The University of Trans-Disciplinary Health Sciences and Technology

2020-21

ANNUAL REPORT

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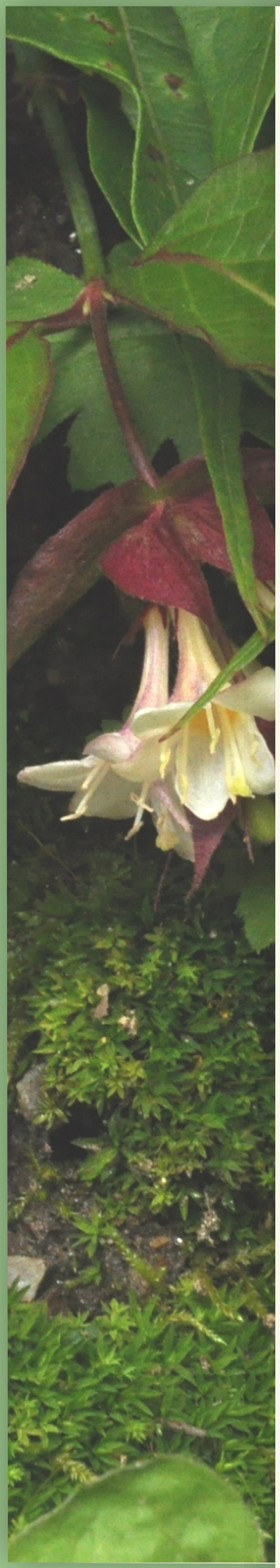

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Annual Report

2020-21

The University of Trans-Disciplinary Health Sciences and Technology

Acknowledgments

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- Srishti Institute of Art, Design and Technology
- Suchitra Cinema and Cultural Academy
- Takshashila Institution

Message from the Chancellor and Vice Chancellor

In this year's annual report one can observe an almost equal balance between the three major functions of research, education and outreach each of which are nurtured and promoted in TDU with equal respect

The report will give you a detailed picture of the actual programs executed by each of the seven functional centres in the university.

In terms of research the TDU team has engaged in a wide spectrum of research activities ranging from literary research to research on scientific issues related productivity of wild plants and botanical research in State forests and botanical studies on medicinal taxa in Andaman and Nicobar islands. The major research programs however relate to different dimensions of Ayurveda-biology viz., metabolism, brain health , malnutrition and food sciences. TDU experience continues to demonstrate that research in the framework of Ayurveda-biology has the unique advantage of combining systemic and molecular perspectives on biology that are in inherent in these two fields. The Trans Disciplinary combination helps one to see biological change in a more complete way.

The educational activities have targeted many different kinds of learners ranging from folk healers, forest dwellers and village based Bio-diversity Management Committees (BMCs) to geneticists, physicians, dieticians, paramedics and ofcourse masters and PhD students.

The outreach programs in TDU have also been varied targeting a range of beneficiaries from village communities to forest departments and professionals in high end food processing industry to livestock owners and managers.

The first convocation of the university was held this financial year on 19th feb 2021. We were honoured to have as chief guest Dr Anand Burman alongside an extremely eminent panel of guests of honour namely Prof K Kasturirangan, Ex-Chairman, ISRO, and chairperson NEP 2020, Prof P Balram, Ex-Director, IISc, Her Highness Pramoda Devi Wadiyar of Mysore Palace and Prof Bhushan Patwardhan, Vice Chairman, UGC.

D.Litt degrees were awarded to four outstanding personalities viz., prof M S Valiathan, the father of Ayurvedic-Biology, Shailaja Chandra former secretary Ayush dept and author of two socially impactful programs of the government of India viz NMPB and TKDL, Vaidyaraj Ramesh Nanal one the countries foremost Ayurveda physcians and theoretician and A V Balasubramanian, a pioneer in Vrksh Ayurveda

Degrees, diplomas and certificates were awarded to 147 students.. 5 PhD scholars, 5 MSc students 30 diploma students in pashu ayurveda (veterinary sciences) and Varmam (accupressure) and 107 certificate students in panch karma therapy.

The convocation was presided over by the Chancellor Shri Sam Pitroda

Enjoy reading the performance of colleagues during the year 2020-2021

Content page

1. Centre for Ayurveda Biology and Holistic Nutrition

RIST Holistic Nutrition Research & Education Program

Relevance: The Holistic Nutrition Program is a key project funded by RIST (Rural India Support Trust). The goal of the program is to Create a healthy India through 'food-first' preventive and curative solutions based on science-backed traditional knowledge.

Highlights: The holistic nutrition program comprises research, outreach & education components. As part of the program we have established or upgraded 13 laboratories & pilot plants in order to conduct end-to-end research & innovation on food first solutions for human health. These include biology (cell & small animal model systems), multi-omics, microbiology, wet chemistry, analytical chemistry, extrusion, liquids processing, post-harvest botanical processing laboratories & pilot plants. Of particular mention is the extruded foods pilot plant set-up to produce functional foods for clinical & consumer studies on iron deficiency anaemia and post-prandial glycaemic modulation as well as for texturizing vegetarian proteins to develop consumer preferred sustainable proteins. A high pressure homogeniser has also been added to the laboratory to develop ghrita based spreads & emulsions as part of our brain health foods portfolio. Our Research Kitchen which will serve as a rapid prototyping facility is nearly complete and should become operational in the July quarter.

The beta-version of the Integrative Food Database is ready and being tested. This database has two parts –Ingredient Properties & Recipes. The Ingredient properties include 1300 ingredients with food compositions, Ayurveda pharmacology, volatile molecule properties. The Recipe part includes 4000 recipes curated from 30 Classical texts spanning 3000 years, from Charaka Samhita to 16 th century texts. The user work-flow is being developed to open up the database for public.

The integrative food database is also being used to power the "Personalized Nutrition program. The capabilities being built are being leveraged to build large food & health related datasets to develop the algorithms for Personalized Nutrition. One such program is being done through funding from Bosch-CSR wherein we will have nearly 3,00,000 data points across various datasets for the analytics. A number of other such smaller studies are being developed to build our datasets. Partnerships with Indian Institute of Science (through Digital Health initiative), ART Park and Metastrings have been developed to bring in AI/ML & analytics skills.

We have made significant progress on functional food prototypes. An iron-rich snack using methi (*Trigonella foenum-graecum*) & amla (*Embelica officinalis*) has been developed that has 20% RDA of iron at 2% daily calories.

The functional food has shown good absorption based on the Caco2 model. The process has been scaled-up and we have produced 100-kg of product to conduct a consumer study in Nilgiri's by partnering with NAWA (Nilgiri Adivasi Welfare Association).

We have been studying the use of turmeric (*Curcuma longa*) & amla for inhibition of digestive enzymes in an enzyme based assay and got good results. We are now exploring their use to modulate post-prandial glycaemic excursions by developing mealtime snacks using this combination. Our prototype incorporates 3g of turmeric & amla in a 10g snack and will be evaluated using continuous glucose monitoring systems.

Our brain health program is researching Brahmi-Ghrita, a spread made by combining *Bacopa monnieri* & Ghee. We have developed a prototype that has a 3X stability compared to pure ghee by introducing a stabilization step that uses Amla as measured by Rancimat. This super-stabilised ghee is being used to develop food products such as spreads for daily consumer use.

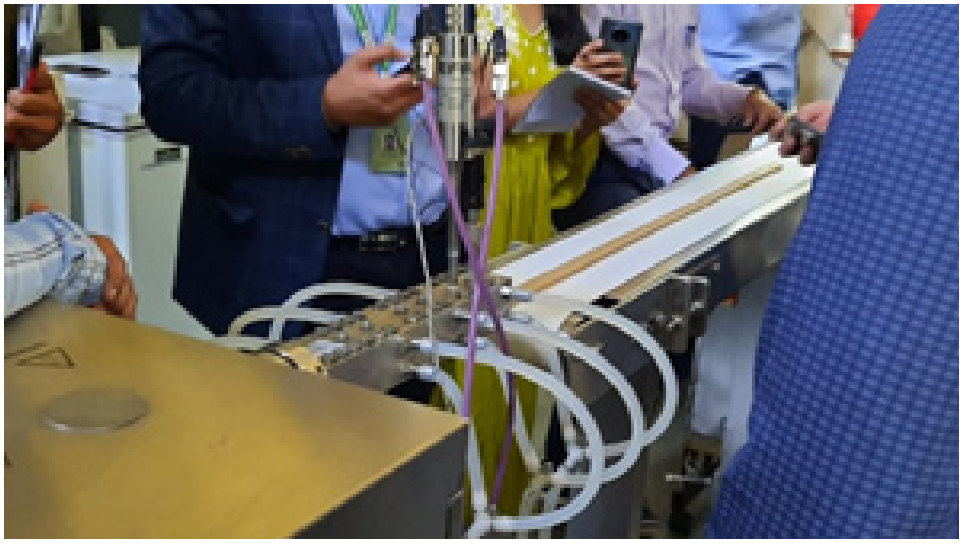
The outreach & education part of the Holistic Nutrition program focuseson 4 target groups – Urban Professionals, Rural Professionals, Urban Non-professionals & Rural Non-professionals.

We have conducted 10+ workshops on Ayurveda Dietetics with Dieticians & Nutritionists and continue to conduct one every month. We have conducted 6 workshops with Healers to train on practices for tackling iron deficiency anaemia. The healers were drawn from 60-villages in Nilgiris and we are now engaging in a community training program through the trained network of healers. A number of Food processing workshops have been conducted throughout the year. Of special mention for the workshops on texturizing vegetarian proteins which have drawn many participants from industry and interest to partner with us on product development.

In addition we have 8 PhD students and 1 MS by Research student enrolled through the Holistic Nutrition program.

Team: Gurmeet Singh, Subrahmanya Kumar, C. Vishnuprasad, Ashwini Godbole, Megha, Varuna Subraminian, BN Prakash Venkatraj Narayanan, Mohana Patel, Abdul Mateen, Shridevi Gothe, Suganthi Fathima.

3 Days Workshop on Twin Screw Extrusion Technology and Food Applications



Instruments

Wiped Film Evaporator

Homogenizer

Academics

Sl. No.	Name of Program	Audience	Final output Certificate/ Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members
1.	Sustainable Proteins Workshops	Industry, Academics, Students	Certificate	Online workshops (5-h) & hands-on workshops (3-days)		Gurmeet Singh	Abdul Mateen (TDU), Siddarth Bhide (Good Foods Institute), Jayakumar (Toshniwal), Maria.Graefenhahn (Brabender)

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work implemented	Principal Investigator and co investigators	Industry-Academia-Government-other country Collaboration Activities	Self-funded/ Funding agency (Industry)	Key achievements
1.	RIST Holistic Nutrition	Research, Education & Outreach	FRLHT, TDU	Gurmeet Singh		RIST	

Academics

Sl. No.	Name of Program	Audience	Final output Certificate/ Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of students)	Funding (if any)	Program Co-ordinators	Team members
1.	Transdis-ciplinarity and Collective knowledge Framework	M.Sc and PhD	Degree	30 hrs Expert lectures No. of students – 48	TDU	Dr. C. N. Vishnuprasad	Prof. Darshan Shankar (TDU), Prof. Sangeetha Menon (NIAS), Dr. Vishnuprasad (TDU), Dr Shivali Tukdeo (NIAS), Prof. Nitin Rai (ATREE), Prof. Gopi Rethinaraj, Prof. Naren Rao (NIMHANS), Prof. Nithin Nagaraj (NIAS), Dr Saurabh Todariya, Prof. Gurmeet Singh (TDU), Dr. Subramanya Kumar (TDU), Dr. Ashwini Godbole (TDU), Dr Madhurima Das, Shri. Jayachandran Palazhi
2.	Research Methodology and Statistics	M.Sc and PhD	Degree	60 hrs Expert lectures No. of students – 38	TDU	Dr. C. N. Vishnuprasad	Prof. Sundar Sarukkai, Prof. Darshan Shankar, Dr. Girish Tillu, Mr. Vinay Mahajan, Ms. Varsha Mahajan, Dr. Nitin Deshpande, Dr. Prakash, Dr. Megha Dr. Sony, Dr. Nandi-ni, Mr. B.S.Somashekhar, Dr. Norunissa Begum, Dr. M. Abdul Kareem, Mr. Jagannatha Rao, Dr. Venkat, Dr. Pavithra, Dr. Subramanya Kumar, Dr. Mohan Kumar, Dr. Ashwini Godbole

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia-Government-other country Collaboration Activities	Funding agency (Industry)	Key achievements
1.	Ayurveda Biology framework for integrative diabetes management	Experimental	CABHN, TDU	Dr. C. N. Vishnuprasad	• Collaboration with OSPF for multi-dimensional data analysis. • Collaboration with SASTRA University for network pharma-cology studies.	TDU	• Published an article in Journal of Ethnophar-macology describing the need and signifi-cance of Ayurveda-Bi-ology framework for integrative diabetes management. • The team conducted a multidimensional analysis of retrospective clinical data of patients treated at IAIM with these formulations using artificial intel-ligence and machine learning tools. The team proposed novel ways of analysing the clinical data of Ayurveda using these advanced tools.

Effective merger of holistic and reductionist views of biology is imperative in contemporary healthcare. Creating a trans-disciplinary knowledge framework between Ayurveda and modern biomedicine could be the paradigm for the management of chronic lifestyle diseases like diabetes, obesity and liver diseases.

Highlights of progress: Report only noteworthy/striking elements of findings/ outputs, as bullets/ short phrases

Gut-centric approach for diabetes management:

The human body regulates glucose metabolism through a multi-targeted mechanism with the gut playing a central role. Remarkably, in traditional medicine such as Ayurveda, the gut is considered central to disease manifestation and cure. Therefore the plant based therapeutics used in Ayurveda can probably act at different levels on the gut, such as digestive enzymes and hormones to exert their biological action. The versatile roles of the gut make it an important target for designing innovative holistic strategies for management of metabolic diseases like diabetes and obesity.

Gastro Intestinal mediated Glucose Disposal (GIGD), an orchestrated event regulated by various gut derived factors, is emerging as a systemic strategy in diabetes management. A deeper understanding of GIGD and its multi-targeted mode of action could open up novel holistic strategies for maintaining whole body glucose homeostasis and management of diabetes. The team studied 5 important Ayurveda formulations to understand their mechanism of anti-diabetic action, with a focus on GIGD.

- The team showed Vasanthakusumakara, one of the anti-diabetic formulations used in Ayurveda, works through inhibiting digestive enzymes as well as reducing adipogenesis through down-regulating key molecular pathways of fat metabolism.
- The team conducted a multidimensional analysis of retrospective clinical data of patients treated at IAIM with these formulations using artificial intelligence and machine learning tools. The team proposed novel ways of analysing the clinical data of Ayurveda using these advanced tools.

Peer reviewed Publications/ books / reports / manual / handbook etc published during year

1. Thottapillil, A., Kouser, S., Kukkupuni, SK., Vishnuprasad, CN* (2021). An “Ayurveda-Biology” platform for Integrative Diabetes Management. Journal of Ethnopharmacology, 113575. doi:10.1016/j.jep.2020.113575
2. Das, G., Shin, H.-S., Kumar, A., Vishnuprasad, CN, Kumar Patra, J. (2020). Photo-mediated optimized synthesis of silver nanoparticles using the extracts of outer shell fibre of Cocos nucifera L. fruit and detection of its antioxidant, cytotoxicity and antibacterial potential. Saudi Journal of Biological Sciences. doi:10.1016/j.sjbs.2020.11.022
3. Bala Balasubramani., Varghese, Vishnuprasad CN, Padma Venkat (2020). Pomegranate Juice Enhances Iron Dialysability and Assimilation in In-Vitro Cell Free and Cell-Based Models. Plant Foods Hum Nutr. 10.1007/s11130-020-00815-1

Team members: Ms. Anjana, T, Ms. Sania Kouser, Dr. Subrahmanya Kumar, Dr. C. N. Vishnuprasad.

Academics

Sl. No.	Name of Program	Audience	Final output Certificate/ Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of students)	Funding (if any)	Program Co-ordinators	Team members
1.	Advanced Ayurveda Dietetics	Practicing dietitians	Certificate	• About 30 hours of online program to provide perspectives of Ayurveda on diet and nutrition • Included guest lectures and interactions and case discussions with Ayurveda practitioners • 20 participants	Nil	Dr. Megha	Dr. Subrahmanya Kumar, Dr. Girish Kumar V and Dr. Megha & invited guest lectures
2.	Introduction to Ayurveda Biology of Nutrition	MSc students	Certificate	• About 28 hours of online program to provide Knowledge of Ayurveda biology of nutrition • Included guest lectures and interactions and case discussions with Ayurveda practitioners • 41 students	Nil	Dr. Megha	Dr. Subrahmanya Kumar, Dr. Girish Kumar V and Dr. Megha & invited guest lectures

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work implement-ed	Principal Investigator	Industry-Academia-Government-other country Collabora-tion Activities	Funding agency (Industry)	Key achievements
1.	Scientific evaluation of marketed substitutes for medicinal plants facing conservation threat	Laboratory based pharmacology research	FRLHT-TDU Laboratory	Subrahmanya Kumar K	Industry Collaboration	Dabur India Ltd.	Establishment of substitutes for three highly demanded plant drug species through bioequivalence studies
2.	Human Microbiome Initiative of Select Endogamous populations in India	Survey	TDU and selected communities in India	Subrahmanya Kumar K	Government	Department of Biotech-nology	Translation of Prakriti assessment formats into various Indian languages & Prakrit assessment of selected participants of Human Microbiome Initiative of Select Endogamous populations in India.

Human Microbiome Initiative of Select Endogamous populations in India

Relevance: This project attempts a comprehensive characterization of human associated microbes and diverse dietary habits from carefully selected endogamous groups including key tribal populations. The project will find the influence of diet, lifestyle, geography and age on gut microbiome. Ayurveda connects Prakriti of an individual with the physiology of his/her gastrointestinal tract (Koshta) & its expression through digestion and metabolism (agni, jatharagni) and systemic pathologies as well. The project will also try to find the association between microbial enterotypes and distinct Ayurvedic Prakriti types.

Highlights: In the project, a method to quantify Tridoshas viz., Vata, Pitta, Kapha on physical, physiological and psychological aspects in an apparently healthy individual was developed with the insights from classical Ayurvedic literature and contemporary Prakriti analysis tools. Validated Prakriti analysis tools were translated into various Indian languages. SoPs were developed to assess the gastrointestinal tract (koshta) and digestion and metabolism (agni) of the individuals through specific questionnaires. The intricate relationship between Dosha Prakriti & Gastrointestinal tract (Koshta) and digestion and metabolism (agni, jatharagni) was examined.

Mapping of population and required partners across the planned study area in Northern, Western, Eastern and Southern parts of India was done. Dosha-Prakriti analysis of about 25% of the participants of the HMI project from Kallar community in Thanjavur district was done. Data were collected in the field using online data collection tools and analyzed using the software CDAC-AYUSOFT. As per the initial analysis, it was found that, about 44% of the participants were of Kapha, 32% Vata and 24% Pitta Dosha-Prakritis (Pradhana dosha). However, it was also found that most of the individuals have a Prakriti which is a combination of more than one dosha.

Team members: Dr. Subrahmanya Kumar K, Dr. Girish Tillu, Dr. Sanket Sharma, Dr. Venkatesh, Dr. Sumith Salunke, Ms. Prachi Ingawale

Academics

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2.	Introduction to Ayurveda Biology of Nutrition	MSc students	Certificate	• About 28 hours of online program to provide Knowledge of Ayurveda biology of nutrition • Included guest lectures and interactions and case discussions with Ayurveda practitioners • 41 students	Nil	Dr. Megha	Dr. Subrahmanya Kumar, Dr. Girish Kumar V and Dr. Megha & invited guest lectures

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work implement-ed	Principal Investigator	Industry-Academia-Government-other country Collabora-tion Activities	Funding agency (Industry)	Key achievements
1.	Scientific evaluation of marketed substitutes for medicinal plants facing conservation threat	Laboratory based pharmacology research	FRLHT-TDU Laboratory	Subrahmanya Kumar K	Industry Collaboration	Dabur India Ltd.	Establishment of substitutes through bioequivalence studies for three plant drug species in high demand was successfully done.
2.	Human Microbiome Initiative of Select Endogamous populations in India	Survey	TDU and selected communities in India	Subrahmanya Kumar K	Government	Department of Bio-technology	Translation of Prakriti assessment formats into various Indian languages completed. Prakriti assessment of selected participants from Human Microbiome Initiative of Select Endogamous populations in India, completed.

Scientific evaluation of marketed substitutes for medicinal plants facing conservation threat

The Ayurvedic drug industry is facing the problem of inadequate supply of authentic plant drugs. Ayurvedic literature and practices have identified substitutes (*Abhava Pratinidhi Dravya*) with identical pharmacological properties for some of the rare species. The Current study is a systematic R&D attempt to establish the bioequivalence of rare species and their substitutes using appropriate pharmacology tools. The supply chain for medicinal plants could be made more robust, if genuine and authentic substitutes were available for the species consumed in high volumes.

Highlights of progress: Report only noteworthy/striking elements of findings/ outputs, as bullets/ short phrases

Functional similarities of the substitutes for three plant drugs in high demand, viz., Asoka [*Saraca asoca* (Roxb.) Willd.], Vidanga (*Embelia ribes* Burm.f.) and Sariva [*Hemidesmus indicus* (L.) R.Br.] were established using various in vitro and in vivo pharmacology models.

Arishtas (fermented therapeutic formulations) prepared with authentic species and the substitutes of Ashoka, including the bark of commonly available *Shorea robusta* Roth were examined for their estrogenic activities using rodent, small animal and in vitro cell based pharmacological models. Substitutes taken in this study also possessed the estrogenic potential, with varied levels, and thus indicates the possibility of using alternative plant drugs in place of S. asoca.

Vidangarishta is one of the compound preparations prescribed to manage helminthiasis and obesity. The Vidangarishtas prepared using the authentic source of *Embelia ribes* and the common substitute (*Embelia tsjeriam-cottam*) showed significant similarity, when compared in terms of anthelmintic and antihyperlipidemic potential. The anthelmintic activity of Vidangarishtas and their ability to denature the eggs were studied using *Caenorhabditis elegans*. Antihyperlipidemic activity was compared in high fat diet induced obesity and hyperlipidemia (Figure 1) models in rodents.

Pharmacological similarities of *Hemidesmus indicus* and its common substitutes including *Ichnocarpus frutescens* were examined for their potential to withstand the heat-stress and oxidative stress in *Caenorhabditis elegans*.

Peer reviewed Publications/ books / reports / manual / handbooketc published during year: None

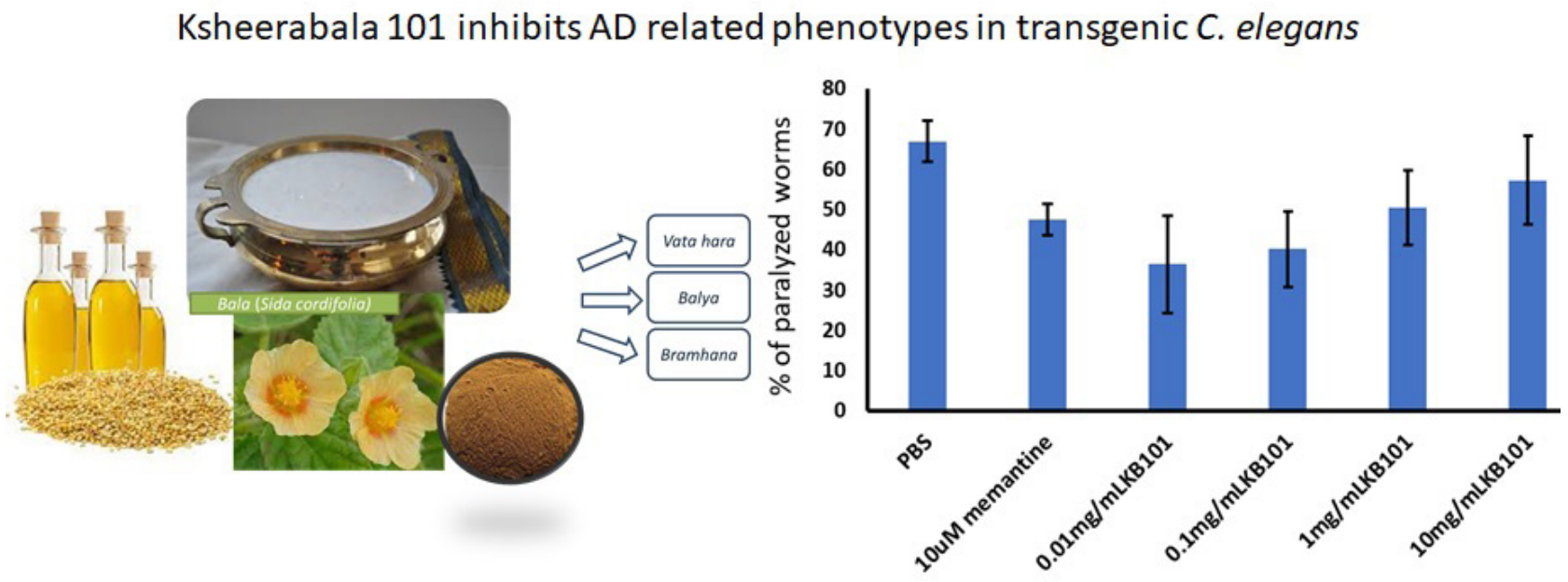
Team members: Dr. Subrahmanya Kumar K, Dr. CN Vishnuprasad, Dr. Ashwini Godbole, Ms. Ashwini Elango, Ms. Seema VG , Mr. Prasanna Simha

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia-Government-other country Collabora-tion Activities	Funding agency (Industry)	Key achievements
1.	Effect of Ayurvedic Nootropics on cognitive f unction in breast cancer patients on adjuvant chemotherapy: A randomized controlled trial	Clinical Research	TDU, IAIM and HCG Hospitals	Ashwini Godbole	-	AYUSH-EMR Scheme	1. Objective assessment of cognitive alterations in breast cancer patients. 2. Preliminary results indicating enhancement of cognition in the trial participants consuming Brahmi Ghrita
2.	Pratiksha Trust Faculty Funding	Experimental and Clinical research on?	TDU	Ashwini Godbole	NCBS, IAIM	Pratiksha Trust	1. Brahmi formulations have positive effect on cognition and related factors-observation from clinical and experimental studies 2. Investigations at molecular level indicate general anti-aging (Rasayana) and stress relieving effects of Ayurvedic nootropics (Medhyarasayana)

Outreach

Sl. No.	Title of the project/ program	Principal Investigator	Nature of the activity: Community service / Community education	Place of work implemented	Number of beneficiaries	Self-funded/ Funding agency (Industry)	Key achievements
1.	Webinars on different topics like 'Food for Brain', 'Grow and use the Herbs'	Ashwini Godbole	Community Education	On-line	500	Self/ Corporate funding	Awareness about Ayurveda for Wellness



Understanding biological effect of Ayurvedic Nootropics

Mode of Action studies: *Caenorhabditis elegans* models

1. Correlation of aging and nervous system function. Effect of Ayurvedic anti-aging formulation
2. Study of mode of action of Ayurvedic Nootropic formulation on protein homeostasis and neurodegeneration in Alzheimer's and Parkinson's Disease models of C elegans
3. Effect of different dosage forms of Brahmi on neuronal health and Disease
4. Molecular and cellular insights in correlation of sugar and lipid homeostasis with nervous system function

Clinical studies: Effect of Brahmi ghrita on memory

(In collaboration with Centre for Clinical Research, TDU)

1. Age-related Cognitive Impairment (CI): A community based clinical research done in collaboration with a team from NCBS-TIFR
2. Chemotherapy Induced Cognitive Impairment (CICI) in breast cancer patients: In collaboration with HCG, Bangalore

Relevance: Optimum development, function and structural integrity of the nervous system is of high importance for good quality of life. Good sensory and motor functions as well as high cognition are indications of a healthy nervous system.

Aging is the most common factor which leads to decline in cognitive health, however, stress, unwholesome lifestyle and injuries can also affect the nervous system health and cognition. Maintenance and enhancement of cognition is very vital not only for fulfilling all the required mental and physical tasks at all ages, but also for reducing risk of getting age-related neurodegenerative disease (Blagosklonny.et al 2009) and enhancing quality of life. Despite this, very few well researched solutions are available for enhancement and maintenance of health of the nervous system.

Ayurveda has concepts and elaborate descriptions of different aspects of nervous system health and disease (Sushruta Sutrasthana 2/3, Charaka Samhita VS 8/8). It describes many concepts and suggests various practices, diet, herbs and formulations for enhanced cognition, sensory and mechanical abilities. However, both the concept and practices from Ayurveda are largely not backed up by contemporary scientific evidence (Singh and Rastogi 2012). This has led to limited acceptability and use of potentially very effective health solutions from Ayurveda.

Highlights: Experimental Studies with C*aenorhabditis elegans* models

- *Centella asiatica* (Mandookaparni) swarasa (fresh juice), *Sida cordifolia* (Bala) in the form of Ksheerabala 101, plain ghee and Brahmi (*Bacopa monnieri*) ghee enhanced life span of wild type worms and ameliorate disease phenotypes in AD (Fig 1) and PD models of C. elegans.

- Molecular biology based experiments (qRT-PCR) indicate involvement of insulin signaling pathway and unfolded protein response genes in the life extending and neuroprotective effect of the Ayurvedic nootropics (Medhyarasayana)

Clinical Studies

- Breast cancer patients who have undergone chemotherapy level show significant cognitive impairment as compared to age matched healthy control groups .
- Brahmi ghrita treatment reduced age-related cognitive decline (Fig 2) in urban Indian elderly population (≥ 55 yrs). No significant alteration in physiological parameters, like sugar and lipid profile, was observed in the participants who completed the trial.

Differential Effect of Ayurvedic Nootropics on Caenorhabditis elegans models of Parkinson's Disease

J Anjaneyulu, Vidyashankar R and Godbole A* (Corresponding author)
Journal of Ayurveda and Integrative Medicine, Sep 2020, DOI: 10.1016/j.jaim.2020.07.006

Team members: Dr. Ashwini Godbole, Mr. Anjaneyulu J, Dr. Varghese Thomas, Ms. Ashwini Thakare, Mr. Prasanna K Simha, Mr. Pushpendra Jat, Dr. Swathi G H, Mr. Arman Deep Singh, Dr. Bhaktee Dongaonkar (NCBS-TIFR)

Academics

Sl. No.	Name of Program	Audience	Final output (CME/ Certificate/ Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
1.	Unravelling the metabolic diversity using multi-omic technologies	Life science students and faculty	1- Credit Certificate Course	• 30 Participants attended • 5 Days Program for, 07 October 2020 to 12 October 2020	Rs. 0.35 Lakh self funded Self-funded	Dr. Mohana Kumara P	Dr. Renuka Joshi	Flyer done
2.	Multi-omic applications in medicinal plant research	Life science students and faculty	Certificate Course	• 59 Participants attended • 3 Days Program, 10-12 November 2020	Rs. 0.45 Lakh, Indian Academy of Sciences, Bengaluru	Dr. Mohana Kumara P	Prof. Uma Shaanker R (Course Director)	Flyer done

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia- Govt-other country Collaboration Activities	Funding agency	Key achievements
1.	Multi-omic approaches and mass spectromety-based tissue metabolite imaging towards understanding metabolites localisation and metabolic path-ways in specific cell/tissues of key medicinal plant, Dysoxylum binectariferum.	Both field and lab studies	TDU	Dr. Mohana Kumara P	Collaborated with IIT Madras and UAS, GKVK, Bangalore	SERB, Gov. of India	1. Mass spectrometry imaging of different seed developmental stages of D. binectariferum was done. 2. De novo transcriptome analysis leaf and root samples of D. binectariferum revealed the possible role of 5 partial genes in the biosynthesis of chromone alkaloid, Rohitukine. Chalcone Synthase is one of the important genes shortlisted. Orthology analysis of chalcone synthase gene using the available SRA data, has been attempted. 3. Leaf and root of D. binectariferum and D. malabaricum were subjected for transcriptome analysis, followed by simultaneous analysis of SRA dataset using free web servers. 4. Putative genes involved in the biosynthesis of chromone alkaloids identified in D.binectariferum

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia- Govt-other country Collaboration Activities	Funding agency	Key achievements
2.	"Development of sustainable technology for the production of antican-cer chromone alkaloids, rohitukine and dysoline from Indian forest trees" – [BT/PR31331/ TRM/120/ 227/2019]"	Both field and lab studies	TDU	Dr. Mohana Kumara P and Dr. Vish-nu	Collaborated with UAS, GKVK, Bangalore	DBT, Govt. of India	1. Select species were identified as the newer plant sources for chromone alkaloids, based on phylogenetic analysis. 2. Elite lines/ populations were identified for the production of chromone alkaloid, Rohitukine. Estimation of Rohitukine done for different stages of seed and seedling development in Dysoxylum binectariferum. It was found that, the root and leaves produce higher quantity of chromone alkaloid, rohitukine, as compared to other parts of the tissues. 3. Seeds of elite lines/ populations of Dysoxylum binectariferum were collected and mass multiplied through nursery techniques. Seedling stock of ~1000 seedlings was established for establishing demonstration plots in farm lands and natural forest with the help of Forest department

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia- Govt-other country Collaboration Activities	Funding agency	Key achievements
3.	"Development of SSR markers and assessment of genetic diversity of natural populations of Pterocarpus santalinus L.f. distributed in the Eastern Ghats, India"	Both field and Lab based studies	IWST, Bengal-uru and TDU	Co-PI Dr. Mohana Kumara P	IWST, Bengaluru	NBA, Gov. of India	1.DNA isolation protocol was standardised for the species. 2. Samples sent to the company for Whole genome sequencing. Results awaited. 3. Cross amplification of SSR markers from related species was initiated.

Multi-omic approaches and mass spectrometry based tissue metabolite imaging towards understanding metabolites localisation and metabolic pathways in specific cell/tissues of key medicinal plant, Dysoxylum binectariferum.

Relevance: Diverse plant species worldwide produce important medicinal compounds which are used extensively in the treatment of major diseases, including cancer. Often, availability is limited, due to low levels in planta and/or coming from biodiversity hotspots. Furthermore, their commercial chemical production is frequently difficult because a) synthesis of their complex skeletal structures is not economic, and, b) metabolic pathway engineering is currently not feasible because of lack of information on biosynthetic machinery involved.

Trying to address this need, through this program, we focus on identifying the possible genes associated with Rohitukine, using a multi-omic approach.

Highlights of progress/ achievements:

- Mass spectrometry imaging of different seed developmental stages of *D. binectariferum* was carried out. Rohitukine accumulation increased with seed development and its distribution was largely restricted to cotyledonary tissue. Analogues of Rohitukine such as Rohitukine acetate, glycosylated rohitukine and rohitukine methoxylated are reported for the first time. Further, tissue specific localization of metabolites during different developmental stages of seedling growth have been identified.
- HPTLC and mass analysis showed that, Rohitukine is produced in *Dysoxylum bienctariferum* while it is not found in *D. malabaricum*.
- The leaf and root of *D. binectariferum* and *D. malabaricum rohitukine* were subjected for transcriptome analysis.
- De novo transcriptome analysis of leaf and root samples of *D. binectariferum* revealed the possible association of genes in the biosynthesis of chromone alkaloid, rohitukine. The following are the identified putative genes possibly involved in the biosynthesis of chromone in *D. binectariferum*: Cinnamyl alcohol acyltransferase, Phenylalanine ammonia lyase, Phenylalanine hydroxylase, Cinnamate 4-hydroxylase, 4-hydroxyphenylpyruvate dioxygenas, Phosphoethanolamine N-methyltransferase, Chalcone synthase belongs polyketide pathways. Chalcone synthase, 4-coumarate CoA ligase, Chalcone isomerase, Flavanone 3beta-hydroxylase, Dihydrokaempferol 4-reductase, Leucoanthocyanidin dioxygenase and Chalcone-flavanone isomerase family.

Team members: Ms. Madhushree, Mr. Tapas and Dr. Mohana Kumara

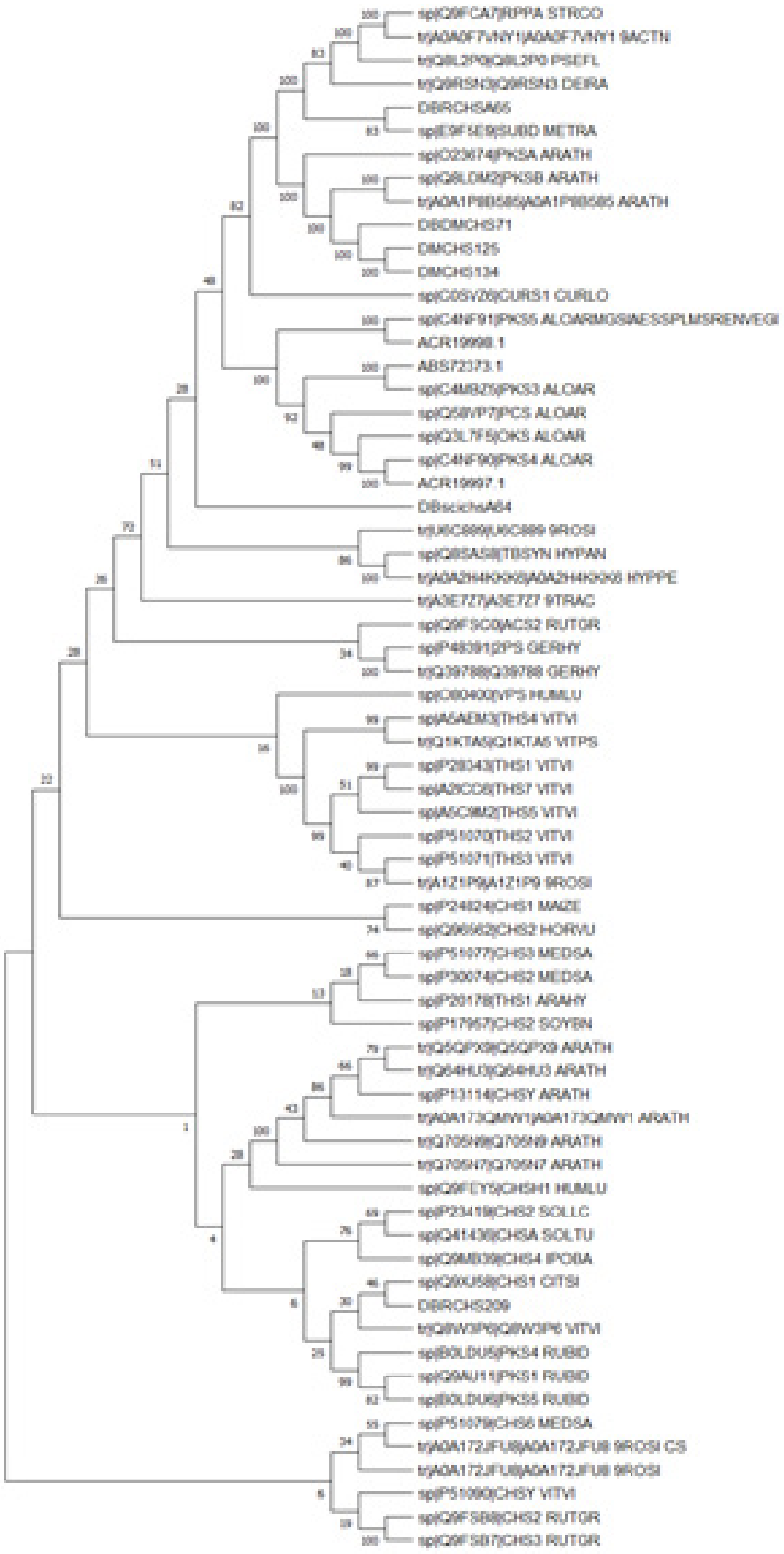


Fig 1: Molecular Phylogeny of chalcone synthase (CHS) from Dysoxylum binectariferum

"Development of sustainable technology for the production of anticancer chromone alkaloids, rohitukine and dysoline from Indian forest trees" - [BT/PR31331/TRM/120/227/2019]"

Relevance: Chromone alkaloids including rohitukine (Rh) and dysoline have gained enormous attention in recent years for their anti-cancer properties. The natural occurrence of rohitukine (Rh) is restricted to only five plant species- Amoora rohituka, Dysoxylum binectariferum, D. acutangulum, (all from the Meliaceae family), Schumanniophyton magnificum and S. problematicum (from the Rubiaceae family). Among these 5 species, D. binectariferum has been found to accumulate the highest contnts of Rh. Identification of additional new sources of these compounds could contribute to developing a sustainable production technology.

In this project, we have attempted to : a) explore alternative plant species which produce the chromone alkaloids, rohitukine, dysoline and other related compounds, b) develop sustainable production technology for rohitukine and dysoline from the newly identified high yielding sources, and, c) promote the cultivation of promising sources in agroforestry mode.

Highlights of progress/ achievements:

- Shortlisted the species based on phylogenetic analysis for the identification of newer plant sources for chromone alkaloids.
- Identified elite lines/populations for the production of chromone alkaloid, rohitukine. Rohitukine estimation was done for different stages of seed and seedling development in Dysoxylum binectariferum. It was found that, the root and leaves produce higher amount of chromone alkaloid, rohitukine compared to other parts of the plant.
- Seeds of elite lines/populations of Dysoxylum binectariferum collected and mass multiplied through nursery techniques. Seedling stock of about 1000 seedlings was maintained for establishing demo plots on farmers' fields, and natural forest with the help of Forest Department (Fig 1).

Team members: Mr. Varun, Dr. Renuka Joshi, Dr. Jagadish MR and Dr. Mohana Kumara P

Fig. 1. Seeds of elite lines/populations of Dysoxylum binectariferum collected and mass multiplied thorough nursery techniques.

Table:1 List of equipment's procured from the DBT project

Sl. No	Name of Equipment
1	Hamilton Syr 25ul (Minor Equipment - Syringe)
2	Cyber Scan pH 700 (Minor Equipment - pH Meter)
3	Eppendorf Research Plus G6 Pack Pipette (Micropipettes)
4	Soxhlet Apparatus-1L (Minor Equipment - Chemical Soxhlet Extraction Unit)
5	Speed Vacuum Concentrator
6	-86C Upright Freezer (Deep Freezer)
7	Shimpack Kits (Minor Equipment - LCMS Column)

"Development of SSR markers and assessment of genetic diversity of natural populations of Pterocarpus santalinus L.f. distributed in the Eastern Ghats, India"

Relevance: Pterocarpus santalinus L.f. (Red sanders) is one of the most valuable plant species found in Eastern Ghats of Southern India, and is endemic to this region. It is listed in the appendix II of CITES and its export and import is restricted in India. However, Illegal trade of its wood, is a major cause for the decline of natural populations. Current need is to develop specific tools to ascertain the source of such material under illegal trade, and link it to a wild population. from which the material has been sourced. In this current study we aimed to address: a) development of SSR markers using the Next generation sequencing, b) assessing the genetic diversity, and, c) identify, if any, population specific markers for Pterocarpus santalinus.

Highlights of progress:

- Collected Pterocarpus santalinus samples from 14 forest ranges from Eastern Ghats, India
- Standardised the DNA isolation protocol for the species.
- Samples were sent for whole genome sequencing (to an outside agency). Results are awaited.
- Cross amplification of SSR markers from related species initaited.

Team members: Dr. Pooja, Ms. Sneha, Ms. Madhshree, Dr. H. R. Prabuddha, Dr. B. N. Divakara and Dr. Mohana Kumara P

Publications: Renuka S. Joshi, Pooja Bharti, Mohana Kumara P. 2020. Genetic diversity analysis of Indian Sandalwood. Springer nature book. Pages ?...

Conferences and workshops conducted

- Course Coordinator- Science Academy Virtual Lecture workshop on "Multi-omic applications in medicinal plant research" 10 to12 Nov 2020, by Indian Academy of Science, Bengaluru (Grant Received Rs. 0.45 Lakh)
- Course Coordinator: Virtual lecture workshop / one Credit course (15hr) on "Unraveling the metabolic diversity using multi-omic technologies, 7-12th October, 2020, held at TDU, Bengaluru (Rs. 0.35 Lakh)

Invited talks

- Spatial and temporal distribution of Chromone alkaloids in Dysoxylum binectariferum (Meliaceae), Science Academy Virtual Lecture workshop, 10 to12 Nov 2020, TDU, Bengaluru .
- Spatial and temporal distribution and metabolic pathways Virtual lecture workshop 7-12th October, 2020, TDU, Bengaluru .
- Webinar lecture on "Mass spectrometry imaging of medicinal plants" by 30th July 2020 at 4:00pm, Amity University, Noida

Outreach

Sl. No.	Title of the project/ program	Principal Investigator	Nature of the activity: Community service / Community education	Place of work implemented	Number of beneficiaries	Self-funded/ Funding agency (Industry)
1.	Ayurveda Dietetics Program	Dr. Megha	Education	On-line	>600	Self funded

Ayurveda Dietetics Program

Source of funding: None

Highlights: Short format courses were developed and executed. Curriculum focus was to present authentic Ayurveda knowledge and format focussed on practical applications to everyday life. Games and assignments were designed to improve the retention and learning of new subject matter. Where applicable, lectures were arranged by eminent Ayurveda Vaidya's who incorporate diet advice in their practice.

- Introduction to Ayurveda Dietetics – 9 hrs – Professionals & public [10]
- Advanced Ayurveda Dietetics – 24 hrs – Professionals only [1]
- Ayurveda Biology of Nutrition – 2 credit course - UG students [1]

Webinars on food topics of significance to Ayurveda

- Ghee [2]
- Viruddha Ahara [1]

Team members: Dr Mahumitha Krishnan, Dr Subrahmanya Kumar, Dr Girish

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia- Govt-other country Collaboration Activities	Funding agency	Key achievements
1.	Drosophila model for Environmental Enteric Dysfunction	Fundamental	TDU	Dr. Megha	None	Bill and Melinda Gates Foundation via BIRAC	- Infrastructure for fly lab: C02 set up, incubators & microscope - Establishment of assays to measure immune response, gut permeability and gut cell types. - Establishment of a protocol to emulate early life malnutrition in flies and characterisation of phenotypes, some of which overlap with EED in humans. Potential to use read-outs to test the effect of various diets.

Drosophila model for Environmental Enteric Dysfunction

Source of funding: BIRAC

Relevance: Children in middle and low income countries suffer from frequent diarrheal diseases as well as malnutrition. These two conditions together have been hypothesised to result in significant changes in gross gut morphology with subsequent consequences for digestion, immunity and permeability. Along with these, elevated markers of systemic inflammation are considered as hallmarks of Environmental Enteric Dysfunction (EED). This project sought if a combination of early life malnutrition and adult enteric infection results in EED Drosophila.

Highlights:

- Our results suggest that the chosen combination results in flies with poor overall immunity and increased gut permeability, but did not result in elevated systemic inflammation. Interestingly, early life malnutrition resulted in changes in proportion of stem cells and enteroendocrine cells, which are important for gut renewal and gut hormones respectively. Functional implications of this observation are yet to be uncovered. An enteric infection increases gut renewal to the same extent in malnourished and control flies.
- Together, these suggest that Drosophila can model only certain aspects of EED. In the broader context however, it appears to be a good model to understand early life malnutrition and our assays are optimised to start studying the impact of dietary interventions using Ayurvedic principles

- Peer reviewed Publications/ books / reports / manual / handbook etc published during year: None

Team members: Oviya TS, Sushmitha HS, Sonia NB

Dr. CN Vishnuprasad

Dr. Subrahmanya Kumar

Dr. Venkatesh

Dr. Sanket Sharma

Mrs. Anjana T

Ms. Sania Kouser

Ms. Sonia NB

Ms. Oviya TS

Dr. Mohana Kumara P.

Ms. Sneha M V

Dr. Renuka Sanjay Joshi

Dr. Pooja Sinha

Mr. Tapas Ranjan Samal

Ms. Madhushree A H

Ms. Ashwini S

Mr. Varun E

2. Centre for Clinical Research and Education

Projects undertaken during the year: 2020-2021

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work implemented	Principal Investigator and co investigators	Industry-Academia-Government-other country Collaboration Activities	Self-funded/ Funding agency (Industry)	Key achievements
1.	Systems Biology approach to delineate molecular signatures of Prakriti in healthy humans	Clinical Research-Exploratory study	Sample collected at 7 CCRAS centers across India Sample analysis will be at TDU	Dr. Poornima Devkumar Dr Ashwini Godbole Dr Vishnu Prasad	Collaborative project between Central Council for Research in Ayurvedic Sciences, (CCRAS), Jawaharlal Nehru University (JNU), International Centre for Genetic Engineering & Biotechnology (ICGEB)	AYUSH-CCRAS	-IEC approval completed -Initiated procurement of project consumables and equipment along with recruitment process for required human resource. Preparation of SOP for sample analysis is prepared.

Sl. No.	Title of the project/ program	Nature of Research	Place of work implemented	Principal Investigator and co investigators	Industry-Academia-Govern-ment-other country Collaboration Activities	Self-funded/ Funding agency (Indus-try)	Key achievements
2.	An exploratory pilot study to evaluate the effects of Ayurveda and yoga health practices on Swasthya (wellness) of the health seekers with special reference to respiratory health	Prospec-tive single arm pre-post ex-ploratory study	IAIM and TDU	Dr. Poornima Devkumar Dr Prakash Dr Prasan Dr Subraman-ya Dr Megha Dr Gurmeet	This is an inter center collabo-rative project of TDU- IAIM.	BOSCH-CSR fund	-IEC approval complete -278 participants were re-cruited for the study and intervention is being given.
3.	Exosomal biomarkers of obesity treatment	Clinical Biomarker study	IAIM and TDU	Dr. Satish Rao Dr Poornima Ms. Bhavya (MSc project work)			-Completed sample analysis and interpretations -Identified key exosomal markers of obesity treatment

Research work in detail:

1. Systems Biology approach to delineate molecular signatures of Prakriti in healthy humans

Source of funding: AYUSH-CCRAS

Relevance: Ayurveda classifies individuals into 7 specific types of Prakriti based on dosha composition. Understanding the physiological attributes of tridosha may help us understand the disease susceptibility. Exosomes are multivesicular bodies which are used as biomarkers due to their specificity and availability in various biofluids. This study, attempts to characterize the urine exosome profiles from healthy male individuals (n=294) identified across India belonging to 7 prakriti types classified by Ayurveda. The study also attempts to identify biomarker relevance of prakriti categories phenotypically classified at two time points Uttarayana and Dakshinayana. Based on the biomarker profiles, biological pathways would be correlated to the disease profiles to determine the disease susceptibility.

Highlights of progress/ achievements of projects/programs:
MoU was signed between the collaborating institutes. IEC approval for the study was obtained at TDU. The study received the funds for Year-I of the project. Recruitment of project personnel was initiated through advertisements. Procedures for procurement of Laboratory consumables and equipment initiated. The draft protocol for urine exosome isolation and analysis was developed and standardization of the same initiated.

Team members: Dr. Poornima Devkumar, Dr. Vishnuprasad, Dr. Ashwini Godbole, Dr. Satish Rao, Ms. Bhavya V

Signing of MoU between TDU and CCRAS

BOSCH team along with a few participants on their first visit to IAIM

2. **An exploratory pilot study to evaluate the effects of Ayurveda and yoga health practices on Swasthya (wellness) of the health seekers with special reference to respiratory health**
   This is a inter center collaborative project within TDU in which the centers CCRE, CLHT&P, CABHN, CTKDI and IAIM would be associated.

Source of funding: BOSCH-CSR

Relevance: Ayurveda defines wellness by the term Swasthya, a multifactorial homeostasis. An individual with a balanced homeostasis, diet and lifestyle practices is thus, less prone to diseases and illness, however such awareness about balanced lifestyle is lacking. In this study, an attempt was made to evaluate the effect of Ayurveda and yoga based health practices, implemented through an ecosystem for improving wellness of the health seekers. A total of 278 male and female apparently healthy individuals from 5 villages in Bidadi were identified, for the study.

Highlights of progress/ achievements of projects/programs:
Complete programme details have been covered in another section of annual report from CLHT while only the clinical portion of the project are highlighted here.

After obtaining required approvals from SASC and IEC, the study was registered with Clinical Trials Registry- India (CTRI). The recruitment of the participants was done as per the inclusion criteria, and a total of 278 participants were enrolled. They were evaluated for their Prakriti type, wellness (a validated questionnaire-based assessment), respiratory health and quality of Life. This study has both a tech

and touch component which is working using a software platform and ecosystem of health workers, health coaches and physicians. The participants were also evaluated for various lab investigations, bone mineral density test, body oxygen level test (BOLT) and 6-minute walk test. They were advised with customized diet and lifestyle including yoga, along with common intervention consisting of Kshamatva kashayam, anu thailam and tilataila gargling for everyday usage. The intervention lasted 6 months. The participants were evaluated again for the end line. Compliance and monitoring were carried out frequently along with monthly consultations with the physicians. Data analysis is initiated.

Team members involved : Dr. Poornima Devkumar, Dr. Prakash, Dr. Prasan Shankar, Dr Subramanya, Dr. Megha, Dr. Gurmeet, Mr. Varun Subramanyam, Dr Prashanth R, Dr. Neelambika GB, Dr. Rashel M Rego, Dr. Sahana, Dr. Shreelatha, Dr. Vikram Balu, Dr. Yashawini, Ms. Bhavya, Dr. Sreejesh, Dr. Bhargavi, Dr. Abhilash, Dr. Arpita, Dr.Poorvi, Dr. Soundarya RJ, Ms. Sushila, Ms. Asha, Ms. Shobha, Ms. Sudha, Mr. Prakash, Mr. Ashwin Perumal, Ms. Avineet Luthra, Mr. Raghavendra

Dr. Poornima orienting BOSCH participants

3. Exosomal biomarkers of obesity treatment

Source of funding: Internal funding

Relevance: Obesity is a rising pandemic and a risk factor of many chronic conditions including cancer, diabetes, hypertension etc. This study aims to identify biomarkers of obesity from urine samples of a clinical study on Ayurveda Lekhana basti obesity treatment. The study attempts to determine the key markers and pathways of interaction during the course of obesity management in Ayurveda and correlate to the literature evidence of obesity markers.

Highlights of progress/ achievements of projects/programs:
The study performed Polyethylene Glycol (PEG) based exosome isolation and mass spectrometric analysis of the trypsinized samples from n=6 at three timepoints of treatment, with a total of 18 samples. The proteomic analysis of the data indicated 12 pathways associated with digestion and absorption to be enriched at a significance of $p<0.05$. The top molecular pathways were related to intestinal transmembrane transport activity suggesting the relation between gut permeability and obesity. Further, the Gene Ontology (GO) analysis identified the genes which are common between biological processes, molecular functions and cellular components in this study. A disease gene correlation was conducted to determine the common genes from literature to the exosome data. The final output indicated 8 genes as the key biomarkers of obesity treatment with the differential expression pattern as expected from literature post-treatment. This is the first study to identify biomarkers of Ayurveda treatment on obesity using a non-invasive sample source.

Team members involved: Ms. Bhavya V, Dr. Satish Rao, Dr. Poornima Devkumar

Academics

Sl. No.	Name of Program	Audience	Final output (CME/ Certificate/ Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
1.	CME on Ayurveda dermatology	Faculty, Students of Ayurveda, PG scholars, Practitioners and Researchers	Continuing medical education (CME)	* One day CME * 65 participants * Reorientation and education of participants on various Ayurveda dermatological aspects and its approach through both Ayurveda and integrative management.	Self-funded	Dr Poornima Dr Shashidhar	Ms Bhavya V Dr Chumki Howlader Dr Sreelatha Dr Sahana Mrs Bhagya Mohan Mr Yogesh Dr Prasan Shankar	In zip file on CME-Dermatology
2.	Panchakarma therapy & Yoga Basics	10th grade pass candidates from rural parts of Odisha state	Certificate	* 6 months residential training * Fundamental Principles of Ayurveda * Concepts of Swasthavritta * Basic physiology of human body in Ayurveda * Elementary structures and functions of human body (Sharir Rachana and Sharir Kriya)	Odisha skill development authority	Dr Girish kumar V	Dr Sreeja Dr Devisree Dr Yashawini Dr Uday kumar Mrs Tarika Ms Bhavya V Mr Indrajit	

Sl. No.	Name of Program	Audience	Final output (CME/ Certificate/ Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Art-work about program
				* Medicinal plants & Medicine Preparation * Panchakarma * Basics of Yoga * Personal hygiene * Good Housekeeping * Spoken English * 21 students completed training				
3.	Pancha-karma therapy & Yoga Basics	10th grade pass candidates	Certificate	* 6 months residential training * Fundamental Principles of Ayurveda * Concepts of Swasthavritta * Basic physiology of human body in Ayurveda * Elementary structures and functions of human body (Sharir Rachana and Sharir Kriya) * Medicinal plants & Medicine Preparation * Panchakarma * Basics of Yoga	BOSCH CSR grant	Dr. Girish kumar V	Dr Sreeja Dr Devisree Dr Yashawini Dr Uday kumar Mrs Tarika Ms Bhavya V Mr Indrajit	See zip file on BOSCH PK

Sl. No.	Name of Program	Audience	Final output (CME/ Certificate/ Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Art-work about program
				* Personal hygiene * Good Housekeeping * Spoken English * 50 students completed training				
4.	General Duty Assistant	8th grade pass candidates	Certificate	* 3 months residential training * Broad functions of Patient Care Assistant * Introduction to Human Body Structure & Function * Personnel Hygiene and Professional Behavior * Bio Medical Waste Management * Emergency Medical Response * Soft Skills and communications * Basic nursing skills * Housekeeping skills * 50 students finished the training	BOSCH CSR grant	Dr. Girish kumar V	Dr Rashel rego Dr. Devisree Dr. Yashawini Mrs Shwetha Mrs Tarika Ms Bhavya V Mr Indrajit Mrs Bhagya lakshmi Mr Venkatesh	See zip file on BOSCH GDA

Academics work in detail:

1. Continuing medical education (CME) on Ayurveda dermatology

Source of funding: Self-funded

Relevance: The CME was organized to reorient and educate participants with various aspects of dermatology in Ayurveda.

Highlights of progress/ achievements of projects/programs:
65 participants from the field of Ayurveda, that includes students, PG scholars, teachers and researchers participated in the program. Eminent resource persons in the field of dermatology were invited to take the sessions from both Ayurveda and Allopathic fields to share their knowledge. Concepts like Functional- Anatomy and Physiology, Ayurveda understanding and assessment of Pathology, Clinical Examination of the Skin, Concepts of management of Dermatological diseases in Ayurveda and Approach to Integrative Dermatology were discussed.

Team members: Dr. Shashidhar, Dr. Poornima, Dr. Prasan Shankar, Dr Shreelatha, Dr Sahana, Mrs. Bhagya Mohan, Ms. Bhavya V, Dr. Chumki Howlader, Mr. Yogesh

2. "Panchakarma Therapist" training for youth of Odisha state

Source of funding: Orissa Skill Development Authority (OSDA)

Relevance: The program aimed at training unemployed youth with 10th grade across Odisha state, who are interested to work in paramedical-field and seek Placement-linked-training-programs. This training program, sponsored by OSDA, Government of Odisha, orients the youths with skills on Panchakarma therapy for a duration of 6-months. Each student is individually monitored and trained. The trained candidates will be facilitated for placement in various Ayurvedic & Wellness establishments across the country. Post placement they will also be shadowed for 3-6 months for continuity at work place and then the final report will be submitted to OSDA.

Highlights of progress/ achievements:

- Systematic selection process which follows qualitative parameters to grade/score the potential candidate's eligibility to enter the training was practiced.
- Effective evaluation of the training which includes assessment of Awareness, Knowledge & Skills by various methodologies was developed and administered.
- One batch of 21 students completed the training- of which 16 students got job placement at various Ayurveda establishments, while 5 students returned to their native places, due to COVID-19 pandemic imposed lockdown.

Team members: Dr. Girish Kumar V., Dr. Sreeja, Dr. Devisree, Dr. Yashaswini, Dr. Udaykumar, Ms. Tarika, Ms. Bhavya, Senior Therapists of I-AIM, Mr. Indrajit, Mr. Prashanth acharya, Mr. Eso gamango, Mr. Venkatesh Das

3. Bridge training, sponsorship program of TDU-BOSCH CSR grant, for unemployed youth across the country towards first employment, with special skills of General duty assistant & Panchakarma therapy.

Relevance: The program is a unique skill development training program in line with the BRIDGE model of BOSCH where potential unemployed youth across the country are identified for their need for first employment and trained in relevant skill sectors. Here the Bridge model of BOSCH CSR initiative has been supported by the BOSCH team with training of trainers & workbook support for basic skill in the area of communication & other specific skills that attract immediate job opportunities.

Highlights of progress/ achievements:

- The program accepted the students from a wide geographic reach. Students from various states of India including Ladakh, Arunachal Pradesh, Tamilnadu, Karnataka, Chhattisgarh, Uttar Pradesh, Kerala and Odisha, participated in this program.
- 100 Potential candidates who have passed 8th grade to 10th grade and are interested in paramedical work were screened and sourced.
- Fifty among the100 students selected General duty assistant (GDA) training for 3-months while another 50 selected Panchakarma therapy (PK) skills training for 6 months.

- Systematic Selection process which follows Qualitative parameters to grade/ score the potential candidate's eligibility to enter the training was practiced. Criteria for selection of candidates involved education qualification, socio-economic background, age, physical fitness, Personality trait, Prakriti body type, communication skills, etc which were individually scored qualitatively.
- Effective training evaluation mechanism (including the assessment of Awareness, Knowledge & Skills by various methodologies) was developed and carried out

All the 100 students completed their training. Around 60 students got placement immediately after the training in various health establishments. Remaining 40 students returned to their native places, due to COVID-19 pandemic imposed lockdown.

Team members: Dr. Girish Kumar V., Dr. Sreeja, Dr. Rashel Rego, Dr. Yashaswini, Dr. Devisree, Dr. Abdul kareem, Ms. Amrutha, Dr. Udaykumar, Sr. Shwetha, Ms. Tarika, Ms. Bhavya, Senior Therapists of I-AIM, Ms. Bhagyalakshmi, Mr. Venkatesh, Mr. Indrajit

3. Centre for Conservation of Natural Resources

Sl. No.	Projects	Team
1	Strengthening the National Herbarium, Raw Drug Repository, and multidisciplinary databases of Medicinal Botanicals of India.	Herbarium
2	Revisiting the 7 Medicinal Plants Conservation Areas in West Bengal Background	Herbarium
3	Development of an electronic database on medicinal plants of Andaman and Nicobar Islands	Herbarium
4	Study of Galls of Karkatashringi	Herbarium
5	Development and standardization of semi-processing technology to enhance the quality and market value of selected medicinal plants in Peechi Wildlife Sanctuary and Silent Valley National Park, Kerala.	JR team
6	Baseline survey of MPCAs in Karnataka	JR team
7	Conservation Assessment and Management Plan (CAMP) for Medicinal and Aromatic plants of Ladakh	AK team
8	Medicinal plants and health security	
9	Assessment of medicinal and aromatic plants species (including collection, usage, demand, market, price trends & life cycle) focusing on landscapes, with special references to RETs.	AK team
10	Preparation of People's Biodiversity Register of 13 Villages of Achanakmar Tiger Reserve Chhattisgarh	AK team
11	Design and development of innovative educational modules related to conservation and sustainable use of medicinal plants.	AK team
12	Preparation of PBRs of Chikkaallapura district, Doddaballapura and Devanahalli of Karnataka	AK team
13	Facilitating BMCs in Education, Awareness and Skill Development and preparation of People's Biodiversity Registers (PBRs)in Haryana	Chetan team
14	Documentation of Textual Literature on Ecology & Biodiversity of Chhattisgarh State Chhattisgarh, India	Chetan team
15	Impact of Climate Change on wild populations of Medicinal Plants of Conservation Concern (Endemic, Niche-specific & Red Listed): A Futuristic Scenario	BSS team
16	Study on Phenological Response of Endemic Plants of the Western Ghats to Climate Change: Based on Herbarium records, Historical datasets & Ground truthing	BSS team

Sl. No.	Projects	Team
17	Revitalization of MPCA and MPDA program; Review of the progress and conservation status of MPCAs, and Guidelines for strengthening the Program	BSS team
18	Project 18a - Development of Geospatial Database for HD Kote Taluka (Funded by AYUSH, Govt of Karnataka	Sangeetha and team
19	Project 18b - Development of Geospatial Web Portal for HD Kote Taluka Herbal Pharmacopeia Portal & collaborative portal with KSRSAC KGIS Health portal and virtual launch (Funded by AYUSH, Govt of Karnataka)	Sangeetha and team
20	Project 18c - Hd Kote taluka database on KSRSAC-KGIS Health portal	Sangeetha and team
21	Project 19a- Development of a Course Module on Geographical Information systems (1- credit) Project 19b.Preparation of GIS maps for two concepts. (Agroecological zone and Desh Vichaar concept).	Sangeetha and team
22	Capacity building and exchange and enrichment of major Indian medicinal plant resource (December 2020)	Suma and team
23	Development of a comprehensive database on folk level medicinal uses recorded in Ethno-botanical publications	Suma and team

1. Strengthening of National Herbarium, Raw Drug Repository and multidisciplinary databases of Medicinal Botanicals of India.

Relevance: The National Repository of the medicinal plants of India at TDU is the only medicinal plants herbarium in the country. It brings together a range of information related to medicinal plants of the country (vernacular names, currently accepted botanical names, specific location of its occurrence on the Indian territory, including -latitude, longitude, altitude details). It also involves the collection of morphological variations of select species. The herbarium and raw drug repository serve as one-stop center for the information related to medicinal plants used in Indian Systems of Medicine. The traded botanical in raw drug repository is a referral collection for research for authentication of botanicals traded in the country.

Highlights: 3338 voucher specimens were collected from southern India, North East India, and the Andaman Islands. These specimens were processed, mounted, labelled during the academic year. These collections include 400 species (1638 voucher specimens) from Karnataka, 70 species (200 voucher specimens) from Tamil Nadu, 250 species (800 voucher specimens) from the Andaman Islands; 100 species (300 voucher specimens) from Manipur; 175 species (400 voucher species) from West Bengal.

In the Raw Drug Repository, 210 plant samples collected from the market were critically identified, curated, and added to the repository. The addition of 1400 plant images representing their habit, habitat, population, and key diagnostic characters were made to the repository collections.

Project Team: PI: Dr. K.Ravikumar, Team: Dr. S. Noorunnisa Begum, Dr. N. Dhatchanamoorthy

2. Revisiting of 7 Medicinal Plants Conservation Areas in West Bengal

Relevance: The study involves re-visiting 7 MPCAs in West Bengal, which were established from 2000 to 2005. The fieldwork focused on studying the wild populations of threatened medicinal plants, and shortlisting of species for threat assessment at the State level and conducting the CAMP exercise, followed by ground-truthing.

Highlights: The team carried out botanical studies, in which 60 species were recorded and collected in Bonnie CAMP MPCA, Sundarbans, West Bengal.

The team carried out community studies in 140 households in three villages viz., Bagmara, Shiulibari, and Rampur. A stratified sampling method with a semi-structured questionnaire format was used to gather the required information from farmers, traditional healers/ kabiraj, govt. workers, teachers, students, and others.

A total of 63 medicinal plants are used by the local communities residing in the three villages around Garpanchkot MPCA, Purulia. Of these, a total of 17 species have been recorded for their trade. Few of these species are restricted to the local markets only.

Some of the highlights of collections from Mangroves of Sundarbans, West Bengal

Sl. No.	Coll. No.	Botanical name	Family	Habit
1	124462	Avicennia alba Blume	Acanthaceae	Tree
2	124496	Avicennia marina (Forssk.) Vierh.	Acanthaceae	Tree
3	124495	Avicennia officinalis L.	Acanthaceae	Tree
4	124456	Bruguiera cylindrica (L.) Blume	Rhizophoraceae	Tree
5	124451	Bruguiera gymnorhiza (L.) Lam.	Rhizophoraceae	Tree
6	124497	Ceriops decandra (Griff.) W.Theob.	Rhizophoraceae	Small tree
7	124457	Ceriops tagal (Perr.) C.B.Rob.	Rhizophoraceae	Tree
8	124488 124487	Excoecaria agallocha L. (Female &Male flowers)	Euphorbiaceae	Tree
9	124492	Rhizophora apiculata Blume	Rhizophoraceae	Tree
10	124493	Rhizophora mucronata Poir.	Rhizophoraceae	Tree
11	124504	Sesuvium portulacastrum (L.) L.	Aizoaceae	Herb
12	124459	Sonneratia alba Griff.	Lythraceae	Tree
13	124491	Sonneratia caseolaris (L.) Engl.	Lythraceae	Tree
14	124502	Sonneratia griffithii Kurz	Lythraceae	Tree
15	124509	Suaeda maritima (L.) Dumort.	Chenopodiaceae	Herb
16	124465	Tamarix troupii Hole	Tamaricaceae	Shrub

Team Members: PI-Dr. S. Noorunnisa Begum, Team: Dr. K. Ravikumar,, Dr. N. Dhatchanamoorthy, Dr. Debabrata Saha, Mr. Arun

Bruguiera cylindrica

3. Development of an electronic database on medicinal plants of Andaman and Nicobar Islands

Relevance: The database of medicinal plants of Andaman and Nicobar Islands will be useful to understand the available medicinal plant resources for research and conservation action programs.

Highlights: The team worked on the nomenclature and distribution of 1100 medicinal plant species in the database. The special section on traded and threatened medicinal plants was added to the database. The team completed the fieldwork and the ecological studies. The ecological studies involved laying 45 transects in the north, middle, and south Andaman Islands. Those 45 transects were laid in 5 different landscapes like five predominant forest types viz, evergreen, semi-evergreen, moist deciduous, littoral, and mangroves. In the present study, a total of 451 plant species were recorded in all the 45 studied plots. They were further classified as 199 trees, 151 shrubs (including tree saplings), 55 climbers, and 217 understory species (including grasses and seedlings-Table 1). Among the 451 species, 17 species have highly traded potential medicinal values (RET). The predominant medicinal plants like Abelmoschus moschatus, Abrus precatorius, Achyranthes aspera, Aegle marmelos, Aphanamixis polystachya, Asparagus racemosus, Baccaurea ramiflora, Caesalpinia bonduc, Celastrus paniculatus, Cyperus rotundus var. tuberosa, Embelia ribes, Operculina turpethum, Oroxylum indicum, Podocarpus neriifolius, Pongamia pinnata, Terminalia citrina and Tinospora cordifolia were recorded in the study plots.

Project Team: PI: Dr. S. Noorunnisa Begum, Team: Dr. K. Ravikumar, Dr. N. Dhatchanamoorthy, Mr. Arun

4. Study of Galls of Karkatashringi

Relevance : Pistacia chinensis subsp. integerrima (J. L. Stewart ex Brandis) Rech. f. belongs to family Anacardiaceae; a dioecious tree; native to Asia; widely distributed in eastern Afghanistan, Pakistan, North West, and West Himalaya. In India, it is called by different names such as Kakra, Kakar Singhi, Karkatashringi. It is an important medicinal plant used in Ayurveda and other Indian systems of medicine. The horn-shaped galls on leaves and petioles are traded. There has been fluctuation and a decrease in gall formation due to the demand of the herbal industries and local healers. This project aims to study the distribution of Karkatashringi. To study the factors affecting gall formation and to understand the bottleneck in galls production.

Highlights of progress/ achievement:

- Two distinct kinds of galls were found on the Pistacia trees. One form is in circular/ globular shape with pinkish-red coloration. On the exterior, it is elongated, thin, and dull green.

- On average, about 80- 100 galls per tree were found, but all had been aborted.
- Noticeable was the fact that both types of galls had this sticky droplet oozing from them.
- The team has carried out pharmacognostic studies of the galls. The transverse section of galls showed a single layer of the epidermis and air & lumen (upper & lower) cells. Parenchymatous cells are rounded and elongated cells with polyphenols and tannin inclusions and calcium oxalate crystals. vascular bundles are two rows, collateral open more development in an upper layer. Secretory ducts are present in phloem cells.

Project Team: PI: Dr. S. Noorunnisa Begum, Team : R. Patturaj, Dr. K. Ravikumar

5. Development and standardization of semi-processing technology to enhance the quality and market value of selected medicinal plants in Peechi Wildlife Sanctuary and Silent Valley National Park, Kerala.

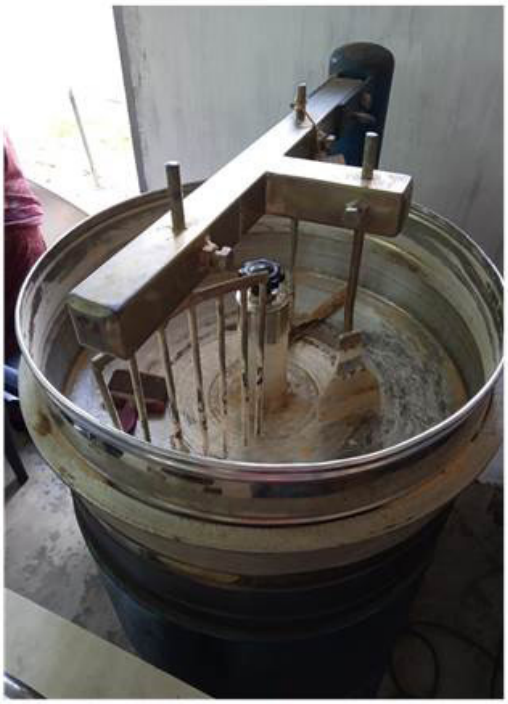
Relevance: It was an attempt to explore value addition and semi-processing opportunities that can happen at the field level with minimal machinery requirements for the tribal collectors in eight Eco-Development Committees (EDCs) in Silent Valley and Peechi study sites. The main objective of this project is to explore the prospects of post-harvest management practices for 14 medicinal plant species and honey. Additionally, the development and standardization of semi-processing and packaging methods were made to improve the quality of the herbal products for supplying to the herbal industries.

Highlights of progress/ achievement:

- Prioritized the 14 medicinal plant species and honey for the development of semi-processing techniques following the selection criteria
- Documented the simple processing methods or post-harvest management techniques practiced locally by community members through interviews and meetings
- Consulted with industry on their requirements and standards with semi-processing and value addition practices
- Conducted need assessment for infrastructure and tools and equipment needed for organizing semi-processing and value addition practices locally
- Conducted meetings with local community members and plants collectors to take their opinions on the developed semi-processing and packaging technologies, and also to explore ways to implement these practices
- Organized consultation meetings with Forest department officers on how to implement semi-processing technologies among local community members
- Developed and finalized the species-specific semi-processing practices for the prioritized species after incorporating the suggestions made by herbal industries and community members

Project Team: PI: Mr. Jagannatha Rao R, Co-PI: Dr. Arthur Selwyn Mark,Field Coordinator, Kerala: Mr. A.K. Pramod,

Visit to a Kudumbasree Mission supported unit in Palakkad provided with machineries to grind and mill the plant items to make value added saleable products in powder and paste form



6. Baseline survey of MPCAs in Karnataka

Relevance: The Karnataka Forest Department from the year 1993-2017, had established 17 Medicinal Plants Conservation Areas (MPCAs) with technical support from TDU-FRLHT. This project had the goal of undertaking a baseline survey in all the 17 MPCAs (Table 1) to develop a long-term monitoring strategy for the management and conservation of medicinal plant species of Karnataka.

Table 1: List of MPCAs in Karnataka

Sl. No.	MPCA	Forest range	Forest division	District
1	BRT hills	BRT	BRT Tiger Reserve	Chamrajnagara
2	Talacauvery	Talacauvery	Madikeri (T)	Madikeri
3	Savanadurga	Magadi	Ramanagara (T)	Ramanagara
4	Subramanya	Subramanya	Mangaluru (T)	Mangaluru
5	Charmadi	Belthangadi	Mangaluru (T)	Mangaluru
6	Devrayandurga	Tumakuru	Tumakuru (T)	Tumakuru
7	Kudremukh	Karkala Wildlife	Karkala Wildlife	Chikkmagaluru
8	Kemmangundi	Bhadra Wildlife	Chikkamagaluru (T)	Chikkmagaluru
9	Agumbe	Karkala Wildlife	Karkala Wildlife	Shivamogga
10	Devimane	Janmane	Honnavar (T)	Honnavar
11	Sandur	Sandur	Bellari (T)	Bellari
12	Karpakapalli	Humnabad	Bidar (T)	Bidar
13	Kolluru	Karkala Wildlife	Karkala Wildlife	Udupi
14	Baluru	Mudigere	Chikkamagaluru (T)	Chikkamagaluru
15	Bababudangiri	Mudigere	Chikkamagaluru (T)	Chikkamagaluru
16	Kanakambi	Kanakambi	Belagavi (T)	Belagavi
17	Kappathagudda	Mundargi	Gadag (T)	Gadag

Highlights of progress/ achievement:

- The current status of the 17 MPCAs such as entrance gate and structure, boundaries, communication and interpretation utilities, maintenance of trekking paths, forest department's interventions such as soil and water conservation measures, de-weeding, prevention of grazing, etc., were documented.
- A final technical report was prepared on the current status of the 17 MPCAs and long-term management strategies covering in situ conservation, resource augmentation, support to JFMCs/ BMCs, training and capacity building programs, and home herbal gardens. This study and its outcomes were presented to the Principal Chief Conservator of Forests, Head of Forest Force, (PCCF, HoFF), Karnataka Forest Department along with other top-level officers in Aranya Bhavan on 26th February 2021.

Project Team: PI: Mr. Jagannatha Rao R., Scientist F, Co-Pi: Dr. Arthur Selwyn Mark, Research Associate

7. Conservation Assessment and Management Plan (CAMP) for Medicinal and Aromatic plants of Ladakh

Relevance: Ladakh is rich in medicinal plants and traditional knowledge associated with it. Owing to the excessive anthropological and climatic factors, the medicinal plants of the cold desert are highly threatened in their natural habitat. It is necessary to intensify the efforts to conserve (both in situ and ex situ conservation) and cultivate medicinal plants for the prevention of further depletion of herbal wealth. Ladakh requires CAMP to evaluate their threat status and provide recommendations for intensive management of medicinal plants. In this project, an effort has been made to conduct CAMP for listing the conservation concern species for in situ and ex situ conservation.

Highlights of progress/ achievements of projects/programs:

- There are 62 prioritized medicinal plant candidate species from Ladakh of conservation concern due to habitat degradation, excessive collection, endemic, threatened, population reduction from secondary sources such as published floras, books, research papers and earlier assessed reports.
- The online PRE-CAMP workshop was organized on 11th and 12th December 2020 with the experts to finalize the candidate species for assessment during the CAMP workshop proposed during March 2021. The experts added 51 more species to the list, hence the working list increased to 113. The deliberations happened on 113 species and prioritized 55 species based on the occurrence, population reduction, uses, and threat status.

Project Team: PI:Dr. M. Abdul Kareem Team:Dr. K. Ravikumar, Dr. T.S. Suma & Mr. Fayaz Hussain.

8. Medicinal Plants and Health Security

Relevance: This component will demonstrate a multi-faceted, bio-cultural intervention around medicinal plants to create a multilingual participatory knowledge portal, undertake spatial mapping, strengthen herbaria, undertake in situ conservation, establish community health and livelihood security programs, impact UHC and generate organic solutions for livestock and agriculture. The program design and strategy can also serve to guide planning for "One Health" in developing countries, in Asia, Africa, and South America. The key players involved in design and execution.

Highlights of progress/ achievements of projects/programs

- Organized one inter-state virtual workshop on 27th March 2021 titled "National Consultation on Citizens' Portal on Medicinal Plants" to demonstrate the potential applications of the multi-faceted citizens' portal on medicinal plants to identified State-level partners (forest departments, civil society organizations, CBOs, R&D organizations, university researchers, schools – in Karnataka, Rajasthan, Chhattisgarh, Maharashtra, and Sikkim) and obtain feedback and suggestions for improvement. Around 74 members participated in the workshop.

- A shortlist of high volume traded, endemic, and threatened species that occur in each of the five States were identified and prioritized for both in situ conservation and value addition for health and livelihood security data by analyzing data on geographical distribution, trade data, information on endemism and IUCN threat lists has been prepared. Current status of medicinal plants recorded - Karnataka (1838 species), Maharashtra (2000 species), Rajasthan (367 species), Sikkim (1681 species), Chhattisgarh (1377 species). Literature work is being continued. The number of threatened medicinal plants recorded in each of the above states are Karnataka (81 species), Maharashtra (35 species), Rajasthan (38 species), Sikkim (46 species), Chhattisgarh (47 species)
- A Standard trans-disciplinary draft protocol was developed for R&D. The value addition to selected species of high therapeutic value to develop star products for scalable community enterprises and health security program has been prepared.
- A technical report to guide the development of a comprehensive National Medicinal Plants Herbarium of India filling the current gap areas viz: Species that need to be added to National Medicinal Plant Herbarium accessions in TDU to capture all the plants documented in codified classical literature of Indian systems of medicine has been prepared.
- A roadmap on medicinal plant health security for the execution of the full-fledged National Biodiversity Mission has been prepared.

Project Team: Advisor: Shri. Darshan Shankar, Dr. Atul Kumar Gupta, PI. Dr. M. Abdul Kareem, Team: Mr. Prabakaran, Ms. Varnita (Metastring Foundation) Dr. Noorunnisa Begum, Dr. Chetan H.C., Dr. Vishnu Prasad, Dr. Dhatchana Murthy, Mr. Varun, Mr. Nishanth Gaurav, Mr. Naresh

9. Assessment of medicinal and aromatic plant species (including collection, usage, demand, market, price trends & life cycle) focusing on landscapes, with special references to RETs.

Relevance: The high-range Himalayan ecosystem in India is of critical importance for the biodiversity and ecosystems of global significance that it harbors. It forms an important life-support system for many remote agro-pastoral communities that depend on it. These natural ecosystems are under severe threat from the high dependence of local communities on natural resources, pressures from economic development, selective unsustainable removal of medicinal and aromatic plants, and the emerging threats of illegal wildlife trade and wildlife crime. To address these threats, the project SECURE Himalaya aims to demonstrate best practices of conservation for scaling up and replicating in other landscapes nationally and globally. In this project, an attempt has been made in identification of suitable forest sites for establishing Medicinal Plant Conservation and Development Areas.

Highlights of progress/ achievements of projects/programs

- More than 150 references (scientific papers, books, unpublished technical reports,

online resources etc.) related to focal topics such as Biodiversity Conservation, climate change, ethnobotany, folk traditions, rapid surveys, ecology of the region was referred and a comprehensive understanding of the status of MAPs of the study area was generated.

- Sustainable harvesting and collection protocols were developed, which provide species-related information (scientific name, common/ local/ trade names, habit, habitat, description, phenology, mode of propagation, medicinal uses, geographical distribution, threat status based on IUCN criteria, resource assessment and good collection practices).
- Harvesting techniques of the focal species were collected from published literature and field sources by using structured questionnaires. Phenology of focal species, quantum and season of collection, assess the harvesting mechanisms and sustainable harvesting protocols was developed appropriate to the existing conditions.
- Identifying appropriate sites for establishing MPCAs for the focal 10 species was attempted, initially from the perspective of HCV (High Conservation Value), with the assumption that such sites could be eventually treated as suitable sites for MPCAs.

Project Team: PI:Dr. M. Abdul Kareem, Mr. Somashekhar Team: Dr. Ravi Kumar K. Mr. Jagannatha Rao, Dr. Noorunnisa Begum, Dr. Suma T.S, Dr. Chetan H.C, Dr. Dhatchana Murthy, Dr. Arthur Mark, Mrs. Sathya Sangeetha, Mrs. Deepa srivathsa, Mrs. Bhagyalakshmi KB, Srujana (Intern), Mrs. Nandini D, Mr. Arun Kumar, Mrs. Amrita G.

10. Preparation of People's Biodiversity Register of 13 Villages of Achanakmar Tiger Reserve Chhattisgarh

Relevance: The People's Biodiversity Register (PBR) is a mandatory document to be prepared in all levels of panchayats in India according to the Biodiversity Act 2002. This is one of the most crucial steps to preserve Traditional Knowledge of communities, recognizing Local Healers and giving them a platform, power, and responsibility to manage the local Biodiversity present in the area.
The document can also be used for livelihood creation based on the guidelines of NBA and declare Biodiversity Heritage Sites. This can be very beneficial to the region.

Highlights of progress/ achievements of projects/programs:

- The BMC members and community members were familiarized with the provisions of the Biological Diversity Act, People's Biodiversity Register, and the possible advantages of engaging in the PBR process. The public was sensitized about the study, survey, and possible management.
- Training of members in identification and collection of data on biological resources and traditional knowledge was completed based on guidelines of National Biodiversity and using local resources.

Project Team: PI:Dr. M. Abdul Kareem, Team:Mr. Nishanth Gaurav.

11. Design and development of innovative educational modules related to conservation and sustainable use of medicinal plants.

Relevance: Foundation for Revitalization of Local Health Traditions, Bangalore with the support of Infosys Foundation, Bangalore has developed a unique one-day orientation program for the students pursuing their secondary education. To give the students an opportunity to learn the basics of plant identification, primary health care, and biodiversity conservation. This program has been designed in line with their school curriculum. This program will broaden their understanding about nature (specifically plants) and help them develop their interest in urban nature conservation. This could be a precursor to any environmental education program that the government wishes to introduce at the school level.

Highlights of progress/ achievements of projects/ programs:

- Online teacher's training program was conducted on Primary Health Care, a tour of Ethnomedicinal garden, Introduction to the terrace garden and short stories on Biodiversity conservation for 100 government high school teachers on 31st October 2020.
- One day training program on the Identification of medicinal plants and primary health care was conducted at Mahila Samaja, Doddaballapur on 19th December 2020 to create awareness on usage of medicinal plants as primary health care for rural women.
- Due to Pandemic the yearly school program was paused. The 4 sessions on Biodiversity Conservation, Primary Health care, Identification of medicinal plants, and introduction to terrace gardening was broadcasted on Doordarshan - DD Chandana. This program reached government school students and teachers of Karnataka. The program was appraised by viewer's feedback and telephonic discussion. Finally, a report on Teacher's training program was prepared.

Project Team: PI:Dr. M. Abdul Kareem, Team: Ms. Amrita G.

12. Preparation of PBRs of Chikkaballapur district, Doddaballapura and Devanahalli of Karnataka.

Relevance: The People's Biodiversity Register (PBR) is a mandatory document to be prepared in all levels of panchayats in India according to the Biodiversity Act 2002. This is one of the most crucial steps to preserve Traditional Knowledge of communities, recognizing Local Healers and giving them a platform, power, and responsibility to manage the local Biodiversity present in the area.

The document can also be used for livelihood creation based on the guidelines of NBA and declare Biodiversity Heritage Sites. This can be very beneficial to the region. The regions of Chikkaballapura, Bangalore rural, and Mysore are filled with a plethora of Biodiversity and consist of natural historical places.

Highlights of progress/ achievements of projects/programs:

- The BMC members and community members of 2 districts, 10 talukas, and 6 urban local bodies were familiarized with provisions of the Biological Diversity Act, the concept of People's Biodiversity Register, and possible advantages of engaging in the PBR process.
- Around 100 vaidyas/Local healers were identified across 2 districts, 10 talukas, and 6 urban local bodies and were involved to document data. This was done according to the prescribed formats.
- Around 1000 plus flora and fauna species and associated traditional knowledge was recorded in the People's Biodiversity Registers.
- The press release of the People's Biodiversity Registers of Bagepalli CMC and Gudibande TMC was completed in the presence of local media newspapers, local news channels, BMC members, and relevant stakeholders.

Team members: PI:Dr M. Abdul Kareem, Center Head, CCNR Team: Ms. Amrita, FRLHT, Nishanth Gurav, Research fellow, FRLHT, Arun N, Taxonomist, FRLHT, Mr. Chidanand- Doddaballpur CMC, Mrs. Thribhuneshwari, Bagipalli, Gauribidnur and Gudibande taluk Panchayat

13. Facilitating BMCs in Education, Awareness and Skill Development and preparation of People's Biodiversity Registers (PBRs) In Haryana.

Relevance: The Biological Diversity Act 2002 provides for the establishment of Biodiversity Management Committees (BMCs) and preparation of People's Biodiversity Registers (PBRs) in all local bodies (Panchayats, Municipalities, and blocks) of Rohtak, Nuh, and Palwal districts. The preparation of PBR mainly focuses on participatory documentation of local biodiversity, traditional knowledge, and local practices. These documents are seen as key legal documents in ascertaining the rights of local people over the biological resources and their associated traditional knowledge.

Highlights of progress/ achievements of projects/programs:

The proposed activities have resulted in

a) Sensitization of the public about the study, survey, and possible management
b) Raining of BMC members, Panchayats and folk healers and local communities in identification and collection of data on biological resources and traditional knowledge
c) Collection of data. Data collections includes a review of literature on the natural resources of the districts, Participatory Rural Appraisal (PRAs) at the village level, household interviews, individual interviews with village leaders and knowledgeable individuals, household heads, key actors of the panchayat raj institutions and NGOs and direct field observations
d) Analysis and validation of data in consultation with a technical support group and BMC
e) Preparation of People's Biodiversity Register (PBR)
f) Computerization of information and resources

Project Team: Prof. Atul Kumar Gupta IFS Retd. (advisory), PI: Chetan HC, Team: B. S. Somashekar (expert), Ms. Nandini (expert), Ms. Pallavi Vishnoi (expert), Ravi Ramalingam (expert), Ms. Sheetal Singh (coordinator), Mr. Manish Kumar (coordinator), Mr. Akshay Kumar (coordinator), Mr. Aryan Vats (coordinator), Mr. Ankith (coordinator) and more than 100 local volunteers

Project 14. Documentation of Textual Literature on Ecology & Biodiversity of Chhattisgarh State Chhattisgarh, India

Relevance: Since 2000, Chhattisgarh declared as a new state, state owned knowledge has become a tool for implementing policies and future proposed activities. In this regard, Chhattisgarh State Biodiversity Board (CHSBB) initiated consolidating the knowledge which is already available within State and National public libraries, Universities, Colleges, and book publishers. This knowledge will be used for the ongoing projects and future activities reference materials of the SBB.

Highlights of progress/ achievements of projects/programs:

Consolidated and printed 532 peer-reviewed articles and reports on Medicinal plants, Agriculture, Ecology, Flora, and Fauna.

Archived 14 Ph.D. thesis which was carried out within Chhattisgarh on Flora, and Fauna enumeration, Medicinal plant, and Agriculture, Ecology.

All the resources archived using JabRef index software and also catalog.

Project Team: PI: Dr. Chetan HC Team: Dr. Abdul Kareem, Ritesh Kumar Shricar, Mr. Samarth Karanth

Haryana Biodiversity Management Committee awareness program

15. Impact of Climate Change on wild populations of Medicinal Plants of Conservation Concern (Endemic, Niche-specific & Red Listed): A Futuristic Scenario

Title of the project/ program	**Impact of Climate Change on wild populations of Medicinal Plants of Conservation Concern (Endemic, Niche-specific & Red Listed): A Futuristic Scenario**
Nature of Research	Qualitative and quantitative- Literature review, followed by field ecological study.
Place of work implemented	Central Western Ghats of Karnataka
Principal Investigator	Somashekhar B S
Industry-Academia-Government -other country Collaboration Activities	Collaboration by Academia. Scientists from the University of Agricultural Sciences, Dharwad Forestry College, Sirsi were associated, who also shared some of their datasets. Within India collaboration.
Self-funded/ Funding agency (Industry)	MoEF & CC, Govt. of India, New Delhi
Project duration	2018-2020
Key achievements	Elaborated below

Relevance: Climate change has sparked a widespread interest among the scientific fraternity about studying its impact on biodiversity. In India climate change research is of recent origin and is confined to temperate landscapes, leaving behind a gap in respect of the tropical forests. Understanding the impact of climate change on medicinal plants in India becomes a priority, since the majority of high volume traded medicinal plants in India are sourced from tropical landscapes while the current projected climate scenarios have considered such tropical landscapes are vulnerable to climate change.

This study is thus an attempt to address this gap by way of developing an overview about the impact of climate change on wild populations of medicinal plants, based on published literature on climate change studies in India.

Highlights of Project progress/ Achievements:

The study focused on selected NTFP tree species of medicinal importance from the Western Ghats, which are endemic and niche specific, with a limited distribution range (table1 below). These are:

Continuing from the previous year (2019-20), the Climate Change study team during the current year, was engaged in the following activities and successfully completed them.

Table 1: Focal species of Medicinal plants considered for the study

Artocarpus lakoocha	*Garcinia gummi-gutta@*	*Hydnocarpus pentandra #*
Artocarpus gomezianus	*Garcinia indica #*	*Mesua nagassaricum*
Calophyllum apetalum#	*Garcinia morella #*	*Myristica malabarica #*
Calophyllum inophyllum	*Garcinia xanthochymus*	*Myristica fatua var. magnifica **
Cinnamomum macrocarpum#	*Holigarna arnottiana*	*Saraca asoca **
*Cinnamomum riparium**	*Hydnocarpus macrocarpum #*	*Vateria indica #*
Threat status: # Vulnerable, *Endangered, @Near Threatened		

a) Literature Review: Impact of climate change-futuristic scenario: emerging trends The team critically reviewed the literature and datasets gathered from different sources during the previous year and completed the analysis. The study indicated that, the overall futuristic scenario of medicinal plants along the Western Ghats broadly conforms to the currently available projections of climate change related to other tropical forests. This may be seen in the form of,

§ Altered distribution of a species (range shift and range expansion)
§ Altered population structure along altitudinal gradient
§ Large variation in growth and phenology,
§ Large variation in overall yield and productivity.

The Literature review further identifies that the Impact of climate change on medicinal plants would result in cascading changes, which would be seen as : a) growth in a new location leading to an altered pace of growth (slow or rapid), b) altered pace of flowering (early or late flowering and fruiting), c) this timing would be incompatible with the dependent pollinators and seed dispersers visit- such failure or disturbed visitations might lead to poor pollination, poor seed set, poor dispersal and consequently poor seed material availability for regeneration. Poor regeneration would lead to poor survival of the population and in the long run local extinction. Such local extinctions of many species despite the expansion of their range and presence of congenial climate, would be disastrous.

The future predictions of medicinal plants scenario due to climate change, may be summarized as:

1. There will be degradation of evergreen forests in the northern western ghats, while the southern parts will be fairly stable. This would imply all those medicinal plants originating from these landscapes would be greatly affected. The overall habitat suitability of niche specific plant species will be adversely affected and reduced from these landscapes.
2. Habitats of endemic flora in the northern western ghats, will be drastically reduced and as a result, there will be large scale range shift in south-South western direction. There will be local extinction of many endemic species in the

northern Western Ghats (particularly species of Garcinia, Cinnamomum, Surgi, Myristica, Syzygium, Ashoka) would soon vanish.

3. There will be reduced availability of local plant resources, currently dominating local food and medical traditions. Species such as *Artocarpus lakoocha, Garcinia morella, Zanthoxylum rhetsa* and *Semecarpus anacardium*, whose fruits are used in local cuisine would soon become scarce.
4. There is a likely reduction in the overall yield of major NTFP-Medicinal trees (*Garcinia indica, Garcinia gummi-gutta, Garcinia morella, Artocarpus lakoocha, Semecarpus anacardium, Myristica dactyloides, Myristica malabarica, Mammea suriga, Mesua ferrea, Cinnamomum malabathrum, Cinnamomum sulphuratum*). The future predictions (based on early symptoms and altered flowering patterns as noticed by community groups), indicate drastic yield reduction in many major NTFP species (almost all Garcinia spp., all Myristica spp, all Cinnamomum spp, all Artocarpus spp, *Mammea suriga*). Consequently, the regeneration potential of wild populations will be reduced, which in turn will lead to gradual deterioration of productivity of a given landscape. This will adversely affect the lives of local communities, associated with collection, and trade of NTFPs.

The Synthesis puts together a collective picture of 4 kinds of verifiable changes due to climate change: Altered distribution may emerge with all the focal species, except Calophyllum ionophyllum and Saraca asoca. Wild population structure may undergo change in all the species except, Artocarpus lakoocha, Garcinia gummi-gutta, Garcinia morella, Knema attenuata, Mesua ferrea and Shorea roxburghii. Growth cycles would be altered in all the species except, Knema attenuata, and Shorea roxburghii. Likewise, the yield will be altered in the majority of species, with no major effect in Calophyllum apetalum, C. inophyllum, Cinnamomum macrocarpum, Holigarna arnottiana, Knema attenuata, Mesua ferrea, and Saraca asoca.

Project Team PI:Somashekhar B S Team: Dr.Noorunnisa Begum

Photo 1: Delayed onset of flowering noticed in the recent years, in many population clusters of Shorea roxburghii across Tumkur, Mandya and Ramanagara districts (drift in the Peak flowering month is noticed from February to March).

16. Study on Phenological Response of Endemic Plants of Western Ghats to Climate Change: Based on Herbarium records, Historical datasets & Ground truthing

Title of the project/ program	**Study on Phenological Response of Endemic Plants of Western Ghats to Climate Change: Based on Herbarium records, Historical datasets & Ground truthing**
Nature of Research	Qualitative and quantitative- Literature review, followed by field ecological study.
Place of work implemented	Central Western Ghats of Karnataka
Principal Investigator	Somashekhar B S
Industry - Academia - Government-other country Collaboration Activities	Collaboration by Academia. Scientists from University of Agricultural Sciences, Dharwad Forestry College, Sirsi were associated, who also shared some of their datasets. Within India collaboration.
Self-funded/ Funding agency (Industry)	MoEF & CC, Govt. of India, New Delhi
Project duration	2018- 2020
Key achievements	Elaborated below

Relevance: Phenology, the study of the key growth stages in a plant, is considered one of the most sensitive biological indicators of climate change, and studying the phenology has become an important means of understanding the impact of global warming and climate change. Impact of climate change on medicinal plants in India will be significant and any decline in their productivity will adversely affect their usage for health care, as well as their trade. It is therefore a priority issue to address this issue.

However, there is a dearth of long-term data on flowering of perennial medicinal plants in India. The present study attempted to fill this gap by relying on 3 surrogate sets of long-term datasets: a) herbarium sheets collected during the last century, b) published and unpublished phenology research data, c) qualitative data from NTFP collectors and local communities, about variations in harvest cycles and flowering patterns, and d) ground-truthing. These data were used to examine the phenological patterns of select endemic medicinal plants in the Western Ghats, as a means of understanding the impact of climate change.

Highlights of Project progress/ Achievements:

The following species were considered for the study. C*alophyllum apetalum, Cinnamomum macrocarpum, Garcinia indica, Myristica malabarica, Saraca asoca, Vateria indica, Dysoxylum malabaricum, Kingiodendron pinnatum, Mammea suriga, Shorea roxburghii*

These are known to be niche-specific, habitat specialists, and endemic species with limited distribution range, and are considered vulnerable to climate change.

a) historical data on phenology -through Herbarium data

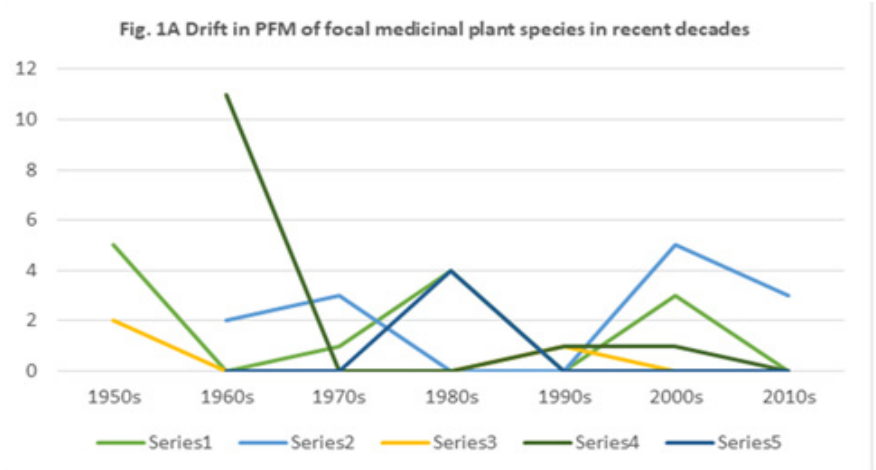
As the authentic source of phenology data from the herbarium sheets of 10 focal species, the team completed consulting the top 7 herbaria in the country (Botanical Survey of India, Coimbatore; French Institute, Pondicherry; Institute of Forest Genetics & Tree Breeding (IFGTB), Coimbatore; Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Trivandrum; Kerala Forest Research Institute (KFRI), Peechi and Shivaji University, Kolhapur).

Herbarium sheets of the focal species for the period 1950-2015 were examined and data from 285 herbarium sheets gathered (date & place of collection, latitude-longitude, phenology). It includes 172 records with flowering data and 113 records with fruiting data. The 285 herbarium records were further analyzed to ascertain peak flowering month (PFM)[1]. The PFM of a species was aggregated under different decades and further examined for flowering patterns. We found that the peak flowering phase in all the species was gradually drifting in the recent years (2000-2015) from the corresponding regular flowering period from the previous decades. This drift appears to indicate the emergence of at least 3 altered flowering patterns (Fig.1A and 1B):

1. Flowering advanced (early flowering onset than usual): seen in Calophyllum apetalum (PFM advanced from May to March), Dysoxylum malabaricum (from February to January), Mammea suriga (from May to February), Myristica malabarica (from February to January), Saraca asoca (from April to February) and Vateria indica (from March to February).
2. Flowering delayed (late flowering than usual): seen in Cinnamomum macrocarpum (PFM delayed from February to March).
3. Flowering duration reduced: seen in Garcinia indica (PFM appears to have been shortened from November-January to January) and Shorea roxburghii (remained at March).

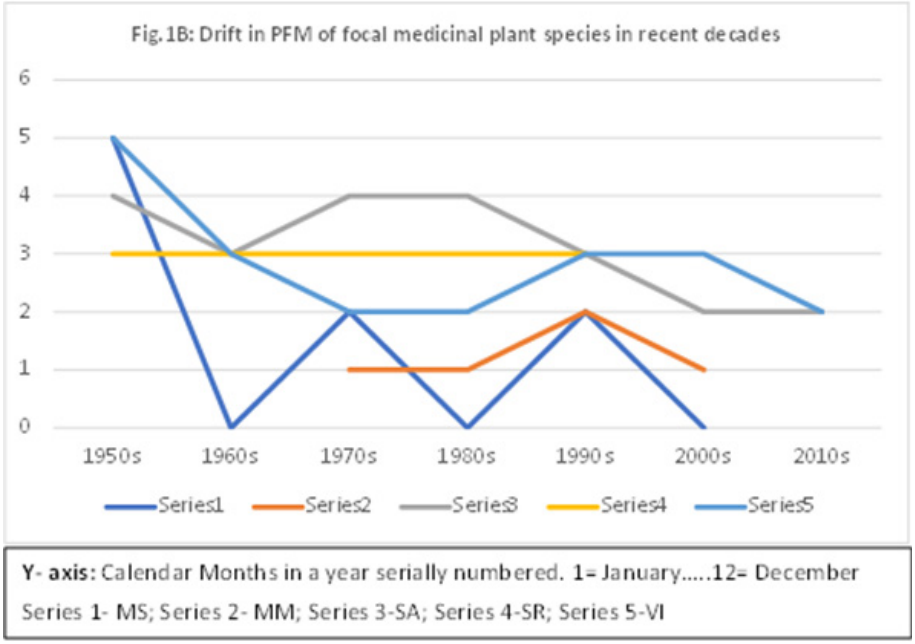
[1] For this purpose, we considered the date of collection of a herbarium specimen to be its proxy data for its peak flowering period, since the collection chances of a herbarium specimen would be high during the peak flowering phase of a plant. We thus considered a particular calendar month in which a greater number of herbarium specimens of a species has been collected to be its PFM.

Fig. 1A Drift in PFM of focal medicinal plant species in recent decades



Y- axis: Calendar Months in a year serially numbered. 1= January,.....12= December

Series 1- CA; Series 2- CM; Series 3-DM; Series 4-GI; Series 5-KP



Comparing the current phenology data, with the historical data revealed an overall disturbance in the flowering patterns of all the species. It was found that, out of the 10 focal species, three species have registered advancement of flowering (*Calophyllum apetalum, Garcinia indica,* and *Saraca asoca*); five species recorded delayed flowering (*Cinnamomum macrocarpum, Mammea suriga, Myristica malabarica, Shorea roxburghii, Vateria indica*).

b) Ground Truthing phenology studies:

Ground truthing studies were carried out at 15 locations in the Western Ghats and Eastern plains. Flowering phenology of select individual trees of the focal species was observed during the respective flowering period for two annual cycles. It was found that, in the wild populations too, a slight drift in the flowering cycle (bud burst and flowering) was emerging with three disturbed flowering patterns.

a) Flowering onset delayed (late flowering than usual (seen with *Mammea suriga, Myristica malabarica, Saraca asoca* and *Vateria indica*);
b) Flowering delayed but duration reduced (seen with *Garcinia indica* and *Shorea roxburghii*);
c) Overall Flowering phase reduced (seen with *Calophyllum apetalum*).

Focal species	Species code	No. of sites	Annual cycle 1		Annual cycle 2	
			Bud burst	Flowering	Bud burst	Flowering
Calophyllum apetalum	CA	3	November	December	November	November
Garcinia indica	GI	6	December	January	January	January
Mammea suriga	MS	8	February	March	March	April
Myristica malabarica	MM	6	November	December	December	January
Saraca asoca	SA	4	December	January	January	February
Shorea roxburghii	SR	8	February	March	March	March
Vateria indica	VI	2	January	February	February	-----

c) Qualitative phenological observations by the local communities:

Fifteen focus group discussion episodes were carried out with the local community groups (NTFP collectors, Farmers, Shepherds and local NGOs) to solicit qualitative data about changes in phenological patterns, in the following localities: a)Western Ghats: Mavinagundi, Menasi, Keelara, Bheemana Kone, Channigana thota villages of Siddapura, Sagara taluks, b) Eastern Plains: Basavana Betta and Halaguru villages of Malavalli taluk, Kabbalu and Bheemana Kindi villages of Channapattana taluk, Huliyurudurga and Ungra-Amruthuru villages of Kunigal Taluk, and Holathalu-Baraka, Siddara Betta, Tovinakere and Kolala villages of Koratagere Taluk.

It was found that the local communities too have noticed drifts in flowering periods and plant phenophases in the recent years. These drifts are in the form of:

- Unusually delayed flowering onset (Mammea suriga, Garcinia indica, Vateria indica, and to certain extent with Myristica malabarica and Myristica dactyloides, Shorea roxburghii, Salix tetrasperma).
- Overall reduction in yield (Terminalia chebula, Buchanania lanzan, Semecarpus anacardium, Ximenia americana and Acacia concinna),
- Long-time absence of flowering and fruit set (Boswellia serrata).
- Prolific availability of fodder (Syzigium cumini, Salix tetrasperma, Erythrina indica, Ficus asperrima)

The study found that climate change appears to have impacted the flowering pattern of 10 endemic trees of the Western Ghats in the recent two decades (2000-2015). Although the very concept of 'climate change' is not so comprehensible to local communities, the diverse observations made by them, coupled with phenology data and herbarium records, strongly suggest that the impact of climate change is being perceived even in the otherwise cooler landscapes like the Western Ghats.

Project Team: PI: Somashekhar B S; Team: Dr. K Ravikumar, Dr. Noorunnisa Begum, Assistance: Manjunath Naik, Veeresh Gowda, S Manjunatha, G V Anandamurthy

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[1] For this purpose, we considered the date of collection of a herbarium specimen to be its proxy data for its peak flowering period, since the collection chances of a herbarium specimen would be high during the peak flowering phase of a plant. We thus considered a particular calendar month in which a greater number of herbarium specimens of a species has been collected to be its PFM.

17. Revitalization of MPCA and MPDA program; Review of the progress and conservation status of MPCAs, and Guidelines for strengthening the Program

Title of the project/ program	**Revitalization of MPCA and MPDA program; Review of the progress and conservation status of MPCAs, and Guidelines for strengthening the Program**
Nature of Research	Qualitative and quantitative- Literature review, Evaluation, and field ecological studies
Place of work implemented	All over India, selected MPCA sites
Principal Investigator	Somashekhar B S
Industry-Academia-Government-other country Collaboration Activities	Collaboration by Academia. Scientists
Self-funded/ Funding agency (Industry)	National Medicinal Plants Board, Ministry of AYUSH, Govt. of India.
Project duration	2020- 2022
Key achievements	Elaborated below

Relevance: MPCAs (Medicinal Plants Conservation Area) have been considered as a unique approach for insitu conservation of wild medicinal plants. Although small in size (average of 200 ha), MPCAs are known to represent a significant proportion (~50%) of a state's total medicinal plant diversity. There are about 210 MPCAs established during 1993–2015 across different forest types in 21 States of India.
These MPCAs are currently in different stages of succession. The prevailing understanding about the overall significance (in respect of diversity, distribution, population status, regeneration of medicinal plants, prevailing threats, and overall health of vegetation etc) is not sufficient to enable a resource manager to devise necessary conservation strategies. The present project is a step towards filling this information gap, by making a comprehensive review of the current status of MPCAs, and make recommendations for overall management.

Highlights of Project progress/ Achievements:

a) Preparation of priority list of medicinal plants: The team took up a comprehensive literature review and analysis of the list of traded medicinal plants from NMPB's demand and supply of medicinal plants[1], and species of high-volume trade which are endemic and red listed were segregated. This list serves as the master list of focal species for the review.

b) Selection of MPCAs for the review: Select MPCAs from the network of 210 MPCAs, would be chosen as sampling sites for the review. Accordingly, a sampling methodology was devised, based on these parameters: presence of red listed medicinal plants species, presence of endemic and HVT species, ratio of RET-overall plant diversity, intensity of

threats, forest type covered, extent of area. The prototype sampling tool was put for testing, and the finalized version would be used for the raking.

c) Design of Review methodology: The team further initiated a comprehensive review of different conservation assessment methods/ management tools currently in use by IUCN and WWF, for assessing the conservation status and management strategies followed in protected areas across the globe. The available methodology is being reviewed to devise a suitable assessment method/ tool for the current project.

Project Team: PI: Somashekhar B S, Team: Dr. Noorunnisa Begum, Dr. Tabassum Fathima, Sangeetha

18a. Development of Geospatial Database for HD Kote Taluka Pharmacopeia (Funded by AYUSH, Govt of Karnataka)

Relevance: The project titled **"HD Kote Herbal Pharmacopeia on an ICT platform for Advancement of Healthcare at Local levels using Traditional knowledge in sync with modern database and analysis"** was envisaged to develop a Geospatial database for HD Kote taluka, as an innovative transdisciplinary project. This project has been endorsed by the Karnataka Knowledge Commission. It is funded by the AYUSH, GOK. It is developed by TDU with collaborative efforts from KSRSAC & SVYM teams to combine multifaceted diverse information of spatial and non-spatial data on 1,203 botanical names of medicinal plants (English and Kannada script) with 28,246 vernacular names in three different languages namely Kannada, Hindi, and Sanskrit. A botanical survey of 150 plots laid across 30 villages captured 4549 plant images queried across villages. Health survey of 650 households in 30 selected villages presented both baseline and end-line results indicating the positive social impact of this project. Solutions for 30 primary health conditions, validated from Classical Ayurvedic texts. Single plant drug remedies for 187 plants (in Kannada) and 1125 compound formulations for Ayurveda scholars and practitioners. Sustainable harvesting guidelines for 35 medicinal plants in Kannada and English, with educational training modules and videos for health and environment education for primary health care management. It is designed to serve as a replicable model to be scalable across the rural areas of India where people can find low-cost health solutions for primary health care management.

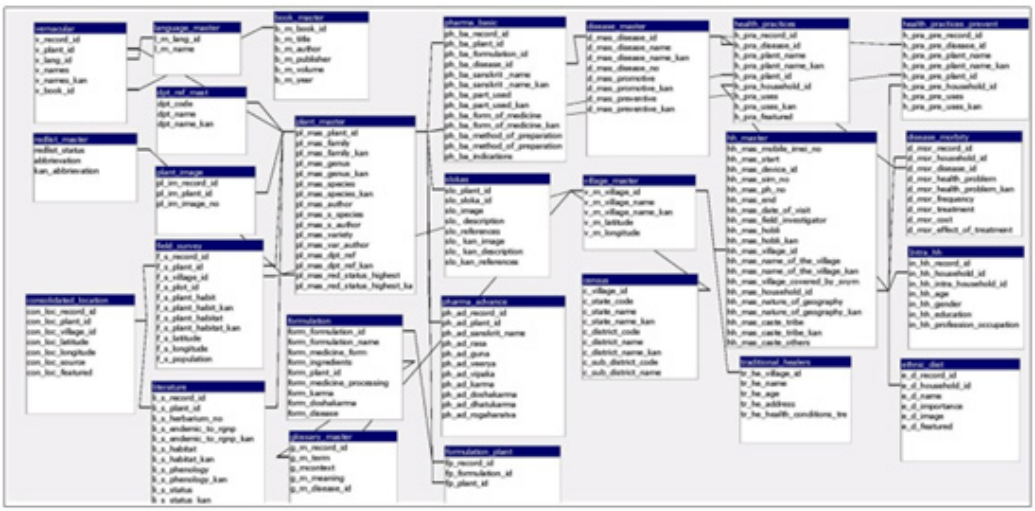
Highlights of progress/ achievements: Physically a functional database involving multifaceted information, updated and completed, has been loaded into the Postgres Database in the TDU server. (Fig - Entity Relationship diagram 2020)

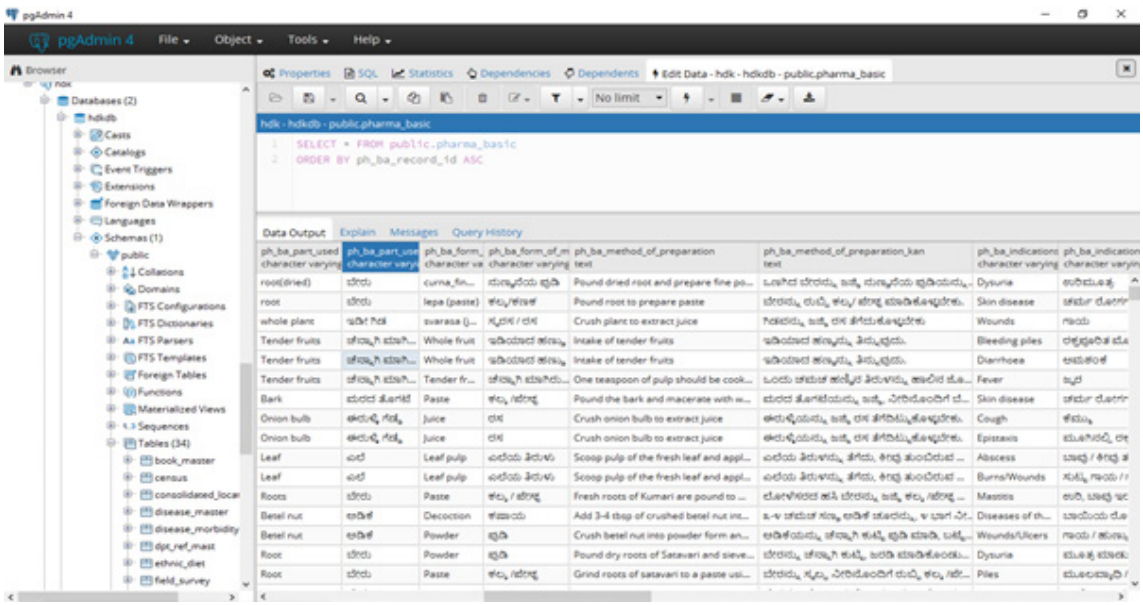
1. Database design document & Software requirement System (SRS) document for Websites (2017-2020)
   The Design Plan for Web portal with the technical flow diagram which depicted the structure of the database, tables, fields, the relationships among the tables, and the constraints/validations governing these tables

2. Updated Database dump provided to KSRSAC portal and India Biodiversity Portal
3. Addition of end-line survey of 650 households' data. Health report was available in Kannada and English version
4. Sustainable Harvesting guidelines of 35 medicinal plants in Kannada and English.
5. Botanical names in Kannada – Updated and corrected

Project Team members: Advisors : Darshan Shankar, Late D.K. Ved, IFS, Dr. (Flt Lt) M. A. Balasubramanya, SVYM, Dr. D.K. Prabhuraj, Director, KSRSAC; PI's:- Dr. Abdul Kareem & B.S. Somashekhar (Envmt. Education); Co-PI : M. Sathya Sangeetha (Geospatial Database & Website), Shiva Subramanya (Geospatial expert, ATREE), Bhagyalakshmi KB (SRF, GIS team); Co-PI-Dr. Venu Gopal SN (Pharmacopeia database Team), Dr. K. Ravikumar (Botanical Survey Team), Dr. B. N. Prakash (Health Survey Team), Dr. Mohankumar B. Thambad(IEC, Health Component, SVYM team)

Entity Relationship Diagram of the Database – 34 tables





18b. Development of Geospatial Web Portal for HD Kote Taluka Herbal Pharmacopeia Portal & collaborative portal with KSRSAC KGIS Health portal and virtual launch (Funded by AYUSH, Govt of Karnataka)

Relevance: The project titled "" HD kote Herbal Pharmacopeia on an ICT platform for Advancement of Healthcare at Local levels using Traditional knowledge in sync with modern database and analysis" was envisaged to develop a HD Kote Herbal Pharmacopeia portal to serve relevant information on his geospatial Portal (hdkotetalukaphc.org) for the HD Kote users. It is a storehouse of 1,203 botanical names of medicinal plants (English & Kannada script) with 28,246 vernacular names in three different languages namely Kannada, Hindi, and Sanskrit. A total of 150 plots laid across 30 villages, 4549 plant images, a health survey of 650 households in 30 selected villages is presented with both baseline and end-line results indicating the positive social impact of this project. 30 primary health conditions, which were validated from Classical Ayurvedic texts with single plant drug remedies for 187 plants (in Kannada) and 1125 compound formulations. This information will serve as a valuable resource for Ayurveda scholars and practitioners. Training of Trainers (ToT) modules have been developed on Environmental education covering the botany, ecology, populations, and conservation of medicinal plants of HD Kote, and serve as downloadable resources for Teacher education. The portal also contains Training of Trainers (ToT) modules for 30 primary healthcare conditions (in English and Kannada), designed for healthcare providers, available in downable PDFs and videos. This project has thus demonstrated an ecosystem-specific medicinal plants herbal pharmacopeia on a Geospatial platform, for enhancement of health security of local citizens using traditional knowledge in sync with modern database and ICT.

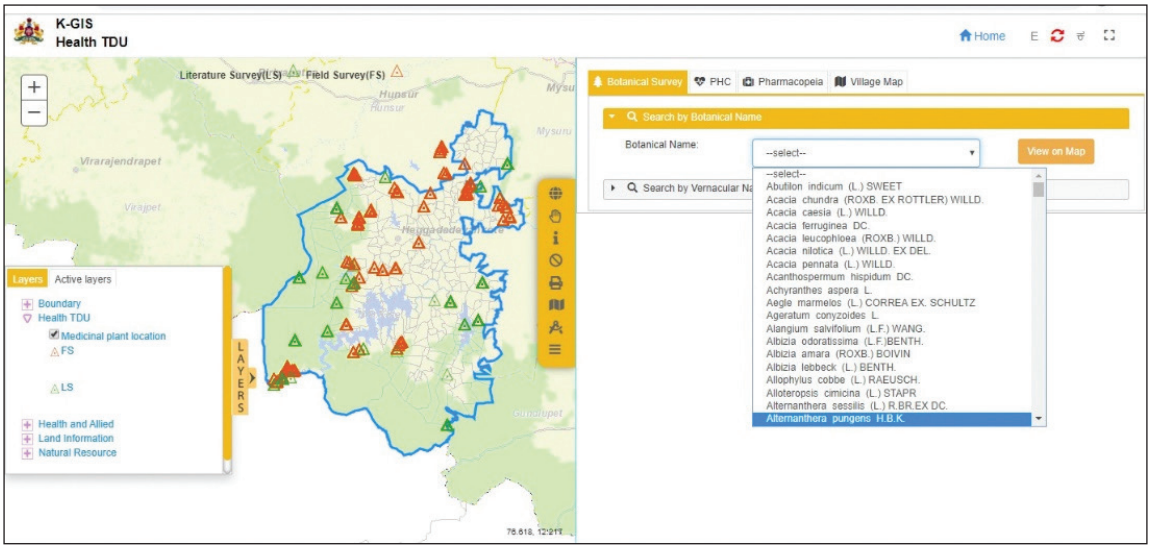
Given wider dissemination of the information it has been made available to larger user groups through collaborative efforts with Karnataka State Remote Sensing Application Center (KSRSAC), Bangalore where an exclusive module for HD Kote database and has been incorporated as Health GIS module under the KGIS portal, which has specialized information for public health. KGIS Portal. Secondly, the data has been shared and incorporated in India Biodiversity Portal (IBP), Bangalore which has unique geospatial information layers on Biodiversity aspects and also a citizen science portal, information here will reach out to a sector of specialized user groups of Biodiversity, conservation, sustainable use of flora and fauna. HD Kote database information on KSRSAC and IBP portals was visualized to increase the value of the information in multitudes for the future and have scope to build new research ideas on medicinal plant resources and primary health management.

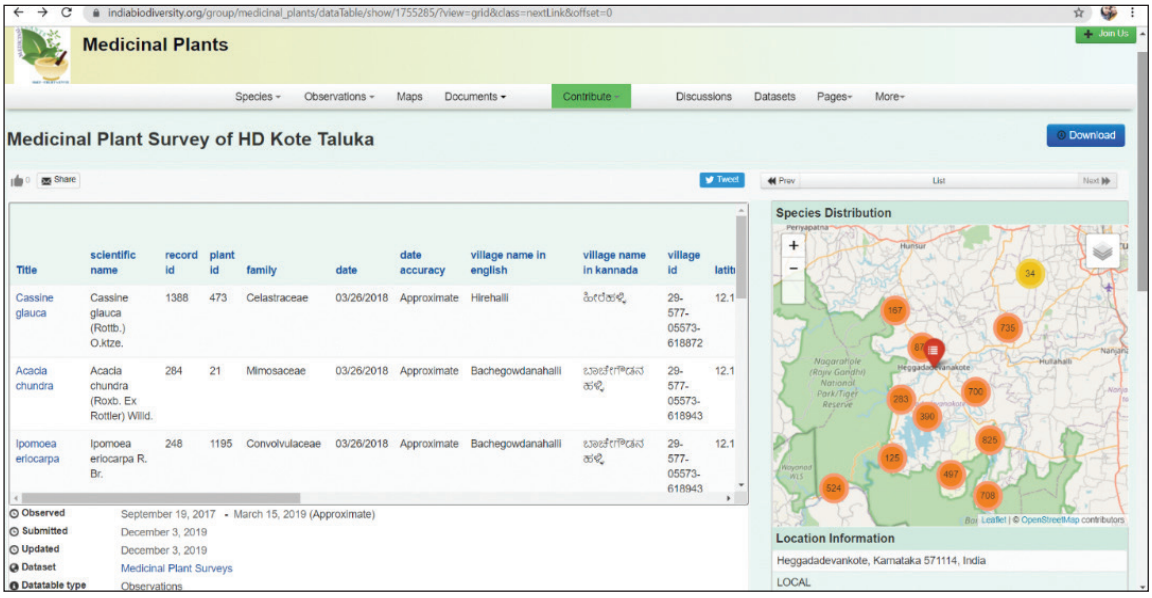
Highlights of progress/ achievements:

1. Web GIS application of TDU - HD Kote taluka Portal.
2. Static Pages updated (About page, FAQ's, Preamble, Teams, Resource with links)
3. HD Kote taluka database was hosted on KSRSAC Health GIS Portal & India Biodiversity Portal

4. A standalone version of plant list with images, vernacular names for each of 30 villages
5. Image PDF module for 30 villages with plant list linked to images for schools without internet facility (Output 4&5 submitted to SVYM for future school programs)
6. Preparatory tasks and presentations were done to AYUSH Director, Bangalore, DC Mysore, Ayurveda college, Mysore, District Health Officer Mysore, and other stakeholders for the website launch on April 3rd, 2021. by Shri. Jawaid Akhtar IAS, Principal Secretary (H F& W), Govt. of Karnataka, Bangalore
7. This geospatial Portal (hdkotetalukaphc.org) for the HD Kote users, is a storehouse of 1,203 botanical names of medicinal plants (English and Kannada script) with 28,246 vernacular names in three different languages namely Kannada, Hindi, and Sanskrit. Botanical survey of 150 plots laid across 30 villages, captured 4549 plant images, queried across villages. Health survey of 650 households in 30 selected villages presented both baseline and end-line results indicating the positive social impact of this project. Solutions for 30 primary health conditions, validated from Classical Ayurvedic texts. Single plant drug remedies for 187 plants (in Kannada) and 1125 compound formulations for Ayurveda scholars and practitioners. Sustainable harvesting guidelines for 35 medicinal plants in Kannada and English, Training of Trainers (ToT) modules have been developed on Environmental education covering the botany, ecology, populations, and conservation of medicinal plants of HD Kote, and serve as downloadable resources for Teacher education. Training of Trainers (ToT) modules for 30 primary healthcare conditions (in English and Kannada), designed for healthcare providers, available in downable PDFs and videos.

Project Team: Advisors : Darshan Shankar, Late D.K. Ved, IFS, Dr. (Flt Lt) M. A. Balasubramanya, SVYM, Dr. D.K. Prabhuraj, Director, KSRSAC
PI's: Dr. Abdul Kareem & B.S. Somashekhar (Envmt.Education); Co PI: Sathya Sangeetha (Geospatial Database & Website), Shiva Subramanya (Geospatial expert, ATREE), Bhagyalakshmi KB (SRF, GIS team), B.V. Suresh, A.S Rajashekhar, Nandini and KSRSAC Team. Collaborators - Dr. Prabhakar, Thomas Vattakavan and IBP Team, Dr. Venu Gopal SN (Pharmacopeia database Team), Dr. K. Ravikumar (Botanical Survey Team), Dr. B. N. Prakash (Health Survey Team), Dr. Mohankumar B. Thambad (IEC,Health Component, SVYM team), TDU, SVYM, KSRSAC teams.


K-GIS
Health TDU
Home
Literature Survey(LS)
Field Survey(FS)
Botanical Survey
PHC
Pharmacopeia
Village Map
Search by Botanical Name
Botanical Name:
--select--
View on Map
Search by Vernacular Na
Abutilon indicum (L.) SWEET
Acacia chundra (ROXB. EX ROTTLER) WILLD.
Acacia caesia (L.) WILLD.
Acacia ferruginea DC.
Acacia leucophloea (ROXB.) WILLD.
Acacia nilotica (L.) WILLD. EX DEL.
Acacia pennata (L.) WILLD.
Acanthospermum hispidum DC.
Achyranthes aspera L.
Aegle marmelos (L.) CORREA EX. SCHULTZ
Ageratum conyzoides L.
Alangium salvifolium (L.F.) WANG.
Albizia odoratissima (L.F.)BENTH.
Albizia amara (ROXB.) BOIVIN
Albizia lebbeck (L.) BENTH.
Allophylus cobbe (L.) RAEUSCH.
Alloteropsis cimicina (L.) STAPF.
Alternanthera sessilis (L.) R.BR.EX DC.
Alternanthera pungens H.B.K.
Layers
Active layers
Boundary
Health TDU
Medicinal plant location
FS
LS
Health and Allied
Land Information
Natural Resource
LAYERS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Medicinal Plants
Join Us
Species
Observations
Maps
Documents
Contribute
Discussions
Datasets
Pages
More
Medicinal Plant Survey of HD Kote Taluka
Download
Share
Tweet
Prev
List
Next
Title
scientific name
record id
plant id
family
date
date accuracy
village name in english
village name in kannada
village id
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December 3, 2019
Updated
December 3, 2019
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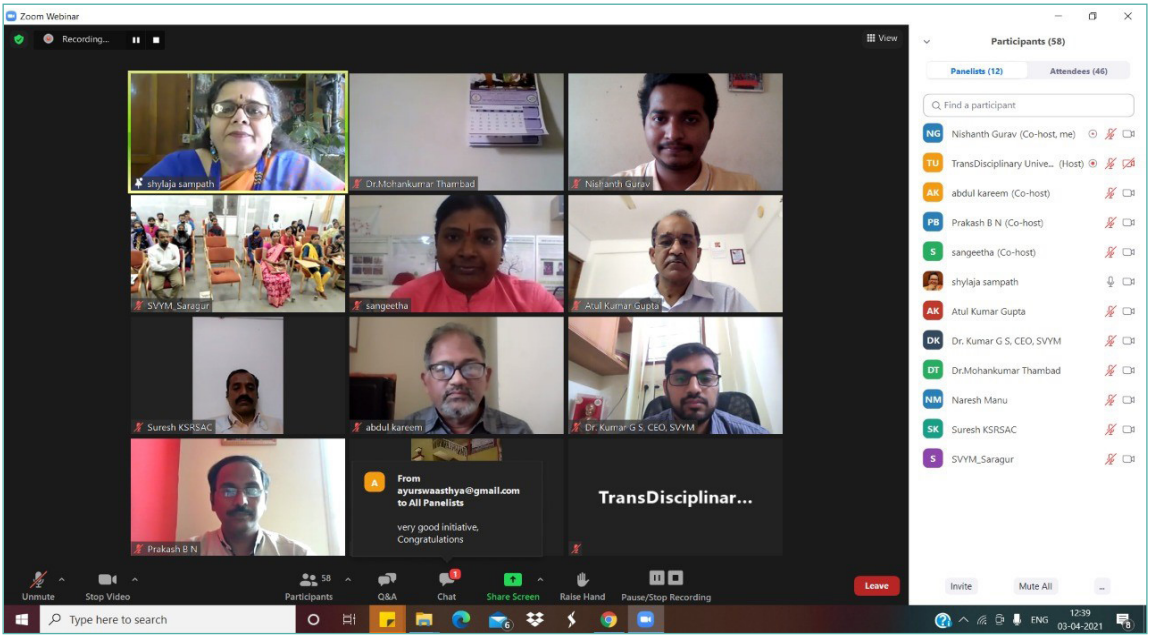
Datatable type
Observations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Panelists (12)
Attendees (46)
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abdul kareem (Co-host)
Prakash B N (Co-host)
sangeetha (Co-host)
shylaja sampath
Atul Kumar Gupta
Dr. Kumar G S, CEO, SVYM
Dr.Mohankumar Thambad
Naresh Manu
Suresh KSRSAC
SVYM_Saragur
shylaja sampath
Dr.Mohankumar Thambad
Nishanth Gurav
SVYM_Saragur
sangeetha
Atul Kumar Gupta
Suresh KSRSAC
abdul kareem
Dr. Kumar G S, CEO, SVYM
Prakash B N
From ayurswaasthya@gmail.com to All Panelists
very good initiative, Congratulations
TransDisciplinar...
Unmute
Stop Video
Participants
Q&A
Chat
Share Screen
Raise Hand
Pause/Stop Recording
Leave
Invite
Mute All
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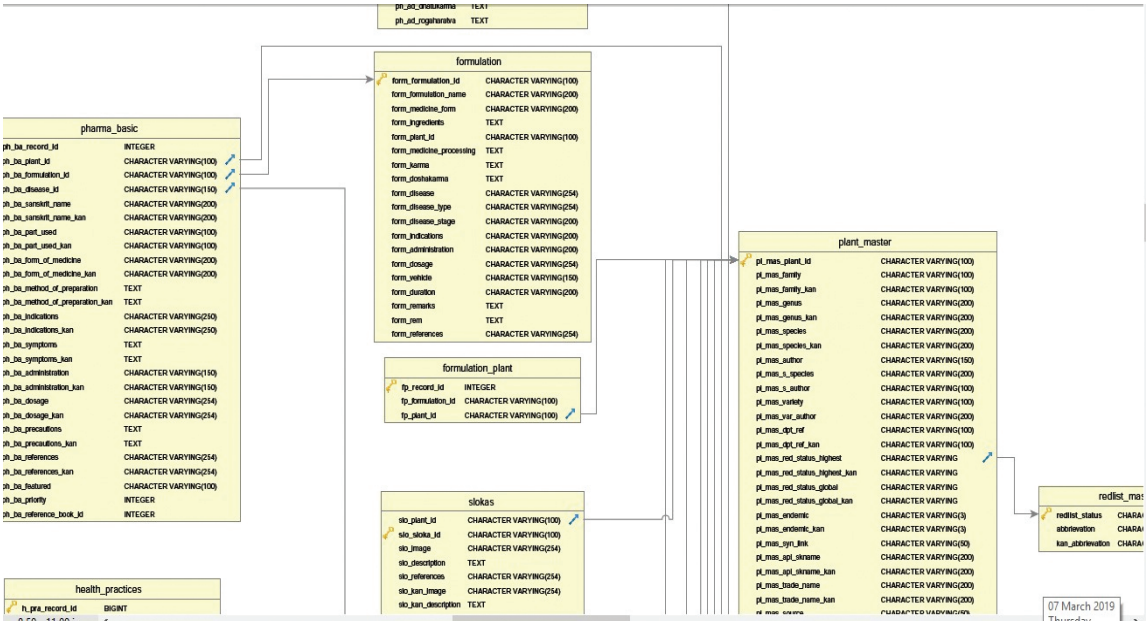
03-04-2021

18 c - Hd Kote taluka database on KSRSAC-KGIS Health portal

Relevance: To Build a collaborative geospatial portal to search & visualize locations of medicinal plants and use by Ayurveda system on a remote sensing platform KSRSAC-KGIS Health portal. It is involved in design of a GIS database as per KGIS standards, preparing land use data of H D Kote Taluk on high-resolution satellite image, and development of the geospatial application.

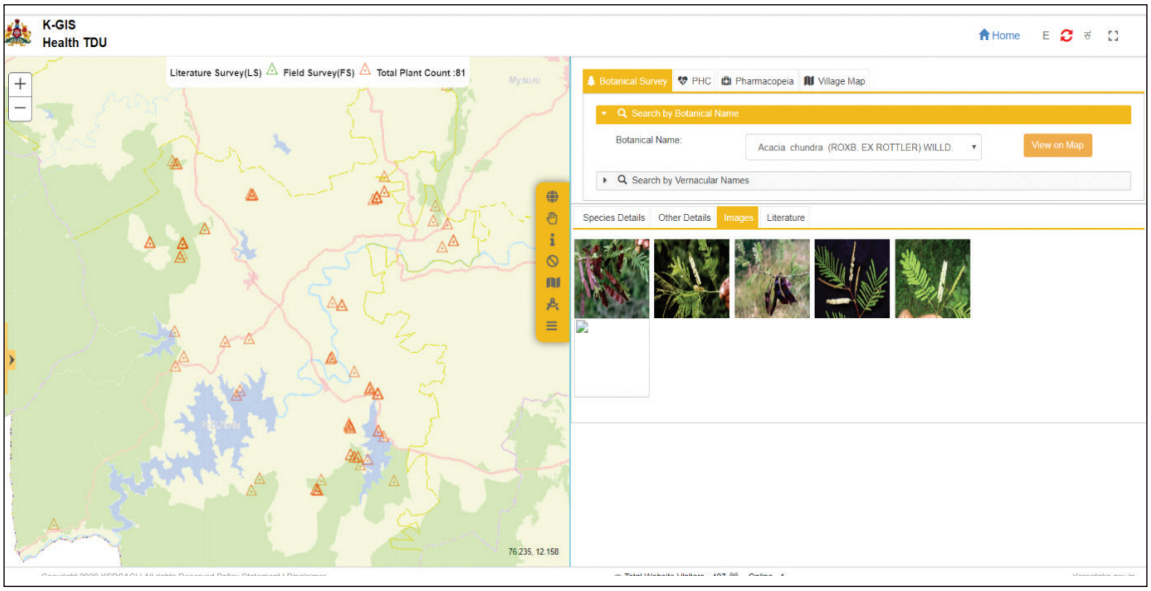
Highlights : 1.Database design
Database Design composed of database objects by mapping, tables, attributes column, unique keys, and relationships to foreign keys were established. The requisite tables, constraints, index, functions were considered for the finalization of the database. It is carried out as per KGIS standards by organizing spatial data and corresponding MIS / department data and establishing the relationships.



Web Application : A GIS web application to search and visualize the locations of medicinal plants id developed. It contains functionalities like map visualize, navigation tools, search/query on botanical names, villages, pharmacopeia, and others. This web application will be integrated into the KGIS Portal as part of Health GIS applications for the AYUSH department. The GIS data organized and available / prepared under KGIS is used. The grids, a network of evenly spaced horizontal and vertical lines used to identify locations, are created for different intervals. Each grid is assigned with unique grid numbers.

HD Kote Taluk is covered by about 80 grids of 5km interval. The base layers spatial data like road, rail, water body and administrative boundary layers from village to state organized as per KGIS Standards is used.

Project Team: Advisor: Dr. D.K. Prabhuraj, Director, KSRSAC; Co PI: Suresh B. V., Scientific Officer, KSRSAC; Team members: A.S. Rajashekar, Scientific Officer, KSRSAC, Dr. Jayakumar P D, Scientific Officer, KSRSAC, Thirthesh H V, Database Specialist, KSRSAC, Nikhil, Programmer, KSRSAC, Priyanka Pereira, Team Lead – Applications Development, KGIS – KSRSAC, Nandhini, Programmer, KSRSAC



Spatial query of medicinal plants on KSRSAC-KGIS PORTAL

19a. Development of a Course Module on Geographical Information systems (1- credit)

Relevance: This module is intended to provide the students of Undergraduates/ Postgraduates with foundational theoretical and practical GIS skills. It offers an introduction of Geographical Information Systems and Science to those with no prior experience and consolidates the knowledge of those who have previously taken an introductory GIS module. Moreover, gaining GIS knowledge and skills is increasingly seen as an essential part of preparing for employment. This is because GIS can be integrated with any kind of information from many disciplines in any sector.

Highlights of progress: Teaching material is aligned with sample medicinal plant data sets available with the TDU-GIS team in the context of conservation. The material is ready for theory and practical sessions with step-wise handouts for using QGIS open-source software basics with 7 demonstration videos prepared for easy hands-on activities. (Image 1- GIS course details). The module is applied in its nature, with components of hands-on practical work which is used to expand and reinforce the learnings provided in the class. (Fig1- GIS course modules)

Project Team: PI- Ms. Sathya Sangeetha, Team : Bhagyalakshmi KB

19b. Preparation of GIS maps for two concepts. Agro Ecological zone concept and Desh vichaar concept.

Relevance: In view of the rapid decline of the wild population and foreseeing the constant pressure on the wild supply of medicinal plants this project addresses two needs

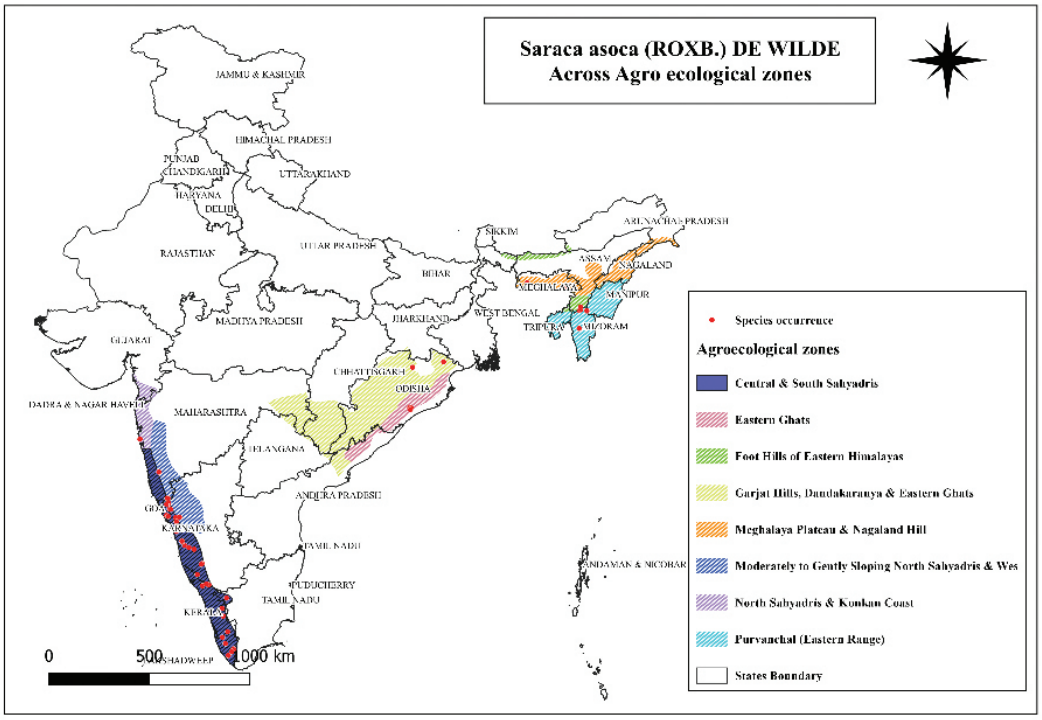
1) To identify & highlight the phytogeographical areas of wild presence corresponding to the supply sources of species, will aid in Conservation action
2) To identify the ecological factors such as rainfall, altitude, soil, forest type, in which the species is present in nature.

Maps generated information is visualized to help in identifying similar agro ecological areas for cultivation of medicinal plants to guide a new frontier of organic agriculture called agroecology and also promote Conservation, Resource Augmentation, Education, and Awareness.

Highlights of progress: Agroecological zone concept - Saraca ascoca maps across Agro ecological zones. (Fig a Saraca asoca correlated with precipitation with Agroecological zones (Attached Fig b – Saraca asoca presence across Agroecological zones.) M. Sathya Sangeetha

Desh Vichaar concept: Documentation of Deshas and Tabulation of Agro Ecological zones with comparison to Desh vichaar parameters developed by the team

Project Team: PI- Dr Venugopal, Team- Dr. Shilpa, M. Sathya Sangeetha



20. Capacity building and exchange and enrichment of major Indian medicinal plant resource (December 2020)

Relevance: This is a landmark collaborative project between TDU, Bengaluru, and Royal Botanical Garden's Kew, London. As a first step, Medicinal Plant Names Services (MPNS) of KEW, a global nomenclatural indexing & reference service is now connected to TDU's exhaustive database on Indian Medicinal Plants Nomenclature through mutual data exchange initiative. This move caters to the needs of the global herbal sector & regulatory mechanism by providing validated scientific names as per APG IV classification and common names.

Highlights of the Progress:

1. In this first phase of TDU-KEW collaboration, 2020, data exchange between TDU and MPNS was undertaken. This resulted in enriching the databases of both. Learn lessons permitting us to develop and submit proposals for a larger more significant future collaborative project.

2. During this phase, the release of MPNS (V10) has been published. www.kew.org/mpns. This version of MPNS has included data from TDU sources. It has now, 5916 Unique scientific names with 116230 Non-scientific names cited by the TDU database

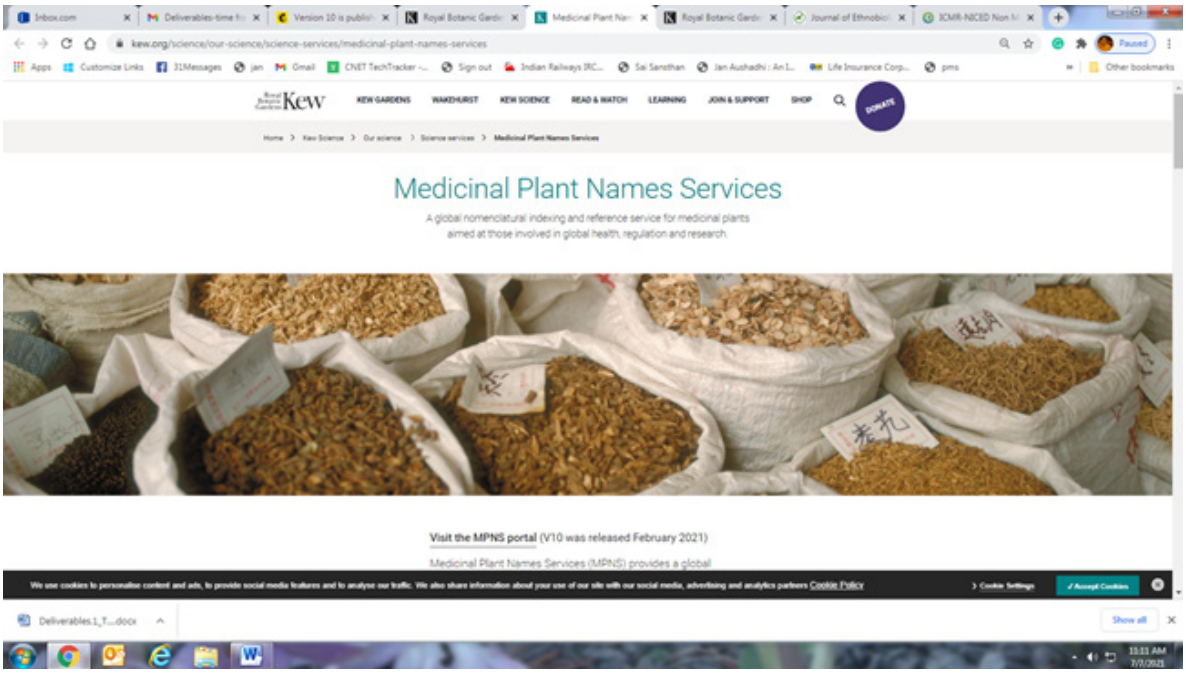
3. TDU dataset is cited here: https://mpns.science.kew.org/mpns-portal/references)

4. All the scientific names are validated against Kew's resources (IPNI/WCVP). Taxonomy updated to reflect a modern global taxonomy (WCVP/AGPIV). The validated set of databases is returned to TDU by KEW for further integration.

5. Along with this resource material on MPNS latest release is also published. (https://us11.campaign-archive.com/?e=__test_email__&u=c82fe6feb1542c251a3b2b97f&id=ffc79f00e7).

This effort has enabled us to achieve the following:

1. greater scientific credibility internationally and nationally through its rigorous adoption of modern scientific plant nomenclature.
2. gain experience of use of methods and techniques for management of scientific plant nomenclature of use going forward



https://www.kew.org/science/our-science/science-services/medicinal-plant-names-services
An online portal which provides access to medicinal plant data and medicinal plant reference citations using any pharmaceutical, drug, common or scientific plant names.

TDU contribution is cited as TDU (ed.) (2020). Indian Medicinal Plants Database (data received 18/12/2020). The University of Transdisciplinary Health Sciences and Technology (TDU), Bengaluru, India. [v10]

Reported by: Dr. Suma TS, Asst. Professor, TDU; PI: Varuna Subramanya; Team: CCNR and Informatics team; KEW Team

21. Development of a comprehensive database on folk level medicinal uses recorded in Ethno-botanical publications

Relevance: As we are aware, India is a rich country with a Living Cultural Heritage, which has contemporary relevance in every walk of life. The proposed objective is to computerize the information on folk medicinal uses from ethnobotanical publications along with mapping of ethnic communities for the protection of IPRs and their applications for both human and animal care.

Highlights of the Progress:

1. A prototype display user interface (UI) for an ethno-meduse database with a special focus on Karnataka comprising of 5 search features such as botanical names /vernacular names/ parts/diseases wise /ethnic communities of Karnataka is being developed. A demo dataset for 278 species resulted in more than 5743 med-uses recorded across India.

2. A database on the compilation of different ethnic communities of Karnataka from literature sources such as the Anthropological survey of India has resulted in 297 ethnic community's distribution across 30 districts of Karnataka. Additionally, 20 journal papers and publications have been referred for the same. Census data information on bilingualism for Scheduled Tribes of Karnataka, 2011 is also gathered.
3. Validation of ethno medical data from the ethnobotanical publications: In continuation with the development of the user interface (UI) and ethnic communities' database, validation of ethno-uses data from the identified literature is being carried out. This term nearly 600 records have been validated (a total of 2210 records comprising about 2100 species) for accuracy of information entered, which is now ready for inclusion in the backend ethno-med-use database.
4. A prototype Tableau Public display for the Karnataka state Ethnic communities has been achieved. More emphasis was laid towards designing and mapping up to District Level in Tableau Public for Karnataka, and incorporation of Ethnic Communities in various Karnataka (District Level) has been implemented.
5. 1000 bibliography references related to ethnobotany have been compiled through this project.

Team Members: Dr Suma TS, Mr. Vijay Srinivas, Mr. Varuna Subramanyam

Outreach

1. Resource Augmentation of selected RET and High Traded Medicinal Plant Species Covering 22 JFMCs in 18 Forest Divisions of Karnataka, India

Relevance: The main goal of this project is to conserve and restore the gene pool of selected medicinal plants in the wild and also to ensure the supply of authentic raw material to AYUSH industries in the future. Technical support was provided to Karnataka Forest Department for the plantation activities to raise selected 19 species of medicinal plants through Artificial Regeneration (AR) and Aided Natural Regeneration (ANR) models covering an area of 295 ha and 905 ha respectively in 22 Joint Forest Management Committees (JFMCs).

Highlights of Progress:

- Facilitated the Deputy Conservator of Forests of 18 forest divisions in preparation, finalization, and submission of the technical reports, expenditure statement, and utilization certificate to the funding agency
- Regular field visits to 22 Joint Forest Management Committees (JFMCs) under 18 Forest Divisions were organized to facilitate the maintenance of the plantation.

Team Members: PI: Mr. Jagannatha Rao R Co-PI: Ms. Deepa G. B.

2. Training of Trainers and Community Level Training Programs on Sustainable Harvesting of Medicinal Plants in Karnataka

Relevance: The National Medicinal Plants Board (NMPB), Govt. of India, New Delhi has entrusted TDU to organize community-level training programs and Trainers of Training (ToT) programs on sustainable harvesting of medicinal plants. Main activities include organising a series of 5 ToT programs and 10 community-level training programs on sustainable harvesting of medicinal plants for different stakeholders in Karnataka.

Highlights of the progress: A state-level consultative workshop was organized on 25th February 2021 at Aranya Bhavan, Bengaluru to understand the medicinal plant sector such as conservation, sustainable harvesting, cultivation, trade, and livelihood opportunities and also discuss the training needs, modalities, technical issues such as content, structure, delivery, and pedagogy for training programs, and logistics support. The workshop was participated by 47 experts representing Karnataka Forest Department, Karnataka Biodiversity Board, AYUSH Department, National Rural Livelihood Mission (NRLM-KSRLPS), TRIFED, National AYUSH Mission (NAM), Department of Horticulture, Government Central Ayurveda Pharmacy, Ayurveda Medical College, Large Adivasi Multipurpose Cooperative Society (LAMPS), Research Institutes, Joint Forest Planning & Management Committees (JFPMCs), AYUSH doctors, Herbal industries, NGOs and CBOs. The workshop had provided an opportunity for the different stakeholders to share their experience in the area of sustainable harvesting as well as mainstreaming the program in Karnataka.

Team Members: PI: Mr. Jagannatha Rao R., Team: Ms. Deepa G.B. and Dr. Arthur Mark Selwyn

Photo 2: Deliberation by an expert in one of the sessions

3. Strengthening NTFP and Ecotourism Value Chain in Thiruvananthapuram Landscape, Kerala

Relevance: This project was funded by USAID through Tetra Tech ARD, New Delhi under Forest PLUS 2.0 program. In this program, two forest-based value chains, namely, Non-Timber Forest Produces (NTFPs) and ecotourism services were identified for assessment and strengthening, and promotion in the Thiruvananthapuram landscape in Kerala. As part of its efforts, the value chain strengthening, and enterprise development are expected to target women, youth, marginal communities and other vulnerable groups in the landscape especially tribal forest dependent communities, who are associated with institutions namely, Vana Samrakshana Samithis (VSSs) or Eco-Development Committees (EDCs). This project was intended to study the value chain of NTFPs, develop protocols and training manuals and organising village level training programs on sustainable harvesting, value addition, cultivation, Cheruthaen beekeeping activities, community based ecotourism activities, and nature camp activities. Besides, the piloting of Cheruthaen beekeeping with identified beneficiaries was attempted by providing beeboxes with bee colonies to enable them to generate additional livelihood income for their households.

Highlights of the progress

- Prioritised NTFPs/medicinal plant species for developing sustainable harvesting and post-harvest management practices and cultivation practices through setting selection criteria and consultations with herbal industries.
- Identified 500 beneficiaries from 10 selected VSSs/EDCs for one-day training on Cheruthaen beekeeping practices and piloting of the Cheruthaen beekeeping practices in their households
- Conducted a three-day Master Trainers' training program with 20 participants selected from 10 VSSs/EDCs on Cheruthaen beekeeping exercises
- Conducted 10 one-day village level Cheruthaen beekeeping general training program covering 500 beneficiaries
- Implemented Cheruthaen beekeeping practices with 50 selected beneficiaries in two villages by providing 3 beeboxes with Cheruthaen colonies to each beneficiary household on a pilot basis
- Developed sustainable wild harvesting and post-harvest management protocols for 10 selected NTFPs/medicinal plants and cultivation protocols for 6 selected NTFPs
- Conducted 20 one-day village level training programs on sustainable harvesting and post-harvest management practices for 10 NTFPs/medicinal plants covering around 1000 NTFP collectors and community members from 20 VSSs/EDCs
- Conducted 3-days Master Trainers' training program on NTFP cultivation practices with 50 participants from 5 selected VSSs
- Conducted research and outreach on traditional food and beverages that are available in the Thiruvananthapuram landscape and also studied the traditional art forms, handicrafts, handlooms that are made with local materials to examine whether these

items can be part of cafeteria and eco shops that are in ecotourism centres

- Developed nature education packages incorporating new set of ecotourism activities with the involvement of more local community members as ways to improving existing community based ecotourism activities
- Conducted 3-days nature education management training program for eco/nature guides in the ecotourism locations on a new set of ecotourism activities

Team Members: PI: Mr. Jagannatha Rao R., CoPI: Dr. Arthur Mark Selwyn, Field Manager: Mr. Arun Kumar

Training program on Cheruthaen (stingless bees) beekeeping

Hands-on experience during a training program on ecotourism and nature camp

4. Establishment of Medicinal Plants Development Areas, Sustainable Harvesting and Marketing of Medicinal Plants in Korba Forest Division of Chhattisgarh

Relevance: This project was aimed at the promotion of conservation and utilization of medicinal plants under the guidelines of Joint Forest Management (JFM). The establishment of Medicinal Plants Development Area (MPDA) provides a great opportunity for the development and sustainable use of medicinal plants in the forests with the active participation of local communities. Integration of development and sustainable use of medicinal plants along with value addition and marketing of the produces offers livelihood opportunities for the local communities.

Highlights of the progress:

- Due to COVID situation in the whole country, field visits could not be organized. Data related to trade, market prices, and harvesting practices were compiled based on telephonic discussions with the traders, folk healers, JFMC members, and representatives from processing units. The following table provides medicinal plants that are in traded and have high market demand.
- Ten species, 1. Asparagus racemosus, 2. Buchanania lanzan, 3. Gloriosa superb, 4. Chlorophytum tuberosum, 5. Holorrhena antidysenterica, 6. Pueraria tuberose, 7. Aegle marmelos, 8. Embelia tsjerium-cottam, 9. Terminalia arjuna and 10. Andrographis paniculata were shortlisted by giving priority on the threat status, market demand, and part harvested, for the development of sustainable harvesting and value addition techniques.

Project Team: PI: Mr. Jagannatha Rao R. Team: Ms. Deepa G. B.

5. Organizing Trainings and webinars on topics related to Plant systematics, ethnobotany and Pharmacognosy.

Relevance: The trainings and webinars are organized with an aim to facilitate the participants in distinguishing plants and raw drugs and identify them. The programs will help the participants to understand the nomenclature inspite being 'Greek and Latin'. The participants will be encouraged to observe, document, and share knowledge of the plants they "feel" in the field. Participants will also be guided to identify plants by observation. The course also involves field visits where participants get exposed to medicinal plants growing in different themes. Life forms/ habitats. Similarly, the online webinars are planned in various themes of plant systematics such as basic and advance taxonomy also on IPR and pharmacognosy with eminent and expert speakers to enhance the awareness amongst the participants in the basic and advanced field of plants systematics.

Highlights of the progress:

- The training was taken up by a) 94 Botany graduates of SJRC women's college, Bangalore (58 students) and Government Art College, Ananthapur district, Andhra Pradesh (36 students) b) 154 Dravyaguna Ayurveda graduates from SDB college, Bangalore (98 students) and RAMC, Bangalore (58 students).
- Organised webinar on a)IPR on 3rd and 4th June 2020 (30 students); b) Ethnobotany webinar as conducted on 16th July 2020 (194 students), c)WeDigBio 2020 Participants were taken on a virtual tour to FRLH Herbarium on 18th October 2020 (110 participants) d)A collaborated webinar by National Museum of Natural History (NMNH), New Delhi (Ministry of Environment, Forest and Climate Change, Govt. of India) and TDU, Bangalore organized D E. K. Janaki Ammal Memorial Lecture Series on " Plant Taxonomy and Ethnobotany in India - Future and Challenges" on 4th - 6th November 2020 (250 participants).

Project Team: PI: Dr. K. Ravikumar, Team: Dr. S.Noorunnisa Begum, Dr. N.Dhatchanamurthy, R.Patturaj, N.Arun

Peer reviewed Publications/ books / reports / manual / handbook etc published during year

Publications:

- Dhatchanamoorthy N, Sathya Sangeetha, Ravikumar K, Noorunnissa Begum S, 2021. Studies on Grass flora of Savandurga forest from Karnataka India, Species 22(70)
- Dhatchanamoorthy N, Ravikumar K, Sathya Sangeetha, Noorunnissa Begum S, 2020. New Distribution of less known endemic grass Dimeria orissae BOR (Poaceae:Panicoideae) from Karnataka, My Forest, Vol.56 (4) 75-80.
- Jagannatha R. Rao, Arthur Selwyn Mark, Pramod, A.K and Deepa G.B, 2020, Sustainable use of wild medicinal plant resources: developing field methods and market linkages in Kerala, India, in Sustainable use and biodiversity conservation in India, Key stone foundation.

Invited talks:

- Ms. Deepa G.B. presented on "Conservation and sustainable use of medicinal plants" during the visit of the students from Krupanidhi college on 4th February 2021 and visit of 35 trainees from Range Forest Officers School, Coimbatore on 10th March 2021.
- Ms. Deepa G.B. presented a television program in Kannada for school children on "Conservation of Biodiversity Components", telecasted on DD Chandana on 9th January 2021.
- Jagannatha Rao R, invited speaker in the training programme organised by Kerala Forest Research Institute for the officers of the Indian Forest Service on the theme 'Conservation and Development of Medicinal Plants and Benefit Sharing with Local Communities' to be held from 09 to 13 November 2020, funded by MoEF & CC. Govt. of India.

- Jagannatha Rao invited speaker in Online Expert Group Meeting on 15th February 2021 and 18th March on Identifying tradable parameters for relevant products from agroforestry systems. This assignment is part of a project - 'Support Implementation of National Agroforestry Policy by Enhancing Tree Cover and Production of Wood', by the FAO and organized by Indian Institute of Forest Management, Bhopal.
- Jagannatha Rao, invited speaker in IGNFA project process and details on E-learning development and authorizing as part of IGOT – integrated Government online training programme, organized on 1st Dec 2020.
- Jagannatha Rao R, facilitated an online meeting of experts of the working group on the development of Nature education held on 19th August 2020 through an online platform and presented methods and strategies for community based nature education CAMPs, Forest Plus, USAID, FRLHT and Kerala Forest Department.
- Jagannatha Rao, Presented the use of tools and equipment's for sustainable harvesting, post harvesting, and value addition of NTFPs on 8th Feb 2021 at Forestry College and Research Institute, Hyderabad under workshop on Training Module Development for Van Dhan Yojana programme in Telengana state.
- Somashekhar B S, delivered a Radio Science Lecture on "Climate Change and its Impact on Forest plants, on All India Radio, Bangalore, on 5th May 2020 and 9th July 2020, which went on the state hook up from all the Radio stations in Karnataka.
- Suma TS, TDU, Bengaluru, delivered talk on Know Your Neighborhood Medicinal Plants Namma Bengaluru (For Managing Primary Health Care) for 200 School and college students at Pre-Lake 2020 conference- Know Your Ecosystem. Organized by: ENVIS-CES-IISC, Bengaluru on 10th Dec. 2020
- Suma TS, TDU, Bengaluru, delivered a talk on Medicinal plants for managing primary health care at your doorsteps for 200 Medical, engineering, undergraduates, and school children. at ENVIS EPTRI along with Telangana Pollution Control Board on 5th Jun. 2020.
- Suma TS, TDU, Bengaluru, delivered a talk on Fresh plant drugs dispensed via local weekly shanties of Madurai city, India for 200 Academicians, medical students, anthropology ONLINE MEETING ON SAFETY AND EFFICACY OF PHYTOMEDICINE Phytomed 2020, Australia https://www.scientificprism.com/phytomed/ on 27th May 2020.
- Suma TS delivered talk on "Fresh plant drugs" dispensed via local weekly shanties of Madurai city, India (based on paper - Suma TS* , Ravikumar K, Somashekhar BS, Ved DK , Zaman R , Rajalakshmi G, Nair SNV, Kumar SK) in the workshop On Safety And Efficacy Of Phytomedicine, Australia.https://www.scientificprism.com/phytomed/. It was attended by 500 participants from a diverse audiences representing 10 countries.
- Suma TS delivered a talk on Introduction to Folk Nomenclature and Folk Taxonomy at Ethnobotany webinar on 16th July 2020. About 120 undergraduate and Post Graduate students, faculties attended the talk.

- Suma TS delivered a talk on Plants used in Ayurveda for boosting immunity at online webinar organized as part of a community healthcare education campaign for the prevention of COVID-19. TDU Bengaluru on 14th September 2020. More than 100 Folk healers and the wider public participated the webinar (in Kannada)
- Dr. Abdul Kareem delivered a talk on medicinal plant conservation and health in JSS Ayurveda College, Mysore, on 26th March 2021 for 45 Postgraduate students and teachers of Dravyaguna.
- M. Sathya Sangeetha delivered a talk on HD Kote taluka medicinal Plants in JSS Ayurveda College, Mysore, on 26th March 2021 for 45 Postgraduate students and teachers of Dravyaguna. highlighting the need for managing primary health care and as a platform for Ayurveda students to make use of Ayurveda information available for UG & PG.

Portal Launch -

- Virtual launch of HDkote Herbal Pharmacopeia on an ICT platform for Advancement of Healthcare at Local levels using Traditional knowledge in sync with modern database and analysis (Funded by AYUSH, Govt of Karnataka) on 3rd April 2021, by the Pr Sec. Shri Javaid Akhtar (HF&W), AYUSH Dept, with TDU, SVYM, KSRSAC teams, community, and stakeholders.
- Dr. Abdul Kareem and Sathya Sangeetha presented the HD kote portal website features on the benefits of medicinal plants usage for managing primary health care, to Smt. Rohini Sindoori IAS, District Collector, Mysore, Seethalakshmi, District Ayush Officer, Principle, Charaka, Govt. Ayurveda College, Mysore on 25th & 26th March 2021.
- Dr Abdul Kareem, B.S.Somashekhar, M. Sathya Sangeetha presented the HDkote Herbal Pharmacopeia on an ICT platform for Advancement of Healthcare at Local levels using Traditional knowledge in sync with modern database and analysis (Funded by AYUSH, Govt of Karnataka to the Ayush Director, Shri Ramachandra IFS, Commissioner AYUSH, on 23rd February 2021.

Academics

Sl. No.	Name of Program	Audience	Final output (CME/ Certificate/ Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
1.	Training and Empowering in Ethno veterinary Practices and Veterinary Ayurveda for reduction of antibiotics and other veterinary drugs for supply chain dairy industries of Abbott.	Veterinary and field officers of four supply chain dairy industries of Abbott Nutrition.	Certificate	* 8 Days of online training (half day training for 2 days every alternate month.) * Ethno veterinary management of 24 clinical conditions. * Morphological identification of medicinal plants used in these formulations. * Ayurveda understanding of medicinal plants used in these formulations. * 28 participants	769,714 Funded by Abbott Nutrition	Dr Kumar S K	Dr MNB Nair Dr Punniamurthy N Dr Sathesh Kumar Anitha N	No fliers

Relevance: This project presented to ABBOTT (Abbott Healthcare Private Limited) aims to improve animal health, farmers' income and milk quality in smallholder dairy farmers organized by Abbott Nutrition through popularizing the use of ethno-veterinary practices and Veterinary Ayurveda.

Objective: To train and empower the stakeholders to reduce the use of antibiotics in dairy farming by using Ethno-veterinary and Veterinary Ayurveda to achieve the quality standards of milk (Antibiotic residue free).

Highlights of progress/ achievements of projects/programs:

TDU and Abbott have collaborated for training and empowering the stakeholders of supply chain dairy industries. The first phase of the training was conducted at TDU. Twenty six participants from four dairy companies (Prabhat Dairy, Parag Dairy, Schreiber Dynamix Dairy and Govind Dairy) participated in the training. All the stakeholder and participants felt EVP and Veterinary Ayurveda can bring changes in quality milk procurement.

As a part of the program, a field level training was organised at Govind dairy. During the field training we could observe a few gaps from the participants for successful implementation of the concept. Keeping all these observations, the team from TDU decided that we need to continue the training and empowering for success of the collaboration with the objective mentioned above. Since August 2020 TDU and Abbott Nutrition is conducting online training for four supply chain dairy industries.

The Success of Ethno veterinary formulations from April 2020-March 2021 from Abbott Nutrition

Diseases	No. of cases treated	Cured	Not-cured	% Achievement
Bloat & Indigestion	510	483	27	94.7%
Blood in milk	138	133	5	96.4%
Diarrhoea	2429	2192	237	90.2%
Downers cow syndrome	7	6	1	85.7%
Enteritis	28	28	0	100.0%
Fever	177	172	5	97.2%
FMD foot lesions/ Wound	310	305	5	98.4%
FMD mouth lesions	162	151	11	93.2%
Lameness/ Bursitis	16	13	3	81.3%
Lumpy skin disease	11	11	0	100.0%
Mastitis	3983	3670	313	92.1%
Metritis	18	16	2	88.9%
Warts	249	196	53	78.7%
Pox/ Cracks	952	790	162	83.0%
Prolapse	85	81	4	95.3%
Repeat breeding	382	247	135	64.7%
Retention of placenta (ROP)	181	151	30	83.4%
Teat obstruction	1256	1118	138	89.0%
Tick/ Ectoparasite	1400	1362	38	97.3%
Udder oedema	1181	1148	33	97.2%
Worms	3257	3170	87	97.3%
Grand Total	**16732**	**15443**	**1289**	**92.3%**

Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work implemented	Principal Investigator and co investigators	Industry-Academia-Govt-other country Collaboration Activities	Self-funded/ Funding agency (Industry)	Key achievements
1.	"Management of antibiotic resistance pathogens in clinical mastitis by Ethnoveterinary formulations".	Observational research on large animals	Gokul dairy Kolhapur district, Maharashtra	Dr Kumar SK	Dairy industry collaboration – Gokul dairy	Gokul Dairy – 78.58 lakhs	This project has started from this January
2.	Metagenomics profiling of bovine milk from mastitis infected udder of the cows before and after treatment with ethno-veterinary practice (EVP)	Confirming the efficacy of the Mastitis spray	TDU	M N Balakrishnan Nair	Nil	Self-funded	After 6 days of treatment with herbal formulations, it is indicated that mastitis is cured
3.	Sustainable harvesting of Oleo-gum Resin of Guggulu (*Commiphora wightii*).	Field research in which a tapping technique is developed to ensure the survival of the tapped plants and production of optimum viable amount of guggulu for commercial use to prepare Ayurveda products	Kutch, Gujarat	Dr M N Balakrishnan Nair	GUIDE, Gujarat	DABUR	Plants are healthy and the tapped regions regenerated fully after 4 years of tapping. The 2nd tapping of the plants in 2020 could not be conducted because of the lock down due to COVID 19.

1. "Management of antibiotic resistance pathogens in clinical mastitis by Ethnoveterinary formulations".

Relevance: Antibiotics are used extensively in the dairy industry to combat different diseases and to improve animal performance. An increase in the incidence of disease in a herd generally results in increased use of antimicrobials, which in turn increases the potential for antibiotic residues in milk and the potential for increased bacterial resistance to antimicrobials.

The aim of this work was to detect antibiotic resistance pathogens isolated from milk samples in clinical mastitis in cattle and its management by ethno veterinary formulations.

Objectives

1. Screening of animals for clinical mastitis collecting milk samples.
2. Identification of antibacterial resistance pathogens in clinical mastitis.
3. Intervening with Ethnoveterinary formulation for antibacterial resistance pathogen in clinical Mastitis
4. Identifying the antimicrobial residues in the milk samples.

Highlights of progress/ achievements of projects/programs

This research project was prepared and submitted in the month May 2020 to Gokul dairy. The project was approved in the month of August 2020. MoU and Agreement between TDU and GOKUL dairy signed to execute the project. The project has started from January 2021, 5 resistance cases to antibiotics identified and recruited for the study. After our intervention with Ethno-veterinary formulations for ten days, many antibiotics have become sensitive in all the five cases and clinically all the five cases showed positive results.

2. Metagenomics profiling of bovine milk from mastitis infected udder of the cows before and after treatment with ethno-veterinary practice (EVP)

Relevance: Bovine mastitis affects a large number of dairy cattle throughout the world and continues to remain as the most challenging disease. Mastitis is generally caused by various microbes. Mastitis therapy protocol includes antibiotics. The misuse of antibiotics led to development of the Antimicrobial resistance (AMR) in different regions of the world creating threat to public health.

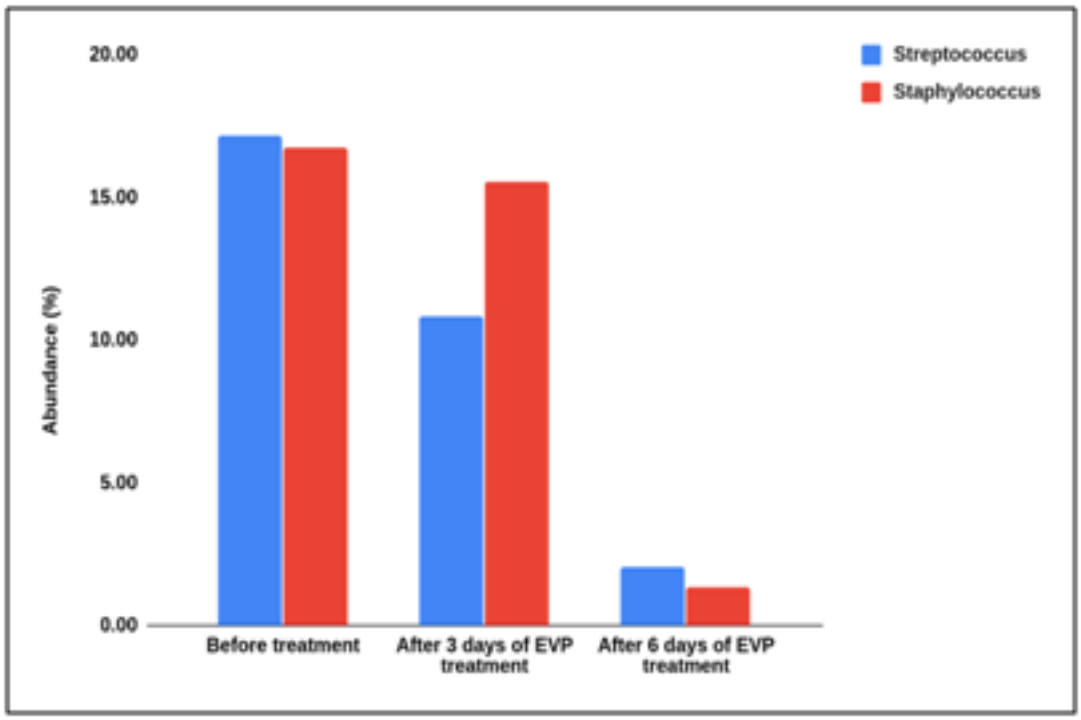
Objectives

1. To compare the milk microbiome of cows with clinical mastitis before and after treatment with the ethno-veterinary practice based herbal formulations.

2. The genus level abundance of bacteria which causes mastitis before and after EVP treatment and to find out the effectiveness of the herbal formulations for cure of mastitis.

Highlights of progress/ achievements of projects/ programs

The average abundance of *Staphylococcus* was reduced from 40.59% to 2.03% (20 times), *Streptococcus* from 25.8% to 2.06(12.52 times), *Pseudomonas, Pseudomonaceae* family 20.28% to 1.9 % (10.67 times), *Klebsiella* from 8.4% to 0.26% (32.31 times) and *Enterobacteriaceae* family from 24% to 1.69 %(14.37 times) after 6 days of treatment with herbal formulations indicating the cure of mastitis.



Abundance of Streptococcus and Staphylococcus of Mastitis affected cow milk before and after 3days and 6 days of Ethno-veterinary practice treatment.

Team members involved: Santhosha Hegde, Pavithra Narendran, Malali Gowda, M N Balakrishnan Nair

3. Sustainable harvesting of Oleo-gum Resin of Guggulu (*Commiphora wightii*).

Relevance: *Commiphora wightii* is a small arid zone tree which upon injury exudes a yellowish oleo-gum-resin. This exudate is called "Guggulu" which is used for treating several disease conditions in Ayurveda. The traditional guggulu tapping methods are less productive, employ destructive techniques and the plant generally dies after 3 years of tapping. Commiphora wightii is listed in the endangered plants of India.

Objectives

1. Develop a sustainable tapping technique to avoid destruction of guggulu plant
2. Enhance the production of guggulu for commercial viability without destroying the plant

Highlights of progress/ achievements of projects/programs :

- Seven plants tapped at Vandhay village which were tapped for the fourth year after treating with 5.98% ethephon yielded average 8.56 grams per plant(about 5 times more than the control
- Eight Plants at Vandhay village tapped for the second time after treating with 5.98% ethephon yielded average 13.38 grams per plant (7.9 times more than the control)
- 25 plants tapped for the first time at Faradi village after treating with 5.98% ethephon yielded average 204..65 grams per plant (6.2 times more than the control)

Tapping of the guggulu at Faradi village

Healed injury on the bark after 4 years tapping

Team member: Dr. M N Balakrishnan Nair, Dr. Jayeshkumar B. Bhatt, Mr Bhagirath

Webinar conducted

1. "Ethno-veterinary practices for cattle with special emphasis on viral disease in livestock (FMD and LSD) and Repeat breeding", on 17 November 2020. Organizers NLF, India and TDU
2. International Webinar on "Natural Livestock Farming: An approach to reduce use of antimicrobial and towards sustainable Dairy farming", on 15 December 2020. Organizers NLF, India and TDU

Publications/Research papers/ invited talks related to the activity

Prof. M N Balakrishnan Nair was Invited to give 2 virtual lectures at Sri padmavathi mahila Visva vidyalayam: Tirupati (Women's University) Trans-disciplinary Research Initiative at Centre for Adolescent health – on the subject "Contemporary relevance of Indian systems of medicine" and "Development of Technology/model for understanding Trans-disciplinary Health Sciences" on 29th January 2021 and 1st February 2021.

Invited lecture on "Traditional systems of medicines, Ethnoveterinary Practices and Veterinary Ayurveda" by Dr Kumar S K, on 5th January 2021. Invited by Institutional Development Plan Cell, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana.

Publication

M. N. Balakrishnan Nair1, N. Punniamurthy and S. K. Kumar. 2021. Ethno-veterinary Practices for Animal Health Management and the Associated Medicinal Plants from 24 Locations in 10 Indian States. Current Research in Agriculture and Veterinary Sciences. Vol. 3, Chapter10 Print ISBN: 978-93-90768-45-5, eBook ISBN: 978-93-90768-46- DOI: 10.9734/bpi/cravs/v3/1691C

Academics - Short-term hands-on skill development training course

Sl. No.	Name of Program	Audience	Final output (CME/ Certificate /Diploma/ Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
Next Generation Sequencing and Bioinformatics Training program Conducted during May 2020-Feb 2021 (13 training programs)								
1.	Introduction to Python in Biological data analysis.	UG, PG, PhD Scholars, Faculty, Post-doctoral Researchers & from Industry.	Certificate	The Training program aimed at training the participants on Computing language which is used in genomics data analysis. Duration: 3 hrs. No. of participants (3 series): 38+10+4 =52	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Santhosh Hegde , Manasa KH & Namitha R	Annexure 1

Sl. No.	Name of Program	Audience	Final output (Diploma/ Certificate /Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
2.	Introduction to Phylogenetic analysis using molecular tools		Barcoded and E-Signed Certificate	The workshop aimed at training the biologists for authentication of species diversity, taxa identification using molecular tool and building phylogenetic trees Duration: 3 hrs No. of participants: 9	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Lavanya D. K, Manasa K H, Namitha R	Annexure 2
3.	Introduction to R for Biological data analysis	UG, PG, PhD Scholars, Faculty, Post-doctoral Researchers & from Industry.	Barcoded and E-Signed Certificate	The workshop aimed at training biologists, students and researchers, about basic concept of R within the context of biological research Duration: 3 hrs, No. of participants (3 series): 50+7=57	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Prasanna S Koti, Manasa K H, Namitha R	Annexure 3
4.	Introduction to Perl Computing language Linux		Barcoded and E-Signed Certificate	The program aimed at using the emerging computing languages that provide new ways for NGS data analysis. Duration: 3 hrs No. of participants: 5	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Pavithra N, Manasa K H & Namitha R	Annexure 4

Sl. No.	Name of Program	Audience	Final output (Diploma/ Certificate /Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
5.	Introduction to primer designing	UG, PG, PhD Scholars, Faculty, Post-doctoral Researchers & from Industry.	Barcoded and E-Signed Certificate	The program aimed at teaching Bioinformatics technique used to design primer for authentication of species Duration: 3 hrs, No. of participants: 5	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Pavithra, Manasa K H, Namitha R	Annexure 5
6.	Whole Genome Sequence data analysis	UG, PG, PhD Scholars, Faculty, Post-doctoral Researchers & from Industry.	Barcoded and E-Signed Certificate	The Progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance Knowledge. Duration: 3 days, No. of participants: 20	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Pavithra Dr. Lavanya D. K, Santhosh Hegde, Manasa K H, Namitha R	Annexure 6
7.	Introduction to Bio-informatics		Barcoded and E-Signed Certificate	The program aimed at understanding the depth of Bioinformatics tools and application Duration: 3 hrs No. of participants: 8	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Pavithra, Santhosh Hegde, Manasa K H, Namitha R	Annexure 7

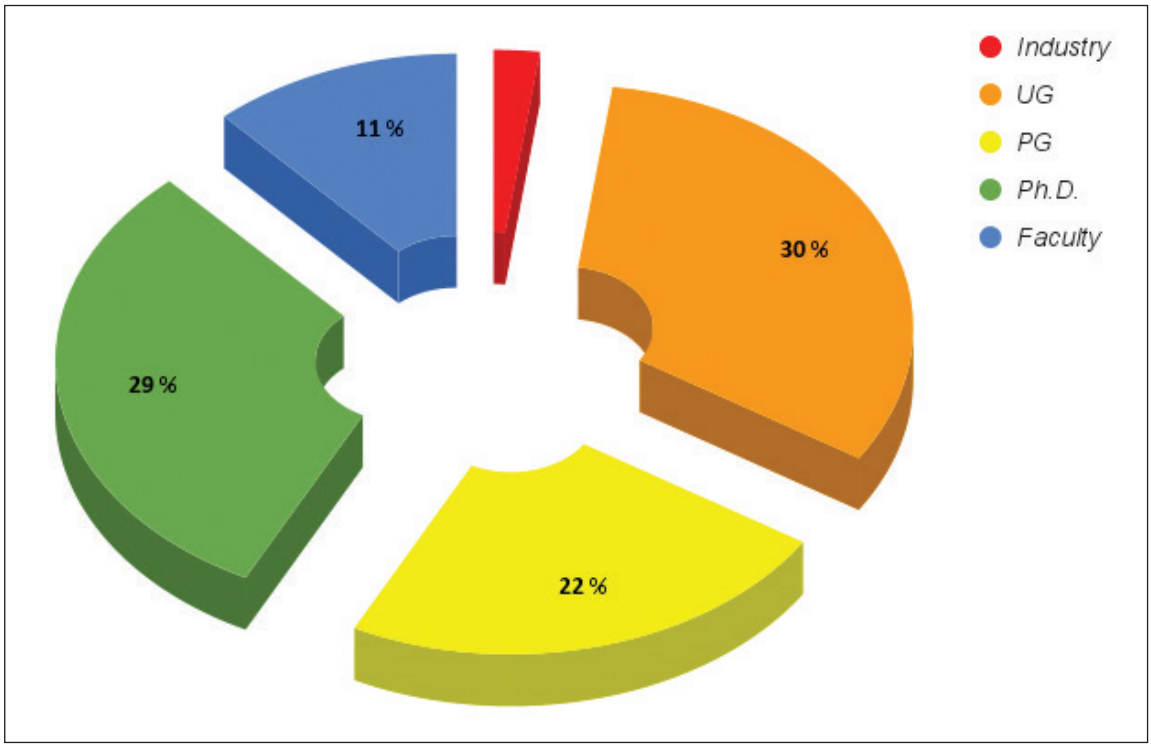
Sl. No.	Name of Program	Audience	Final output (Diploma/ Certificate /Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
8.	Metagenome Sequence analysis		Barcoded and E-Signed Certificate	The program aimed at training the participants to carry out metagenomic data analysis Duration: 3 days, No. of participants: 17	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Prasanna S Koti, Santhosh Hegde, Manasa K H Namitha R	Annexure 8
9.	Introduction to Biological data analysis and programming languages	UG, PG, PhD Scholars, Faculty, Post-doctoral Researchers & from Industry.	Barcoded and E-Signed Certificate	The workshop aimed at making the students understand the depth of Bioinformatics tools, Computing languages, and their application Duration:15 days, No. of participants: 78	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Prasanna S Koti, Santhosh Hegde, Manasa K H Namitha R	Annexure 9
10.	Transcriptome sequence Data analysis		Barcoded and E-Signed Certificate	The program aimed at training the participants to carry out transcriptome data analysis Duration: 5 days No. of participants: 6	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Santhosh Hegde, Manasa K H, Namitha R	Annexure 10

Relevance: The training courses were designed to provide an opportunity for the participants to understand the usage of contemporary science of genomics and bioinformatics.

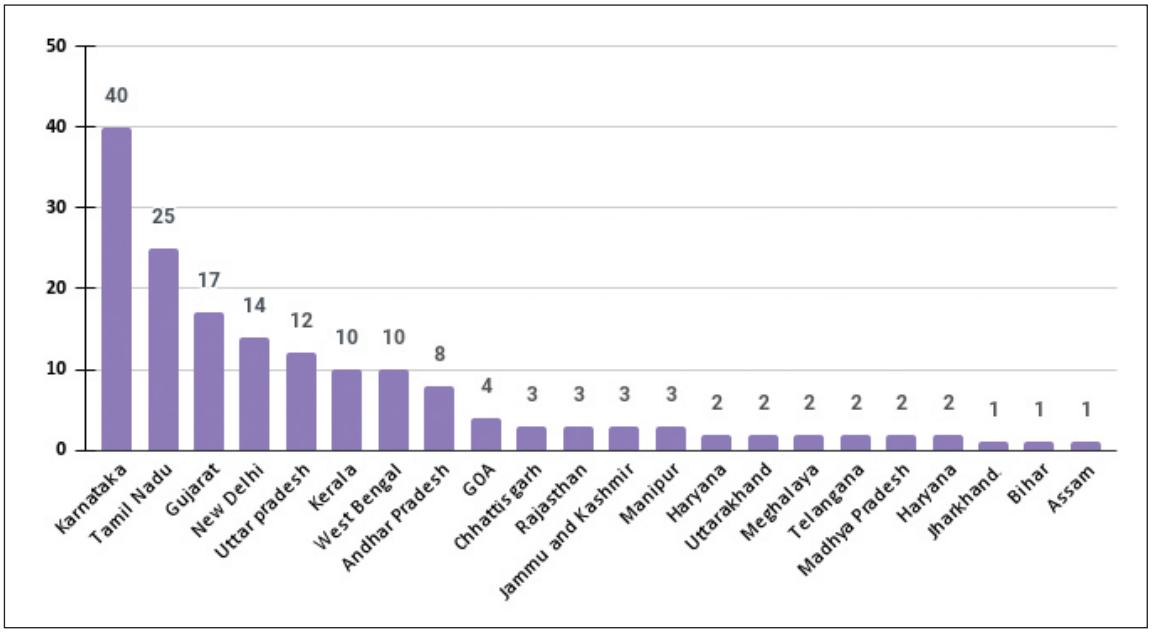
The main objective of the course was to develop skills by providing hands-on training to the discerning participants from diverse levels of academia and Industry (Figure 1. [participants_classification_chart.png]).

Highlights of progress/ achievements of projects/programs:

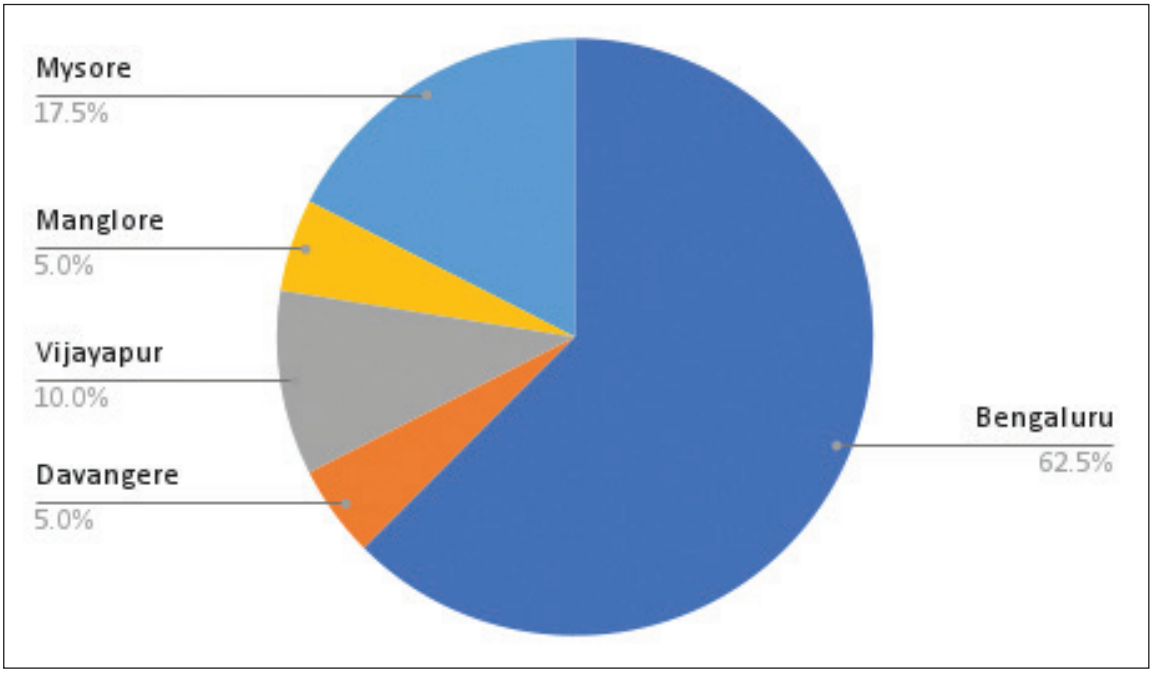
- The courses included several topics from the field of genomics and bioinformatics, so as to expose the participants to cutting-edge research.
- A greater emphasis was placed on skill development through hands-on training, and preparing candidates for employment in the industry.
- Though the courses were initially taught on campus and intended to cover molecular biology, genomics, and bioinformatics, there was more demand for bioinformatics online courses, as a consequence of COVID-19 pandemic. This in turn resulted in successfully conducting online courses in 13 different specializations, with nearly 170 students registering from all over the country (Figure 2.) [participants_location_India.png].
- Many of the participants who received training are from Karnataka, with a majority of them hailing from Bengaluru (Figure 3.)[participants_location_karnataka.png].



Percentage of candidates receiving hands-on training from various levels of academia and industry



Number of candidates who have undergone hands-on training from various locations across the country



Percentage of candidates from the state of Karnataka who have undergone hands-on training

Academics - M. Sc. Biological Sciences (Bioinformatics and Functional Genomics by Research)

Sl. No.	Name of Program	Audience	Final output (Diploma/ Certificate /Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
1.	MSc in Biological Sciences (Bio-informatics and Functional Genomics by Research)	Candidates from any stream Biology (Botany, Zoology, Bio-chemistry, Bio-technology and allied sciences) Engineering (Computer science and other disciplines)	Master's Degree	**Duration**: 2 Years (1 year course work and 1 Year research work) **Content:** 1. Genetics and DNA Science 2. Genomics of Plants, animals and microbes 3. (NGS) Next Generation Sequencing Technologies 4.Multi-Omics technologies. 5. Systems biology 6. Genome Editing and Synthetic Biology 7. Bioinformatics and Big Data Analysis 8. Basic of computing (Linux) and high-end server 9. Programming Languages 10. Genome databases 11. Intellectual Property Rights (IPR) 12. Industrial Exposure No. of Students: 2	Self funded	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Pavithra N, Dr. Lavanya D. K, Dr. Prasanna S Koti, Mr. Santhosh Hegde, Ms. Manasa K H & Ms. Namitha R	Annexure 11

Relevance: This program aims to provide an insight into biological data which would help the students in data acquisition, representation, retrieval, visualization and their analysis from genomics and proteomics perspective. Unlike the mainstream classroom learning, this course offers research based training in subjects that bridge the gap between education and industry requirements.

Highlights of progress/ achievements :

- Currently 2 M.Sc. R students have been enrolled.
- One student (Annapoorna Prabhu) - has secured 23 credits in 1st and 2nd semester. Her topic of Research for the 3rd and 4th Semesters:"Know Your Pedigree: A family-based webtool to understand the inheritance of genetic traits ". Thesis submitted on 31st March 2021, awaiting dates for the Viva/Defence.
- Another student (Mahalakshmi P) - Secured 14 credits from 6 courses in 1st semester. Her Topic of research: "Genome sequencing and molecular marker development for economically important vulnerable tree species Saraca asoca (Roxb.) Willd". completed 6 courses and waiting for 1st semester exams.

Team members involved

Dr. Pavithra N, Dr. Lavanya Devi, Dr. Prasanna Koti, Mr. Santhosh Hegde, Ms. Manasa K H, Ms. Namitha R, Mrs. Annapoorna Prabhu, Ms. Mahalakshmi P

Academics - M. Sc. Internship program (1 - 6 months)

Sl. No.	Name of Program	Audience	Final output (Diploma/ Certificate /Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
1.	Internship	Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines	Certificate	To enhance the knowledge in Genomics and Bioinformatics, an internship was offered by CFGB for the duration of 1-6 months. **Contents:** Introduction to bioinformatics, and its application, Introduction to Next Generation sequencing and Bioinformatics, NGS data formats, NGS data submission, Primer designing Duration: 1 month No. of Students - 3	Self funded	Dr. Lavanya D. K	Dr. Pavithra N, Dr. Lavanya D. K, Dr. Prasanna S Koti, Santhosh Hegde, Manasa K H & Namitha R	Annexure 12

Sl. No.	Name of Program	Audience	Final output (Diploma/ Certificate /Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
1.	Internship	Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines	Certificate	**Module:** Project Based Participants: 3 **Name**: Anjali Prajapathi **Title of the project:** Molecular docking analysis for the identification of potential medicinal plant compounds for antiviral (nCoViD-19) and immune boosters **Duration**: 10 months **Name**: Nidhi K V **Title of the project:** In silico profiling of RNA-seq data to distinguish the common and unique molecular markers involved in the neurodegenerative disorders **Duration**: 6 months **Name:** Diya **Title of the project:** Identification and Comparison of STRs in resistance and susceptible Finger miller germplasms **Duration**: 6 months	Self funded	Dr. Lavanya D. K	Dr. Pavithra N. Dr. Prasanna S Koti, Mr. Santhosh Hegde Dr. Lavanya D. K, Dr. Prasanna S Koti	Annexure 12

Relevance: The program is aimed at training students in functional genomics and bioinformatics. The Center for Functional Genomics and Bioinformatics offered a complete hands-on internship programme for a duration of 1-6 months. The internship is an opportunity to enhance the knowledge of Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines in the field of Genomics and Bioinformatics.

Highlights of progress/ achievements

- Three Undergraduate students from biotechnology background were trained in the area of genomics and bioinformatics for 1 month.
- Interns developed the necessary skill sets with respect to research projects. They were trained specifically on framing research questions, experimental design, data collection, data analysis, interpretation and report preparation.

Team members

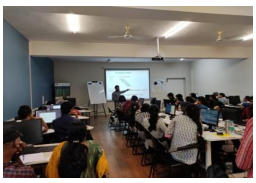
Dr. Pavithra N, Dr. Lavanya Devi, Dr. Prasanna Koti, Mr. Santhosh Hegde, Ms. Manasa K H, Ms. Namitha R

ANNEXURE 11

THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES & TECHNOLOGY

ONLINE INTERNSHIP PROGRAMMES

Organized By
Center for Functional Genomics and Bioinformatics, TDU



Internship programme for students (UG, PG, PhD Scholars, Post-Doc Researchers)

Program Directors:-
Dr. Pavithra N, Asst Professor and Centre-in-Charge
Dr. Lavanya DK, Asst Professor
Dr. Prasanna S Koti, Asst Professor

Training Theme :-
The progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance knowledge.

Who can participate?
Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

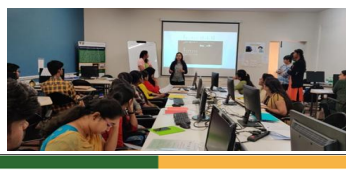
Mission Accomplished (2017-19):
Created "Genomics Ecosystem" in the country by conducting 16 training programs
Trained> 700 Scientists (Streams of Biology, Engineering Technology).
Achieved 100% transformation of participants in the areas of Genomics and Bioinformatics,
More details at: *http://tdu.edu.in/genomics/genomics-events/*

(Topics prescribed here depends on the project carried out at that moment)

Modules	Topics
1	➢ Introduction to Linux and Programming language ➢ Introduction to PERL ➢ Introduction to MySQL ➢ Introduction to java programming ➢ Introduction to Next Generation Sequencing and Metagenome Analysis
2	➢ Introduction to Linux and Programming language ➢ Introduction to PERL ➢ Introduction to MySQL ➢ Introduction to java programming ➢ Introduction to Next Generation Sequencing and Whole Genome analysis
3	➢ Introduction to Linux and Programming language ➢ Introduction to PERL ➢ Introduction to MySQL ➢ Introduction to java programming ➢ Introduction to Next Generation Sequencing and Transcriptome Assembly and Annotation
4	➢ Introduction to bioinformatics, and its application ➢ Introduction to Next Generation sequencing and Bioinformatics ➢ NGS data formats ➢ NGS data submission ➢ Primer designing

Internship Programmes offered	Duration months	Fee /month (INR)
Internship (Short Term)	1-2	3500+18% GST -4130/-
Internship (Long Term for project work)	3-4	3000+18%GST -3540/-
Skilled Internship	6	2500+18%GST -2950/-

Dr. Lavanya Devi K.
Asst. Professor
Internship coordinator
Centre for Functional Genomics and Bioinformatics, TDU
Mail to us at: genomics@tdu.edu.in
9845714170



Research

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator and co investigators	Industry-Academia-Govt-other country Collaboration Activities	Self-funded/ Funding agency	Key achievements
1.	Elucidation of molecular mecha-nisms involved in Pistacia-aphid gall development	Basic Science	Center for Functional Genomics and Bio-informatics, TDU	Dr. Noorunnisa Begum	T. S. Keshava Prasad, Professor and Deputy Director, Center for Systems Biology and Molecular Medicine Yenepoya Research Center, Yenepoya (Deemed University) Mangalore	Dabur India Limited	1. The microbiome of *Pistacia integerrima* gall and leaf has been se-quenced. 2. The key metabolites in *Pistacia integerrima* and *Terminalia chebula* gall and leaf have been identified.
2.	Report on the correlation between HLA and Prakriti types in context with cases of Bone Marrow transplantation from Mazumdar Shaw Medical Centre	Clinical Research	Center for Functional Genomics and Bio-informatics, TDU & Mazumdar Shaw Medical Centre	Dr. Pavithra N	Dr. Sharath Damodar, Mazumdar Shaw Medical Centre, Bengaluru	Kiran Mazum-dar Shaw	1. A total of 86 subjects, including the donor and the recipient, have been recruited. 2. In this preliminary study, it was found that 45 percent of donor and recipient have similarity in prakriti. One or more doshik type scores and 13 percent donor and recipient having similarity w.r.t dominance of one or more doshas

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia-Govt-other country Collaboration Activities	Self-funded/ Funding agency	Key achievements
3.	Integrated genomics-as-sisted breeding for efficient development of superior finger millet varieties for Karnataka	Genomics and Bio-informatics research	Germplasm identifica-tion was achieved at GKVK, Sequencing activities carried out at C-CAMP and data analysis at the Centre for Functional Genomics and Bio-informatics, TDU.	Dr. Malali Gowda (Principal Investigator) Dr. Lavanya D K (In-charge Principal Investigator, TDU)	Consortium project initiated by ICAR-AICRP on small millets involving institutes such as ICRISAT, ICMR, GKVK, C-CAMP-TDU, ZARS Mandya.	Govt. of Karnataka, Dept. of Agriculture.	1. This research involved cata-loguing the trait-specific vari-ations found in several finger millet germplasms. The germplasm included 33 Karnataka-released varieties, 53 breeding lines for blast resistance and susceptibility, and 6 white grain, as well as 30 drought-tolerant germ-plasm. 2. High-quality genomic DNA from all the finger millet germplasm was isolated at TDU and resequencing was done at C-CAMP 3. The sequenced data was mapped to the reference ge-nomes ML365 and PR202, and variations in the form of single nucleotide polymor-phisms (SNPs) and insertions and deletions were discovered (InDels). 4. By April 2021 , the sequenc-ing and data analysis activities had been completed, and the final report had been submit-ted to the C-CAMP.

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator and co investigators	Industry-Academia-Govt-other country Collaboration Activities	Self-funded/ Funding agency	Key achievements
1.	Functional Genomics Resource Data-base for 50 High Volume Traded Medicinal Plants	Database and io-in-formatics research	Center for Functional Genomics and Bio-informatics, TDU	Dr. Prasanna. S. Koti	The project is being completely executed at the Center for Functional Genomics and Bio-informatics, TDU	Funded by Kiran Mazum-dar Shaw	1. Constructed page to perform sequence similarity search using BLAST algorithm. 2. Constructed a genome browser web page to display functional information of the genome. 3. A web page to hold information with respect to the bioactive compounds, its structure information, mechanism of action, admet properties and protein interactors was constructed. 4. Efforts to include Functional analysis of genes including GO annotations and biological pathway analysis were made.

Elucidation of molecular mechanisms involved in Pistacia-aphid gall development

Relevance: Pistacia chinensis subsp. integerrima (J. L. Stewart ex Brandis) Rech. f. from the family Anacardiaceae, is a dioecious tree native to Asia and is well known for formation of galls on its apical buds. These galls are horn shaped and formed due to infestation of insect Baizongia pistaciae L., which follows a two-year life cycle. The galls are the source of secondary metabolites which are used for the treatment of cough and respiratory ailments, loss of appetite, dyspeptic vomiting, and dysentery. Pistacia galls are one of the ingredients in many ayurvedic formulations such as shringiadi chura, karkatakadi churna, balachaturbhadra churna, brihat talisadi churna, devadarvayadi kwatha churna, shatavaryadi ghrita, chyawanprash avaleha, dashmularishta, siva gutika, khadiradi gutika etc.

The drastic decrease in gall formation noticed in recent decades is possibly due to climate change or human interventions, making it an important species for conservation. The molecular mechanisms responsible for induction and development of gall are however not known. There is no genomic information available either. In this study, we aimed to understand the molecular mechanisms of gall development (plant-insect) through the genome, transcriptome and proteome analysis of Pistacia galls. These molecular resources will help in understanding of Pistacia genes and pathways responsible for gall formation.

Highlights of progress/ achievements:

- Microbiome sequencing (16S rRNA and ITS) was performed to identify significant microbes present in gall and leaf of Pistacia integerrima and the comparative analysis between gall and leaf to identify the relative abundance.
- The RNAseq data analysis was done using simulation method to generate the technical replicates and differentially expressed genes were identified
- The global metabolites study was carried out using LC-MS technique and identified key metabolites in the gall and leaf of Pistacia integerrima and Terminalia chebula
- Comparative study of the whole genome sequence of Pistacia integerrima was done and i found that Citrus sinensis and Pistacia vera L. were genetically closer to Pistacia integerrima.

Team member: Dr. Pavithra N, Dr. Noorunnisa Begum, Dr. Subramanya kumar, Mr. Santhosh Hegde

Report on the correlation between HLA and Prakriti types in context with cases of Bone Marrow transplantation from Mazumdar Shaw Medical Centre

Relevance: Human Leukocyte Antigen (HLA), class I (HLA-A, B and C) and class II (HLA-DR, DQ and DP) genes that are the most important in the human genome responsible for the regulation of the human immune system . HLA matching between donor and recipient is important for any organ transplantation. As per the current understanding of genetics, an individual is composed of a complex and large number of independent heritable units or genes, which are transferred from parents to offspring (Murphy, 1951). The mother and father genes through their germ cells exert influence on the personality of offspring. It has been described in Ayurveda that sperm (Shukra), ovum (Shonita), the nature of parental germs act as the influencing factors in the constitution (Prakriti) of individuals.

Ayurveda generally categorizes individuals in one of the three broad classes of 'Prakriti' based on certain physical, physiological and psychological characters. Prakriti of a person is fixed just like a genome of an individual (Amin H and Sharma R, 2017). Bhushan et al., have classified human population based on HLA gene polymorphism and the concept of Prakriti. They observed complete absence of HLA DRB*02 allele in the vata type and HLA DRB1*13 significant in the kapha type. However, these were assessed by low resolution HLA technology and not established the application of Prakriti types for matching HLA types (Bhushan P et al., 2005)

In this project we explore the association between Prakriti phenotypes with HLA gene. We hypothesize that HLA alleles associated with Prakriti types will be of high predictive nature in finding matches for Bone marrow transplant in similar Prakriti types.

For this study, collaboration with Dr Sharath Damodar, Senior Consultant Haematologist and Head of Haematology, & Bone Marrow Transplant, Mazumdar Shaw Medical Center was established. Ethical Committee approval obtained from Narayana Health Academic Ethics Committee (NHAEC) to conduct the study at Mazumdar Shaw Medical Centre. Study trial was registered in Clinical Trial Registry India (CTRI). Study subjects with age groups between 18 and 65 who have undergone or who will be undergoing bone marrow transplant were recruited for the prakriti analysis.

Highlights of progress/ achievements:

- A total number of 86 subjects including donor and recipient were recruited.
- Prakriti analysis was completed for 44 subjects (22 pairs).
- In this preliminary study of 22 donor and recipient pairs, it was found that 45% of donor and recipient having apparent similarity between the Prakriti of donor and recipient w.r.t one or more doshik type scores and 13 % donor and recipient having similarity w.r.t dominance of one or more doshas.

- The results obtained from the preliminary study are promising and indicate that prakriti correlation of donor and recipient is worth exploring and can help in HLA matching and organ transplantation.
- In case of half match cases, it was found that even though there was no apparent similarity between the Prakriti of donor and recipient in terms of one or more doshik type scores, similarity with respect to dominance of one or more doshas existed.

Team members: Dr. Pavithra N, Dr. Poornima Devkumar, Dr. Prasan Shankar, Ms. Namitha R, Ms. Manasa K H (TDU), Dr. Sharath Damodar (Mazumdar Shaw Medical Centre), Hon. Advisor: Prof. Malali Gowda

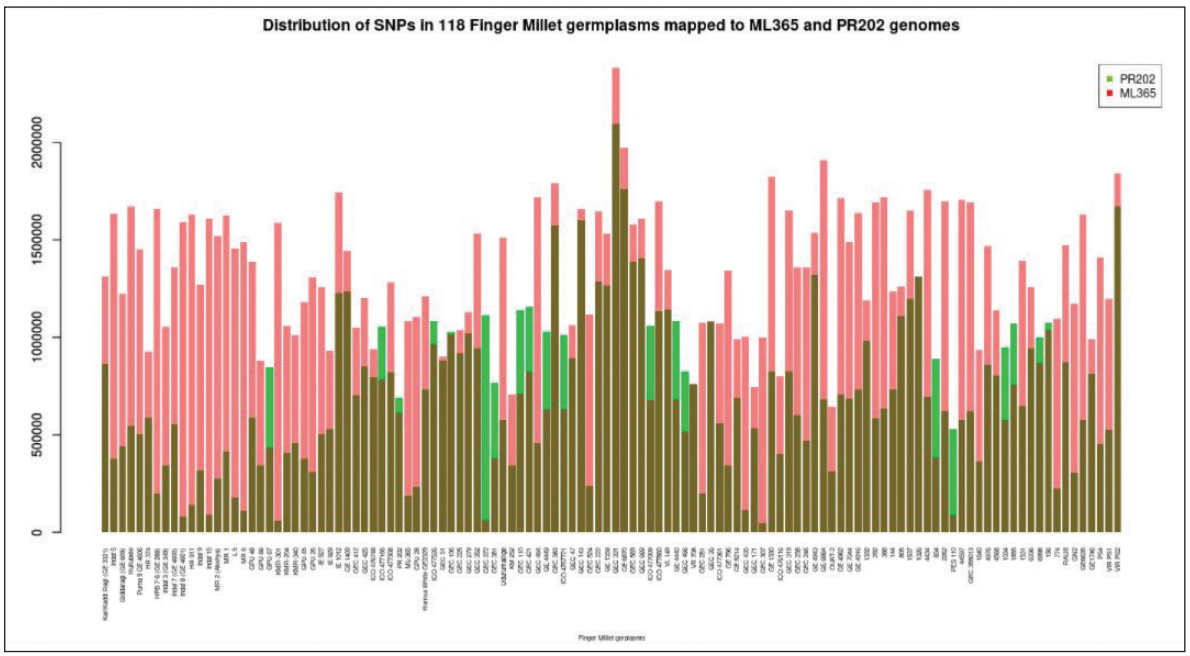
Integrated genomics-assisted breeding for efficient development of superior finger millet varieties for Karnataka.

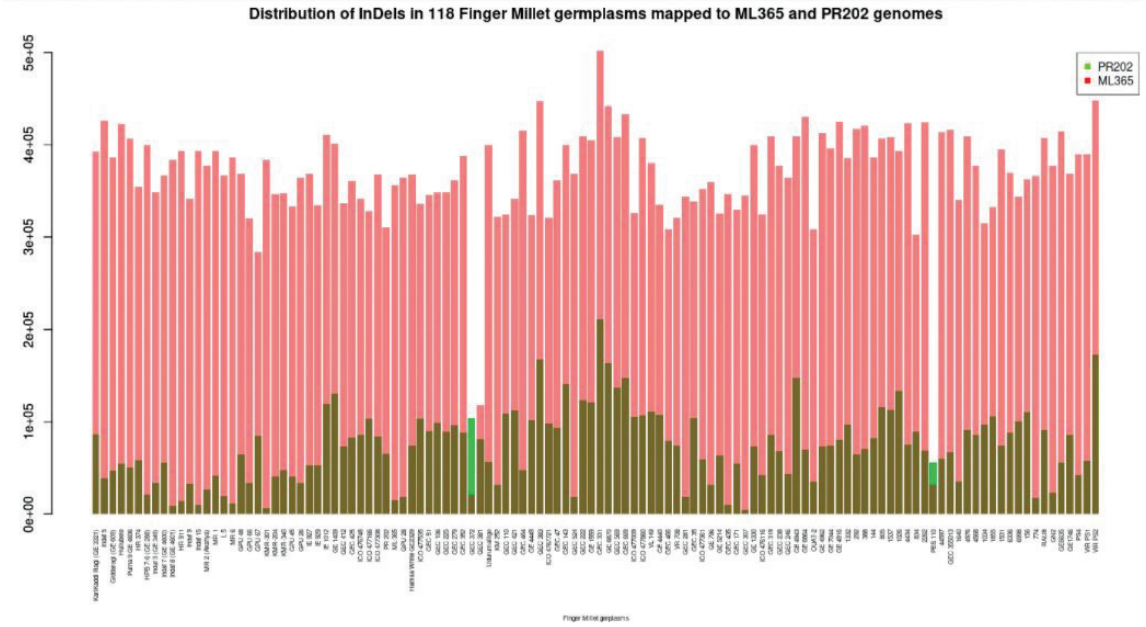
Relevance: Finger millet, scientifically known as Eleusine coracana, and locally known as Ragi, is an annual cereal crop grown primarily in Karnataka and Tamil Nadu in India. To catalogue the information about genomic areas contributing to disease resistance traits, germplasm with adaptive characteristics such as resistance were compared to the germplasms susceptible to blast fungus, by measuring single nucleotide polymorphisms (SNPs) and insertions and deletions (InDels).

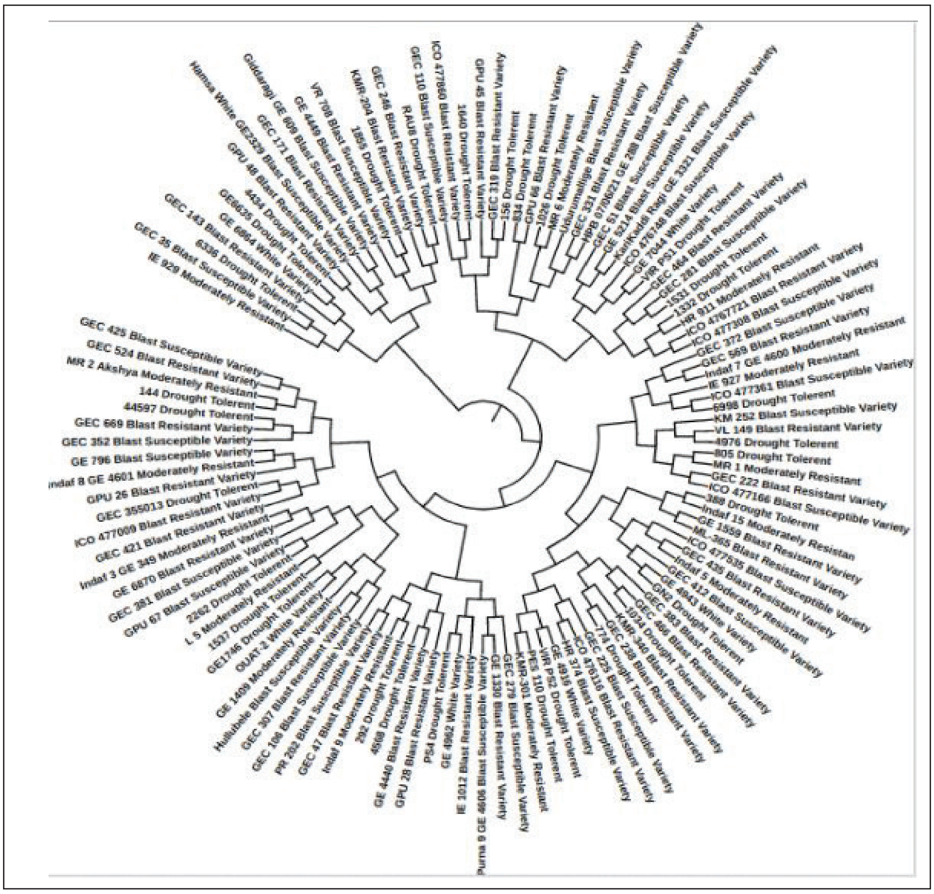
Highlights of progress/ achievements:

- High-quality genomic DNA was extracted from Finger Millet germplasm (Released varieties - 33, Blast susceptible and Blast resistant varieties - 53, White grain varieties – 06 and drought tolerant germplasm - 30) at The University of Trans-Disciplinary Health Sciences and Technology, Bangalore, Karnataka.
- Re-sequencing of the germplasm was prepared using Illumina paired-end (PE) libraries (2 × 150 nucleotides) following manufacturer's instruction using Next Tera Flex DNA Sequencing Kit at CCAMP, Bangalore.
- All of germplasms sequenced reads were individually mapped to the ML365 and PR202 reference genomes, and measurements like single nucleotide polymorphisms and InDels were predicted.
- The variants from all 118 varieties were pooled and analyzed further. With respect to the ML365 and PR202 reference assemblies, the team predicted 8,846,587 and 10,272,494 Single Nucleotide Polymorphisms (SNPs) (Figure 1.) [SNPs.JPG]. In addition, the team discovered 961,554 and 1,546,815 InDels (Figure 2.)[Indels. JPG] in the ML365 and PR202 reference assemblies, respectively.
- To understand the closeness and relationship between each germplasm, a phylogenetic tree was constructed using SNPs obtained from mapping to ML365 (Figure 3.)[ML365_phylo.JPG] and PR202 (Figure 4.) [PR202_phylo.JPG] reference genomes.

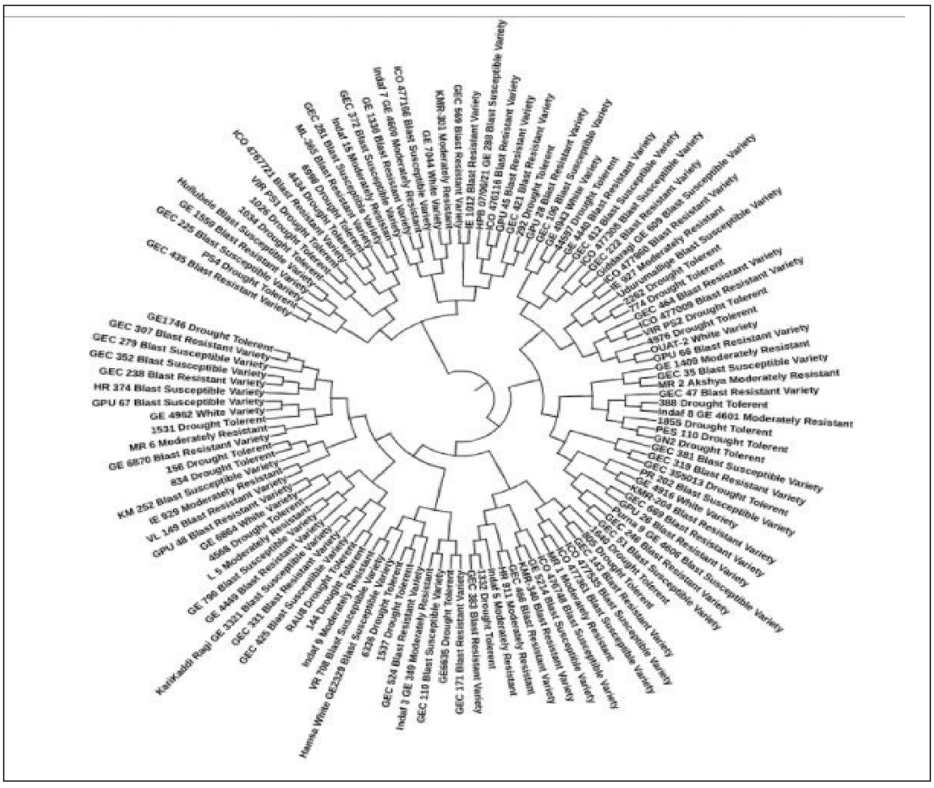
Team members: Dr. Lavanya D. K, Dr. Prasanna S. Koti, and Mr. Santhosh Hegde


Distribution of SNPs in 118 Finger Millet germplasms mapped to ML365 and PR202 genomes
PR202
ML365
0
500000
1000000
1500000
2000000
Finger Millet germplasms


Distribution of InDels in 118 Finger Millet germplasms mapped to ML365 and PR202 genomes
PR202
ML365
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
Finger Millet germplasms



A phylogenetic tree of 118 finger millet germplasm mapped to the ML365 genome



A phylogenetic tree of 118 finger millet germplasm mapped to the PR202 genome

Functional Genomics Resource Database for 50 High Volume Traded Medicinal Plants

Relevance: Scattered genomics data from other large sequence databases (NCBI/ EBI) is consolidated into a single well-organized platform for easier querying and information retrieval . In this study efforts would be made to create a single genomic reference database for medicinal plants used in Ayurveda and other traditional medicinal systems practiced in India. In addition to the sequence information, cataloguing the functional information of phytochemicals of plants, their gene targets in humans, and chemical information of phytomolecules would be collected.

Highlights of progress/ achievements:

- The resource includes a Blast algorithm-based sequence similarity search tool.
- It contains a genome browser web page that displays the genomic information such as gene structure and coordinates, sequence download windows and other visual representation of genome regions.
- It also hosts a website with information about bioactive substances, their structures, mechanisms of action, admet characteristics, and protein interactors.
- After completion, the resource will include web pages with information on phytomolecules biologically synthesized by plants, human genes that interact with bioactive molecules, functional annotation of the interacting genes in the form of gene ontology, pathway data, and close protein interactions between the interacting genes.

Team members: Dr. Prasanna. S. Koti and Mr. Santhosh Hegde

ANNEXURE 1

"Innovative & Successful Program to bridge the gap between Computation and Biology

ONLINE TRAINING PROGRAM

Organized by

CENTRE FOR FUNCTIONAL GENOMICS & BIOINFORMATICS, TDU

THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES & TECHNOLOGY

genomics@tdu.edu.in

Program Directors:-
Dr. Pavithra N, Asst Professor and Centre-in-Charge
Dr. Lavanya DK, Asst Professor
Dr. Prasanna S Koti, Asst Professor

Training Theme :-
The progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance knowledge.

Dates	Modules	Topics	Duration	Cost+18% GST
6-05-20	1	❖ Introduction to Python in Biological Data analysis	2pm-5pm	490 /- (with certificate) 290/-(without certificate)

Organizing Secretaries:- Namitha. R (7892368195)

Our strength:-
Highly skilled resource persons who provide hands on training in the field of both molecular biology and bioinformatics.

Who can participate?
Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

Registration Link :
https://docs.google.com/forms/d/e/1FAIpQLSeTuhuppOJ8v3cUOTFuiwO52V95NgENzsSrbjNLxVDE--5jmg/viewform?usp=pp_url

Last Date for Registration: May 5, 2020, limited seats

Payment Mode NEFT (Online):
Account Name: UTD-HST General Fund
Account Number: 0694104000134705
IDBI Bank, Yelahanka New Town,
Bangalore-560064,
IFSC: IBKL0000694, MICR: 560259014

Coming up with many more computational biology classes

ANNEXURE 2

ONLINE TRAINING PROGRAM

Organized by

CENTRE FOR FUNCTIONAL GENOMICS & BIOINFORMATICS, TDU

THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES & TECHNOLOGY

Program Directors:-
Dr. Pavithra N, Asst Professor and Centre-in-Charge
Dr. Lavanya DK, Asst Professor
Dr. Prasanna S Koti, Asst Professor

Organizing Secretaries:-
Namitha. R (7892368195) and **Manasa. K. H (9738167007)**

Training Theme :-
The authentication, species diversity, taxa identification at different levels of the classification and methods followed using the molecular techniques will be discussed with hands on for building phylogenetic trees and their significance.

Who can participate?
Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

Requirements :-
Hands on for few aspects will be given for better understanding. Participants can install the MEGA software of any version which is available free online.

Our strength:-
- Highly skilled resource persons who provide hands on training in the field of Molecular biology, Genomics and Bioinformatics.
- Successfully completed 16 hands-on training programs on Next generation sequencing and computational biology.

Date	Module	Topics	Time	Cost	+18% GST	Total cost
13-05-20	1	Plant systematics and phylogeny- A molecular approach (For Beginners)	2pm-5pm	500/-	90/-	590/-

genomics@tdu.edu.in

Registration Link and QR code:
https://forms.gle/nqDJw6gLWqNgtncTA

Note: kindly upload a photocopy(image format) of any ID card in the registration form. (PAN card, Adhaar, Driving License, Passport, EPIC(Voter ID), etc.)

Last Date for Registration: May 11, 2020, limited seats

Payment Mode NEFT (Online):
Account Name: UTD-HST General Fund
Account Number: 0694104000134705
IDBI Bank, Yelahanka New Town,
Bangalore-560064,
IFSC: IBKL0000694, MICR: 560259014

Google pay-
Account Number: 0694104000134705
IFSC: IBKL0000694
Recipient name: UTD-HST General Fund

Coming up with many more Computational Biology classes

Barcoded E- certificates will be provided

ANNEXURE 3

THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES & TECHNOLOGY

"Innovative & Successful Program to bridge the gap between Computation and Biology

ONLINE TRAINING PROGRAM

Organized by

CENTRE FOR FUNCTIONAL GENOMICS & BIOINFORMATICS, TDU

Program Directors:-
Dr. Pavithra N, Asst Professor and Centre-in-Charge
Dr. Lavanya DK, Asst Professor
Dr. Prasanna S Koti, Asst Professor

Organizing Secretaries:-
Namitha. R (7892368195) and **Manasa. K. H (9738167007)**

Training Theme :-
The progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance knowledge.
Contents- R Basics, Data handling and visualization, Handling high-throughput sequence data using R

Who can participate?
Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

Requirements :-
Participants should have their laptops with good speed internet.

Our strength:-
- Highly skilled resource persons who provide hands on training in the field of Molecular biology, Genomics and Bioinformatics.
- Successfully completed 16 hands-on training programs on Next generation sequencing and computational biology.

Date	Module	Topics	Time	Cost	+18% GST	Total cost
27-05-20	1	**Introduction to R for Biological Sequence Data Analysis**	2pm-5pm	500/-	90/-	590/-

genomics@tdu.edu.in

Registration Link and QR code:
https://forms.gle/1R2ZTZdfqi7hJ7mh6

Note: kindly upload a photocopy(image format) of any ID card in the registration form. (PAN card, Adhaar, Driving License, Passport, EPIC(Voter ID), etc.)

Last Date for Registration: May 25, 2020, limited seats

Payment Mode NEFT (Online):
Account Name: UTD-HST General Fund
Account Number: 0694104000134705
IDBI Bank, Yelahanka New Town,
Bangalore-560064,
IFSC: IBKL0000694, MICR: 560259014

Google pay-
Account Number: 0694104000134705
IFSC: IBKL0000694
Recipient name: UTD-HST General Fund

Coming up with many more Computational Biology classes

ANNEXURE 4

THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES & TECHNOLOGY

"Innovative & Successful Program to bridge the gap between Computation and Biology

ONLINE TRAINING PROGRAM

Organized by

CENTRE FOR FUNCTIONAL GENOMICS & BIOINFORMATICS, TDU

genomics@tdu.edu.in

Program Directors:-
Dr. Pavithra N, Asst Professor and Centre-in-Charge
Dr. Lavanya DK, Asst Professor
Dr. Prasanna S Koti, Asst Professor

Organizing Secretaries:-
Namitha. R (7892368195) and **Manasa. K. H (9738167007)**

Training Theme :-
The progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance knowledge

Who can participate?
Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

Requirements :-
For hands-on, participants should have their laptops with pre-installed Linux operating system.

Our strength:-
- Highly skilled resource persons who provide hands on training in the field of Molecular biology, Genomics and Bioinformatics.
- Successfully completed 16 hands-on training programs on Next generation sequencing and computational biology.

Date	Module	Topics	Time	Cost	+18% GST	Total cost
20-05-20	1	**Introduction to Linux and PERL program**	2pm-5pm	400/-	72/-	472/-

Registration Link and QR code:
https://forms.gle/hhy6fGjGXR3cUTwU6

Note: kindly upload a photocopy(image format) of any ID card in the registration form. (PAN card, Adhaar, Driving License, Passport, EPIC(Voter ID), etc.)

Last Date for Registration: May 18, 2020, limited seats

Payment Mode NEFT (Online):
Account Name: UTD-HST General Fund
Account Number: 0694104000134705
IDBI Bank, Yelahanka New Town,
Bangalore-560064,
IFSC: IBKL0000694, MICR: 560259014

Google pay-
Account Number: 0694104000134705
IFSC: IBKL0000694
Recipient name: UTD-HST General Fund

Coming up with many more Computational Biology classes

Barcoded E- certificates will be provided

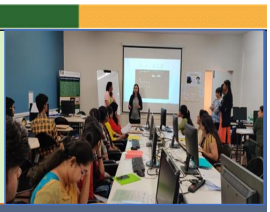
ANNEXURE 5

THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES AND TECHNOLOGY

ONLINE TRAINING PROGRAM

Organized By

Centre for Functional Genomics and Bioinformatics



genomics@tdu.edu.in

Program Directors:-

Dr. Pavithra N, Asst Professor and Centre-in-Charge
Dr. Lavanya DK, Asst Professor
Dr. Prasanna S Koti, Asst Professor

Training Theme :-

The progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance knowledge.

Mission Accomplished (2017-19):

Created "Genomics Ecosystem" in the country by conducting 16 training programs
Trained> 700 Scientists (Streams of Biology, Engineering Technology).
Achieved 100% transformation of participants in the areas of Genomics and Bioinformatics,
More details at: *http://tdu.edu.in/genomics/genomics-events/*

Who can participate?

Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer science , Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

Date	Topic	Time	Cost	+18% GST	Total cost
10-06-20	**Introduction to Computing language and Primer designing tools (Hands-on)**	3pm-5pm	500/-	90/-	590/-

Requirements :- For hands on participants should have their laptops with pre-installed Linux operating system

Registration link:- *https://forms.gle/kJfoLjAwPeGWpaP28*

Last Date For Registration: 8/6/2020 , limited seats

Organising Secretaries:- **Namitha.R (7892368195), Manasa K.H (9738167007)**

Payment Mode NEFT (Online):
Account Name: UTD-HST General Fund
Account Number: 0694104000134705
IDBI Bank, Yelahanka New Town, Bangalore-560064,
IFSC: IBKL0000694, MICR: 560259014

Google pay-
Account Number: 0694104000134705
IFSC: IBKL0000694
Recipient name: UTD-HST General Fund

ANNEXURE 7

The University of Transdisciplinary Health Sciences and Technology, Bangalore- 64

ONLINE TRAINING PROGRAM

by

CENTRE FOR FUNCTIONAL GENOMICS AND BIOINFORMATICS

PROGRAM DIRECTORS:-

❖**Dr. Pavithra N,** Asst Professor and Centre-in-Charge
❖**Dr. Lavanya DK,** Asst Professor
❖**Dr. Prasanna S Koti,** Asst Professor

Who can participate?

Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

Topic:- Introduction to Bioinformatics

- Types of BLAST.
- Primer Designing Tools.
- Bioinformatics Database.
- Translation Tools. (DNA to Protein)

Date :- 8/7/2020
Time:- 6pm- 8pm

Cost :- 500 +18%GST = 590/-

Registration link :- *https://forms.gle/TLghreiIwAw3IuP59*

Last date to register :- 6/7/2020 (Limited seats)

Payment Mode NEFT (Online):
Account Name: UTD-HST General Fund
Account Number: 0694104000134705
IDBI Bank, Yelahanka New Town, Bangalore-560064,
IFSC: IBKL0000694, MICR: 560259014

Google pay-
Account Number: 0694104000134705
IFSC: IBKL0000694
Recipient name: UTD-HST General Fund

Coming up with many more Computational classes

ORGANIZING SECRETARIES:-

❖ **NAMITHA. R** (7892368195),**MANASA. K. H** (9738167007)

E- CERTIFICATES WILL BE PROVIDED

THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES & TECHNOLOGY

ONLINE TRAINING PROGRAM

'WHOLE GENOME SEQUENCE DATA ANALYSIS'

organized by

Centre for Functional Genomics & Bioinformatics, TDU

"Innovative & Successful Program to bridge the gap between Computation and Biology"

genomics@tdu.edu.in

Program Directors:-

Dr. Pavithra N, Asst Professor and Centre-in-Charge
Dr. Lavanya DK, Asst Professor
Dr. Prasanna S Koti, Asst Professor

Objectives:

- The progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance knowledge.
- Next-generation sequencing (NGS) technology, with its high-throughput capacity and low cost, has developed rapidly in recent years and become an important genome-wide tool to discover new **genes, genomes and its elements**.

Mission Accomplished (2017-20):

- Created "Genomics Ecosystem" in the country by conducting 16 training programs
- Trained > 700 Scientists (Streams of Biology, Engineering Technology).
- Achieved 100% transformation of participants in the areas of Genomics and Bioinformatics,
- More details at: ***http://tdu.edu.in/genomics/genomics-events/***

Date	Topics	Time
17-6-2020	➢ Introduction to Next Generation technology ➢ Illumina Demo	6pm -9pm
18-6-2020	➢ Introduction to Computing languages ➢ Next Generation Sequencing data formats (Hands on)	6pm -9pm
19-6-2020	➢ Whole genome sequencing data analysis (Hands on)	6pm – 9pm

Organising Secretaries:- Namitha.R (7892368195), Manasa K H(9738167007)

KNOWLEDGE PARTNERS

BANGALORE BIOINNOVATION CENTRE — Sculpting the Future of Bioinnovation (A Government of Karnataka Undertaking)

premas life sciences

Our strength:-

- Highly skilled resource persons who provide hands on training in the field of Molecular biology, Genomics and Bioinformatics.
- Successfully completed 16 hands-on training programs on Next generation sequencing and computational biology.

Who can participate?

Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

Cost	18 %GST	Total cost
3000/-	540/-	4130/-

Registration link:-
https://forms.gle/XJUK3FVaNDpWKSqu9

Last date for registration: June 15, 2020 limited seats

Note: kindly upload a photocopy(image format) of any ID card in the registration form. (PAN card, Adhaar, Driving License, Passport, EPIC(Voter ID), etc.)

Requirements :- Computers or laptops with minimum 4GB RAM, 250GB free space in hard disk , quard core processors and installed with ubuntu 16.0v or above

Payment Mode NEFT (Online):
Account Name: UTD-HST General Fund
Account Number: 0694104000134705
IDBI Bank, Yelahanka New Town, Bangalore-560064,
IFSC: IBKL0000694, MICR: 560259014

Google pay-
Account Number: 0694104000134705
IFSC: IBKL0000694
Recipient name: UTD-HST General Fund

Barcoded E- certificates will be provided

Online Training Program

METAGENOME SEQUENCE DATA ANALYSIS

Organized by

Centre for Functional Genomics & Bioinformatics, TDU

"Innovative & Successful Program to bridge the gap between Computation and Biology"

genomics@tdu.edu.in

PROGRAM DIRECTORS:-

- **Dr. Pavithra N**, Asst Professor and Centre-in-Charge
- **Dr. Lavanya DK**, Asst Professor
- **Dr. Prasanna S Koti**, Asst Professor

OBJECTIVES:

- The progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance knowledge.
- Next-generation sequencing (NGS) technology, with its high-throughput capacity and low cost, has developed rapidly in recent years and become an important genome-wide tool to discover new **genes, genomes and its elements**.

MISSION ACCOMPLISHED (2017-20):

- Created "Genomics Ecosystem" in the country by conducting 16 training programs
- Trained > 700 Scientists (Streams of Biology, Engineering Technology).
- Achieved 100% transformation of participants in the areas of Genomics and Bioinformatics,
- More details at: *http://tdu.edu.in/genomics/genomics-events/*

Date	Topics	Time
12-8-2020	➢ Introduction to Next Generation Sequencing technology ➢ Illumina Demo	6pm -9pm
13-8-2020	➢ Introduction to Computing languages ➢ Next Generation Sequencing data formats (Hands on)	6pm -9pm
14-8-2020	➢ Metagenome sequencing data analysis (Hands on)	6pm – 9pm

ORGANISING SECRETARIES:- **Namitha R (7892368195)**
Manasa K H(9738167007)

KNOWLEDGE PARTNERS

BANGALORE BIOINNOVATION CENTRE — Sculpting the Future of Bioinnovation (A Government of Karnataka Undertaking)

premas life sciences

OUR STRENGTH:-

- Highly skilled resource persons who provide hands on training in the field of Molecular biology, Genomics and Bioinformatics.
- Successfully completed on campus 16 hands-on training and 8 online training programs on Next generation sequencing and computational biology.

WHO CAN PARTICIPATE?

Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines.

Cost	18 %GST	Total cost
1500/-	270/-	1770/-

REGISTRATION LINK:-

https://forms.gle/ctS59Nu9cs9nnRLw7

LAST DATE FOR REGISTRATION: **August 05, 2020.**

Note: kindly upload a photocopy(image format) of any ID card in the registration form. (PAN card, Adhaar, Driving License, Passport, EPIC(Voter ID), etc.)

REQUIREMENTS :- Computers or laptops with minimum 4GB RAM, 250GB free space in hard disk , quad core processors and installed with Ubuntu 16.0v or above

PAYMENT MODE NEFT (ONLINE):

Account Name: UTD-HST General Fund
Account Number: 0694104000134705
IDBI Bank, Yelahanka New Town,
Bangalore-560064,
IFSC: IBKL0000694, MICR: 560259014

GOOGLE PAY-

Account Number: 0694104000134705
IFSC: IBKL0000694
Recipient name: UTD-HST General Fund

Barcoded E- certificates will be provided

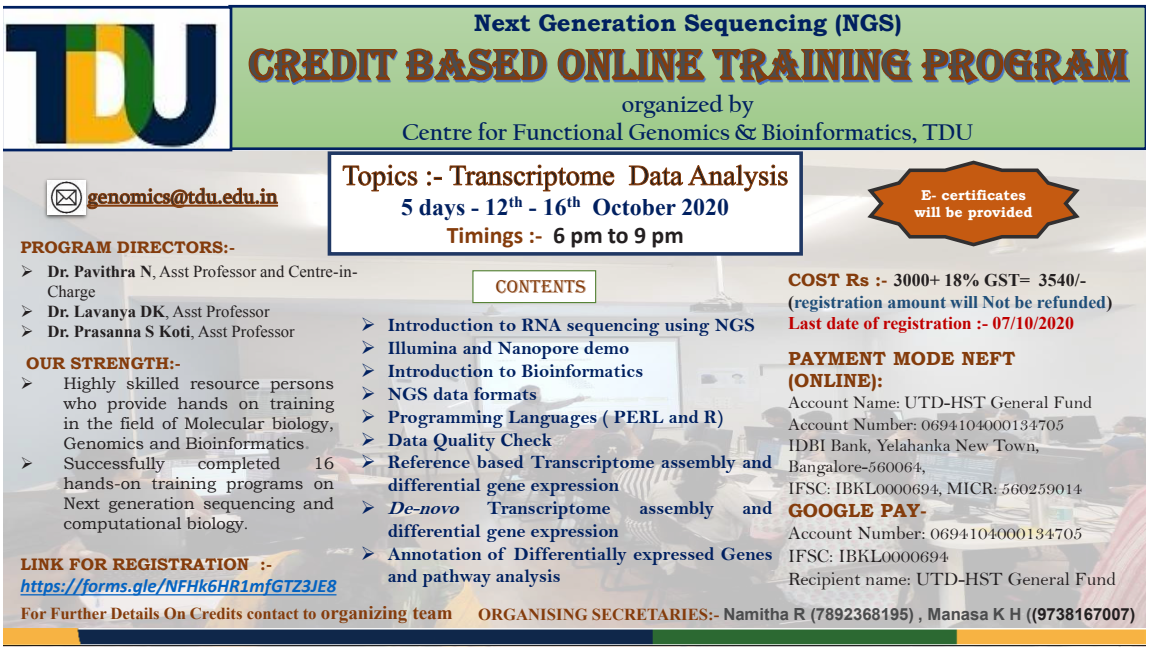
ANNEXURE 9

Online Bioinformatics Training
Organized by Centre for Functional Genomics and Bioinformatics
The University of Trans-Disciplinary HealthSciences and Technology, Bengaluru
27th October to 11th November 2020

Course Coordinators: Dr. Pavithra N & Dr. Lavanya Devi K
Organizing Secretary: Ms. Namitha R and Ms. Manasa KH
No. of students: 50; Fees- Rs. 1270+ 18 % GST per student

Sl.no	Dates	Topic	No of hrs	Resource person	
1	27/10/2020	Introduction to Bioinformatics	1hr	Dr. Pavithra N/ Ms. Namitha R	Lecture
2	28/10/2020	Introduction to Linux and PERL	1hr	Dr. Pavithra N	Hands-on
3	30/10/2020	Introduction to Python in Biological Data Analysis	2hr	Mr. Santhosh Hegde	Hands-on
4	02/11/2020	Introduction to Phylogeny using Molecular Tools	2hrs	Dr. Lavanya Devi K	Hands-on
5	03/11/2020	Introduction to Next Generation Sequencing (NGS)	1hr	Dr. Lavanya Devi K	Lecture
6	04/11/2020	NGS Data formats and Data Quality Control (QC)	1 hr	Ms. Namitha R and Mr. Santhosh	Demo
7	05/11/2020	Whole Genome Sequence Data Analysis	2 hrs	Mr. Santhosh Hegde	Demo
8	6/11/2020	Genetic Diversity	1hr	Dr. Lavanya Devi K	Hands-on
9	07/11/2020	Genetic Diversity	1hr	Dr. Lavanya Devi K	Hands-on
10	9/11/2020	Primer designing	1 hr	Ms. Manasa KH	Hands-on
11	10/11/2020	Introduction to R in biological sequence analysis(Basics)	1.5 hr	Dr. Prasanna S Koti	Hands-on
12	11/11/2020	Introduction to R in biological sequence analysis (Advance)	1.5 hr	Dr. Prasanna S Koti	Hands-on

ANNEXURE 10



The University of Trans-Disciplinary Health Sciences and Technology (TDU)

M. Sc. in Biological Sciences By Research

(Bioinformatics & Functional Genomics)

ADMISSIONS OPEN 2020-2021

Outreach

Sl. No.	Title of the project/ program	Project Co-ordinator	Nature of the activity	Place of work implemented	Number of beneficiaries	Self-funded/ Funding agency	Key achievements
1.	BOSCH – TDU Program on Integrative Health Sciences	Dr. Prakash BN	Community Service	Five villages in Bidadi, Ramanagara district, Karnataka	278 direct beneficiaries and around 1500 indirect beneficiaries	BOSCH-India Foundation-CSR, Bengaluru	• Recruitment of 278 volunteers into the study based on a selection criterion • Understanding of health status (baseline) of individuals using 18 questionnaires • Administration of healthcare products (Kshamatva churna, Nasal drops, Oil for mouth gargling) to all the volunteers
2.	Voluntary Certifi-cation Scheme for Traditional Community Healthcare Providers (VCS-CHP)	Dr. Prakash BN	Community Service	Karnataka, Kerala, Andhra Pradesh	Traditional healers' community	Self-funded and Bio-merieux-CSR	• 5 traditional healers from Karnataka and 20 from Kerala received the TCHP certification • Auditing by internal auditors and surveillance by QCI team was completed to check the quality management system

1. BOSCH - TDU Project on Integrative Health Sciences

Relevance of the Project: The CoVID-19 pandemic brought to fore the individuals' ability to deal with infectious diseases. Individuals have been primed to improve overall wellness as well as respiratory health. This pilot project was designed to learn lessons for design and execution of a scalable community health program, in low resource settings, for enhancing general immunity and respiratory health based on Ayurvedic principles. The design incorporates a touch (through health workers and health coaches) + tech platform (data collection and integration platform) to reliably communicate and capture data that would help us understand how to embed Ayurveda and Yoga into daily life.

Centres involved in the project: This is an inter-centre collaborative project of TDU, designed and implemented by Centre for Local Health Traditions and Policy; Centre for Ayurveda Biology and Holistic Nutrition; Centre for Traditional Knowledge, Data Sciences and Informatics; Centre for Clinical Research & Education; and Institute of Ayurveda & Integrative Medicine (I-AIM).

Highlights of progress/ achievements of project:

The project was initiated during October 2020 and implemented in five villages (Aralalusandra, Bannigiri, B. Hosur, Chowkahalli, H. Gollahalli) of Bidadi, Ramanagara district, Karnataka. The project was titled as *"Nanna Usiru Nanna Swasthya"* – My Breath My Health).

- Around 1000 respondents participated in the initial survey conducted by trained health workers, to capture basic demography information.
- 330 volunteers participated in the detailed health assessment which included assessment of wellness, quality of life, prakruti, family and respiratory health, conducted by Ayurveda physicians/health coaches in the field (Image – 1). Most of the assessment protocols are internationally accepted, while a few which focused on assessing wellness (Swasthya) and prakruti, were developed in-house and validated at multiple strata.
- Out of 330 volunteers, 278 visited Institute of Ayurveda and Integrative Medicine (I-AIM) (Image – 2) for a structured orientation, Ayurveda and yoga consultations. During this visit, each volunteer received a free health check-up, and consultation by the physicians, followed by blood & urine analysis for 10 groups of parameters. They were also given individualised diet advice & yoga demonstration by an expert yoga teacher. Three Swasthya products (Kshamatva Kashaya churna, Anu taila for Nasya/Nasal administration, Moorchita tila taila for Kavala/mouth gargling) were provided to enhance respiratory health and general wellness, while the method of usage was demonstrated. They were also assessed with a 6-minute walk test and body oxygen level test.
- During this project period, communication materials including program brochure, posters, personal diary, product information sheet, product kits, standee for orientation and motivation of the participants were created and distributed. A

web page (https://tdu.edu.in/bosch-tdu-swasthya/) and data collection tools & data integration platforms were also created.

Team members: Dr. Prakash BN, Dr. Gurmeet Singh, Dr. Subrahmanya Kumar, Dr. Poornima Devkumar, Dr. Megha, Mr. Varun Subramanyam, Dr. Sreejesh, Dr. Bhargavi, Dr. Abhilash, Dr. Arpita, Dr. Poorvi, Dr. Soundarya RJ, Ms. Sushila, Ms. Asha, Ms. Shobha, Ms. Sudha, Mr. Prakash, Ms. Bhavya, Dr. Neelambika GB, Dr. Prasan Shankar, Dr. Prashanth R, Dr. Rashel M Rego, Dr. Sahana, Dr. Shreelatha, Dr. Vikram Balu, Dr. Yashawini, Mr. Ashwin Perumal, Ms. Avineet Luthra, Mr. Raghavendra.

Health screening of the study participants by Ayurveda physician

Group photo of BOSCH project study participants, health coaches and health workers during IAIM visit

2. Voluntary Certification Scheme for Traditional Community Healthcare Providers (VCSTCHP)

Relevance of the Program: VCSTCHP is a personal certification, National scheme, jointly launched by Quality Council of India (QCI), New Delhi and Foundation for Revitalisation of Local Health Traditions (FRLHT), Bengaluru. TDU is an accredited personnel certification body (PrCB) by QCI, to recognise & certify community based, traditional healers through the process of evaluation of their prior knowledge and skills in specific streams/health conditions, based on the Minimum Standard of Competence (MSC) as per ISO 17024.

Highlights of program:

- Prior knowledge and skills of 15 traditional healers from Karnataka was evaluated on 10th and 11th March 2020 at TDU campus. Five level evaluation (MCQ -multiple choice questions; case study; viva voce on case study; practical demonstration and field verification in respect of common ailments, jaundice, arthritis) was conducted for the applicants. Five healers were recommended for certification considering the fulfilment of MSC criteria laid down under the VCSTCHP scheme (Image - 3).
- Evaluation of knowledge and skills of the traditional healers from Kerala was conducted during January 2021 in Kerala. Twentyfive healers applied for certification, while 20 were recommended for certification (Image – 4). List of certified TCHPs is available in the TDU website under CLHT&P webpage (VCSTCHP). https://drive.google.com/drive/folders/1VWr_C25gV5P4yqyfN3LhpzmbyUdi0-He
- The management committee meeting was held on 23rd November 2020 to review the progress of the scheme.
- An internal auditing of the PrCB was conducted by auditors on 3rd December 2020 to check the quality management system.
- An assessment team from QCI conducted the online surveillance of TDU's PrCB on 11th December 2020, to assess the overall system requirements of the scheme. The team recommended continuing the provision approval status of the PrCB for 6 streams.
- A State level, TCHP advisory board consisting of 6 traditional healers and PrCB representatives was constituted for Andhra Pradesh.
- Online training programmes on minimum standards of competence (MSC), eligibility criteria to apply, evaluation methodology and process of evaluation were conducted to TCHP advisory board members of Andhra Pradesh (Table 1)

S.No.	Name of program	Date	No. of partici-pants
1	TCHP advisory board, Andhra Pradesh: Awareness program	22/10/2020	16
2	TCHP evaluator training program-Andhra Pradesh	30/10/2020	10
3	TCHP evaluator training program- Andhra Pradesh	06/11/2020	9
4	TCHP evaluator training program- Andhra Pradesh	04/12/2020	11

Team members: Dr. Prakash BN, Dr. Amulya Kannan, Prof. Hariramamurthi G., Dr. Arun Bhanu, Empanelled evaluators and TCHP advisory board members of Karnataka, Kerala, Andhra Pradesh.

Guideline document for traditional healers on the COVID-19 infection

A guideline document for traditional healers on the COVID-19 infection was prepared to educate the community on use of preventive healthcare practices and to boost immune modulation using medicinal plants in the context of COVID-19. The document was shared with the healers of Karnataka and Chhattisgarh in local languages. A Copy of the guidelines is available on CLHT&P webpage (https://tdu.edu.in/home/clhtp/) and also at:https://drive.google.com/drive/folders/1LSp3duAFninhQlWwSdXplreAtYhoh1Wn

Practical demonstration (medicinal plants identification) by a traditional healer in presence of empanelled evaluators during oral evaluation held at TDU campus

Oral evaluation of traditional healer from Kerala by empanelled evaluators and representatives from PrCB-TDU

Academics

Sl. No.	Name of Program	Audience	Final output (Diploma/ Certificate /Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Funding (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
1.	Online Awareness Program on Immune-modulatory properties of medicinal plants for Folk healers and Wider public	Folk Healers/ Wider Public	Participation Certificate	• Medium: Telugu • 27/08/2020 • 63 participants	Self-funded	Mr. Hariramamurthi G. / Dr. Prakash BN	Dr. Noorunnissa Begum; Dr. Girish Kumar; Dr. Suma Tagadur, Dr. Amulya Kannan, Dr. Subrahmanya Kumar; Dr. Thirunarayanan; Dr. Eswar; Dr. Harihara Mahadevan; Dr. Lokesh Deb; Dr. Imlikumba; Dr. K. Jeyaprakash	Flyer: Annexure 1
2.				• Medium: Kannada • 14/09/2020 • 35 participants				
3.				• Medium: Tamil • 25/09/2020 • 30 participants				
4.				• Medium: Telugu • 28/09/2020 • 56 participants				
5.				• Medium: Hindi & English; 17/10/2020 • 54 participants				
6.	Strengthening the Resilience of India's Plural Health System:		Webinar for public health professionals	• 3 Webinars were conducted on 30/09/2020, 18/11/2020 & 02/09/2021		Ms. Meena Putturaj, Mr. Shivanand Savatagi, Dr. Sarin	Dr. Prashanth N S, Dr. Unnikrishnan P M; Dr. Ritu Priya; Dr. Saradindu Bhaduri, Dr. Sundar Sarukkai, Dr. Harilal Madhavan,	Flyer: Annexure 2

Sl. No.	Name of Program	Audience	Final output (Diploma/ Certificate /Degree)	Program Specifics (3-4 bullet points: Duration, content, logistics, number of participants/ students)	Fund-ing (if any)	Program Co-ordinators	Team members	Flyer / Artwork about program
	Lessons from the COVID-19 Crisis			• Totally 275 participants attended			Dr. V.Sujatha; Smt. Shailaja Chandra, Prof. K Srinath Reddy	
7.	Iron-Deficiency Anaemia Awareness Program (online)	Traditional healers of Nilgiris district of Tamil Nadu	Awareness program	• 5 online and one offline programme were conducted in the month of August, September, October, 2020 & January, 2021 • Totally 78 participants were attended	RIST project	Dr. Prakash BN & Dr. Amulya Kannan	Dr. Subrahmanya Kumar; Dr. Harihara Mahadevan, Mr. Hariramamurthi G.	Flyer: Annexure 2

Publications/Research papers/ invited talks

i) Peter EL, Nagendrappa PB, Hilonga S, Tuyiringire N, Ashuro E, Kaligirwa A, Sesaazi CD. Pharmacological reflection of plants traditionally used to manage diabetes mellitus in Tanzania. J Ethnopharmacol. 2020 Dec 25;269:113715. doi: 10.1016/j.jep.2020.113715.

ii) Putturaj M, Van Belle S, Criel B, Engel N, Krumeich A, B Nagendrappa P, et al. Towards a multilevel governance framework on the implementation of patient rights in health facilities: a protocol for a systematic scoping review. BMJ Open 2020 Oct 15;10(10):e038927. doi: 10.1136/bmjopen-2020-038927.

iii) Peter EL, Nagendrappa PB, Kaligirwa A, Ogwang PE, Sesaazi CD. The safety and efficacy of Momordica charantia L. in animal models of type 2 diabetes mellitus: A systematic review and meta-analysis. Phytother Res. 2020;1-20. https://doi.org/10.1002/ptr.6853

iv) Peter EL, Mtewa AG, Nagendrappa PB, Kaligirwa A, Sesaazi CD. Systematic review and meta-analysis protocol for efficacy and safety of Momordica charantia L. on animal models of type 2 diabetes mellitus. Syst Rev. 2020 Jan 8;9(1):7.

v) Invited talk: Dr. Prakash BN presented a talk on 'Therapy without medicine' at RR Institute of Technology, Bengaluru on 6th July 2020.

ANNEXURE 1

ONLINE AWARENESS cum TRAINING PROGRAM ON BOOSTING IMMUNITY BASED ON AYURVEDA FOR FOLK HEALERS AND WIDER PUBLIC (IN KANNADA)

Organised by:

Centre for Local Health Traditions & Policy,
The University of Trans-Disciplinary Health Sciences and Technology (TDU),
Bangalore-560064

Date: 14th September 2020
Time: 1.00 pm to 4:00 pm
The webinar will be conducted over Zoom

E-Certificates will be provided !

ANNEXURE 2

A Webinar series on

Strengthening the Resilience of India's Plural Health System : Lessons from the COVID-19 Crisis

The University of Trans-Disciplinary Health Sciences and Technology (TDU) – Bengaluru in collaboration with Institute of Public Health (IPH) – Bengaluru and Centre of Social Medicine and Community Health, Jawaharalal Neharu University (JNU) – New-Delhi

TDU

IPH INSTITUTE OF PUBLIC HEALTH BENGALURU

JNU Centre of Social Medicine and Community Health

The COVID-19 pandemic has thrown up challenges on multiple fronts and health systems are not exceptional. In fact, even the developed countries with better health systems struggled or struggling to cope with the burden and impact of the corona pandemic. With COVID-19, the beliefs and systems that we follow are bound to change. We should not only focus on returning to normalcy, rather, the time is more relevant now than ever to revamp and rejuvenate the Indian plural health system and seek long term sustainable solutions. In this webinar we would like to highlight the key lessons from the ongoing COVID-19 pandemic and the way forward to build resilience of India's plural health system.

Details of the webinar
September 30, 2020 Time: 11:00 am-12:30 pm
Please register here:
https://docs.google.com/forms/d/1euQeSjNpd1m5qNvIf-LdNdaL_Cixep4X3J23xE-6G0s/edit

OPENING REMARKS

Padmshri. Prof. Darshan Shankar
Vice Chancellor
The University of Trans-Disciplinary Health Sciences and Technology (TDU) – Bengaluru.

MODERATOR

Dr. Ritu Priya
MBBS, PhD (Community Health)
Professor
Centre of Social Medicine and Community Health
Jawaharlal Neharu University (JNU) – New Delhi.

SPEAKERS

Dr. Prashanth N S
MBBS, MPH, PhD
Faculty & DBT/Wellcome Trust India Alliance Fellow
Institute of Public Health (IPH) – Bengaluru.

Dr. Unnikrishnan P M
BAMS, MA (Medical Anthropology), PhD
Visiting Professor
The University of Trans-Disciplinary Health Sciences and Technology (TDU) – Bengaluru.

7. Centre for Traditional Knowledge, Data Science & Informatics

Projects undertaken during the year 2020-21

1. Development of In-silico Platform for Medicinal plants based Drug discovery using Network Pharmacology & Ayurveda database to study the Complexity of Ayurvedic drug action (Funding - Infosys)

Relevance: The current research on In-silico facilitated studying the complex relationship between bioactives, targets, diseases, and genes. It serves as a valuable scientific tool in understanding traditional Ayurvedic medicine through data mining and information synthesis in drug discovery. Using open-source software like Cytoscape for visualizing complex networks and integrating these with attribute data for medicinal plants will help us understand the impact of the phytochemicals on the targets in the human system.

Highlights of progress/ achievements of projects/programs:
This research on developing In-silico Platform based drug discovery using Network pharmacology, initiated the process of phytochemical screening of 1050 plants used in Ayurveda, and further, plants having antimicrobial, antiviral, and antibacterial properties were screened and identified 174 plants used in fever (Jvara) condition. The following top 8 medicinal plants were taken up:

i. *Citrus medica*
ii. *Coriander sativum*
iii. *Cuminum cyminum*
iv. *Elettaria cardamomum*
v. *Phyllanthus emblica*
vi. *Rubia cordifolia*
vii. *Santalum album*
viii. *Trigonella foenuim graceum*
ix. *Zingiber officinale*

Retrieval of bioactive (BA) for all these species was done and the results are shown in the chart below.

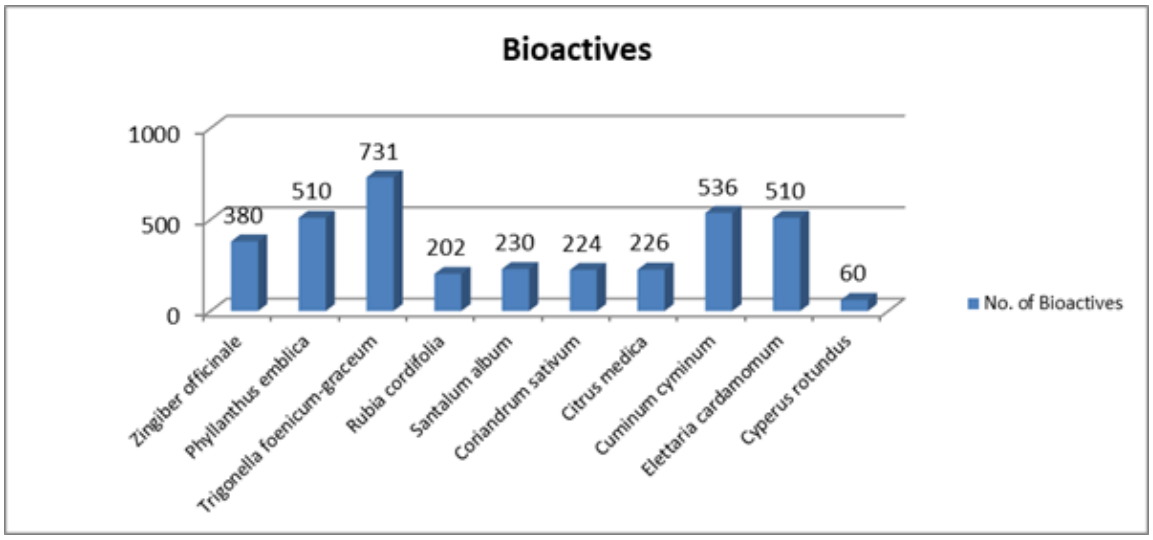


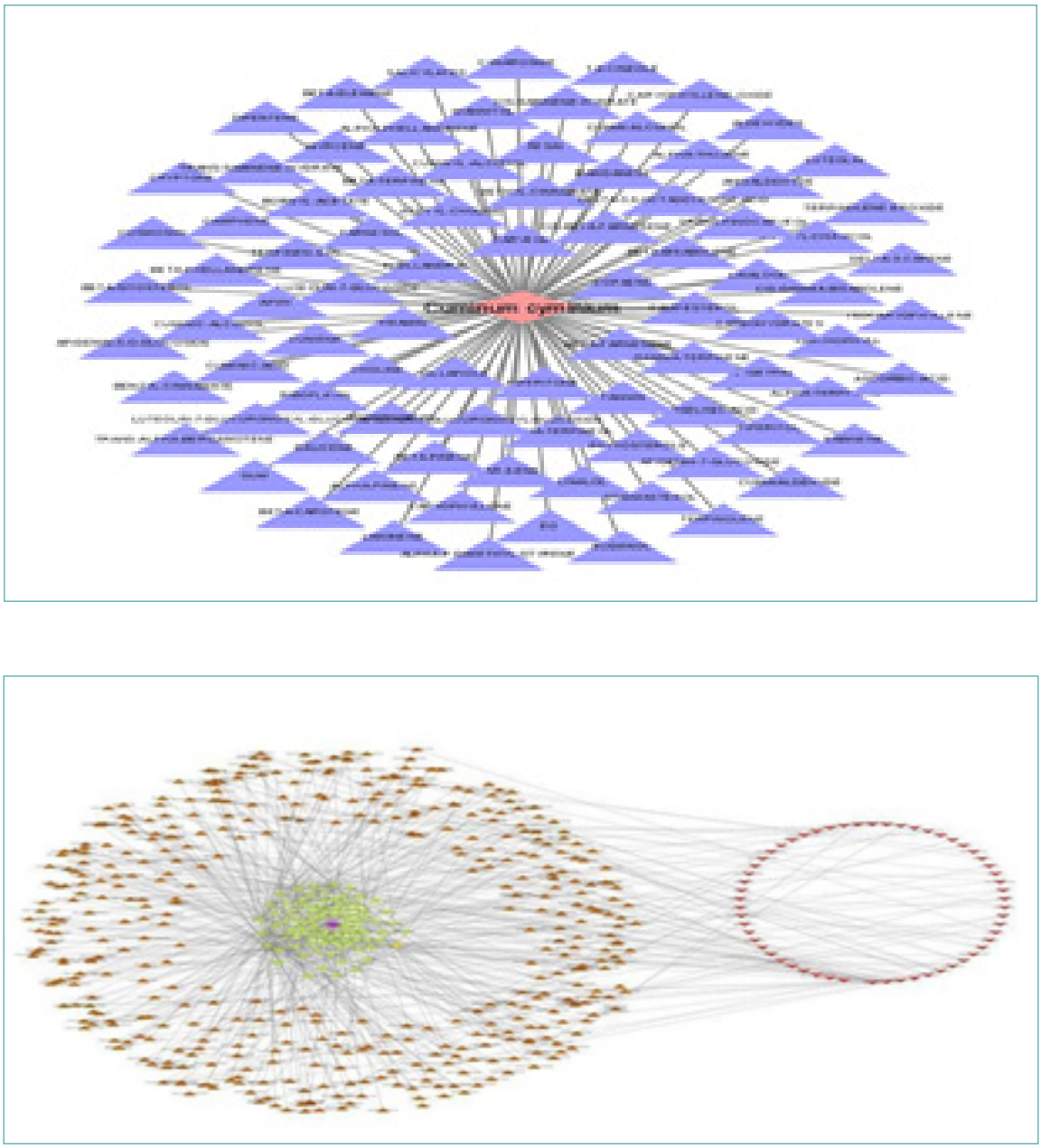
Chart: Highlighting bioactives of selected Medicinal plants

Structural information of bioactive was retrieved from online databases such as UNPD (Universal Natural Product Database), and Dr.Duke's Phytochemical and Ethnobotanical database, which contain all the available UNPD structures of the bioactives that were used to study, including various conformations. The ".sdf" files having the structures of the bioactive were queried in a binding database for identifying their targets using the special tool 'find my compound target'. The target retrieval was done using Binding database, chemBL, and various other databases and published literature. The Binding database was also allowed for fetching information regarding the type of target, and mode of action of the bioactive. The targets of the bioactive through data mining process were carried out for therapeutic targets and their association with disease.

Sl.No	Species	Target	Disease
1	*Coriandrum sativum*	3219	246
2	*Cuminum cyminum*	1215	261
3	*Elettaria cardamom*	1790	180
4	*Zingiber officinale*	39175	1070
5	*Phyllanthus emblica*	1014	639

Table: Visualised analysis for the species

Network construction: A pharmacology network is made up of nodes, the points of communication of redistribution, and the edges, the lines of communication joining the nodes. The entities that form the nodes of the networks are the botanicals of the above-prioritized plants networked with bioactive compounds, related targets, relevant diseases, and their underlying pathways along with the dravyaguna profile of the plant were linked. The network was constructed using Cytoscape 3.7.2 version, a Java-based open-source software. The tools available in Cytoscape were used for analyzing the network.



A visualized network of Phyllanthus emblica, Cuminum cyminum

Team members: Dr.VenuGopalan Nair S.N., Dr.Tabassum Ishrath Fathima, Dr.Shilpa Naveen

2. Preparation of a Comprehensive Sanskrit – Kannada – English Dictionary of Ayurveda (in Print & Electronic Formats)

Brief background: As far as the knowledge of Ayurvedic texts is concerned, students and practitioners of Ayurveda are severely lagging in attaining the knowledge of the fundamentals of this unique medical science due to a lack of knowledge in the Sanskrit language in which the Ayurvedic texts are authored. To overcome this acute problem, TDU has undertaken a project in collaboration with the AYUSH department, Karnataka, to prepare a Dictionary of Ayurveda (Sanskrit – English – Kannada) for the benefit of students, teachers, practitioners as well as interested laymen.

Highlights of the progress/achievements: During the current year, the team completed working on new 1500 technical terms and final editing of 5000 terms of the proposed dictionary (which are classified under 23 different categories), along with references from the primary texts of Ayurveda. A criterion has been followed for developing the dictionary by considering

a) Usefulness of the dictionary
b) Authenticity of data and coverage of the subjects selected for the dictionary
c) Nature of scripts, language, and translations used in the hard and soft copy
d) Guidelines for data editing and final proofing by review experts.

i. Information under 31 fields {Term (in Devanagari Script), English Transliteration, Kannada Transliteration, Reference in Roman script, Granthadhar/Reference in Devanagari Script, Granthadhar/Reference in Kannada Script, Term type, Synonyms (Devanagari Script), Transliteration of Synonyms in Roman Script, Transliteration of Synonyms (Kannada script), Term category / Sub category, Vyutpati (Derivation of the term), Nirukti (Etymology of the term), Anta/Linga, Literal Meaning (English), Implied Meaning (English), Elaboration (English), Antonym (English), Literal Meaning (Kannada), Implied Meaning (Kannada), Elaboration (Kannada), Antonym (Kannada), Explanation according to Ayurveda Shastra (Sanskrit), Explanation according to Ayurveda Shastra (English), Explanation according to Ayurveda Shastra (Kannada), Allied Information (Sanskrit), Allied Information (English), Allied Information (Kannada), Refer Other Terms from Shabdakosh, Term ID coded by AYUSH,. Further Reading Links for each term of Ayurveda and the corresponding information} has been provided in Sanskrit, English, and Kannada.
ii. By the end of March 30th 2021, information about 5,000 terms was collected and scrutinized by experts.
iii. Simultaneously, the Software development of web-app and mobile-app of the dictionary was also initiated.

This Dictionary, to be shortly published in both online and offline versions, is expected to fill a huge gap in terms of a very clear and precise understanding of the fundamental concepts of Ayurveda in a versatile manner.

3. Preparation and Publication of Critical Edition and Kannada & English Translations of Important Unpublished Ayurvedic Manuscripts dealing with 'Jvara'.

Background: As part of this program, descriptive catalogues of in various libraries housing these in palm-leaf and hand-made paper manuscripts all over India were verified and a list of manuscripts dealing with Jvara was prepared and finalized. In this process 3 important manuscripts on 'Jvara', namely, 1) JvaraTrishati, 2) Jvaratimira-bhaskara , 3) Sarva-jvara-samucchaya-darpana were taken up for deciphering, editing, translating, and publishing. The manuscripts contain all aspects concerning 'Jvara', that are not available in other recognized works.

H**ighlights of the progress/achievements:** During the year 2020-21 work on "Sarva-jvara-samucchaya-darpana" was taken up and translated.

The Scheme under which the publication is being prepared is as follows:

1. Detailed scholarly Introduction
2. Abbreviations
3. Edited text – with variations in reading, provided in footnotes.
4. English and Kannada Translations are provided under the text

The following Appendices are provided

- Additional notes
- List of quotations with sources and translations
- List of works referred to in the course of a text (in chronological order)
- List of authors referred to (if any)
- List of technical terms with Kannada & English equivalents
- List of Dravyas along with their 'Gunas' in the alphabetical order
- Recipes / Ingredients for the preparation of different medicines
- List of prescribed and forbidden medicines / foods with the perspective of individual health
- List of slokas in alphabetical order. (wherever applicable)

Editorial work and final proof reading of "Jvara Trishati", and "Jvaratimira-bhaskara" were completed and detailed appendix were prepared. Multicolor illustrations explaining the fundamental concepts of the work were included and the works are ready for publication.

Team members: Prof. M.A. Lakshmithathachar, Dr. SN Venugopalan Nair, Dr. M.A. Alwar, Dr. Hemanth T.R, Dr. Anantha M A

Table of Programs

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia-Govt-other country Collaboration Activities	Self-funded/ Funding agency	Key achievements
1.	Preparation of a Comprehensive Sanskrit – Kannada – English Dictionary of Ayurveda (in Print & Electronic Formats)	Literary research	TDU	Dr.Alwar		AYUSH Karnataka	1. Technical terms pertaining to 30 different fields have been collected, which forms the core of the dictio-nary. 2. Approximately 5,000 tech-nical terms pertaining to the field of Ayurveda, classified under 23 dif-ferent categories of Ayurveda have been covered in the Dictionary along with references from the primary authentic texts of Ayurveda.
2.	Preparation & Publication of Critical Edition and Kannada & English Translations of Important Unpublished Ayurvedic Manuscripts dealing with 'Jvara'.	Literary research		PI: Dr.Alwar Co-PI:Dr. Venugopalan S.N		AYUSH Karnataka	As part of this project, succeeded in understanding, interpreting, or identifying JvaraTrishati, Jvaratimira-bhaskara and Sarva-jvara-samucchaya-darpana manuscripts. These have been edited and translated into Kannada and English.

Sl. No.	Title of the project/ program	Nature of Research	Place of work imple-mented	Principal Investigator	Industry-Academia-Govt-other country Collaboration Activities	Self-funded/ Funding agency	Key achievements
3.	Development of In-silico Platform for Medicinal plants based Drug discovery using Network Pharmacology & Ayurveda data-base to study the Complexity of Ayurvedic drug action.	In-sil-icoRe-search	Deep-ening of IMPLAD database at TDU	Dr. Venugopalan Nair		Infosys	1. Prioritized top eight medicinal plants having antimicrobial, an-ti-viral, and anti-bacterial property 2. Bioactives, targets, and diseases were pooled out for all the above plants through data mining 3. Bioactives contributing to Ayurvedic properties extracted 4.Visualization and analysis using Cytoscape software was completed.

THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064

BALANCE SHEET AS AT MARCH 31, 2021

CORPUS FUNDS, CAPITAL FUNDS & LIABILITIES	SCH REF	As at 31st Mar 2021	As at 31st Mar 2020	PROPERTIES & ASSETS	SCH REF	As at 31st Mar 2021	As at 31st Mar 2020
		Rs.	Rs.			Rs.	Rs.
General Fund	A	3,20,35,902	2,75,07,924	Property, Plant & Equipments	G	1,11,62,447	1,06,74,719
Corpus Fund	B	90,20,000	-	Investments			
				Fixed deposits / Bonds	H	4,86,92,070	3,33,99,953
Reserves	C	50,09,634	37,62,748				
				Assets, Loans and Advances			
Project Grants	D	4,61,88,328	2,96,19,005	Cash on hand	-	5,768	6,302
				Balances with Banks	I	2,49,65,779	2,37,75,320
Current Liabilities	E	19,62,861	18,19,702	Other Current Assets	J	1,16,08,162	33,15,201
				Advances	K	6,45,445	23,30,069
Non-Current Liabilities	F	28,62,946	1,07,92,185				
Total		9,70,79,671	7,35,01,564	Total		9,70,79,671	7,35,01,564

Notes A) to K) referred to above and Notes to the accounts (Note P) form an integral part of this Balance Sheet

For The University of Trans-Disciplinary Health Sciences & Technology

(Professor Darshan Shankar)
Vice-Chancellor

(Dr. A.K. Gupta)
Registrar

(Mr. Suresh Hegde)
Joint Registrar - Finance & Accounts

THE UNIVERSITY OF TRANS-DICIPLINARY HEALTH SCIENCES AND TECHNOLOGY Bengaluru - 64

As per our report of even date attached

For LAWRENCE TELLIS & ASSOCIATES
CHARTERED ACCOUNTANTS
(FIRM REGISTRATION NO. 001857S)

(Rohan Miranda)
Partner
ICAI M. No. 022772

LAWRENCE TELLIS & ASSOCIATES * CHARTERED ACCOUNTANTS * BANGALORE FRN : 001857S

Place: Bangalore
Date : 23/11/2021

THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064

STATEMENT OF INCOME AND EXPENDITURE FOR THE YEAR ENDED 31ST MARCH 2021

(Amount in Rs.)

Income	Grants/Projects Income (Schedule L)	University Income (Schedule M)	Total Income	Previous Year's Total (FY 19-20)
Consultancy Income	58,55,653	20,000	**58,75,653**	**60,76,543**
Donations	20,00,000	2,70,41,216	**2,90,41,216**	**3,12,76,412**
University Course Fees	-	24,84,100	**24,84,100**	**27,68,100**
Training Income	1,56,85,311	18,40,113	**1,75,25,424**	**1,63,49,237**
INCOME FROM OTHER SOURCES				
-Hostel & Guest House Charges	-	4,07,925	**4,07,925**	**48,55,587**
-Miscellaneous Income	-	2,433	**2,433**	**3,25,084**
-Transport & Other Recoveries	-	4,35,644	**4,35,644**	**7,35,061**
INTEREST EARNED				
-Interest on Fixed Deposits	1,69,048	23,50,986	**25,20,034**	**20,09,291**
-Interest on Savings Bank Accounts	3,67,851	3,71,808	**7,39,659**	**8,99,891**
Fees on Projects (Contra)	-	30,79,630	**30,79,630**	**44,46,327**
TOTAL INCOME A]	**2,40,77,863**	**3,80,33,855**	**6,21,11,718**	**6,97,41,533**

Expenditure	Grants/Projects Expenses (Schedule N)	University Expenses (Schedule O)	Total Expenditure	Previous Year's Total (FY 19-20)
Books, Periodicals & Other Literature	1,400	13,130	**14,530**	**21,774**
Communication Costs	31,301	2,66,005	**2,97,306**	**6,20,592**
Consultants & Outsourcing Services	1,17,58,091	6,26,658	**1,23,84,749**	**60,06,158**
Consumables	16,93,107	47,490	**17,40,597**	**26,36,561**
Field Work & Trials	1,51,361	-	**1,51,361**	**3,15,869**
Gratuity Expenses	-	3,70,516	**3,70,516**	**2,48,616**
IT Hardware, Software & Services	5,53,101	1,05,958	**6,59,059**	**1,54,568**
Maintenance, Utilities, Repairs & Improvements	95,315	1,11,24,095	**1,12,19,410**	**1,17,15,219**
Meeting, Conferences & Workshops	10,868	53,464	**64,332**	**7,17,528**
Other Overheads & Contingencies	11,36,558	10,42,197	**21,78,755**	**33,20,482**
Printing & Stationery	47,41,812	1,59,719	**49,01,531**	**4,19,617**
Salaries Including Fellowships	1,98,16,244	1,76,90,606	**3,75,06,850**	**3,10,08,310**
Travel & Conveyance	7,90,615	2,07,897	**9,98,512**	**45,38,701**
Fees on Projects (Contra)	24,69,608	6,10,022	**30,79,630**	**44,46,327**
SUB TOTAL B-1]	**4,32,49,381**	**3,23,17,757**	**7,55,67,138**	**6,61,70,322**
Depreciation (**Schedule G**) **B-2]**	-	23,18,979	**23,18,979**	**21,90,172**
TOTAL EXPENDITURE B] = B-1] + B-2]	**4,32,49,381**	**3,46,36,736**	**7,78,86,117**	**6,83,60,494**
EXCESS / (DEFICIT) OF INCOME OVER EXPENDITURE FOR THE YEAR C] = A] -	**(1,91,71,518)**	**33,97,119**	**(1,57,74,399)**	**13,81,039**

STATEMENT OF I & E (PAGE .....1)

LAWRENCE TELLIS & ASSOCIATES * CHARTERED ACCOUNTANTS * BANGALORE FRN : 007857S

THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064

STATEMENT OF INCOME AND EXPENDITURE FOR THE YEAR ENDED 31ST MARCH 2021

(Amount in Rs.)

Income	Grants/Projects Income	University Income	Total Income	Previous Year's Total (FY 19-20)
Excess / (Deficit) of Income over Expenditure for the year b/d	(1,91,71,518)	33,97,119	**(1,57,74,399)**	**13,81,039**
Appropriations:			-	-
Project income transferred to the respective **Project (Grants) Funds (Schedule D)**	2,40,77,863	-	**2,40,77,863**	**1,65,68,711**
Project Income Recognition (to the extent of project funds / grants utilised as in **Schedule D**)	(4,32,49,381)	-	**(4,32,49,381)**	**(3,03,84,096)**
Depreciation for the year on assets acquired through project funds transferred to **Reserves for Fixed Assets (Schedule C)**	-	(11,30,859)	**(11,30,859)**	**(7,87,974)**
Excess of Income over Expenditure for the year transferred to **General Fund (Schedule A)**	-	45,27,978	**45,27,978**	**1,59,84,398**
TOTAL	**(1,91,71,518)**	**33,97,119**	**(1,57,74,399)**	**13,81,039**

Schedules A, C, D, G, L, M, N & O referred to above and Notes to the Accounts (Schedule P) form an integral part of this Statement of Income and Expenditure.

For The University of Trans-Disciplinary Health Sciences & Technology

(Professor Darshan Shankar)
Vice-Chancellor

(Dr. A.K. Gupta)
Registrar

(Mr. Suresh Hegde)
Joint Registrar - Finance & Accounts

As per our report of even date attached

For LAWRENCE TELLIS & ASSOCIATES
CHARTERED ACCOUNTANTS
(FIRM REGISTRATION NO. 001857S)

(Rohan Miranda)
Partner
ICAI M. No 022772

Place: Bangalore
Date : 23/11/2021

END OF STATEMENT OF I & E

(PAGE .....2)

LAWRENCE TELLIS & ASSOCIATES
Chartered Accountants
No. 44/45, 2nd Floor, Vinayaka Complex
Residency Cross Road, Bangalore - 560 025
Ph.: 41514791/92/93
(FIRM ICAI REGN. No. 001857S)

THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064

RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2021

(Amount in Rs.)

Receipts	Grants/Projects	University	Total	Previous Year's Total (FY 19-20)
OPENING BALANCES AS ON 01/04/2020			-	-
Bank Balances **(Schedule I)**	3,126	2,37,72,194	**2,37,75,320**	**1,52,76,502**
Cash Balances	-	6,302	**6,302**	**30,968**
	Grants/Projects Receipts	**University Receipts**	**Total Receipts**	
RECEIPTS DURING THE YEAR				
Consultancy Income	35,23,761	20,000	**35,43,761**	**58,60,435**
Donations	20,00,000	2,70,41,216	**2,90,41,216**	**3,12,76,412**
Corpus Donations	-	90,20,000	**90,20,000**	**-**
University Course Fees	-	24,84,100	**24,84,100**	**27,68,100**
Training Income	1,12,87,543	16,71,373	**1,29,58,916**	**1,61,17,282**
INCOME FROM OTHER SOURCES				
-Hostel & Guest House Charges	-	5,30,425	**5,30,425**	**47,33,062**
-Miscellaneous Income	-	2,433	**2,433**	**3,25,084**
-Transport & Other Recoveries	-	4,35,644	**4,35,644**	**7,35,061**
INTEREST EARNED				
-Interest on Fixed Deposits	2,26,357	18,45,014	**20,71,371**	**18,87,150**
-Interest on Savings Bank Accounts	3,67,851	3,71,808	**7,39,659**	**8,99,891**
Project Grants received	3,91,94,460	-	**3,91,94,460**	**1,34,02,475**
OTHER RECEIPTS DURING THE YEAR				
Refundable Credits received	-	3,110	**3,110**	**14,624**
Refund of Deposits	-	-	**-**	**-**
Refund/Settlement of Advances paid	45,000	3,52,052	**3,97,052**	**2,67,796**
GST/Other Statutory Liabilities Collected and remitted	-	-	**-**	**1,44,156**
Advance from Foundation for Revitalisation of Local Health Traditions	-	-	**-**	**1,07,92,185**
Investments matured during the year	50,84,953	-	**50,84,953**	**-**
Fees on Projects (Contra)	-	30,79,630	**30,79,630**	**44,46,327**
Inter-Unit Transfers (Contra)	-	1,18,08,335	**1,18,08,335**	**36,85,108**
TOTAL RECEIPTS	**6,17,33,051**	**8,24,43,636**	**14,41,76,687**	**11,26,62,618**

Payments	Grants/Projects Payments	University Payments	Total Payments	Previous Year's Total (FY 19-20)
PAYMENTS DURING THE YEAR				
Books, Periodicals & Other Literature	1,400	13,130	**14,530**	**21,774**
Communication Costs	31,301	2,30,009	**2,61,310**	**6,20,592**
Consultants & Outsourcing Services	1,03,11,812	6,26,658	**1,09,38,470**	**60,06,158**
Consumables	13,36,150	47,490	**13,83,640**	**26,36,561**
Field Works & Trials	1,35,016	-	**1,35,016**	**3,15,869**
Gratuity Expenses	-	4,94,022	**4,94,022**	**2,48,616**
IT Hardware, Software & Services	5,53,101	1,05,958	**6,59,059**	**1,54,568**
Maintenance, Utilities, Repairs & Improvements	95,315	1,14,83,108	**1,15,78,423**	**1,11,21,199**
Meetings, Conferences & Workshops	10,868	53,464	**64,332**	**7,17,528**
Other Overheads & Contingencies	11,17,268	9,78,077	**20,95,345**	**32,91,682**
Printing & Stationery	47,41,812	1,57,123	**48,98,935**	**4,19,617**
Salaries including Fellowships	1,98,96,884	1,76,61,005	**3,75,57,889**	**3,08,68,470**
Travel & Conveyance	7,90,615	2,00,828	**9,91,443**	**45,38,701**
Advances for Purchases	3,89,931	-	**3,89,931**	**15,37,391**
Refund of un-utilised Project Grants	2,87,914	-	**2,87,914**	**86,263**
Purchase of Fixed Assets	24,66,407	4,28,962	**28,95,369**	**25,16,094**
c/fd	**4,21,65,794**	**3,24,79,834**	**7,46,45,628**	**6,51,01,083**

R & P A/C (PAGE .....1)

LAWRENCE TELLIS & ASSOCIATES * CHARTERED ACCOUNTANTS * BANGALORE FRN: 1857S

THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064

RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2021

(Amount in Rs.)

Payments	Grants/Projects Payments	University Payments	Total Payments	Previous Year's Total (FY 19-20)
b/fd	4,21,65,794	3,24,79,834	7,46,45,628	6,51,01,083
OTHER PAYMENTS DURING THE YEAR				
Loans & Staff Advances	80,000	1,26,945	2,06,945	2,29,099
Refund of Caution Deposits received	-	-	-	3,00,000
TDS/TCS recovered during the year	8,706	6,41,797	6,50,503	15,25,138
Statutory payments	16,233	1,27,923	1,44,156	5,35,288
Investments during the year (Schedule H)	42,93,070	1,60,84,000	2,03,77,070	1,30,58,953
Refund of Advance received from FRLHT	-	79,29,239	79,29,239	-
Excess GST/TDS deposited	-	3,63,634	3,63,634	-
Fees on Projects (Contra)	24,69,608	6,10,022	30,79,630	44,46,327
Inter-Unit Transfers (Contra)	1,18,08,335	-	1,18,08,335	36,85,108
	Grants/Projects	**University**	**Total**	
CLOSING BALANCES AS ON 31/03/2021				
Bank Balances **(Schedule I)**	8,91,305	2,40,74,474	2,49,65,779	2,37,75,320
Cash Balances	-	5,768	5,768	6,302
TOTAL PAYMENTS	**6,17,33,051**	**8,24,43,636**	**14,41,76,687**	**11,26,62,618**

For The University of Trans-Disciplinary Health Sciences & Technology

(Professor Darshan Shankar)
Vice-Chancellor

(Dr. A.K. Gupta)
Registrar

(Mr. Suresh Hegde)
Joint Registrar - Finance & Accounts

As per our report of even date attached
For LAWRENCE TELLIS & ASSOCIATES
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(FIRM REGISTRATION NO. 001857S)

(Rohan Miranda)
Partner
ICAI M. No 022772

Place: Bangalore
Date: 23/11/2021

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The University of Trans-Disciplinary Health Sciences and Technology

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