

TIES

Annual Report

2021-2022



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EIGHTEENTH ANNUAL REPORT
(2021-2022)



TIES – ties Mind and Nature

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Content

1. RESEARCH AND DEVELOPMENT	6
A. TIES-OWN PROJECTS	7
<i>i. Bees for life</i>	7
II. PROJECT “THANAL”	7
II. KOTTAYAM COLLECTORATE BUTTERFLY GARDEN	9
B. CSR PROJECTS	10
<i>i. Project on Bees Wax & Value Added Products</i>	10
ii. STUDY ON INTERCROPPING & BEST FARMING PRACTICES IN SMALL HOLDER RUBBER PLANTATIONS	11
C. OTHER	12
<i>ii. Indian Snake Bite Initiative</i>	12
D. GRANTS.....	14
<i>i. Developing an Orchid library and Information centre: Capacity building atTIES- Kottayam ..</i>	14
E. TIES’ INTERNAL PROJECTS.....	15
1. TRTP- STUDENT PROJECTS.....	15
2. ENVIRONMENTAL EDUCATION & OUTREACH	27
A. PH.D COURSE WORK.....	28
B. TIES RESEARCH TRAINING PROGRAM (TRTP)	28
C. INTERNSHIP	32
D. INTERNSHIP PROGRAMME- 2022	33
E. COLLEGE- NGO PARTNERSHIP PROGRAM	35
F. COLLABORATIONS.....	37
G. ENJOY LEARNING	38
H. MEENACHIL RIVER ODONATE SURVEY	39
3. COMMUNITY DEVELOPMENT	40
I. WATER CONSERVATION AND RIVER RESTORATION ACTIVITIES	41
<i>a. Water quality study of manimala river</i>	41
II. WEBINAR: NATURE CONSERVATION-GANDHIAN PERSPECTIVE	42

4. CAPACITY BUILDING	43
A. ONLINE TRAINING ON MUSHROOM FARMING.....	44
B. ONLINE TRAINING ON POULTRY FARMING	45
C. ONLINE TRAINING ON ORGANIC FARMING USING GROW BAGS	46
D. ONLINE TRAINING ON HOMEWASTE MANAGEMENT.....	47
E. ONLINE TRAINING ON BEEKEEPING.....	48
F. ONLINE TRAINING ON FISH FARMING.....	48
G. ONLINE TRAINING STATISTICAL DATA ANALYSIS (WASP AND OPSTAT)	49
H. <i>CHUTTUPAADUM</i> : PHOTOGRAPHY COMPETITION.....	49
I. TIES LABORATORY SERVICES (KSPCB APPROVED).....	50
J. TRAININGS ATTENDED BY STAFF	50
5. TIES VISITORS	51
6. TIES PUBLICATIONS	54
7. CONCLUSION	56

Preface

TIES is stepping to the 18th year of its existence. This year we turned our sail to a new direction with honey bees. We started the project “Bees for Life”, a sustainable apiculture project aimed at providing livelihood support for marginal farmers along with the production pure honey. But the outbreak of Covid-19 has affected many of our projects and which resulted in the overall progress of our projects. Amid this pandemic we strove to achieve our goals. By the end of the year we inaugurated the project *Thanal* which is intended to plant trees at roadside and public spaces. With the help of CSR partners, we trained beekeeping communities on the production of value added products from apiculture, and made study on intercropping and best farming practices in rubber plantations. We also collaborated with colleges for various programmes like green audit, biodiversity surveys, awareness programmes, etc. And as a proud moment one of our doctoral student completed her thesis work and made

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 18th annual report before the board of directors, members and well-wishers.



1. RESEARCH AND DEVELOPMENT

A. TIES-OWN PROJECTS

I. BEES FOR LIFE

This year we launched an apiculture project “*Bees For Life*” - a sustainable apiculture programme of TIES. The project aimed to create and provide livelihood support to marginal farmers that will form part of the conservation initiatives of the organization. Livelihood support, Ecosystem services and guaranteed pure honey are the main objectives of the project. Currently TIES have 6 beneficiaries and 130 boxes. Continuous monitoring is done by the project team in order to ensure the sustainability of the project.



Fig 1. Bees for Life Project

II. PROJECT “THANAL”

Thanal is a flagship project of TIES under which roadsides and public spaces are provided with trees and suitable plants. Planting providing protection and maintenance upto self-survival will be done by TIES. *Thanal* the name denotes Green Belt. The main



Fig 2. Bamboo guard for trees

purpose of the green belt policy is to protect the land around larger urban centres from urban sprawl, and maintain the designated area for forestry and agriculture as well as to provide habitat to wildlife. This year in association with department of Social Forestry, Kottayam and NSS Unit St Mary's College, Manarcaud, TIES planted trees along the roadside of Manarcaud-Ettumanoor Bypass. The programme was inaugurated at Naalumanikattu by SmtP K Jayashree, the honourable District Collector of Kottayam. The programme was attended by Dr. Punnen Kurian, Secretary, TIES; Shri. Saju K A, ACF, Social Forestry Department, Kottayam; Dr. G



Prasad Gopalakrishnan, DFO, Timber Sales, Perumbavoor; TIES staff and NSS Volunteers of St. Mary's College, Manarcaud and Kudumbashree Workers. As a means protection, the plants were guarded by bamboo.



Fig 3. Thanal Project Inauguration at Naalumanikattu

II. KOTTAYAM COLLECTORATE BUTTERFLY GARDEN

It is one of the exemplary project of TIES in the civil station campus of Kottayam district. It was created and is also maintained by TIES. Host and nectarine plants are placed inside the garden for the butterflies. Signages are also placed in the garden showing scientific name, common name and vernacular names of host, nectarine plants and common butterflies. Regular cleaning and weeding out is done under the aegis of TIES every year.



Fig 4. Kottayam Collectorate Butterfly Garden

B. CSR PROJECTS

I. PROJECT ON BEES WAX & VALUE ADDED PRODUCTS

Apollo Tyres Foundation

Beekeeping is a lucrative activity and honey and wax are the best known primary products of beekeeping.

The project aims in providing skill and knowledge for making Value added products from beeswax as support for the beekeeping communities livelihood. TIES was entrusted to train the beekeepers under ATF on bees wax extraction and its processing and the preparation of value-added products. As part of the project hands-on training on value-added products preparation was given to the beekeeping community by TIES Experts. In order to equip the community at a commercial level, an industrial visit was conducted and they were taken to the HortiCorp situated at Mavelikkara. Experts at HortiCorp trained them on the preparation of several value added products like pain balm, honey processing, face cream, etc.



Fig 5. Beeswax & Value Added Products Training at MavelikkaraHortiCorp

II. STUDY ON INTERCROPPING & BEST FARMING PRACTICES IN SMALL HOLDER RUBBER PLANTATIONS

Apollo Tyres Foundation

Rubber is a perennial plant grown as an important cash crop which generates income as well as having a fundamental influence on the way of life for many rural people in India. ATF being a rubber based industry has high priority to address the environmental, social and economic challenges faced by natural rubber production systems. The present project also mooted in this background. The project aimed to study the prevailing best practices in intercropping and integrated farming systems among rubber crops in Kerala along with a soil quality study of monocrop rubber fields. These study data will be used to identify the best integrated farming practices among rubber crops and also to prepare protocols for its maintenance and planting. For the study two sample plots were identified at Vazhoor and Velloorin Kottayam district and soil samples were collected from 6 spots from each site.

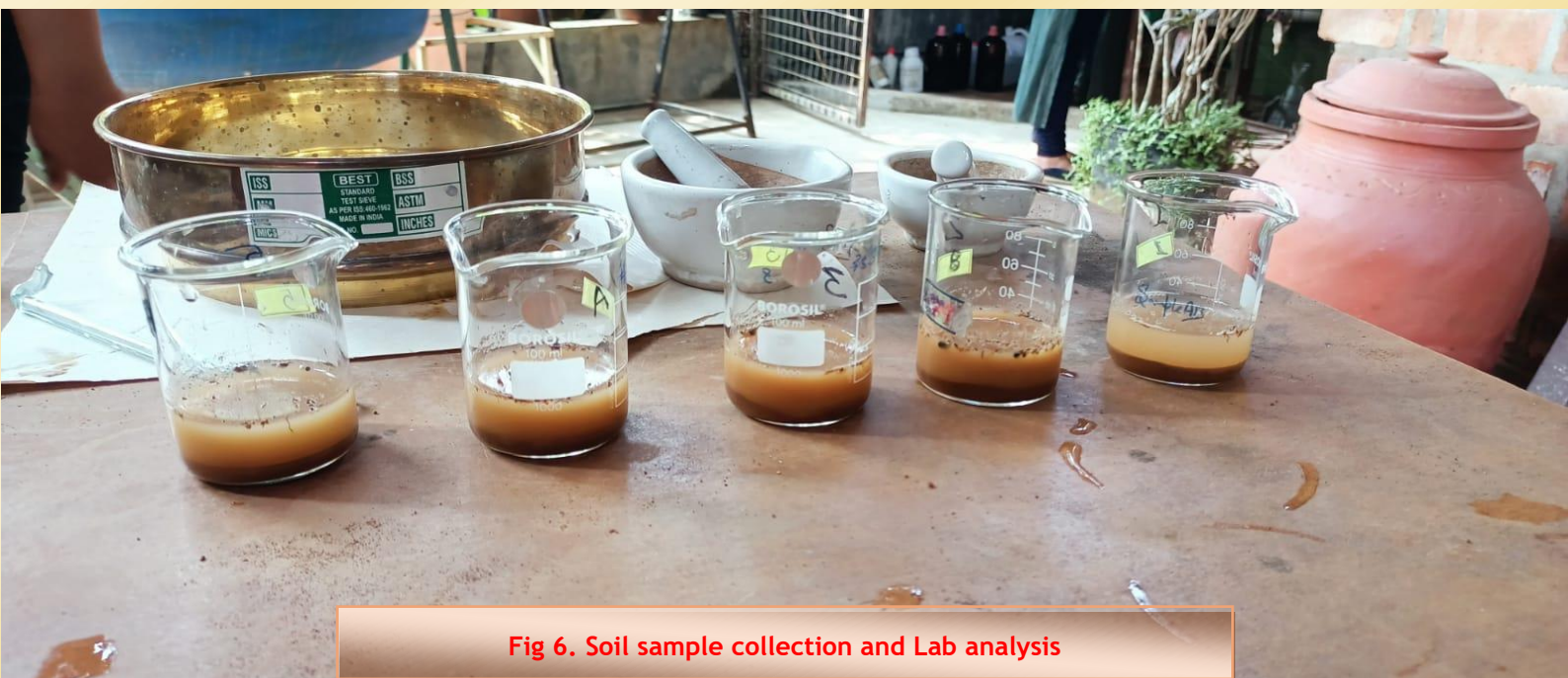


Fig 6. Soil sample collection and Lab analysis

C. OTHER

II. INDIAN SNAKE BITE INITIATIVE

F5 Community Impact Grant & Crowd Funding

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

This year along with crowd funding (Global Giving and Benevity), F5 Community Impact Grant supported the project. The fund were utilized for ASV supply, medical supplies, workshops and trainings for the rural community. Awareness campaign trained villagers on Snake Behavior Patterns, simple measures to prevent Snakebite and the proper first aid during the time of Snakebite. 33 Snakebite awareness workshops were conducted across the country inorder to reduce death and disability resulting from snakebite envenomation. This year workshops were conducted in Maharashtra, Karnataka, Kerala, Rajasthan and Odisha and have reached more than 1500 people including school students, forestry students, B. Ed students, village gathering, etc. The workshops are being conducted by snake rescuers belonging to the Indian Snake Rescue Network (ISRN) and indiansnakes.org. The 2.5 hour workshop comprises sessions on identifying common venomous and non-venomous snakes in the region, how to avoid unpleasant encounters with snakes, simple safety measures to avoid snakebite and proper first aid and treatment of snakebite. The workshops also emphasize on the negative results of delayed medical treatment of snakebite.





Fig 7. Nationwide Snakebite Awareness Workshops

D. GRANTS

I. DEVELOPING AN ORCHID LIBRARY AND INFORMATION CENTRE: CAPACITY BUILDING ATTIES- KOTTAYAM

New Hampshire Orchid Society, Manchester

This year TIES received an international grant from New Hampshire Orchid Society (NHOS). The grant was received under the category Conservation Grant. The project was aimed to create a first time orchid reference and information centre in an organization in the state. Due to the Covid pandemic restrictions the first phase was focused to set up a library and information centre for orchid research and conservation. As part of that relevant books on Orchids were procured along with that also a group of passionate Orchid conservationists donated books and magazines related to Orchids. Along with books scientific papers, theis, dissertations, etc., also availed. An orchid library was setup in the Institute along with an e-library (<https://ties.org.in/ORCHID-LIBRARY>). Along with these, native orchids were also planted inside the campus. An orchid field guide is there in the final stage to publish.

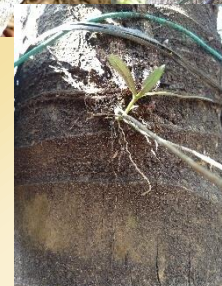


Fig 8. Native Orchids Planting & Orchid Library at TIES Campus

1. TRTP- STUDENT PROJECTS

“A study on diversity of plant growth promoting rhizobacteria (PGPR) in soil”.

Ammu Ann Joy, M. Sc. Microbiology, Submitted to Department of Microbiology, P. G. M. College, Kangazha, Kottayam.

The population has been rising in a rapid state and so is the demand of basic necessities like food requirements. Today agriculture demands increase in yield with a substantial decrease in chemical fertilizer and pesticides that are responsible for huge environmental degradation. The study was undertaken in this concern to identify plant growth promoting rhizobacteria. For the study rhizosphere soil samples were collected from different sites in and around TIES campus. Isolated bacterial strains using serial dilution method and identified the isolates based on their morphological and biochemical characteristics. In vitro screening of the isolates for plant growth promotion were studied by analysing production of Indole Acetic Acid (IAA), Gibberillic acid, Ammonia, Siderophore and phosphate solubilisation efficiency. The isolates were identified as *Bacillus* sp., *Pseudomonas* sp. and *Azotobacter* sp. In vitro screening studies revealed that the isolates were able to produce Indole Acetic Acid (IAA), Gibberillic acid, Ammonia, Siderophore and solubilise phosphate. Hence, it can be concluded that these isolates can be used as effective plant growth promoting agents.

“A study on the biopreservative effect of bacteriocin on food products”.

Unnimaya Babu, M. Sc. Microbiology, Submitted to Department of Microbiology, P. G. M. College, Kangazha, Kottayam.

Shafeena Karim, M. Sc. Microbiology, Submitted to Department of Microbiology and Biochemistry, St. Berchmans College, Changanacherry.

Sruthy V. Ajay, M. Sc. Biotechnology, Submitted to Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.

Bacteriocinogenic lactic acid bacteria and their isolated bacteriocins are considered safe additives and it is useful to control the frequent development of pathogen and spoilage microorganisms in foods and feeds. In the present study, the bacteriocin producing *Lactobacillus* sp. was isolated from the samples including soil and intestine of chicken. The isolates were inoculated into MRS broth and incubated at 37°C for 48 hours. The ability of the isolates to produce bacteriocin was checked with *E. coli*, *Klebsiella pneumoniae*, *Streptococcus* sp. and *Bacillus cereus* using agar well diffusion method. The crude bacteriocin was collected

through centrifugation. Biopreservative efficiency was determined using fish and pineapple juice. The highest activity showed that the refrigerated products containing bacteriocin extended their shelf life. The present study revealed that the presence of bacteriocin in food products extent their shelf life. The present study revealed that the presence of bacteriocin in food products extent their bio preservative effect.

“Efficiency of bacteriocin producing *Lactobacillus* species to inhibit multi drug resistant bacteria”.

Aiswarya Rajan, M. Sc. Microbiology, Submitted to Department of Microbiology, P. G. M. College, Kangazha, Kottayam.

Anju Binu, M. Sc. Biotechnology, Submitted to Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.

Probiotics produced by LAB have broad inhibitory spectra and may be used as antimicrobial agents for various practical applications towards other organisms. *Lactobacillus* species were isolated from curd, yoghurt, cheese and intestine of fish using serial dilution method. Sensitivity of isolates towards antibiotics (ampicillin, amoxicillin, bacitracin, chloramphenicol, cotrimaxazole, kanamycin, penicillin and tetracycline) was tested and bacteriocin was extracted, purified from the isolates to determine their antibacterial effect against *Escherichia coli*, *Pseudomonas* and *Staphylococcus aureus*. Isolated multidrug resistant pathogenic (MDR) bacteria by exposing some bacterial pathogens against standard antibiotics. The MDR bacteria were then tested with bacteriocin using well diffusion method. The isolates were identified as *Lactobacillus lactis*, *L. cellobiosus*, *Lactobacillus* sp. and *L. plantarum* and showed inhibitory activity against *E. coli*, *Staphylococcus aureus*, *Bacillus* sp. and *Pseudomonas* sp. The isolates, except *L. lactis* was resistant to all the five antibiotics tested. It was found that *S. aureus* was resistant to the antibiotics such as penicillin amoxicillin and bacitracin and selected as MDR bacteria. From the study it was revealed that bacteriocin isolated from *L. lactis*, *L. cellobiosus*, *Lactobacillus* sp. and *L. plantarum* showed inhibitory activity against multidrug resistant bacteria *S. aureus*. Hence, from the study it can be concluded that the isolates have good antimicrobial activity against multidrug-resistant and food-borne pathogenic bacteria and have excellent probiotic properties.

“Isolation and characterization of biopolymer producing microorganisms”.

Smithalakshmi P. S., M. Sc. Microbiology, Submitted to Department of Microbiology, P. G. M. College, Kangazha, Kottayam.

Synthetic polymer has become an essential part of our life and causes significant impact to the

environment. The only solution to reduce plastic residue is the use of biodegradable plastics. Biopolymers are polymers produced by living microorganisms under natural conditions. Therefore, the study was undertaken with the aim to study the biopolymer producing efficiency of bacterial strains with the objectives to isolate and identify biopolymer producing bacterial strains from the soil samples, to screen the isolates for biopolymer production and to quantify the biopolymer produced by each isolates. In this present study, soil samples were collected from four different plastic dumping sites and bacterial strains were isolated by serial dilution method. The isolates were identified based on their morphological and biochemical characteristics and screened for biopolymer production by Sudan black staining. The extracted polymers were compared with the standard PHB and were confirmed to be PHB using TLC analysis. The sample collected from plastic dumped riverside sample showed highest population count, 12 morphologically different bacterial isolates were isolated and belonged to the genus *Pseudomonas* (3), *Bacillus* (5), *Alcaligenes*, *Streptococcus* (2) and *E. coli*. It was found that in the screening for PHB production 7 isolates (*Pseudomonas sp.* (1), *Bacillus sp.* (3), *Alcaligenes sp.*, *Streptococcus sp.* (1) and *E. coli*) showed positive result. Extraction and quantification procedures revealed that maximum PHB yield was obtained from *Bacillus sp.* (B2). The extracted polymers confirmed as PHB in TLC. Hence, from the present study it can be concluded that the use of microbial polymers with further studies can reduce the use synthetic polymers.

“A study on the role of biosurfactant producing microorganisms in the degradation of kerosene”.

Sisira S. Nair, M. Sc. Microbiology, Submitted to Department of Microbiology, P. G. M. College, Kangazha, Kottayam.

Fawsina Noorudeen, M. Sc. Biotechnology, Submitted to Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.

Sruthimol A., M. Sc. Microbiology, Submitted to Department of Microbiology, SNGIST Arts and Science College, North Paravoor.

Production and spillage of petroleum hydrocarbons which is the most versatile energy resource causes disastrous environmental pollution. Elevated oil degrading performance from microorganisms is demanded for successful microbial remediation of those toxic pollutants. The employment of biosurfactant-producing and hydrocarbon-utilizing microbes enhances the effectiveness of bioremediation as biosurfactant plays a key role by making hydrocarbons bio-available for degradation. The present study aimed the isolation of a potent biosurfactant producing indigenous bacteria which can be employed for crude oil remediation, along with the characterization of the biosurfactant produced during crude oil biodegradation. Samples

were collected from hydrocarbon-contaminated sites; bacterial strains were isolated by serial dilution method and identified based on their morphological and biochemical characteristics. The isolates were screened for biosurfactant production by estimating haemolytic activity, drop collapsing test, blue agar plate method and emulsification test. biosurfactant was extracted from the isolates, quantified and confirmed by TLC. Conducted degradation study by treating the isolates with kerosene. 7 morphologically different bacteria were isolated and the screening tests revealed that three isolates have the ability to produce biosurfactant which were identified as *M. luteus*, *S. odorifera* and *B. subtilis*. Observations from TLC confirmed that *M. luteus* and *S. odorifera* were able to produce glycolipid biosurfactant whereas *B. subtilis* were able to produce lipopeptide biosurfactant. Thus, it can be concluded that the study will aid us in understanding the role of biosurfactant in hydrocarbon degradation and provide a new dimension in the field of biosurfactant mediated bioremediation of hydrocarbon pollutants.

“A study on bio-control activity of endophytic bacteria on plant pathogens”.

Sumi Soman, M. Sc. Microbiology, Submitted to Department of Microbiology, P. G. M. College, Kangazha, Kottayam.

Biological control of plant pathogens is considered as a potential control strategy in recent years, because chemical residues from pesticides lead to serious ecological problems. The study was undertaken with the objectives, to isolate and identify endophytic bacteria and plant pathogens and to study the antagonistic activity of the isolates against plant pathogens. For the study, leaf, stem and roots of *Piper longum* and bacterial strains were isolated and identified based on their morphological and biochemical characteristics. Fungal pathogens were isolated from the infected leaves of *Jasminum sambac* and identified based on their macroscopic and microscopic characteristics. Antagonistic activity of the endophytic isolates against the pathogens was tested by dual culture method. Six morphologically different isolates were isolated and identified as *Bacillus* sp. (4), *Pseudomonas* sp. and *Xantomonas* sp. The fungal pathogen was identified as *Phytophthora* sp. the results of antagonistic activity revealed that all the isolates showed inhibitory activity against *Phytophthora* sp. and among them *Bacillus* sp. group showed more activity (2.5 cm). From the results it can be concluded that *Bacillus* sp. was more effective in controlling the plant fungal pathogen *Phytophthora* sp.

“A study on dyeing of cotton fabrics using microbial pigments”.

Athira Jamal, M. Sc. Microbiology, Submitted to Department of Microbiology, SNGIST Arts and Science College, North Paravoor.

Natural colours are generally extracted from plants and microorganisms and are called bio-colours because of their biological origin. With the increasing awareness about toxic effects of synthetic colours and consumer safety, there is increasing interest in the development of colours from the microbial sources. This study is concerned with reducing the hazardous impact of synthetic colorants by microbial pigment applications. For this purpose pigment producing bacterial isolates were isolated, from soil and identified based on their morphological and biochemical characteristics. Pigment production by the isolates was optimized under different parameters such as carbon source, nitrogen source, temperature and pH. The pigments from the isolates were extracted and characterized by TLC and by measuring optical density. Antibacterial activity of the extracted pigments was also studied against *Escherchia coli*, *Klebsiella pneumoniae*, and *Bacillus subtilis*. The pigments were then subjected to dyeing of cotton cloths and the side effect of dyed cloth was studied by testing skin allergy. From the results three morphologically different pigment producing microorganisms were identified as *Micrococcus luteus* (yellow), *Serratia* sp. (red) and *Chromobacterium* sp. (violet). During optimization studies maximum pigment production was observed at pH 7, the temperature of 37°C, and nutritional parameters such as glucose as carbon source and yeast extract as nitrogen source. From the Results of antimicrobial activity, it was found that pigment M. Luteus have inhibitory activity upon K. pneumoniae and B. subtilis and the pigment from Serratia sp. showed inhibitory activity on E. coli. Chromobacterium sp. does not show any inhibitory activity. Rf values from TLC showed closest relation to carotene (yellow), prodigiosin (red) and violacein (violet). Among all the isolates, pigments of Micrococcus sp. and Serratia sp. showed comparatively good results fabric dyeing and do not cause any skin allergy. The results clearly indicate that the extracted pigments have potential application fabric industries.

“A study on microbial pectinase enzyme in fruit juice clarification”.

Gayathri G., M. Sc. Biochemistry, Submitted to Department of Biochemistry, St. Berchman's College, Changanacherry.

Gayathri C. V., M. Sc. Biotechnology, Submitted to Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.

Pectinase is a big group of enzyme that breaks down pectic polysaccharides into simpler molecules like galacturonic acids. It was expected that the study would reveal a microbial source for natural pectinolytic enzymes which are better and more commercial. The study was undertaken with the objectives, to isolate and identify microorganisms from the collected samples, to screen the isolates for pectinase enzyme production and to study the application of

pectinase in fruit juice clarification. Five samples were collected from different dumping sites and bacterial colonies were isolated by serial dilution method. The isolates were then identified based on their morphological and biochemical characteristics and screened them for pectinase enzyme production. Enzyme from the isolates were purified by dialysis and subjected to fruit juice clarification at different time intervals. From the results, it was found that, sample collected from poultry waste dumping site showed more population count and pectinase producing bacteria. Also, among five isolates only one isolates was showed enzyme production and identified as *Bacillus subtilis*. The results of fruit juice clarification revealed that the enzyme from the isolate was able to clarify the fruit juice from 3rd hour. Thus, future studies on pectinase production from this strain can be recommended for the commercial production because of its better output for commercial production as well us it is more eco - friendly in nature.

“A study on application of microbial protease enzyme in stain removal and egg white degradation”.

Gopika T. G., M. Sc. Biotechnology, Submitted to Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.

Bacterial proteases are of great importance due to its wide variety of applications in detergent, bioremediation, food, leather processing and pharmaceutical industries. Hence, this study was undertaken with the aim to isolate and characterize the protease producing microorganisms for their protein degradation ability. For the study soil samples were collected from different dumping sites and bacterial colonies were isolated by serial dilution method. The isolates were then identified based on their morphological and biochemical characteristics and screened them for protease enzyme production by hydrolysis method. The enzymes from the isolates were partially purified by dialysis and were subjected to blood stain removal and egg yolk degradation. Eight bacterial isolates producing protease were selected and were identified as *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, *Proteus sp.*, two *Bacillus sp.* and *Propionibacterium sp.*. Among the isolates two isolates (two *Bacillus sp.*) exhibited the highest proteolytic activity with a clear zone of 25mm. The stability of the enzyme in presence of various detergents was remarkable. The results of the washing performance with detergent were clearly indicated and the enzymes from the isolates were highly efficient in removal of blood stains and egg yolk degradation. Further studies on this study can eliminate the use of pollution causing chemicals such as sodium sulphide and lime, greatly helping to prevent environmental pollution.

“A comparative study on the activity of curcuminoids extracted from different species of turmeric rhizomes”.

Nisha A. S., M. Sc. Biotechnology, Submitted to Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.

Curcumin, (diferuloylmethane) the main yellow bioactive component of turmeric has a wide spectrum of biological actions. In the present study, collected two turmeric species, *Curcuma aromatica* and *Curcuma longa* and isolated the curcumin from the ethanolic turmeric extracts. Purification of curcumin from turmeric was TLC and the concentration of curcumin in the collected samples was analyzed spectrophotometrically at different wavelengths. Analysis, evaluation of its efficiency of was determined by analyzing its antioxidant activity, antibacterial antimicrobial activity and phytochemical contents analysis. The sensitivity of ethanolic extracts against bacterial species such as *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Bacillus subtilis* were tested by agar well diffusion method .The result obtained from two turmeric species showed that, concentration of curcumin content was high in *C. longa* than in *C. aromatica*. In the present study, the antimicrobial activities of *Curcuma aromatica* and *Curcuma longa* were inhibited all the tested pathogens and *C. longa* showed more activity than *C. aromatica*. The bands produced in TLC showed Rf values near to standard curcumin. Spectrophotometric analysis revealed that peak absorbance was found at 425nm. Phytochemical analysis confirmed that alkaloids, flavonoids, glycosides, steroids, betacyanin, terpenoids, coumarins, quinone, phenol, carbohydrate were present in *Curcuma aromatica* and flavonoids, terpenoids, carbohydrate, Coumarins, quinones, betacyanin, glycosides and carbohydrate were present in *Curcuma longa*. Hence, it can be concluded that the use of curcumin was better to tolerates bacterial diseases and other health issues.

“Evaluation of microbial consortium on growth and nutrients uptake in *Pennisetum glaucum* L. (Pearl Millet)”.

Renju Raju., M. Sc. Biotechnology, Submitted to Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.

The role of biofertilizers alone or in combination with organic or inorganic fertilizers has recently gained recognition in sustainable crop production. Considering all the benefits of biofertilizers, this study was taken up in pearl millet to enhance the yield and reduce the use of chemical fertilizers. For the study a consortium of *Pseudomonas aeruginosa*, *Bacillus* sp., *Azospirillum* sp., *Azotobacter* sp. and Mychorrhizae. The pot experiment with three replications under different treatments was carried out to study the effect of inoculation of microbial

consortia. After 45 days of growth different growth parameters and nutrient content such as plant height, number of leaves, root length, root dry weight, shoot dry weight, nitrogen, phosphorous and potassium content were analysed. From the findings of this study, it can be it was found that the treatment applied with the consortia can improve growth, nutrient uptake and percent root colonization when compared to treatments applied with chemical fertilizers alone. Thus it can be concluded that the use of microbial consortia can replace the use of chemical fertilizers and thereby prevent environmental pollution.

“A study on antimicrobial activity of biologically synthesised silver nanoparticles”.

Sarimol Babu, M. Sc. Biotechnology, Submitted to Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.

Development of reliable and eco-accommodating methods for the synthesis of nanoparticles is a vital step in the field of nanotechnology. Silver nanoparticles are important because of their exceptional chemical, physical, and biological properties, and hence applications. The present study reports an environment friendly and rapid method for biosynthesis of silver nanoparticles and their antibacterial activities. Fruits such as pomegranate (*Punica granatum*), green lemon (*Citrus aurantifolia*), orange (*Citrus sinensis*) and tomato (*Solanum lycopersicum*) were collected for silver nanoparticle synthesis which contain high amount of ascorbic acid. The biosynthesized AgNPs was confirmed and characterized by analysis of spectroscopy profile of the UV-visible and Energy dispersive spectrophotometer. Antibacterial activity of the synthesized silver nanoparticles was tested against *Salmonella* sp., *Bacillus* sp., *E. coli* and *Pseudomonas* sp. The results revealed that UV-visible spectra showed a surface resonance peak of 430 nm corresponding to the formation of AgNPs. The synthesized silver nanoparticles showed antibacterial property against all the tested gram negative and gram positive bacteria. Overall, this study suggested that AgNPs can be an attractive and eco-friendly candidate to control rice bacterial disease.

“Study on the biocontrol activity of endophytic bacteria isolated from *Quassia indica* against plant pathogens”.

Aiswarya S. Nair, B. Sc. Zoology, Submitted to Post Graduate and Research Department of Zoology, C. M. S. College, Kottayam.

Bacterial endophytes are known to reside inside tissues of plants and can form a range of different relationships including symbiotic, mutualistic, commensalistic and trophobiotic. The endophytic bacteria suppress the growth and spreading of pathogen is referred to as the

biological control agent (BCA). Plant pathogens were isolated from infected leaves and identified as *Fusarium* sp., *Sclerotium* sp. and *Corynespora* sp. based on their macroscopic and microscopic characteristics. Endophytic bacteria was isolated from different parts such as leaves, stem and root of *Quassia indica* and were identified as *Pseudomonas fluorescens*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Planococcus citreus*, *Enterobacter aerogenes*, *Alcaligenes faecalis* and *Micrococcus luteus* based on their cultural and biochemical characteristics. Studies on hydrogen cyanide production, volatile organic compound production and antagonistic activity of the isolates revealed that all the isolates have inhibitory effect on the pathogens and among the isolates, *Pseudomonas fluorescens* and *Bacillus subtilis* highest inhibitory activity. Hence, the findings clearly define the beneficial effects endophytes, the study may lead to development of a new biocontrol agent.

“Evaluation of probiotic properties of *Lactobacillus* species isolated from selected dairy products”.

Annu Jose, M. Sc. Biotechnology, Submitted to Department of Biotechnology and Research, K. V. M. College of Science and Technology, Cherthala.

Aswathy M., M. Sc. Microbiology, Submitted to Department of Microbiology, SNGIST Arts and Science College, North Paravoor.

Probiotics are live bacteria that may confer a health benefit on the host. They are supplements that consist of live microorganisms and are digestive to promote good bacteria in the body, particularly gastrointestinal tract. Hence, the study was undertaken with the objectives, to isolate and identify *Lactobacillus* sp. from different samples, to evaluate the probiotic potential of bacterial isolates and to determine bacterial activity of the isolates against bacterial pathogens. For the study, samples such as milk, curd, cheese, butter and dosa batter were collected and the microorganisms were isolated by enrichment method on MRS broth. The isolates were then identified based on their morphological and biochemical characteristics and screened to determine their probiotic activity by testing antimicrobial property against *Escherichia coli*, *Pseudomonas* sp, *Klebsiella* sp. and *Staphylococcus aureus*. Optimum pH for growth of the isolates was determined by incubating them at different pH (2-10), inhibitory activity of different substances was also studied by incubating the isolates at different concentrations of sodium chloride (2-10%), bile (0.01 – 0.1%), phenol (0.1 – 0.4%) and standard antibiotics. Probiotic was produced by fermenting the isolates in tomato juice, the amount of lactic acid production, variation in pH and cell viability was determined at regular intervals (24, 48 and 72hrs). Results revealed that six morphologically different isolates were

Lactobacillus sp. and among them only two isolates from curd showed the antimicrobial property in screening test. Maximum growth of the isolates was found at pH8 and the isolates were able to tolerate all the concentrations of inhibitory substances. It was also found that the organic acid production was increased with incubation time, pH of the media decreased with increasing acid production and cell viability of the *Lactobacillus sp.* (CL₁ and CL₂) remained high after 24, 48 and 72 hours on cold storage. Thus, the study can be concluded that the isolate fulfils the required criteria for a probiotic and fermented tomato juice could be used as raw material for lactic acid production.

“Isolation of pectinase producing microorganisms, enzyme purification and industrial application”.

Sreelakshmi V. S., M. Sc. Biotechnology, Submitted to Department of Biotechnology and Research, K. V. M. College of Science and Technology, Cherthala.

Pectinase is a well known term for commercial enzyme preparation that breaks down pectin; a polysacchride substrate found in the cell wall of plants. Microorganisms are generally preferred to plant and animal as a source of industrial enzymes because their production cost is low, enzyme contents are more predictable, controllable and easy availability of raw materials with constant composition for their cultivation. The study was undertaken with the objectives, to isolate and identify pectinase producing microorganisms from different soil samples and to study the industrial uses of purified pectinolytic enzyme such as clarification of fruit juice, bio-bleaching of coir and bio-scouring of cotton. For the study soil samples were collected from five different dumping sites and microorganisms were isolated by serial dilution method. The isolates were then screened for pectinase production by hydrolysis method and the isolates were identified based on their morphological and biochemical characteristics. Total pectinase activity, polygalactouronase activity and effect of temperature and pH on enzyme activity were also studied. The enzyme was produced by solid state fermentation and partially purified by dialysis and subjected to study the efficiency in fruit juice clarification, Bio-bleaching of coir and Bioscouring of cotton. From the results, it was found that sample from vegetable dumping site showed more population count and only one isolate showed pectinase production on screening which was identified as *Bacillus sp.* It was found that total pectinase activity was 20.31 units/mL, polygalactouronase activity was 60.48 µg /mL and maximum activity was found at a temperature of 40°C and at pH6.0. Apple juice was clarified from 1hr and the enzyme extract smoothened the surface area of the coir fiber

and removed impurities from the surface of cotton. Thus, the study can be recommended for the commercial production because of its better output from cheapest source.

“A comparative study between the effect of medicinal plants and shampoos against dandruff causing fungal pathogen”.

Arun P. K., M. Sc. Biotechnology, Submitted to Department of Biotechnology and Research, K. V. M. College of Science and Technology, Cherthala.

Dandruff is a scalp disorder characterized by excessive shedding of skin cells from the scalp. The treatment options currently available for management of dandruff have certain limitations, which may be due to poor efficacies or due to compliance issues. Therefore, the study was undertaken with the aim to evaluate potential inhibitory action of medicinal plants on dandruff causing fungal pathogen and compare its effect with shampoos available in market. For the study, 12 different plant materials were collected and their crude as well as oily extracts were prepared to evaluate their antifungal activity. Their activity was compared with three branded antidandruff shampoos available in market. Dandruff samples were collected from five different patients under sterile conditions and isolated the causing agent by enrichment method. The isolates were based on their macroscopic and microscopic characteristics. Antimicrobial activity of crude plant extract, oil extract, combinations of plant extracts and shampoos were tested against the causative agent using agar well diffusion method. The results revealed that the causative organism of dandruff is *Malassezia furfur*. From the results, it was found that the crude extract showed more activity than oil extract for all the samples collected except *Trigonella foenum-graecum* and *Pisidium guajava* and *Agave americana* did not showed any activity in both extracts against *M. furfur*. Better antimicrobial activity was found with plant extracts when compared with shampoos available in the market especially the combination of *Allium sativum*, *Citrus limon* and *Phyllanthus emblica*. Also, found that combinations of plant extracts showed more activity than single plant extract and shampoos. Thus, from the study, it can be concluded that plant extracts showed good activity against *M. furfur* and could be safely used for treating dandruff to reduce the use of synthetic shampoos.

“Evaluation of elephant grass (*Pennisetum purpureum*) as substrate for bioethanol production using microorganisms”.

Arun Babu, M. Sc. Microbiology, Submitted to Department of Microbiology, SNGIST Arts and Science College, North Paravoor.

Elephant grass (*Pennisetum purpureum*) is regarded as a promising feedstock for second generation ethanol production, due to its high cellulose content, biomass production and rapid growth. Elephant grass was evaluated for its ethanol production potential using microorganisms isolated from different soil samples. The isolates were then screened for cellulase enzyme production. Fermentation of grass substrate was carried out at different concentrations ranging from 2-10%. Cultural parameters for maximum ethanol production were optimized at different pH and temperature. Cellulase producing isolates were identified as *Bacillus* sp. and *Saccharomyces cerevisiae* and the isolate *Bacillus* sp. showed highest cellulase activity. Highest ethanol yield of 1.68g/100ml was observed at an optimum substrate concentration of 6%. Optimization of culture parameters for ethanol production showed maximum ethanol yield at pH 5 and 35°C. The results of the research also revealed that ethanol production by *Bacillus* sp. showed highest yield and *S. cerevisiae* mediated ethanol production was reduced from the fourth day of fermentation. Hence, the study can be recommended that elephant grass which is abundant, renewable and cheap source of feed stock be used for industrial production of ethanol.



2. ENVIRONMENTAL EDUCATION & OUTREACH

A. PH.D COURSE WORK

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

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 too. One undergraduate student from C. M. S. College, 23 post graduate students from six colleges, has undergone this training. The students were from two universities, Mahatma Gandhi University and Cochin University, respectively.

Table 1: List of student's undergone TRTP training at TIES during 2021-2022.

Sl. No.	Student Name	Topic	Course and College
1	<i>Ammu Ann Joy</i>	A study on diversity of plant growth promoting rhizobacteria (PGPR) in soil	<i>M. Sc. Microbiology, Department of Microbiology, P. G. M. College, Kangazha, Kottayam.</i>
2	<i>Unnimaya Babu</i>	A study on the bio-preservative effect of bacteriocin on food products	<i>M. Sc. Microbiology Department of Microbiology, P. G. M. College, Kangazha, Kottayam.</i>
3	<i>Shafeena Karim</i>		<i>M. Sc. Microbiology Department of Microbiology and Biochemistry, St. Berchmans College, Changanacherry.</i>
4	<i>Sruthy V. Ajay</i>		<i>M. Sc. Biotechnology, Department of</i>

			<i>Biotechnology, Sree Narayana Arts and Science College, Kumarakom.</i>
5	<i>Aiswarya Rajan</i>	Efficiency of bacteriocin producing Lactobacillus species to inhibit multi drug resistant bacteria	<i>M. Sc. Microbiology Department of Microbiology, P. G. M. College, Kangazha, Kottayam.</i>
6	<i>Anju Binu</i>		<i>M. Sc. Biotechnology, Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.</i>
7	<i>Smithalakshmi P. S.</i>	Isolation and characterization of biopolymer producing microorganisms.	<i>M. Sc. Microbiology Department of Microbiology, P. G. M. College, Kangazha, Kottayam.</i>
8	<i>Sisira S. Nair</i>	A study on the role of bio-surfactant producing microorganisms in the degradation of kerosene.	<i>M. Sc. Microbiology Department of Microbiology, P. G. M. College, Kangazha, Kottayam.</i>
9	<i>Fawsina Noorudeen</i>		<i>M. Sc. Biotechnology, Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.</i>
10	<i>Sruthimol A.</i>		<i>M. Sc. Microbiology Department of Microbiology, SNGIST Arts and Science College, North Paravoor.</i>

11	<i>Sumi Soman</i>	A study on bio-control activity of endophytic bacteria on plant pathogens	<i>M. Sc. Microbiology Department of Microbiology, P. G. M. College, Kangazha, Kottayam.</i>
12	<i>Athira Jamal</i>	A study on dyeing of cotton fabrics using microbial pigments	<i>M. Sc. Microbiology Department of Microbiology, SNGIST Arts and Science College, North Paravoor.</i>
13	<i>Gayathri G.</i>	A study on microbial pectinase enzyme in fruit juice clarification	<i>M. Sc. Biochemistry, Department of Biochemistry, St. Berchman's College, Changanacherry.</i>
14	<i>Gayathri C. V.</i>		<i>M. Sc. Biotechnology Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.</i>
15	<i>Gopika T. G.</i>	A study on application of microbial protease enzyme in stain removal and egg white degradation	<i>M. Sc. Biotechnology Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.</i>
16	<i>Nisha A. S.</i>	A comparative study on the activity of curcuminoids extracted from different species of turmeric rhizomes	<i>M. Sc. Biotechnology Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.</i>
17	<i>Renju Raju</i>	Evaluation of microbial consortium on growth and nutrients uptake in <i>Pennisetum glaucum</i> L. (Pearl Millet)".	<i>M. Sc. Biotechnology Department of Biotechnology,</i>

			<i>Sree Narayana Arts and Science College, Kumarakom.</i>
18	<i>Sarimol Babu</i>	A study on antimicrobial activity of biologically synthesised silver nanoparticles	<i>M. Sc. Biotechnology Department of Biotechnology, Sree Narayana Arts and Science College, Kumarakom.</i>
19	<i>Aiswarya S. Nair</i>	Study on the biocontrol activity of endophytic bacteria isolated from <i>Quassia indica</i> against plant pathogens	<i>B. Sc. Zoology, Post Graduate and Research Department of Zoology, C. M. S. College, Kottayam.</i>
20	<i>Annu Jose,</i>	Evaluation of probiotic properties of <i>Lactobacillus species</i> isolated from selected dairy products	<i>M. Sc. Biotechnology Department of Biotechnology and Research, K. V. M. College of Science and Technology, Cherthala.</i>
21	<i>Aswathy M.</i>		<i>M. Sc. Microbiology Department of Microbiology, SNGIST Arts and Science College, North Paravoor.</i>
22	<i>Sreelakshmi V. S.</i>	Isolation of pectinase producing microorganisms, enzyme purification and industrial application	<i>M. Sc. Biotechnology, Department of Biotechnology and Research, K. V. M. College of Science and Technology, Cherthala</i>
23	<i>Arun P. K.</i>	A comparative study between the effect of medicinal plants and shampoos against dandruff causing fungal pathogen	<i>M. Sc. Biotechnology Department of Biotechnology and Research, K. V. M. College of Science and Technology,</i>

			<i>Cherthala.</i>
24	<i>Arun Babu</i>	Evaluation of elephant grass (<i>Pennisetum purpureum</i>) as substrate for bioethanol production using microorganisms	<i>M. Sc. Microbiology Department of Microbiology, SNGIST Arts and Science College, North Paravoor.</i>

C. INTERNSHIP

Students who completed their course and during academic benefitted from internship at TIES for varied periods of five days to one year. During the reporting year, 23 students, 13 of them were academic interns from two colleges successfully completed their internship at TIES on various topics of interest.

Table 2: List of intern's undergone training at TIES during 2021-2022.

Sl. No.	Name	Topic	Institution
1	Karthik M.	Various Research and education programmes.	Academic intern Department of botany and biotechnology St. Berchmans College, Changanacherry.
2	Gourikrishna A. V.	Field survey and soil quality analysis of different intercropping sites of Rubber plantations	Academic interns B. Voc. Agriculture Carmel College, Mala, Thrissur
3	Niveditha T. S.		
4	Joshna Anie K. S.		
5	Rakhi K. R.		
6	Sumayya T. S.		
7	Arshiya Siddique K. K.		
8	Nandana T. B.		
9	Resmi B.	Phytochemical analysis and antimicrobial activity of different plant extracts	Academic intern Department of Biochemistry St. Berchmans College, Changanacherry.
10	Soniya Varghese	Water quality analysis and Determination of dry rubber content (DRC)	Academic interns Department of Microbiology St. Berchmans College, Changanacherry
11	Titty Joseph		
12	Merin V. Philip		
13	Pooja Pushpan		
14	Renjitha Rajan	Various Research and education programmes.	TIES Intern

15	Athira K. P.	A comparative study between the effect of medicinal plants and shampoos against dandruff causing fungal pathogen.	TIES Intern
16	Mekha Thomas	Study on the effect of liquid plant extracts on termite colonies	TIES Intern
17	Savithri L.	Various Research and education programmes.	TIES Intern
18	Gayathri S.	Comparative study on quality of honey collected from different sites	TIES Intern
19	Arya Devi V. K.	Various Research and education programmes.	TIES Intern
20	Sumi Joy	Comparative study on microbiological quality of water samples collected from different sites	TIES Intern
21	Aashin Mani Rajan	Various Research and education programmes.	TIES Intern
22	Saumiya Cherian	Various Research and education programmes.	TIES Intern
23	Hima Grace Abraham	Various Research and education programmes.	TIES Intern

D. INTERNSHIP PROGRAMME- 2022

In order to equip students in sophisticated and deep research TIES started a new programme "Internship Programme". This programme aims to give research experience to students those who has completed their bachelor's or master's degree. Interns will get incomparable experience in various microbiological, biochemical, biotechnological and environmental science tools and methods, both lab and field. Along with this they will be provided with experiences in every stages of commercial eco-products- lab to packing.



Fig 9. Internship Programme

E. COLLEGE- NGO PARTNERSHIP PROGRAM

College NGO Partnership Initiative (CNPI) is a mutually benefitting research cum extension project of TIES, involving students and faculty of affiliated colleges in India. CNPI is basically a student capacity building programme, equipping them to meet the challenges and to evolve a socially and environmentally responsible society and to promote environmental awareness among the community. CNPI helps to inculcate research culture among students and faculty of affiliated colleges to empower colleges to take up social and environmental issues and to develop the right scientific temper and outlook. The technical report submitting after the audit contains the recommendations for improving the energy efficiency, biodiversity, waste management and water usage along with the action plans to reduce resource consumption. CNPI program was inaugurated at Christian College, Chengannur in December, 2016.

This year the green audit programme initiated at St Thomas College, Ranni, and the auditing at St Thomas College, Kozhencherry continued. The CNPI Green Audit programme was inaugurated at Pavanathma College, Murickkassery. The green audit report of Henry Baker College was also completed. The green audit

was done under four major heads: Energy Audit; Water Audit; Waste Audit and Biodiversity Audit. This year direct training sessions were restarted after the halt during the pandemic with limited number of students. The report also suggested the essential changes that is to be made to avoid energy, water and biodiversity loss and for the management of waste. All the data's were collected through questionnaire survey, except for biodiversity survey and all were done by students (due to Covid restrictions limited students were there) under the supervision of teachers. Continuous evaluation is done throughout the auditing process in order to make data more clear and precise. Auditing groups are maintained in social media's in order to evaluate the day-to-day activities and to share the data. The pre and post auditing attitude of students and faculties also showed much change in the view of conservation. The knowledge they acquired via the training and auditing process has showed much change in the behavioural pattern and was noted by the teachers and which is a good sign for a better future.



Fig 10. CNPI Green Audit Inauguration at St Thomas College, Kozhencherry



Fig 11. CNPI Programme: St Thomas College, Kozhencherry & Ranni

F. COLLABORATIONS

This year several colleges has been collaborated with TIES in order to use our expertise in the field of biodiversity conservation, ecosystem studies, waste management, biodiversity surveys, capacity building, etc. As part of this a *Certificate course on Mushroom Farming* was conducted for the students of Catholicate College, Pathanamthitta in association with Department of Botany. This fifteen hours training programme started on November 27, 2021 and ended on March 30, 2022. 61 students were attended the training. Due to the Covid pandemic training was conducted through online mode. Along with this a *Skill Development Training on Mushroom Farming* was conducted for the students of St Thomas College, Kozhencherry in association with the Post Graduated and Research Department of Botany. 81 participants attended the programme including both teachers and students.

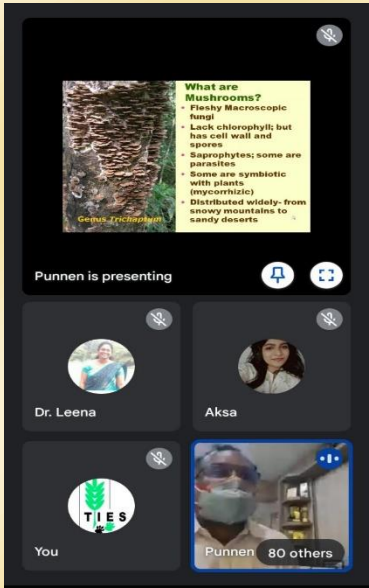


Fig 12. Skill Development Training on Mushroom Farming for St Thomas College



Fig 13. Certificate course on Mushroom Farming for Catholicate College

Other colleges that signed MoU with us is as follows:

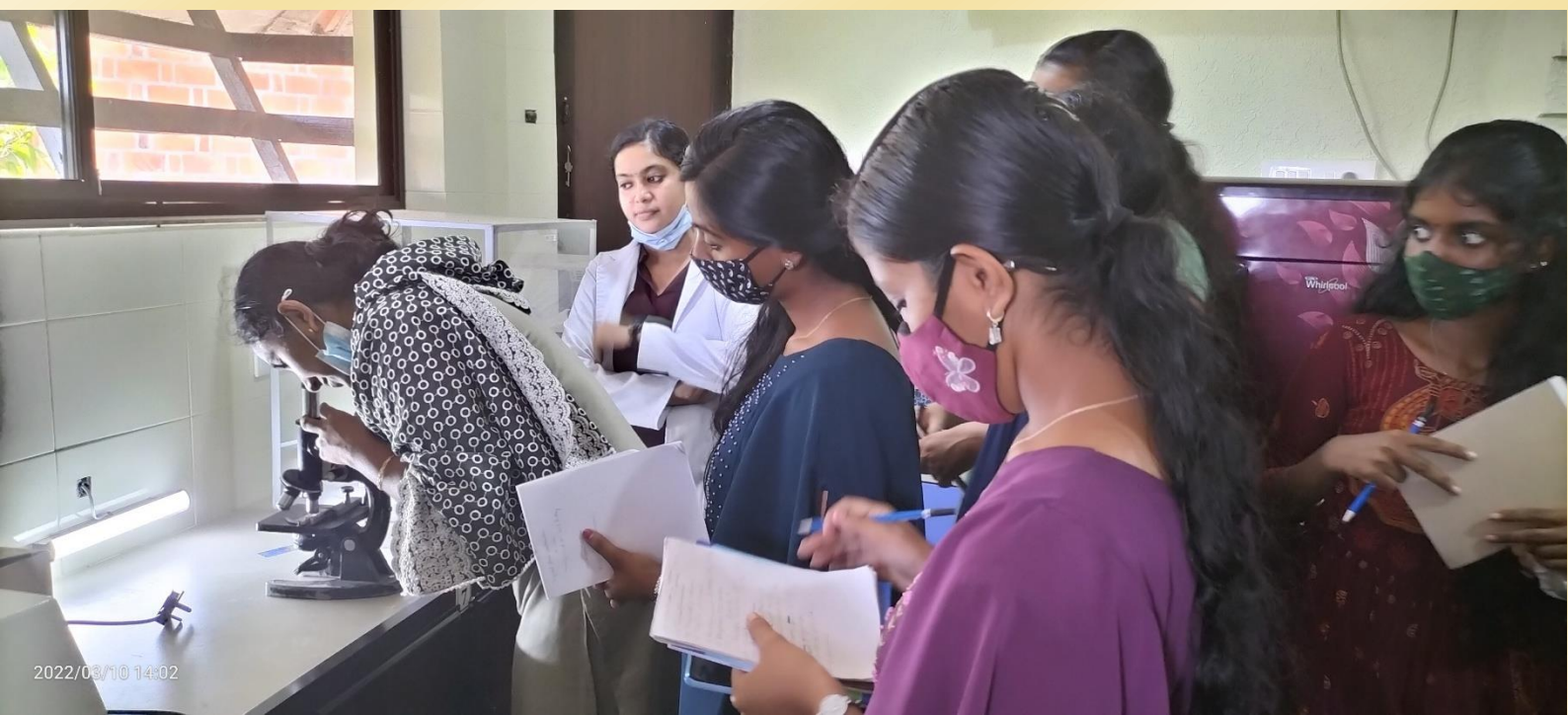
1. Department of Zoology, Assumption College, Changanassery
2. Department of Zoology, Baseliious College, Kottayam

G. ENJOY LEARNING

Enjoy Learning is a customised one day nature education session designed for school and college students. The sessions include introduction on nature study, medicinal plants, waste management, building walk, research methodology, studying the flora and fauna inside the campus, eco-friendly games, etc. Regardless of Enjoy Learning programme, several other schools and colleges also visited TIES Campus. Enjoy Learning programme was conducted at TIES for the students of S.N. College, Cherthala, who were pursuing their Bachelor's degree in Zoology.



Fig 14. Enjoy Learning for S N College, Cherthala



H. MEENACHIL RIVER ODONATE SURVEY

The sixth series of TIES Meenachil Odonate Survey was conducted on 12th and 13th of March 2022 along the Meenachil river basin. The survey was in collaboration with the Department of Forests and Wildlife, Kerala (Social Forestry Division). It was a two day programme to monitor and survey the dragonflies and damselflies in the Meenachil River Basin. Over 87 participants from educational and research institutions attended the training session and survey and about 130 attended the training programme. Dr.Punnen Kurian and Dr. Abraham Samuel led the online training session which were intended to familiarize the participants on Odonates. The sites were assigned to each team with an expert. The survey team surveyed dragonfly and damselfly population in their respective sites. The survey was conducted from Adukkam- Pazhukkamalakayal, covering an area of 27km and surveying 11 locations. Each location was assigned to 3-8 amateurs along with a field expert.



From the Survey, a total of 54odonate species including 32 dragonflies and 22 damselflies were found. Social forestry Assistant Conservator Dr. G Prasad, Forest Officer Jayan M and experts like Dr. Abraham Samuel, Dr.Punnen Kurian, Dr. Nelson Abraham, Manoj P, Sathrumitra, Mohammed Haneefa, Sarath N Babu, M N Ajayakumarled the survey.



Fig 15. Sixth Meenachil Odonate Survey



3. COMMUNITY DEVELOPMENT

I. WATER CONSERVATION AND RIVER RESTORATION ACTIVITIES

A. WATER QUALITY STUDY OF MANIMALA RIVER

As part of Manimala River Restoration programme water samples were collected from different locations of Manimala river in order to assess the water quality of the river as there arised panic among the riverine community due to the pollution expelled from nearby areas. 9 samples were collected from river as well as nearby open wells and ponds and analysed. The study revealed that the water quality is highly depleted due to the presence of heavy metals, oil content, faecal coliform, etc. and the DO level is also highly declined which has affected the riverine ecosystem. The river is clogged with plastic waste as well as aquatic weeds like Pistia, etc.



Fig 16. Aquatic weed filled Manimala River



Fig 17. Water sample collection at Manimala River

II. WEBINAR: NATURE CONSERVATION-GANDHIAN PERSPECTIVE

TIES in association with the National Service Scheme (NSS) unit of St. Mary's College Manarcaud conducted a webinar on the day of Gandhi Jayanti with respect to River Day. The programme was conducted under the aegis of Enty Manimalayar People's Fraternity, a voluntary public movement led by Dr. N Jayaraj, MLA, working mainly for the conservation of the Manimala River and its watershed. TIES is the technical partner for this movement. "NATURE CONSERVATION: GANDHIAN PERSPECTIVE" was the theme of the programme and was led by Dr. K Vasudevan Pillai, Principal, Coaching Centre for Minority Youth, Palakkad. The webinar was inaugurated by Dr P K Jayashree, District Collector, Kottayam

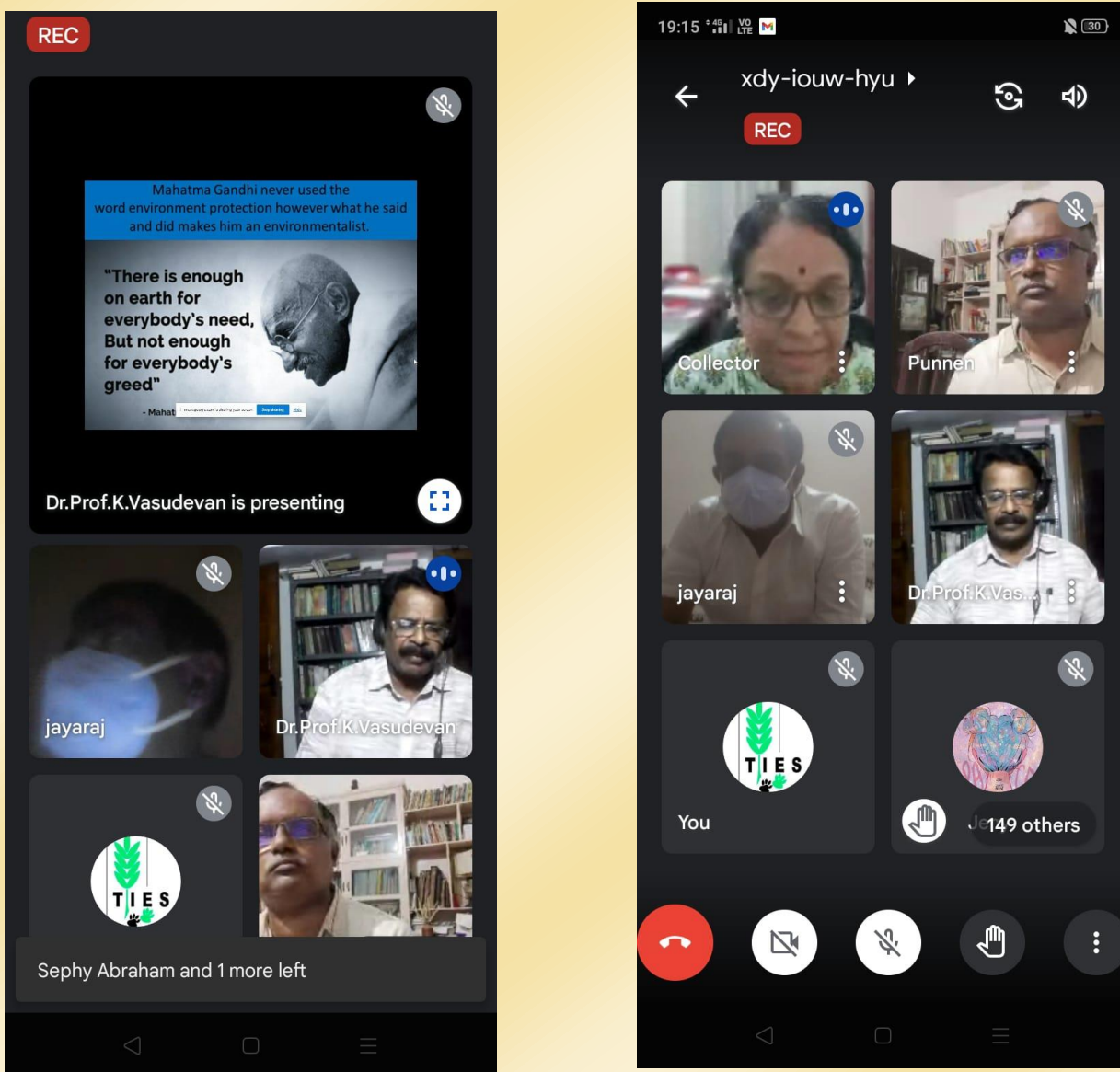


Fig. 18. Webinar-Nature Conservation-Gandhian Perspective



4. CAPACITY BUILDING

A. ONLINE TRAINING ON MUSHROOM FARMING

A total of six online training programme were conducted during this year and 88 people from different parts of India attended the training. The training in the online mode was a great success as it was able to cover a wide demography. It was attended by people from outside and inside Kerala. Beginners, mushroom farmers, students, techies, etc. all were part of our training programme. The session covered topics like tissue Culture, Mother Spawn production, Spawn Production, Bed preparation, post harvesting technologies, Mushroom disease management etc. Dr.Punnen Kurian took the introductory session and Mrs. Roshni Susan Elias led the theoretical and practical sessions. Mushroom includes edible, medicinal and poisonous species and care should be given for its cultivation. So the training was intended to cover all these aspects and make people closer to these nutraceuticals!!!

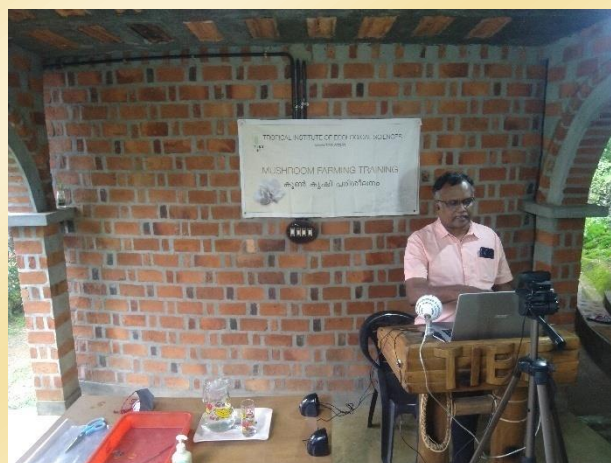
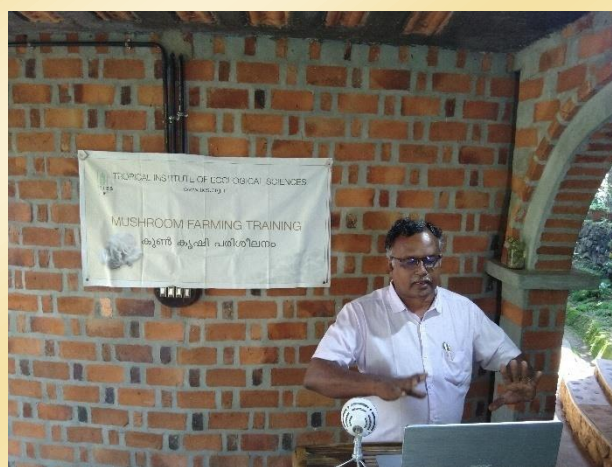


Fig. 19. Online Mushroom Farming Training

B. ONLINE TRAINING ON POULTRY FARMING

Two online training programme were conducted during this year and were attended by 58 people from several parts of India. The session was led by Manoj Kumar, Asst. Director, Poultry Farm, Manarcaud; Dr.Punnen Kurian, Secretary, TIES and Sarath Babu, NEO TIES. The focal area of the training was on different varieties of Poultry, its management, feeding, cage types and its maintenance, disease control, etc. A poultry package was developed at YIES as part of the training programme.

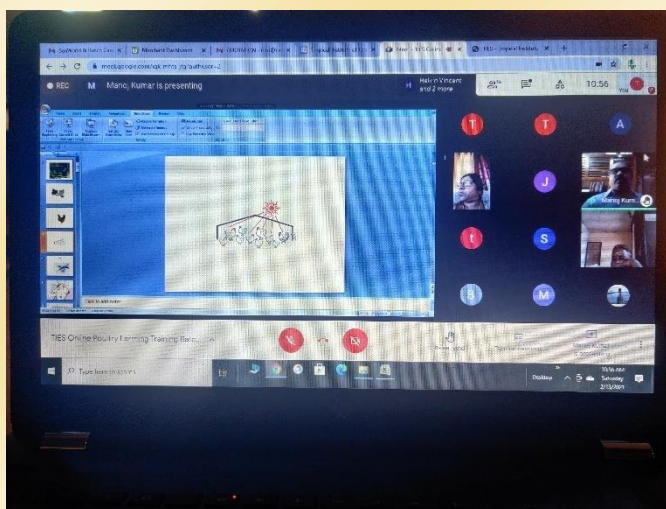
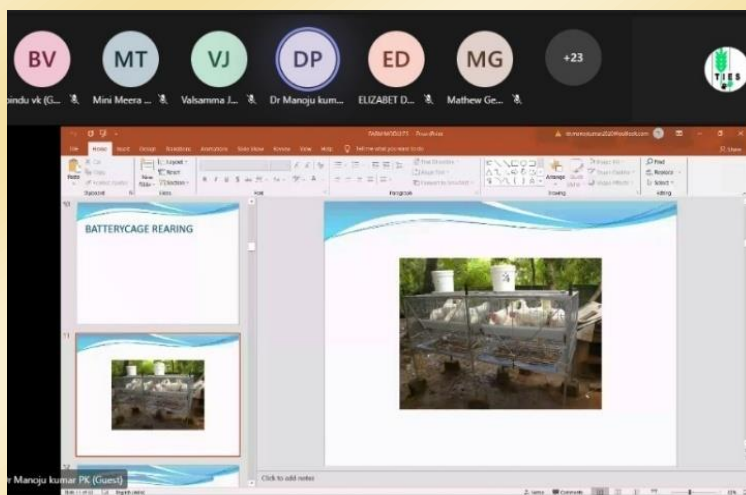
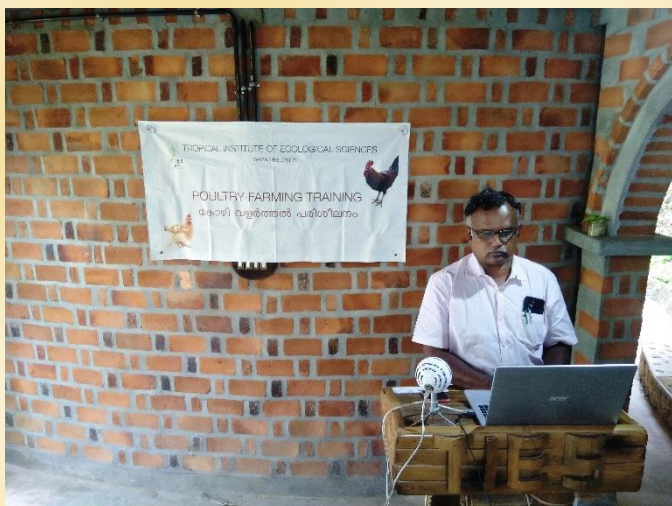


Fig 20. Online Poultry Farming Training

C. ONLINE TRAINING ON ORGANIC FARMING USING GROW BAGS

Alike mushroom and poultry farming online training on organic farming using grow bag was also conducted to equip people to cultivate their own at their own homes even with limited space and less time. Healthy food is the basic for keeping health in better condition and for that chemical free organic foods plays the best role. Grow bag farming not only provides fresh and organic products but also is a good means of exercise and recreation and is a popular method among the urban gardeners. The session was all about organic farming using growbags with limited space as well as other available conditions, management measures, potting mix, preparation of grow bag, purpose of grow bag farming, need of secure food, seasons for vegetable farming, organic fertilizers and its preparation, irrigation forms, benefits of lime, daily routine for farming, etc., along with demonstration on, grow bag filling, cow dung slurry, fish amino acid, lime application, etc. Sessions were led by John Sherry, Assistant Director of Agriculture, Farm Information Bureau (FIB), Dr. Punnen Kurian, Secretary TIES, and assisted by Mrs. Roshni Susan Elias and Mrs. Omana.

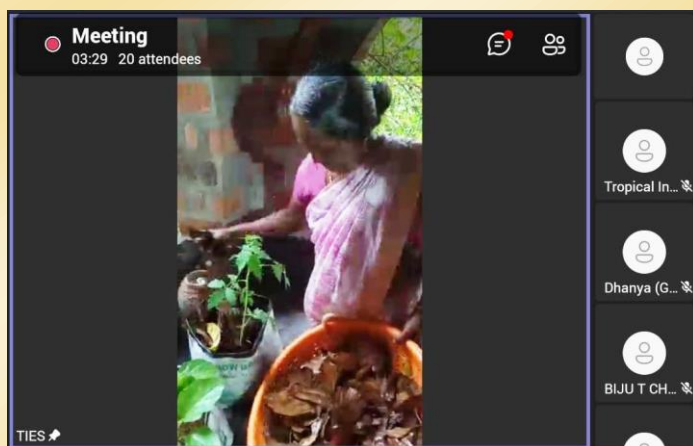


Fig 21. Online Organic Farming Training

D. ONLINE TRAINING ON HOMEWASTE MANAGEMENT

Homewaste management training is another online training given to the community to manage their homewaste at household level. These waste can be transformed into good , eco-friendly fertilizers which help to maintain the soil health. Training covered areas like: waste management, different home waste management techniques, composting (what and how to and what not to) benefits, how to compost at home, etc. The session was led by Dr.Punnen Kurian, Secretary TIES, and Mrs.Roshni Susan Elias. In the current financial year 3 online sessions was given to the community and was attended by 56 people.

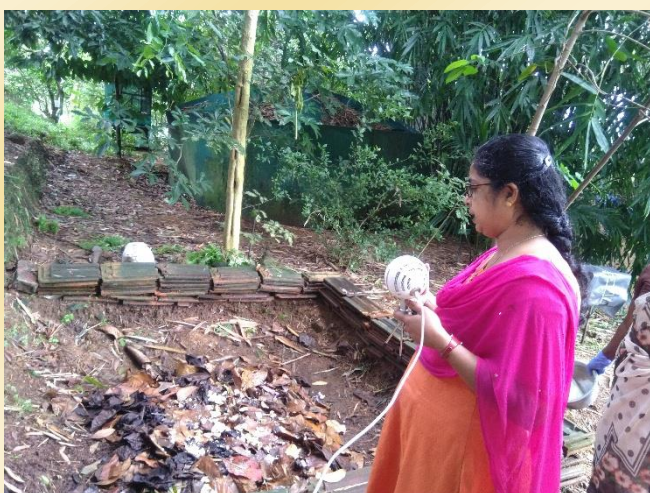


Fig 22. Online Homewaste Management Training

E. ONLINE TRAINING ON BEEKEEPING

Honey bees the social insects have immense importance in maintain the ecosystem services and balance. An elementary course on honey bee rearing was given to community by online mode. One online session was carried out and was attended by 26 people. Training constituted live-interactive session along with live colony division. The session was headed by Mr. Jose Louie, wildlife conservationist and founder of indianssnakes.org and also working with Wildlife Trust of India (WTI). Training covered the basics of bee, bee-keeping, apiary management, etc along with different equipment's used in apiculture.

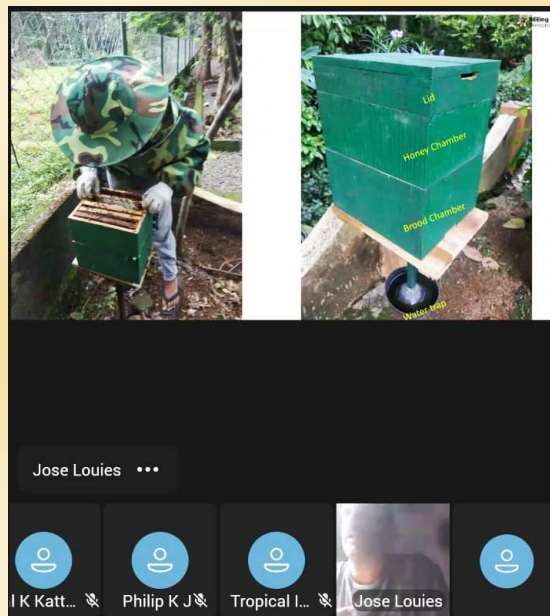


Fig 23. Online Beekeeping Training

F. ONLINE TRAINING ON FISH FARMING

Online Fish farming training was another training given to the community and was attended by around 35 people. The training was led by Surendran Nair CR, Retd. Deputy Director of Fisheries. Training constituted an introduction to aquaculture, different types of production systems, fishes that can be farmed at our backyards which can be used for home needs, fish health management, etc. There was also an open forum for the participants to clarify the fish farming related queries and also demonstration of two aquaculture models at TIES. Dr.Punnen Kurian, Secretary, TIES; Sarath Babu, NEO, TIES co-ordinated the session



Fig 24. Online Fish Farming Training

G. ONLINE TRAINING STATISTICAL DATA ANALYSIS (WASP AND OPSTAT)

Analysis of data using Statistical tools has immense importance in the research fields and thus TIES is conducting Hands-on training on Statistical data analysis and this year it was changed to online mode and covered WASP and OPSTAT packages. Web based Agricultural Statistics Software (WASP) is useful for those who are not comfortable with standalone packages. The seven day session was attended by 28 people and which included researchers, students, teachers, professionals, etc. The training consisted of both theoretical and practical sessions and was led by Dr. Ramesh Nair, Rtd. Head of the Department of Statistics and Planning Division & Joint Director of Rubber Board.

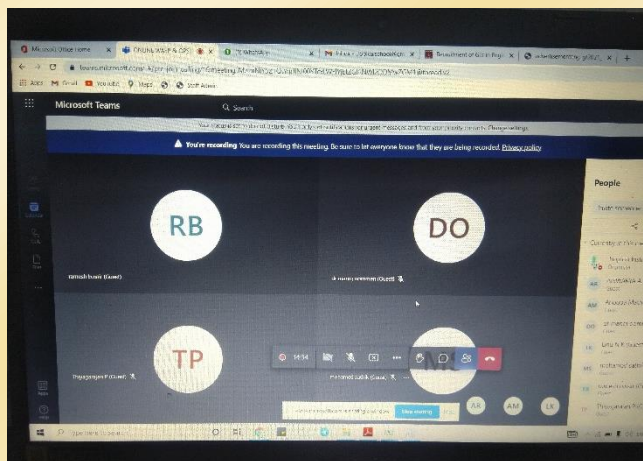


Fig 25. Online WASP & OPSTAT Training

H. CHUTTUPAADUM: PHOTOGRAPHY COMPETITION

TIES conducted a photography competition during the lock down period and the theme of the competition was “The Surroundings”. The completion was aimed to make a sneak-peak into the nature, which will provide a positive energy to minds. From among the three hundred and eighty four entries the expert team selected three best pictures and they were awarded with cash prize.

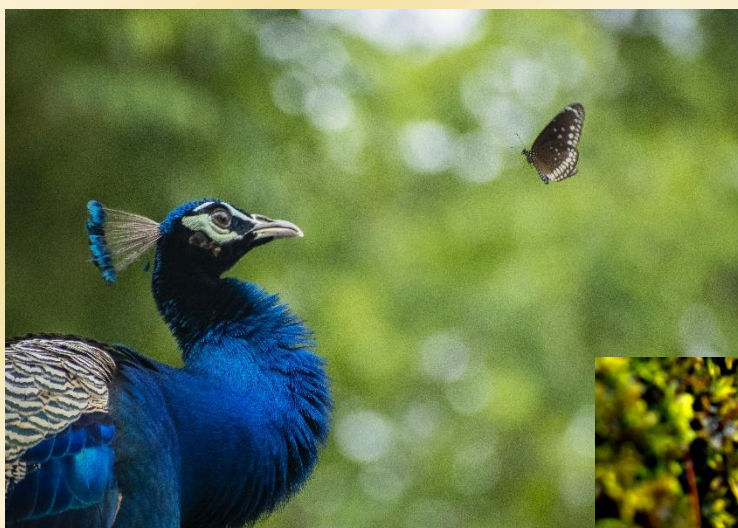


Fig 26. Chuttupaadum Photography Competition



I. TIES LABORATORY SERVICES (KSPCB APPROVED)

1	Water Quality Analysis	
A	MPN	33 samples
B	MPN/FC/EC	202 samples
C	Full test	304 samples
D	Special parameters	61 samples
2	Dry Rubber Content (DRC)	
A	DRC	872 samples
3	Lab Tests	
A	Antimicrobial activity	454 samples
B	Minimum inhibitory concentration	9 samples
C	Isolation and identification of microorganisms	11 samples
D	Quantitative estimation of phytochemicals	34 samples
E	Qualitative estimation of phytochemicals	5 samples
F	Estimation of calcium and protein	1 sample
G	Estimation of antioxidant activity	3 samples
H	Soxhlet extraction	5 samples
I	Estimation of pH, protein, total solids and lactometer reading	4 samples
J	Tests for adulteration	8 samples
4	Soil Test	
A	Soil quality analysis	16 samples

Samples for lab tests were given by postgraduate students and research scholars of Chemistry, Zoology, Engineering, Pharmaceutical science of CMFRI, CUSAT and different colleges of Mahatma Gandhi University and Calicut University

J. TRAININGS ATTENDED BY STAFF

1. *Apiculture Training at Horticornp Pala attended by Sarath Babu N B from July 26th to July 28th, 2021*
2. *Urja Kiran Pre-Proposal Workshop attended by Dr Roshni Susan Elias and Anooa Mathews on August 07, 2021*
3. *Responsible Tourism Training by RT Mission from 22nd September, 2021 till 30th October, 2021*
4. *Training on testing of DRC for Skill Development from 27th October, 2022 till 29th October, 2022 attended by Soumya S and Aashin Mani Rajan*
5. *100 days action plan of Kerala Govt. with Kerala Forest attended by Anooa Mathews on March 31st 2022*



5. TIES VISITORS

 **Bishop Visit** *August 02, 2021*

 **Fr Deepu and Assistant, CSI Church Manarcaud** *October 25, 2021*

 **Durga Pokhrel, Nepal** *October 28, 2021*

 **Kottayam District Collectors Family** *December 28, 2021*

 **Students of College of Engineering, Trivandrum** *January 08, 2022*

 **Students of RIT Engineering College, Pampady** *February 18, 2022*

 **Karoor Grama Panchayat President, Member and Suchitwa Mission Resource Person,** *March 30, 2022*

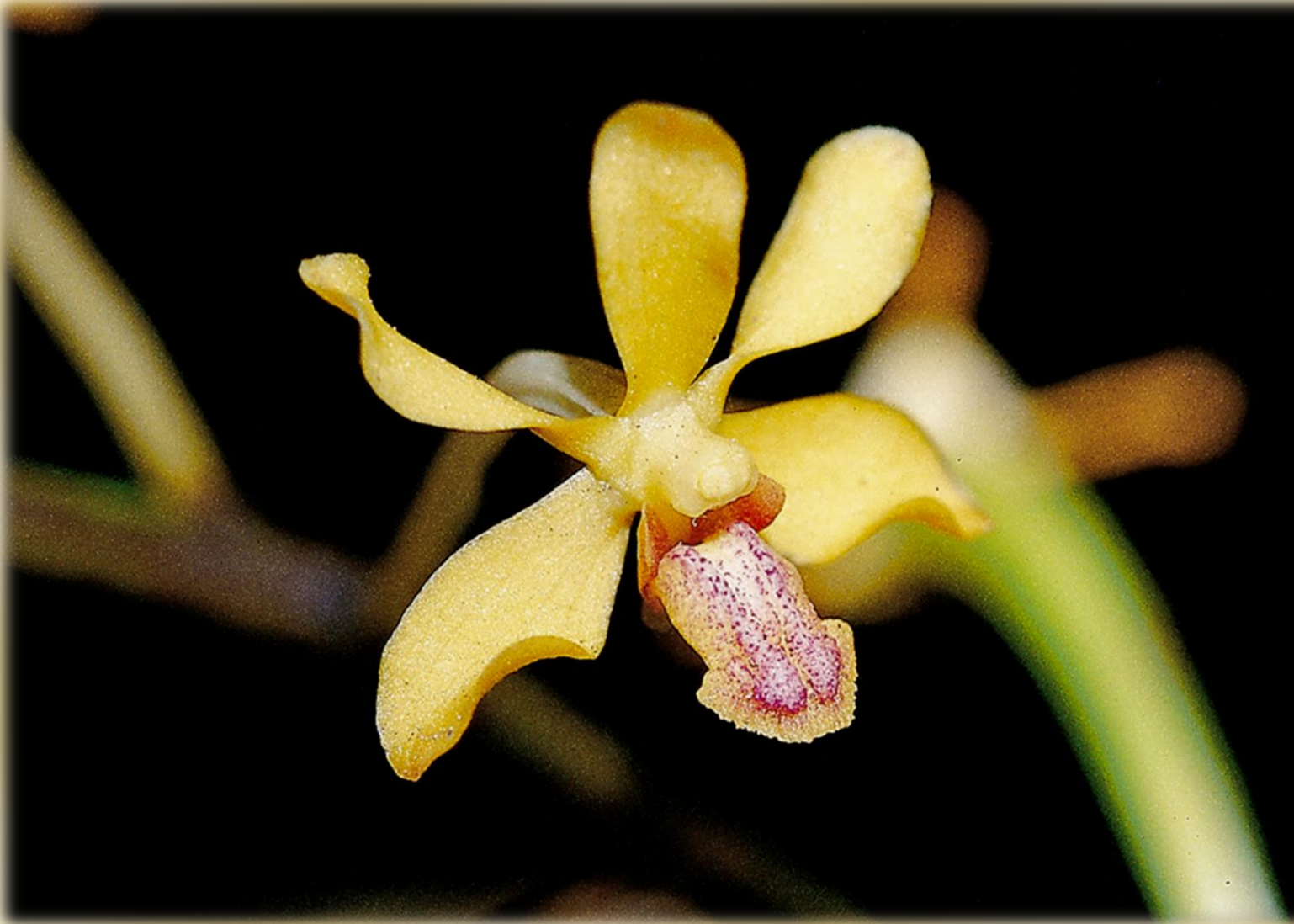






6. TIES PUBLICATIONS

- Sadasivan, K., V.P. Nair & A. Samuel (2022). A new species of *Protosticta* Selys, 1885 (Odonata: Zygoptera: Platystictidae) from Western Ghats, India. *Journal of Threatened Taxa* 14(7): 21421–21431. <https://doi.org/10.11609/jott.7792.14.7.21421-21431>
- Sadasivan, K., V.P. Nair & K.A. Samuel (2022). The dragonflies and damselflies (Insecta: Odonata) of Shendurney Wildlife Sanctuary, southern Western Ghats, India. *Journal of Threatened Taxa* 14(6): xxxxx–21213- 21226. <https://doi.org/10.11609/jott.7885.14.6>.
- Nair, V.P., Samuel, K.A., Palot, M.J. and Sadashivan, K. 2021. The Dragonflies and Damselflies (Odonata) of Kerala-Status and Distribution. *Entomon.* 46(3): 185-238.
- Nair, V.P., Samuel, K.A., Palot, M.J. and Sadashivan, K. An updated checklist of Dragofles and Damselflies (Odonata) of Kerala with their Malayalam names. *Malabar Trogon.* 20(1): 19-27.



7. CONCLUSION

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

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

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

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

Dr. Abraham Samuel

President

Dr.Punnen Kurian

Secretary

18

of Committed Service to our Mother Nature



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