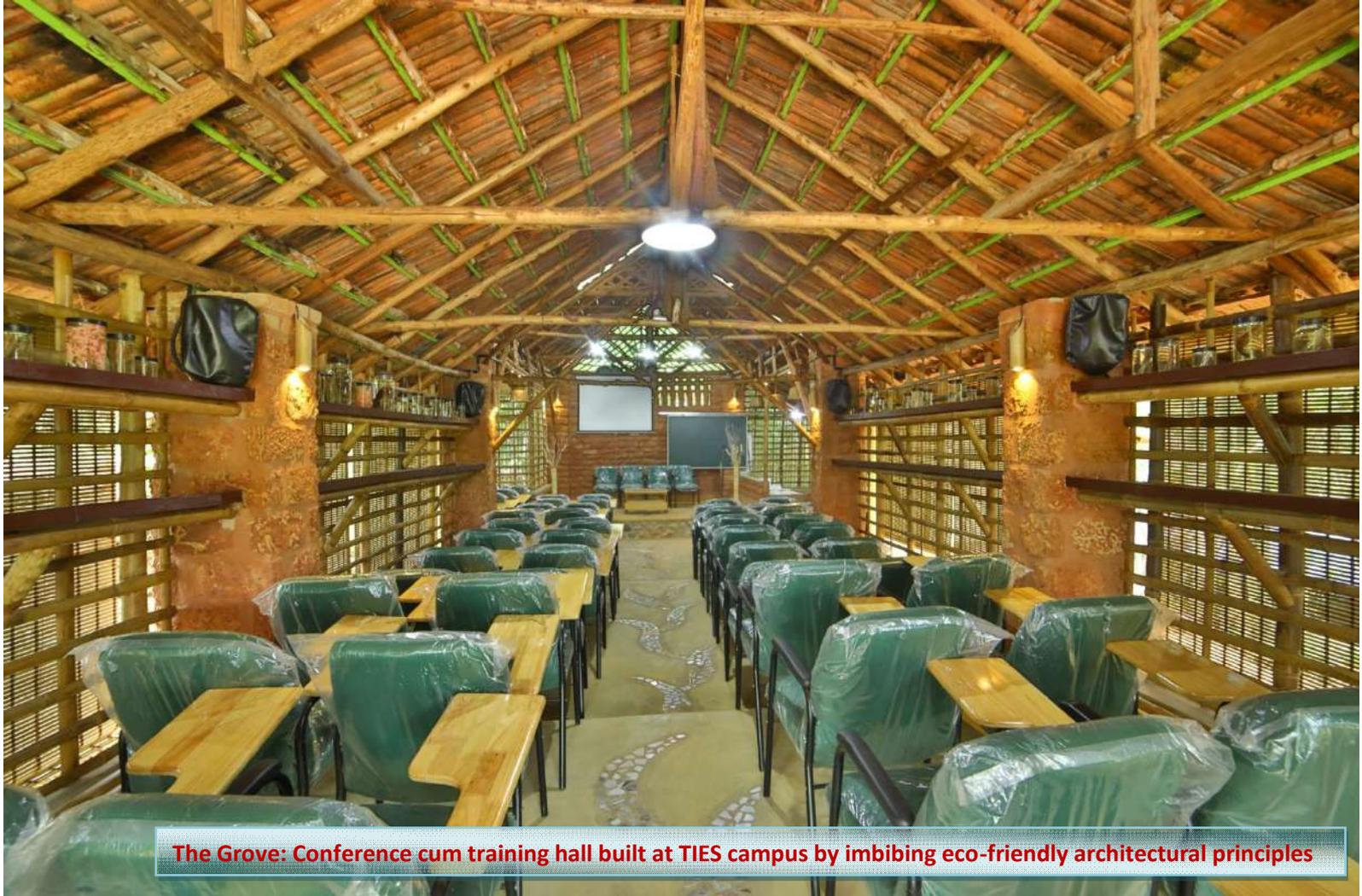
TIES participated in 2016 NextGen Genomics, Biology, Bioinformatics and Technologies (NGBT) Conference at Le Meridian Hotel, Cochin, and Agri Fest 2016 at Manarcaudem, Kottayam.

#### **E. World Environment Day - 2016**

The World Environment Day was celebrated at TIES in Association with Akhila Kerala Bhalajanaskhyam. The programme was inaugurated by Singer, Kumari Vaikom Vijayalakshmi and was attended by prominent environmentalists.

#### **F. 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**

## **G. Good Earth Launched**

TIES launched Organic Products under its Brand Good Earth. Sri. K. M. Radhakrishnan Pillai (President, District Residents Association, Kottayam) launched the products by receiving it from Sri. John Sherry (Agricultural Officer, Choornikkara).

### **Visitors:**

1. Ms Maya Sundararajan, Regional Officer, United States-India Educational Foundation
2. Murielle Ikareth, Environmentalist, France

## **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. 2016-17 marks a tremendous milestone for TIES as it celebrates its first decade of achievement in all spheres of its activities.

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. 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 thirteenth annual report for the approval of the general body.

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Annual Report presented in annual General Body Meeting conducted on 24<sup>th</sup> December 2017 at TIES campus.



## TROPICAL INSTITUTE OF ECOLOGICAL SCIENCES

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