

XAVIER RESEARCH FOUNDATION



LOYOLA CENTRE FOR RESEARCH & DEVELOPMENT
(Recognized SIRO, DSIR, Govt. of India)
(Recognized Research Centre of NFSU, Gandhinagar)
St. Xavier's College Campus, Navrangpura, Ahmedabad-9.



2020-21

ANNUAL

REPORT

V I S I O N

Our vision is to catalyze, encourage, promote and support research in the humanities, social sciences and various branches of the regular sciences to address poverty alleviation and eradicate it in our country. We thus aspire to build an egalitarian world in which the fruits and progress of our current day knowledge society are at the service of the poorest of the poor of our earth home.

The mission of the Centre is to do research that propels innovation to fuel entrepreneurship, and to work with the marginalized and discriminated segments of our society, grassroots and rural communities on the fringes of our economy; and through training and handholding for entrepreneurship to empower them to set up production units of a micro, small and medium level for sustainable livelihoods. Through these interventions our ultimate mission is to develop our villages and rural areas as sustainable communities and environments

M I S S I O N

Cover Page

- Left (T to B) : Training women in the use of Oil Expellers at Jivan Vikas Kendra (JVK) Narukot; MS Medium preparation for Plant Tissue Culture in the XRF-LCRD lab.
- Middle : Diyas being prepared at XICE, the entrepreneurial unit of XRF.
- Right (T to B) : Women of the Reliance Foundation planting Kali musli supplied by XRF in the Dediapada - Netrang area; Dr. Priya Vyas with her guide Dr. Vincent Braganza after successful defense of her Ph.D. thesis.

VALUES



We love to see the cactus bloom

OUR MOTTO

**Learn and Relearn,
Search and Research,
Create and Recreate.
To Build a Better Earth for all.**

OUR SLOGAN

Decimate Poverty! Do Innovative Research!!

PREFACE

I cast a glance on last year's Annual Report. We were emerging from the Covid pandemic lockdown of 2020, when it was put together. The focus was on personal safety and we had been proactive about it. Though all of us at XRF got through the first wave of the virus fine, the labs and our experiments had paid heavy prices. But each and every member of the staff came through okay.

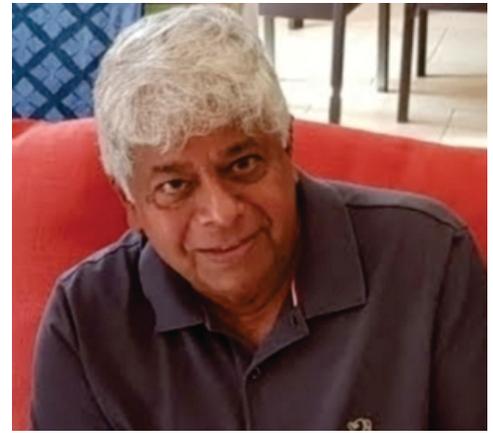
Sadly, that is not the story after the second wave hit us in 2021 and as we set about this current annual report. This time no major damage occurred in the labs, but we have paid an unexpected and heavy price in human lives. We have been left devastated with the demise of Mr. Anil Hilwala our Office Coordinator and senior most employee, Mr. Justin Khristi our Office Assistant cum Driver, and Capt. Simon Braganza, my own brother who from the time this centre was started has been our dependable benefactor. In the space of a month the virus had claimed their precious lives and left their families and all of us at XRF, numb with grief and disbelief. The 'dark night of the soul' became distinctly real.



Mr. Anil Hilwala



Mr. Justin Khristi



Capt. Simon Braganza

As members of our staff, Anil and Justin are irreplaceable. They were men that we could invariably count on. They fulfilled their duties conscientiously and were exemplary in their loyalty and care for the Xavier Research Foundation. Capt. Simon was an ideal benefactor. Whenever I approached him in times of difficulty, he was ever forthcoming with a 'willing yes' to share with us, what God had blessed him with. He took pride in hearing about our achievements.

We lovingly dedicate this report to each one of them, in the knowledge that they exemplify the tradition of commitment and hard work and willingness to root for the cause of those on our margins. That is indeed what is described and highlighted in this annual report.

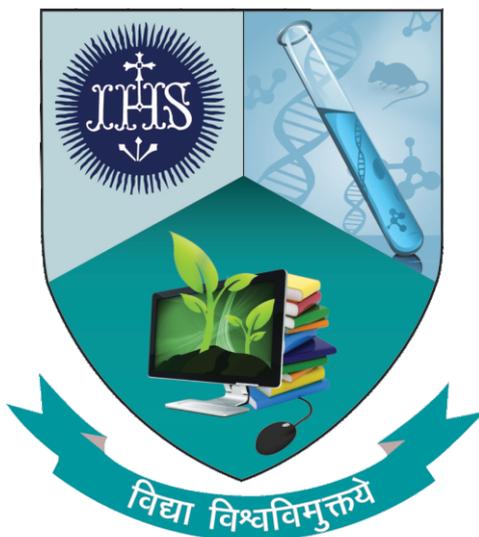
We believe that they rest eternally from their labours in the bosom of our God. We believe that from their place in God's bosom, they will continue to bless our efforts to do more and better in the service of our people, as the years go by.

Dr. (Fr.) Vincent Braganza, sj
Director

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Completed 25 years

Going for Gold

XAVIER RESEARCH FOUNDATION

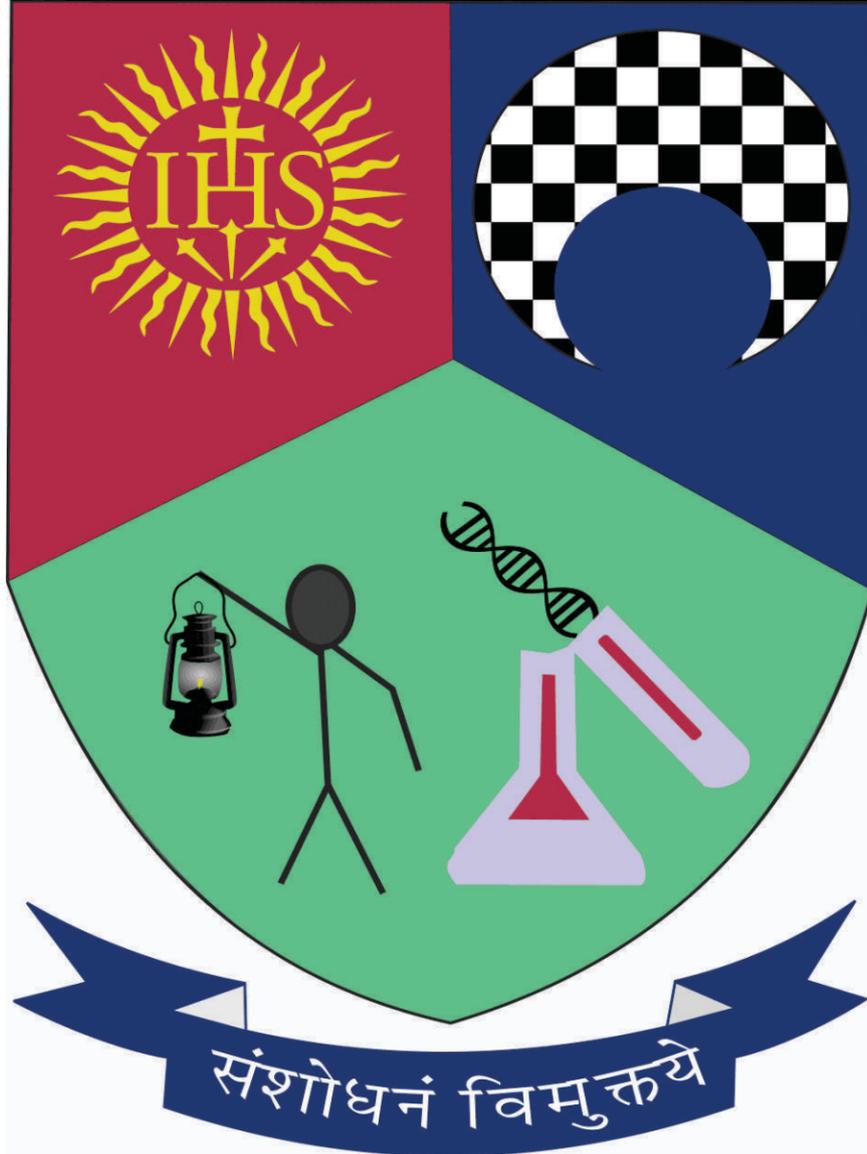
ANNUAL REPORT

of the Activities and Achievements of the

Loyola Centre for Research and Development

1 June 2020 to 31 May 2021

St. Xavier's College Campus,
Ahmedabad - 380 009.



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1. RESEARCH ACTIVITIES

1.1. On-going Scientific Research Projects

1.1.1. Completed/Ongoing Sponsored Scientific Research Projects:

- Based on the feasibility study report for value added products, the Province Development Office (PDO), Gujarat Province had approved a 9 months **“Pilot Project for Oil Extraction and Shea butter equivalent towards Market for Sustainable Livelihood for Tribal Women”** to the Xavier Research Foundation (XRF) in January 2020; financed through the Province of Spain (ALBOAN).

As the Government lockdown was lifted in a phased manner in May end 2020, from the 1st of June all staff and research scholars at XRF-LCRD started reporting for duty. A scientist (Dr. Mayur Panchal) and Social Entrepreneur (Sr. Vandana Parmar) had already been appointed earlier. Besides, a part-time Research Assistant (Dr. Disha Patel) was also appointed to the project from 1st June in order to sustain the tests to be done on the various samples of doli collected, along with a local coordinator at Jivan Vikas Kendra (JVK) Narukot, the site where the project was being implemented.

Trips to Narukot were begun again from the 11th of June 2020 after getting Sr. Vandana’s consent. To ensure safety from infection, a number of materials and safety practices were conveyed to the Narukot centre in keeping with those practiced at LCRD. Further two permanent flex posters were designed and made for the Narukot centre, one was put up at the main entrance and the other before the office entrance to alert visitors about the safety requirements on entry to the centre.



Poster at Narukot Centre



Women at the meetings wearing masks

Towards the last weeks of the lockdown, the traders notwithstanding the Government restrictions began accepting doli, and the women sold the bulk of what they could collect from the forest to them as money was badly needed for family expenses. As the women had already sold their doli to the traders, concerted attempts were made by Sr. Vandana and the team to encourage the women to deliver doli to the Narukot centre. At the meetings in Narukot, smaller groups (around 15-20) were involved and the infrared thermometer was used to monitor infection, if any, with masks as a requirement. As a result of the efforts made and notwithstanding that with the advent of July the season for doli neared its end, approx. 4600 kgs. of doli were collected. 100 Mahua saplings were prepared and delivered to the social entrepreneur, Sr. Vandana, at the Narukot centre for distribution amongst the women for planting in their fields

Mr. Vijay Parmar visited Narukot as an external reviewer for the project on 27th August 2020. He discussed with the women about the project and got feedback from them. He also reviewed the working of oil expellers, grinders, seeds storage, oil storage etc. at JVK. He appreciated that XRF was providing Mahua saplings free of cost to JVK, for replantation in their farms by the women.



Mr. Vijay Parmar at Narukot (1) Interacting with the women (2) Inspecting seed storage facility

Mr. Parmar also noted the work done by the scientists in undergoing quality control check for the shelf life of Mahua seeds and oil at LCRD, in order to ensure good quality. He also visited LCRD to check the products from Mahua oil like soap, incense sticks etc.

- Due to the pandemic situation and the project implementation being affected by it, and based on the feedback of the external reviewer, a **Supplementary Project for “Pilot Project for Mahua Oil Extraction and Shea butter equivalent towards Market for Sustainable Livelihood for Tribal Women in Narukot”** was approved by PDO-ALBOAN for continued implementation in 2021 cycle.

The supplementary project enabled the team to continue through the months of September to December 2020. The team was able to set up for training of a small group of women to process the doli that they were able to acquire in the original project (4600 kgs.). Keeping safety rules etc. in mind, smaller teams of around 5 women were trained to expel oil and do the necessary processing.

Several trips were made to Narukot from January to May 2021 to install equipment (using low-cost table top technology), and with the objective of meeting and training the women, and follow up coordination with the social entrepreneur and the local coordinator.

Month (2021)	Trips made
January	One trip
February	Three trips
March	Three trips
April	The second wave prohibited any trips in April till almost end of May
May	One trip



Dr. Braganza explaining the operation of solar dryer to Sr. Vandana

On 8th March 2021, the LCRD project team including Dr. Fr. Vincent Braganza, Dr. Mayur Panchal and Dr. Disha Patel visited Narukot to install oil expeller, and to deliver ancillary material for oil expelling and storage. On this occasion women’s day was celebrated at JVK by Sr. Vandana along with the women of Jambugoda.



Women's Day Celebration at JVK, Narukot

In further visits, demonstration of oil expeller and grinder was given by Dr. Mayur Panchal assisted by Dr. Vincent Braganza. About 10 women have been trained and they have proceeded to expel oil independently using 3120 kgs. from the 4600 kgs. of doli collected, with zero supervision from the LCRD staff.



Training women in small batches in use of the Oil Expellers



Women doing the Oil Extraction at JVK Independently



Five oil expellers, stabilizers and seed grinder installed at JVK



Food prepared at JVK Narukot using the Mahua Oil extracted at JVK

Looking at the situation of the rural communities during the second wave, and considering that the 40 women participating in the project would be coming in small batches to JVK in the future for implementation of our project, their safety was an immediate concern. Hence, they were provided with covid safety kits.



Distribution of Covid Safety Kits

An opportunity to extend the collaboration network was also explored. Ms. Geeta Oza and her team from ANANDI (an NGO) also visited JVK to see the demonstration of oil expellers. The visiting team bought 5 lt. of Mahua oil from JVK. The same evening the oil was used for cooking by them and we got highly positive feedback on the quality of the oil.



Demonstration of Oil Expeller to the ANANDI team

Besides, in our labs at LCRD, our scientists are also working on value addition by exploring ways of using the oil cake to make soaps, agarbattis etc. Soap preparation and procedures have been put in place and their efficaciousness has also been tested. Few samples have been distributed for feedback. Long term storage of seeds, the quality control of the oil extracts and the method for optimum extraction and analysis of the oil is also being worked on continuously.



Dr. Disha and Dr. Mayur setting up for soap making at LCRD



Soap Samples



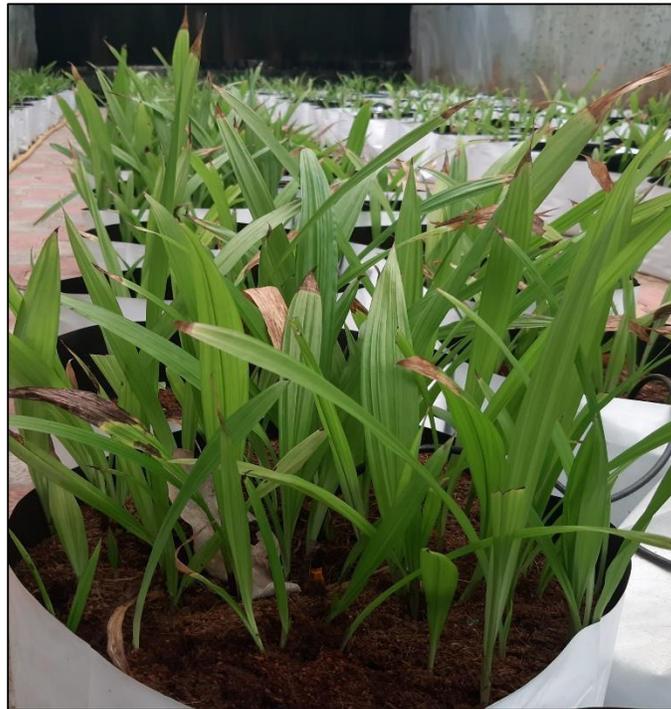
Doli stored at JVK in Double-lined PP laminated plastic bags worked out by LCRD for long term storage to ensure year long extraction

- The project “**Forest to Farming for Sustainable Livelihoods for Tribal Women in North Gujarat**” was sanctioned to the Xavier Research Foundation by the Jesuit Missions, UK, to set up a process where we give *Curculigo orchioides* (Kali musli) plantlets propagated through

plant tissue culture in the laboratories of the LCRD to women farmers, and train them for the conversion of this forest plant to a crop for cultivation, so that they can have an additional source of income without disturbing their regular agriculture patterns.

Production for plantlets was initiated by the scientific group at the LCRD in 2019. An important and significant development during this phase was that the Jesuit Community allocated a small hilly area on our campus for us to do field trials on our campus itself, with the added objective that monitoring and testing of the viability of the plantlets could be done in our vicinity. Accordingly, the plot was set up with plant tissue culture and regular forest plantlets. Almost 10,000 plantlets were planted from stocks produced in the first year of the project. This exercise also kept in mind the added advantage that we could make mother plants for plant tissue culture available at the LCRD itself.

We also succeeded in hardening the tissue culture plants in durable, reusable bags in multiples of ten with minimum fertilizer inputs. Besides sourced mother plants acquired from the forests of the tribal communities were also multiplied and preserved using vegetative propagation through a similar approach.

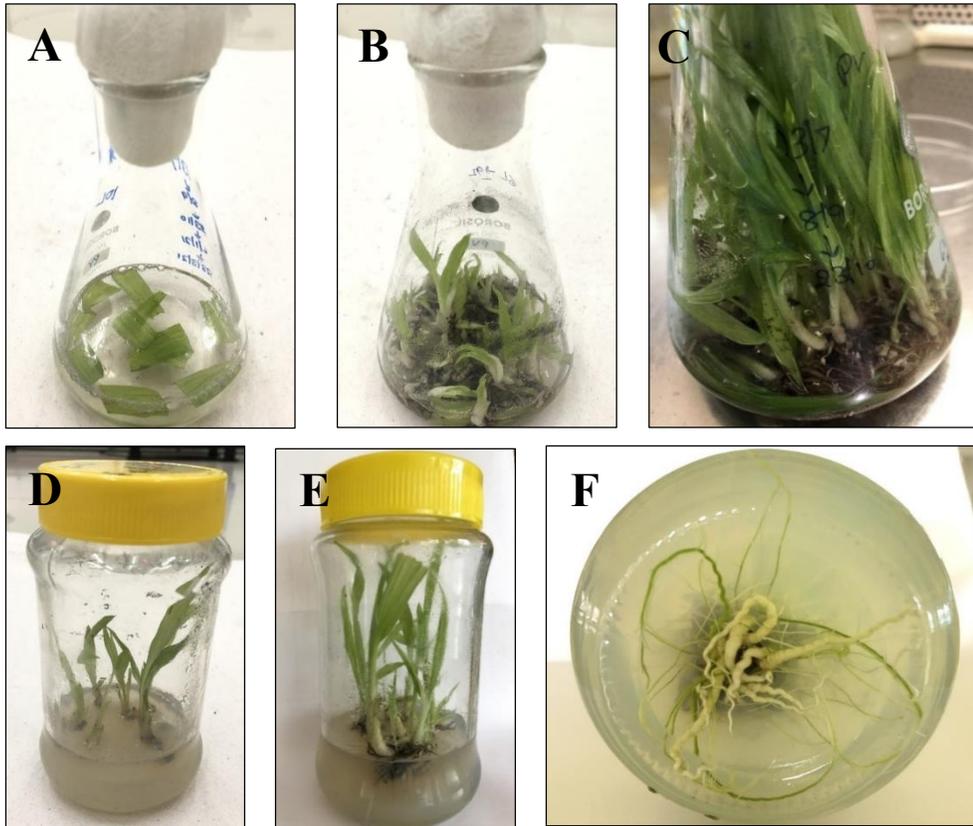


Growth of Kali musli in reusable bags in our Greenhouse

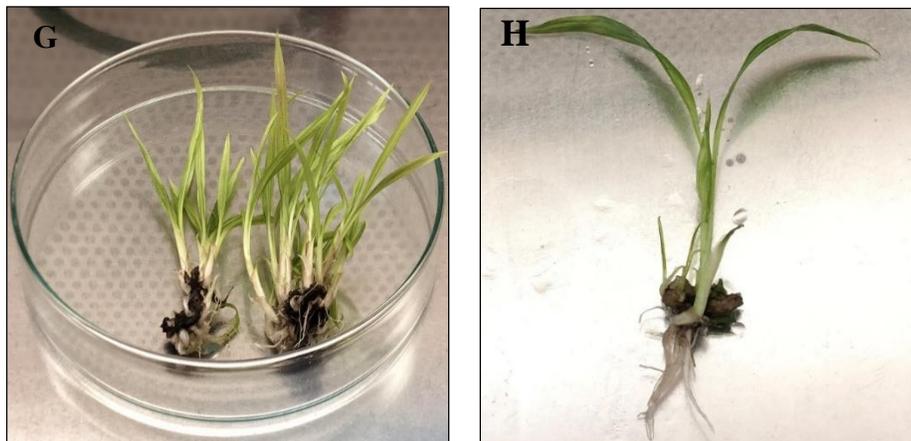
Once the Govt. imposed Covid-19 pandemic lockdown was lifted in June 2020, we managed to salvage the plantlets in our tissue culture growth room and Greenhouse (a few thousands in number) that survived the power outage that occurred during the lockdown and which could not be rectified, as no staff was on hand. The overall loss suffered as a result of the lockdown due

to loss of consumables and damage to instruments and ongoing experiments is roughly estimated in the range of 25 lakhs.

We re-started the mass production using mother plants from Greenhouse and successfully regenerated plantlets.



A-F: Successful regeneration of plantlets from leaf explants



G & H: Plantlets ready to be sub-cultured on solid media



PTC plantlets in the Growth Room of XRF-LCRD

A comparative study was done to assess the growth of Musli plantlets under *in vitro* condition by using two widely used medium, as well a comparative study to assess the growth of roots under *in vitro* condition by using two solidifying agents.

In view of the Govt. Lockdown and the prevailing pandemic, though the scope to move further was restricted, we steadily and consistently moved forward to achieve the goals of the project. Thanks to the above initiatives, we have supplied 5000 plantlets to a group of 50 women of the Reliance Foundation, for planting in the Dediapada-Netrang area. They have been given instructions for caring for them and will be monitored as a pilot group for production of the roots for marketing till the next monsoon. The group was selected by us as they are well organized already, and are eager to diversify into areas for self-sustainability. In the meantime, we have generated another 10,000 plantlets which were delivered to another set of 50 women in the Poshina area. Our local Greenhouse has also been developing to increase its capacity to house 30,000 plantlets.



Women of the Reliance Foundation, planting Kali musli in the Dediapada-Netrang area



Kali musli plantlets distributed to the women in Poshina area

1.1.2. New Sponsored Scientific Research Project:

- **Livelihood and Entrepreneurship Development Programme (LEDP)** is a programme of **National Bank for Agriculture and Rural Development (NABARD)** for **promotion of rural livelihood and employment**. Under this programme, women Self-Help Groups (SHGs) are provided with technical training and handholding support for creating micro-enterprises by using local resources.

NABARD has sanctioned a project to **Institute of Social Pragmatics (INSPIRA)** for creating micro-enterprises around Mahua. The project is being implemented **in collaboration with the Loyola Centre for Research and Development as a resource agency**.

The project covers 120 members of 15 SHGs in four villages of Bhiloda block viz. Chunakhan, Sardarnagar, Kanadar and Virpur.

A six day's training programme (in February and March 2021) was organized by INSPRA in collaboration with LCRD around three products:

- (1) Hand sanitizer
- (2) Hot and cold pressed mahua oil
- (3) Value added products like soap

From LCRD, Dr. Mayur Panchal and Dr. Disha Patel served as resource persons for the training programme under the leadership of Dr. Fr. Vincent Braganza.



Inaugural Session on 18th February 2021

On the inauguration day, Dr. Braganza shared vital information about the use of Mahua oil in daily life. He also mentioned that the objective of this training programme was to create awareness about the use of mahua seeds and flowers as a sustainable livelihood option for the rural women of Bhiloda.



Training sessions in Bhiloda

The women were divided into four groups based on their village. During the training sessions, the resource persons from XRF shared information about the storage of Mahua seeds throughout the year using double-lined durable bags, the shelf life of Mahua oil and how the quality of oil extracted from oil expeller machine is superior than the oil extracted through the conventional method. It was also mentioned that they can prepare incense sticks, fertilizers etc. from de-oiled seed cake of Mahua. On the last day of the training session, Dr. Vincent Braganza, Mr. Navalbhai (DDO officer from NABARD) and Mr. Ankur Baruah (Director of INSPRA) were also present. XRF distributed one 50 ml. sanitizer bottle to each woman who had taken part in the training sessions.

1.1.3. Ongoing Ph.D. Projects:

LCRD supports research scholars by offering them a number of research labs which provide facilities for Ph.D. researchers, a library that subscribes to various national and international journals, and by fostering an environment that gives them freedom and creativity to think outside the box. In a few cases, their theses studies too are funded by the Xavier Research Foundation (which administers the Loyola Centre for Research and Development).

The Ph.D. scholars' research programmes are guided/co-guided by the Director of LCRD. The Director has regular meetings with them to discuss their work progress. A collaborative mentoring approach not only provides more effective support and opportunities to the research scholars, but has also expanded the research network of LCRD.

Research Scholar	Research Project	University
Ms. Riddhi Parmar Field of Research: Zoology	Studies on the effects of selected plant extracts in relation to stress, memory and ageing using <i>Caenorhabditis elegans</i> model.	Gujarat University <i>Guide:</i> Dr. Hyacinth Highland <i>Co-Guide:</i> Dr. (Fr.) Vincent Braganza
Ms. Priyanka Dube Field of Research: Biochemistry	Influence of extracts from selected medicinally important plants on <i>C. elegans</i> in terms of regularizing metabolism and stress.	Gujarat University <i>Guide:</i> Dr. Nayan Jain <i>Co-Guide:</i> Dr. (Fr.) Vincent Braganza
Mr. John D'Costa Field of Research: Forensic Environmental Chemistry	Environmental audit of the Pirana landfill of Ahmedabad.	National Forensic Sciences University <i>Guide:</i> Dr. Harshad Patel <i>Co-Guide:</i> Dr. (Fr.) Vincent Braganza
Ms. Saeida Saadat Field of Research: Bio nanotechnology	Development of Halloysite nanotubes based antimicrobial nanocomposites for myriad applications.	National Forensic Sciences University <i>Guide:</i> Dr. Deepak Rawtani <i>Co-Guide:</i> Dr. (Fr.) Vincent Braganza

Brief Overview of the Ongoing Theses:

i) **Studies on the effects of selected plant extracts in relation to stress, memory and ageing using *Caenorhabditis elegans* model.**

The present investigation is aimed at evaluating the antioxidative and stress resistance efficacy of *Bryophyllum pinnatum* extracts (BP) using *Caenorhabditis elegans* as the experimental model. The antioxidant activity of the BP extract was evaluated *in vitro* (DPPH, Total Phenolic and Flavonoid content) and *in vivo* (DCF-DA assay). Different pharmacological doses of BP crude extract were used to determine dose dependent impact on Lifespan, Health span assay, Thermotolerance (37°C). ROS scavenging activity (20 mM H₂O₂) was also carried out. This study revealed that BP extract possesses significant *in vitro* and *in vivo* antioxidant activities which possibly contribute to its role in enhanced stress tolerance. The extracts also proved effective in increasing the mean lifespan of *C.*

elegans following exposure to thermal and oxidative stress. It is also suggested that the protective and lifespan extending action of the crude extract is not only due to its antioxidant capacity but may also be mediated by modulation of certain related signaling pathways. The study strongly suggests that the *B. pinnatum* extract acts as an antistressor and potent scavenger of reactive oxygen species, which consequently enhances the survival of the worms in different stress conditions.

ii) **Influence of extracts from selected medicinally important plants on *C. elegans* in terms of regularizing metabolism and stress.**

Diabetes mellitus is increasingly becoming a very common health problem in the current world; the occurrence and mortality related to it is increasing. Regulation of the blood sugar imbalance results in serious consequences to health. Conventional drugs are effective against diabetes mellitus, but often come with unavoidable side effects. Diabetes mellitus accounts for about 9.3% of global disease burden affecting people of all age groups, and causes social and economic burden to society. Ayurveda plants are known to act as alternative sources of anti-diabetic agents. Identification of anti-diabetic herbs collected from research articles of PubMed NCBI was done and shortlisted manually. A list of phytoconstituents was collected from some online database sources, mainly 1. Duke's Phytochemical database, 2. TCMSP (Traditional Chinese Medicine Systems Pharmacology) and 3. PCIDB (Phyto Chemical Interactions DB). Phytochemical structure details were collected from Pubchem and ChEMBL open source database systems. Three online target prediction softwares were used, 1. Swiss target prediction, 2. BindingDB and 3. STITCH. Cytoscape (version 3.8.2), an open source software which was used for the network construction, visualization and analysis. Pharmacokinetics prediction and drug likeness evaluation were done with the help of PkCSM open source software.

From this, 126 anti-diabetic ayurvedic herbs and 6488 Phytomolecules (PMs) were collected. 4067 Phytomolecules were assigned with a unique ID. The network analysis of Herb-Phyto molecule network led to the finding that PM36 (Beta-sitosterol) is the most common PM found in 42 out of 126 anti-diabetic herbs. Some other phytoconstituents apart from PM36, like PM459 (Quercetin) and PM450 (Kaempferol), are shared by 37 and 26 anti-diabetic herbs respectively. Total five genes were identified as target genes, viz INS, IL6, AKT1, ALB and TNF.

Wet labs using the *C. elegans* system have been initiated in order to correlate and confirm the *in silico* insights discussed above. Acquisition of the relevant mutant strains due to covid pandemic disruption of international transport is currently posing a major hurdle for proceeding with data acquisition in a timely and systematic way.

iii) **Environmental audit of the Pirana landfill of Ahmedabad.**

Environmental audit started developing in the beginning of the 70's, in the United States of America. It can be defined as a management tool comprising a systematic, well documented periodic and objective evaluation of how well the management systems are performing with the aim to safeguard the environment. It was introduced in India for the minimization of generation of wastes and pollution. In this regard a gazette notification was issued by the Ministry of Environment, Forests and Climate Change, on March 13, 1992, and later amended vide Government notification GSR (386), dated April 22, 1993. The audit is not an evaluation of alternatives that will optimize a course of action to solve a particular problem, but to reveal whether the system is controlling in a way that will yield expected results. The audit will succeed if it reveals the shortcomings as well as satisfactory conditions and identifies the necessary steps to cure these shortcomings.

Municipal solid waste is an acute problem due to the enhanced economic activities and rapid urbanization. Increased attention has been given by the Government in recent years to handle this problem in a safe and hygienic manner. In this regard we have made an attempt to study the environmental audit of a municipal solid waste dump through the collection of primary and secondary data from the Government authorities and its related stake holders involved in the collection, segregation, transportation and final disposal of wastes of the MSW at the Pirana dumpsite in Ahmedabad.

The most common environmental issues for dumpsites relate to the contamination of surface and ground water, soil contamination from potentially toxic elements, air pollution from open surface burning of materials, underground fires fueled by landfill gases and gas leakage, bio diversity issues of flora and fauna contamination from leakage of waste and gas emission. The most common health issues are related to gastrointestinal, dermatological, respiratory and generic systems, apart from infectious diseases. Nearby dwelling populations suffer from diarrhea, headaches, chest pain, irritation of skin, and stomach ulcers.

Remote Sensing: In the broadest sense, it is the measurement or the acquisition of information of some property or an object of phenomenon, by a recording device that is not in physical or intimate contact with the object or the phenomenon under study. As during the major part of the year, we were under the influence of the pandemic and the Pirana dumpsite was out of bounds, data was gathered using RS - GIS (Remote Sensing and Geographic Information Systems) technology that helped to study the levels of pollution at the site without actually being physically present there.

Land Surface Temperature of Ahmedabad : May 2020

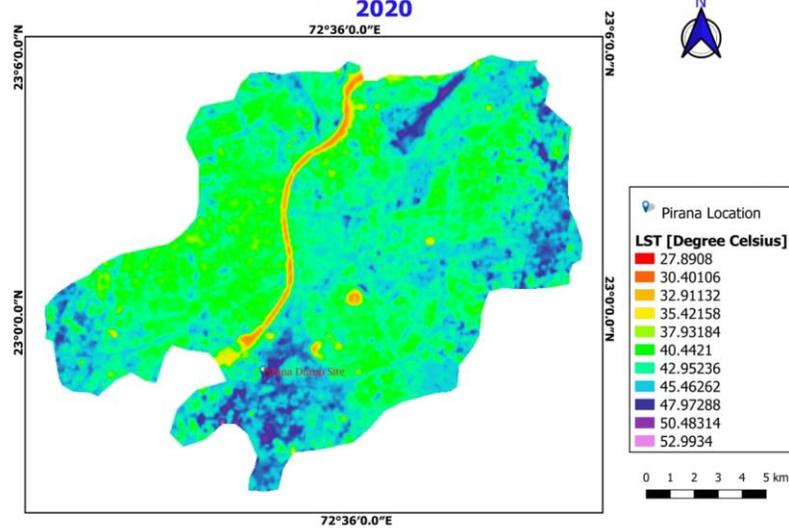
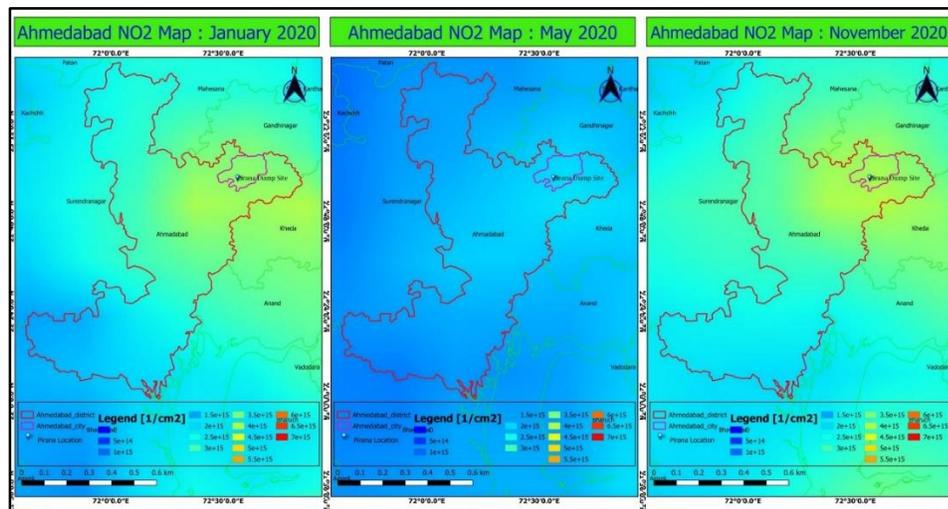


Fig. above indicates the higher land surface temperatures at the Pirana dumpsite (dark blue) as compared to the rest of the areas. This is mainly due to the fires breaking out at the dumpsite due the emission of methane.

Cars, trucks and other vehicles are the largest sources of NO₂ emissions along with power plants and industries. Nox is produced when fossil fuel is burnt and the pollutant is released directly into the atmosphere. The figure below corresponding to May 2020 clearly indicates a major drop in the Nox levels during the lockdown period and then a gradual increase in the values nearing November, which validates the viewpoint that we should not blame ONLY Pirana for the pollution in that area



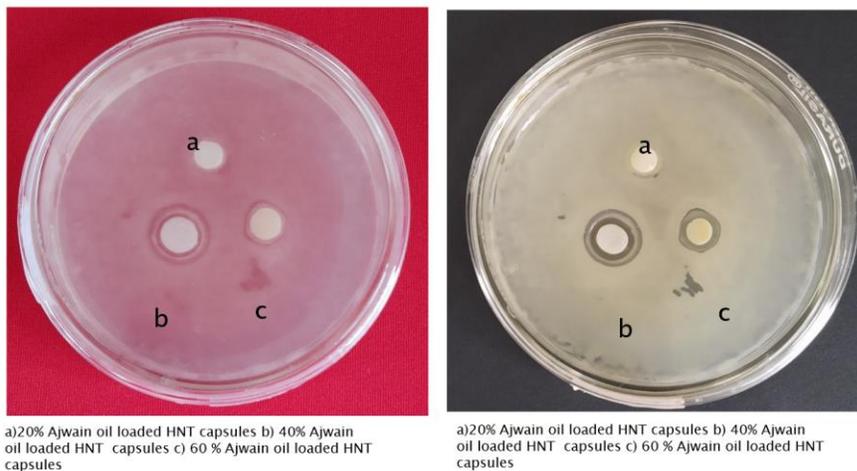
iv) **Development of Halloysite nanotubes based antimicrobial Nano composites for myriad applications.**

The aim of this study is to develop Ajwain (*Trachyspermum ammi*) essential oil loaded HNT Nano composite films for antimicrobial applications. HNTs are clay-based minerals with exceptional properties. $Al_2Si_2O_5(OH)_4$ is the construction formula of these nanotubes in which the contribution of oxygen is 55.78%, silicon 21.76, aluminum 20.90, and hydrogen 1.56%. These nanotubes mostly occur by hydrothermal amendment of aluminosilicate minerals and are used in different fields. These Nano clays have oppositely charged outer and inner surfaces which paves the way for loading several antimicrobial agents into their surfaces for sustained release of the agents. In this study, essential oils as antimicrobial agents were used to load onto HNT, and for this purpose HNT was treated with NaOH to roughen the surface of the nanotubes in order to load more oil into their outer and inner surfaces. Then the Ajwain essential oil was loaded into this Nano sized tubes by stirring method. The developed Ajwain oil loaded HNTs combined with chitosan for the synthesis of the antimicrobial Nano composite films.

The characterization of the developed Nano composite films was performed by using UV Spectrophotometer, Fourier-transform infrared spectrometer (FTIR), and Differential Scanning Calorimetry (DSC).

Antimicrobial assay of the developed Nano composite films was done by Disk Diffusion method. The antimicrobial studies of the developed Nano composite films showed effective anti-microbial properties against both gram positive and gram-negative bacteria.

The Ajwain oil loaded film materials (Ajwain/HNT/Chitosan) Nano composite was applied on desi tomatoes and kept under observation for 3 weeks. The result of the observations showed that the Nano composite films could protect the tomatoes from insects and microorganisms, as well as enhance their shelf-life.



Antimicrobial/Anti-insect studies of the developed films



Clove essential oil (*Syzygium aromaticum*) loaded HNT nanocomposite films were also developed.



Antimicrobial studies of the developed films

1.1.4. Ongoing In-House Scientific Research Projects:

The focus of our in-house scientific research and development programs is to address our mission vision of equitable and sustainable societies, and are geared towards ultimately creating livelihood opportunities for communities at the grassroots level.

Dr. (Fr.) Vincent Braganza, Dr. S.R. Dave and Dr. S.K. Ghosh supervise all the research and research related activities at the Centre. Lab work presentations and discussions involving the research staff are encouraged to broaden their horizons and create a collaborative environment within the labs.

A few of the ongoing in-house projects are:

- **Callus Induction from *Stevia rebaudiana* Bertoni leaves.**

Stevia rebaudiana Bertoni (natural sweetener) belongs to the Asteraceae family and can be used as a substitute for artificial sweeteners for diabetic patients. Many people are using *Stevia* leaves and leaf extract that are available in the market as a sugar substitute. However, in the cultivation of *Stevia* plant by seeds or stem cutting, the seed viability rate is very poor. Thus, we are developing a protocol for the induction and multiplication of callus from the *Stevia* leaf explant. Our idea is to replace the *Stevia* leaf with induced callus for sugar substitute.

We got the different coloured calli in different combinations and concentrations of plant growth regulators (PFRs), which were added in basal MS (Murashige and Skoog) medium. However nowadays open sale and purchase of Ammonium nitrate (one of the major components of the Murashige and Skoog (MS) medium for the nitrogen source) is prohibited.

Therefore, we re-designed and developed a modified Murashige and Skoog (MMS) medium supplemented with plant-growth regulators (PGRs). This medium was found to be the most suitable medium for *Stevia* green callus induction from leaf explant. We also studied the effect of PGRs on the accumulation of sugar content in callus cultures and regenerated plant leaves. After the success of green callus induction, we optimized a suitable extraction method from the callus followed by a solvents combination in mobile phase to run the TLC (Thin Layer Chromatography) and to get the maximum bands in all crude extracts. We also determined the presence of specific compounds (steviol glycoside) with the help of an appropriate Rf value (Fig. 1). Almost similar band patterns were observed in all samples. However, the bands observed in aqueous extracts were slightly faint as compared to the ethanol extracts. This could be because the solvents of the mobile phase might be more suitable for the separation of compounds in the ethanolic extracts as compared to the aqueous extracts. On the basis of a reported densitogram (*Reference: Radosław J. Ekiert, Jan Krzek, Magdalena Lenartowicz, Halina Ekiert (2014) Analysis of stevioside and rebaudioside A in sweeteners. Prace doświadczalne, pp. 195-199*), the identification of Stevioside and Rebaudioside - A was performed in the callus extract. The TLC chromatography was developed with chosen mobile phase to look into the exact Rf values for both steviol glycosides, i.e. Rf 0.35 for Rebaudioside A and Rf 0.45 for Stevioside. The band separation efficiency was good enough to perform the analysis. The method is characterized by a simple one-step extraction process and enables direct determination in UV light without any need of derivatization and staining.

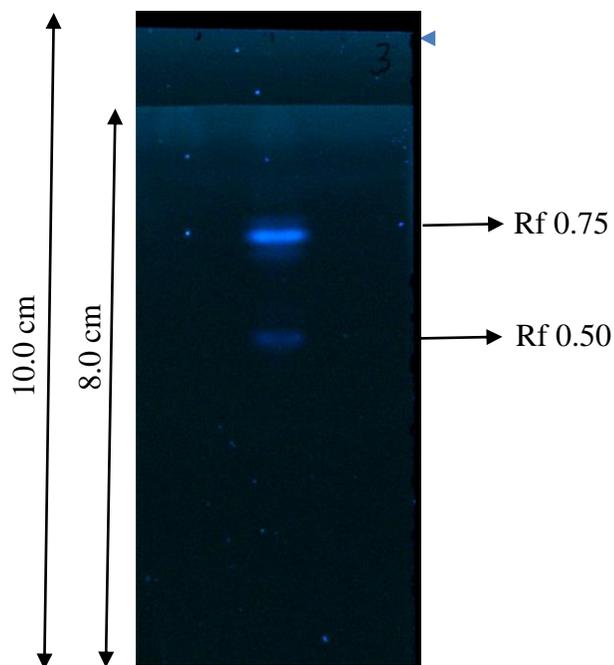


Figure 1: Thin layer chromatography (TLC) of ethanol extract of green callus induced from *Stevia rebaudiana*. Arrows show the bands of two Steviol Glycosides compounds at a specific distance with the values of Rf 0.35 for Rebaudioside - A and Rf 0.45 for Stevioside.

- **Micropropagation of two cactus species i.e., *Melacactus curvispinum* and *Mammillaria schiedeana* for commercial purpose.**

Multiplication of the two cactus species - *Melacactus curvispinum* and *Mammillaria schiedeana* is in progress through plant tissue culture technique. At present, there are around 150 culture bottles in our Growth Room under controlled environmental conditions, with both the actively growing cactus miniature plantlets on modified MS (Murashige & Scoog) medium (Fig. 2 a,b). This year we also started hardening of the tissue culture raised cactus plants. Around 100s of plants were transferred to the Greenhouse for acclimatization to field conditions. After about a month, they were transferred to the field (outside the Greenhouse) under ambient environmental conditions. After transferring to the field, the tissue-cultured cactus plants showed very low mortality rate. About 90% of the transferred cactus plants are healthy and successfully growing in the field conditions (Fig. 2 c,d).



Figure 2: Cactus species (a) *Melacactus curvispinum* and (b) *Mammillaria schiedeana* growing in modified MS medium (c) Hardened cactus plants in Greenhouse (d) Cactus plants growing in field conditions

- **Separation & purification of mycophenolic acid (MPA) from the crude methanol extract of wheat bran treated with *Penicillium brevicompactum* (MTCC 1999).**

Mycophenolic acid (MPA), an important immunosuppressant drug, is produced as a secondary metabolite as a result of fermentation by *Penicillium brevicompactum*. In the previous phase of the experiment, we established the method for the production and enhancement of MPA using Solid Substrate Fermentation (SSF) by *Penicillium brevicompactum* (MTCC 1999), where agriculture residues (wheat bran and rice bran) were used as a substrate. Our findings showed the enhancement of the MPA accumulation/production in the crude extracts of wheat and rice brans, tested at a regular interval of 4, 8 and 12 days of incubation. This part of the work was completed under a MSME project. Now we have moved to the next phase of experiment with in-house support, and established a method for the separation and purification of pure MPA from crude wheat bran extract.

The crude MPA produced in the first phase of experiment was further processed by downstream processing to produce pure crystals of MPA. The pure MPA final product can be further utilized to synthesize APIs. Downstream processing is an important aspect of all biotechnological processes and has significant implications on quality and yield of the final product. The downstream processing operations are divided into four steps: (1) Harvesting (2) pH adjustment of Broth (3) Solvent Extraction, and (4) Crystallization. Further, solvent extraction consists of three steps, (1) Production of crude extract (2) Isolation of crude product/compound, and (3) Purification of final product of our interest. In the present study, we tried to purify the MPA crystals from the crude MPA product, which we isolated from the crude methanol extract of wheat bran after SSF. Several solvent combinations and methodologies were applied for the purification and maximum recovery of pure MPA crystals. Two basic techniques were followed:

- i) **Biphasic separation:** In this technique, the weighed amount of crude MPA was dissolved in methanol taken in a separating funnel. Addition of several solvents (polar/non polar) was done with a known volume to adjust the polarity. The impurities were dissolved in different polar/non polar solvents depending on their solubility, and highly pure MPA dissolved in the solvent at lower phase where its solubility was maximum. The lower phase of aliquot carrying partially pure MPA was collected in a clean and dry beaker. The aliquot was completely dried in air to remove all traces of solvents. The dried content was dissolved in methanol and the sample was run on TLC to check the level of purity of MPA and reduction in the number of impure compounds (Fig. 3). A suitable mobile phase was used to run the TLC plate followed by suitable chemical reagents to visualize the MPA spots under ultraviolet light (Philips HPW 125 lamp) exposed at 254 nm and 366 nm wavelengths.

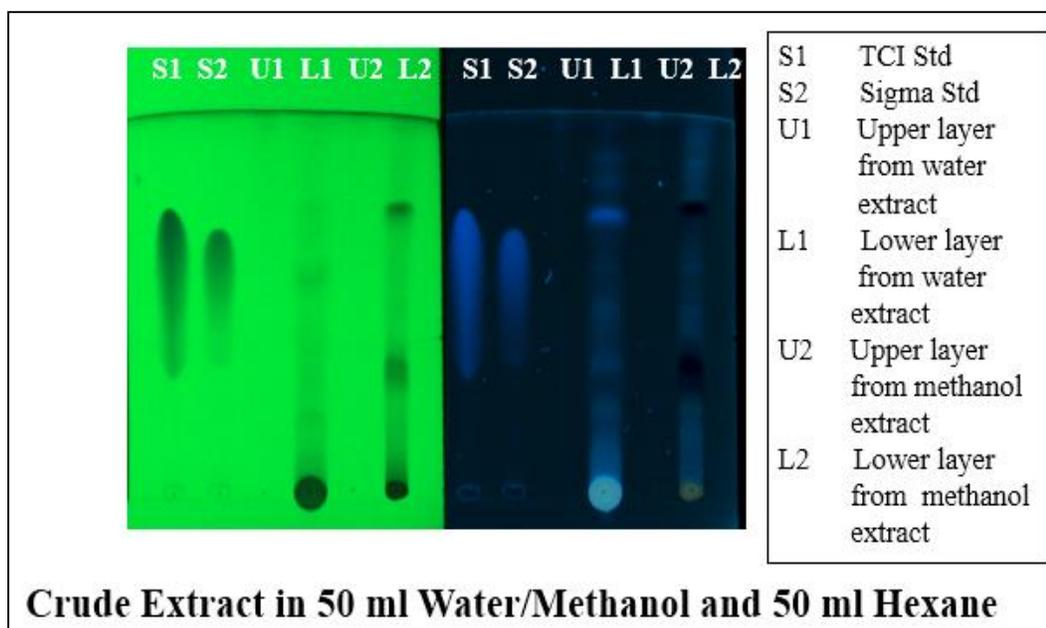


Figure 3: Bi-phasic Separation of MPA

- ii) **Column Chromatography:** The column material was prepared by blending 80 gm of Silica gel (Merck, type 60-120 mesh size) with 200 ml of n-hexane:toluene (50:50 v/v). The silica gel was deactivated with 3% of water. The slurry was added to the chromatographic tube (60 x 4 cm; length x diameter) and allowed to stand for 15 to 20 minutes to pack it firmly. Then 100 ml of n-hexane:toluene (50:50 v/v) was added to the column to elute some of the impurities and extraneous matter present in the silica gel. The isolated MPA powder with weighed amount was poured on top of the column. The MPA along with other traces of impurities was eluted with 600 ml of n-hexane:toluene (60:40 vol/vol). All eluted aliquots were collected in test tubes (20 ml each). Total 30 fractions were collected and were run on TLC to look for the MPA bands. A suitable mobile phase was used to run the TLC plate followed by suitable chemical reagents to visualize the MPA spots under ultraviolet light (Philips HPW 125 lamp) exposed at 254 nm and 366 nm wavelengths. Fraction number 12 to 19 showed pure MPA bands (Fig. 4). All these fractions (12 to 19) were combined and dried in a cold refrigerator (-20°C) to get the Pure MPA crystals.

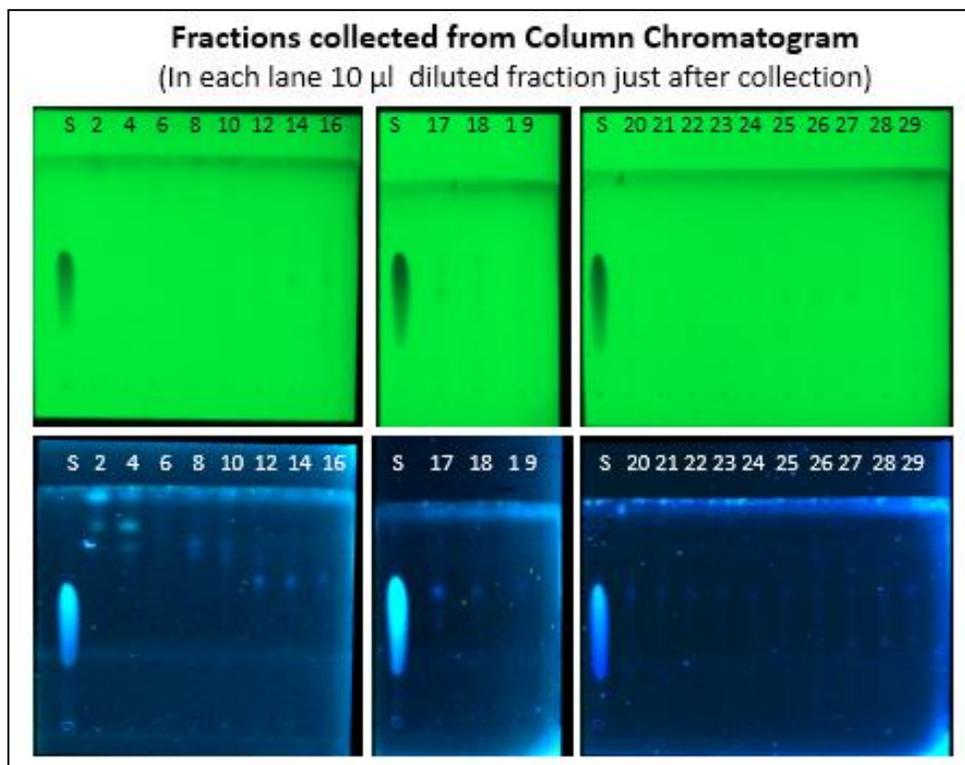


Figure 4: TLC of eluted fractions from Column Chromatography showing MPA bands in fraction number 12 to 19 (S - Standard MPA).

- Production of essential oil/essence from the Mahua (*Madhuca longifolia*) flowers.

Mahua has been traditionally used to cure people of diarrhea, skin diseases etc., and is also known to have aphrodisiac, antibacterial and antioxidant properties. Mahua flowers are a rich source of natural sugars (glucose, fructose, sucrose, etc.) and hence are used for liquor production by tribals. Besides, the flowers are also used to make various food products such as laddoo, barfi, kheer, sweet puri, candy, cake, beverages, toffee, squash etc. in terms of its value-addition. However, flowers remain under-used due to the post-harvest spoilage. To overcome this problem, we are trying to produce natural flower essence/essential oil from the one-year-old flowers. Essential oils can be used in a wide variety of consumer goods such as detergents, soaps, toilet products, cosmetics, pharmaceuticals, perfumes, confectionery food products, soft drinks, distilled alcoholic beverages (hard drinks) and insecticides. We used hydro-distillation method for the production of Mahua flower essential oil. Originally introduced by Von Rechenberg, the term hydro-distillation has become established in the essential oil industry, and is used for the extraction of essential oil/essence from various flowers. The difference lies mainly in the method of handling the material. Sometimes, the volatile oil content of the flower petals is so small that oil extraction is not feasible by the aforementioned method.

Hydro-distillation: In order to isolate essential oils by hydro-distillation, the one-year-old Mahua flowers were packed in a still, and sufficient quantity of water was added and brought to a boil; alternatively, live steam can be injected into the plant charge. Due to the influence of hot water and steam, the essential oil is freed from the oil glands in the plant tissue. The vapor mixture of water and oil was condensed by indirect cooling with water. From the condenser, distillate flowed into a separator, where oil separated automatically from the distillate water (Fig. 5). There was a very thin layer of essential oil observed on the surface of the distilled water collected in the separating funnel. Presently, we are in the process of separating the thin layer of essential oil/essence from the distilled water obtained from hydro-distillation of Mahua flowers.



Figure 5: (a) Hydro-distillation of Mahua flowers (b) Thin layer of essential oil accumulated on the surface of distilled water

1.2. Workshops/Seminars

The staff at XRF-LCRD are encouraged by the Management to attend workshops and seminars, so that they continue to develop skills and get new ideas and approaches that will make them more effective and efficient at work. In view of the pandemic situation in 2020-21, all the seminars/workshops were conducted online, and our staff attended several webinars during this period. A few of them are listed below:

- “How to Improve Article Acceptance Rate and Publish Quicker” organized by Emerald Publishing on 7th August 2020.
- Interactive Webinar on “Gas Chromatographic Techniques” on 8th October 2020, organized by Indian Pharmacopoeia Commission, Ministry of Health and Family Welfare, Government of India, Ghaziabad.

- International Symposium on “Advances in Plant Biotechnology and Genome Editing (APBGE-2021)” organized by ICAR-Indian Institute of Agricultural Biotechnology, Ranchi, held between 8th – 10th April 2021.
- Online Workshop on “PCR, UV-VIS Spec and HPLC” organized by Department of Biotechnology, Ashok & Rita Patel Institute of Integrated Study & Research In Biotechnology and Allied Sciences on 17th May 2021.

As a part of our MoU signed with H.K. Acharya & Co., LCRD has been the co-organizer for several Intellectual Property Rights (IPR) webinars with Markpatent.Org, and Climate change and Sustainable development webinars with Nanoland Ltd. during the year:

- IP in Pharma
- Licensing IP – Law and Application
- IP & SMEs – Taking Your Ideas to Market
- An Interactive Panel Discussion cum Webinar on Climate Change: In Search of Truth for the Freezing World
- How can you preserve the Earth's Climate
- World IP Day webinar on IP & SMEs – Taking Your Ideas to Market
- IPR – An Effective Business Tool for MSMEs: PATENT
- IPR in Artificial Intelligence – Latest Challenges

2. LIST OF PUBLICATIONS

2.1 Manuscripts Published

The following research article was published in the 2020-21 annual cycle:

Disha Patel, Jalpa R. Thakkar, Vincent Braganza, Hasmukh Modi

Metagenomics-based bacterial community analysis: assessment by amplicon sequencing of Tuva Timba and Dholera hot-water springs, Gujarat, India.

Current Science, Vol. 119, No. 10, November 2020, Page 1663-1670. ISSN 0011-3891.

Abstract: Amplicon sequencing of extreme locations helps reveal the presence and abundance of diverse extremophiles within extreme environments. Firmicutes, Proteobacteria and Actinobacteria were identified as a major phyla using 16S rDNA amplicons from the soil and water samples of Tuva Timba and water samples of Dholera in Gujarat, India. Season-wise data when compared with location-wise data showed less diversity. The presence of thermophiles and sulphate-reducing taxa reveals a strong correlation of taxonomy with temperature and sulphate content of the samples. The clear cluster analysis within three sample groups reveals the

importance of geographic as well as environmental factors for diverse bacterial community colonization.

Following are a few lists of publications during the year corresponding to our Administrative Director Dr. S.R. Dave, with his doctoral students at Gujarat University:

- N S Nayak, M S Purohit, D R Tipe, S R Dave
Biosurfactant production and engine oil degradation by marine halotolerant *Bacillus licheniformis* LRK1.
Biocatalysis and Agricultural Biotechnology (Elsevier), Volume 29, Oct. 2020.
- N S Iyer, D D Mandaliya, S R Dave, S K Mathey
A study on Feasibility of Bioremediation of Crude Oil contaminated soil from Kalol with Indigenous Mixed Culture.
Journal of Indian Association for Environmental Management (JIAEM), Volume 40, Nov. 2020.
- D R Tipe, M S Purohit, S R Dave
Marine Bacteria—A Treasure House of Valuable Products and Functions.
Book: Marine Niche: Applications in Pharmaceutical Sciences (Springer, Singapore), Pages 415-436, 2020.
- A Vaishnav, K Upadhyay, D Tipe, S Dave
Utilization of mixed fruit waste for exopolysaccharide production by *Bacillus* species SRA4: medium formulation and its optimization.
3 Biotech (Springer International Publishing), Volume 10, Issue 12, Pages 1-9, Dec. 2020.
- N S Nayak, S C Thacker, D R Tipe, S R Dave
***Bacillus pumilus* - marine bacteria: Unexplored source for potential biosurfactant production.**
Biosci. Biotechnol. Res. Comm, Volume 13, Pages 180-187, 2020.
- K H Upadhyay, A M Vaishnav, D R Tipe, S R Dave
Diversity assessment and EPS production potential of cultivable bacteria from the samples of coastal site of Alang.
Journal of Microbiology, Biotechnology and Food Sciences (Faculty of Biotechnology and Food Sciences in Nitra, Slovakia), Volume 2021, Pages 661-666, Jan. 2021.
- A Vaishnav, K Upadhyay, D Tipe, S Dave
Characterization of potent exopolysaccharide producing bacteria isolated from fruit pulp and potato peels and enhancement in their exopolysaccharide production potential.
Journal of Microbiology, Biotechnology and Food Sciences (Faculty of Biotechnology and Food Sciences in Nitra, Slovakia), Volume 2021, Pages 874-877, Jan. 2021.
- D R Tipe, B R Khatri, S C Thacker, S R Dave
The brighter side of e-waste—a rich secondary source of metal.

Environmental Science and Pollution Research (Springer Berlin Heidelberg), Pages 1-16, Jan. 2021.

- D H Bhagat, C N Patel, H R Gohel, H A Pandya, S R Dave, D R Tipre
Prediction and characterization of substrate specificity and thermal stability for thermostable aliphatic amidases: an in-silico approach.
Journal of Advanced Scientific Research, Volume 12, Issue 1 Suppl 2, Apr. 2021.

2.2. Papers Presented at Conferences

The following Online oral and poster presentations were made at the at the 42nd Annual Meeting of PTCA(I) and International Symposium on Advances in Plant Biotechnology and Genome Editing (APBGE-2021) organized by ICAR-Indian Institute of Agricultural Biotechnology, Ranchi, held between 8th – 10th April 2021.

Oral Presentation

Sudha Sahay, Vincent Braganza

Bioprocessing of Agriculture Residue for the Production of Mycophenolic Acid for Commercial Purpose.

Poster Presentation

Priyanka S. Dube, Vincent J. Braganza, Nayan K. Jain

Integrated computational studies on Ayurvedic herbs for Diabetes Mellitus.

3. ACTIVITIES OF COMPUTER WING (XICS)

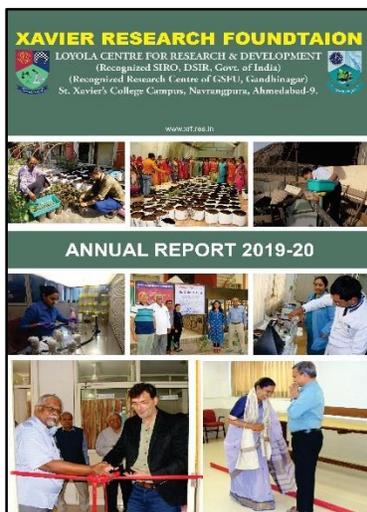
Under the MoU with Seven Seas Solutions to work as a channel partner to jointly conduct educational courses and exams as authorized testing centers for Pearson and Paragon, online exams in both the labs. have been underway since June 2020 as soon as the lockdown was partially lifted.

Our Hardware Technician, Mr. Jalees Hadvaid, continues to maintain and provide support for the computers at LCRD, as well as assists in troubleshooting hardware and software problems for both the Pearson and Paragon computer labs.

As the Controller of Examinations for the Xavier Board for Computer Education (XBCE), India, paper setting and mark sheet printing for the XBCE students continues at XICS.

4. DEVELOPMENTAL / MISCELLANEOUS ACTIVITIES

- The **Annual Report** of our Xavier Research Foundation - Loyola Centre for Research and Development was published for the year **2019-20**, providing comprehensive details about the Centre's various research and research-related activities through the year. The report was shared online with our Trustees, benefactors, staff and students.



- The Register of Public Trust (PTR) for XRF has been regularized and updated with the list of the current Board of Trustees, at the Office of the Charity Commissioner, Ahmedabad.
- The **Fourth meeting of the Institutional Animal Ethics Committee (IAEC)** of the Loyola Centre for Research and Development (LCRD) was held on **25th August, 2020**. In view of the physical distancing required for each one's well-being and safety during the Covid-19 pandemic, the meeting was held online and was chaired by Dr. (Fr.) Vincent Braganza (Director, LCRD). Dr. Tejal Gandhi, the CPSCEA nominee, made an **on-site animal house inspection**.

Dr. Priya Vyas gave a brief overview of the animal work that the committee had approved for her Ph.D. degree, and presented the pertinent data and the findings that were incorporated into her thesis.

- **XICE (Xavier Industrial Chemistry Enterprise), the entrepreneurial unit of XRF**, successfully completed the bulk order **for 5000 diya boxes** given by the Rotary International District 3054 Charitable Trust, in order to help XRF raise funds.

Under this project and as a **part of its initiative in training slum women**, the diyas were produced during Covid times by Neelamben and Roshalben, who have worked safely at XICE. This not only provided them with a skill but also helped them add to the income source of their family.



25000 Diyas (for 5000 boxes) being prepared at XICE, the entrepreneurial unit of XRF

MAY THE 'DIYAS' STORY LIGHT YOU UP



The story of the 'diyas' that you have just invested in drives deep in its roots to the Vision, Mission Values of the Xavier Research Foundation (XRF). From its inception, this 30 year old NGO believes in the Research-Innovation-Entrepreneurship triad as the key to attain sustainable livelihood for our rural and poverty stricken sisters and brothers, especially in our tribal

areas. The diyas here are produced during Covid times, by these women who have worked safely, so that their dreams for a better life come true. XRF has gone on to form



the Adi-Nari-Udyog (ANU) and The Xavier Entrepreneurship Network (XEN) to formalize the work of the women in a STARTUP. We have the stupendous dream of working

with them to establish micro-entrepreneurial units around forest products like Mahua doli and Kali musli which have been researched and mastered at the Loyola Centre of Research and Development (LCRD), administered by XRF. Your support is needed and welcomed to ignite the hopes of these women. Do join us in all the ways you can to dream with them to reality!



Insert inside the Diya boxes

- XRF has gone on to form the **Xavier Entrepreneurship Network (XEN)** to formalize the work of the women in a STARTUP. Under XEN, we have formed the **Aadi Naari Udyog (ANU)**, for marketing of plant-based forestry products by the tribal women, by processing immediately accessible natural resources.



Both the logos have been designed in-house by Ms. Hita Rathore. We are in the process of applying for the logo trademarks for both XEN and ANU.

- The **bi-annual Xavier Research Foundation (XRF) Board Meeting** for its trustees was held on **11th January and 27th March 2021**. In both the meetings, minutes of the of the previous meetings were presented to the Board along with the follow-up action, and were duly passed. The Trustees were apprised about the achievements and developmental activities of the Centre since the last meeting; the audited financial report for 2019-20 and the proposed budget for 2021-22 were reviewed. The meetings were presided over by the Provincial of Gujarat Province, Fr. Durai Fernand, as the ex-officio President in the chair.
- On **2nd February 2021**, we celebrated our **Foundation Day** with the XRF staff and research scholars with a small tea party.



Foundation Day Celebrations

- As a part of expanding XRF's research network, in **February 2021**, Dr. (Fr.) Vincent Braganza and Dr. Mayur Panchal visited the **Maharashtra Prabodhan Seva Mandal (MPSM)** in Shirasgaon of Trimbakeshwar Tehsil Nashik, for **sharing of our technologies** with the women's group there. The women were briefed about our tissue-cultured Kali musli plantlets, as well as given demonstration of oil extraction from Mahua seeds.



(L) Dr. Fr. Vincent Braganza and Fr. Joel Prakash Noronha with the women's group
 (R) Demonstration of Oil Extraction from Mahua seeds by Dr. Mayur Panchal

Dr. Braganza and Dr. Mayur also got back some wild type *Azolla pinnata* at XRF for research, as they were not able to cultivate it in Nashik.



Review of field research through field visits at MPSM

- LCRD prepared 1000 sanitizer kits for the Xavier's college students in batches of 500 each. The hand sanitizer was prepared in-house at the Research Wing in LCRD.



Clockwise from L to R: Hand Sanitizer being prepared at XRF-LCRD, Hand sanitizer prepared at LCRD, Safety Kits for Xavier's College

- **NABARD** organized an exhibition on **9th March 2021** at Fortune Landmark Ahmedabad, where all their stakeholders were invited. **Our Products (Sanitizer & Mahua Oil)** to which the women's group at Bhiloda were exposed, were put on display at the exhibition.

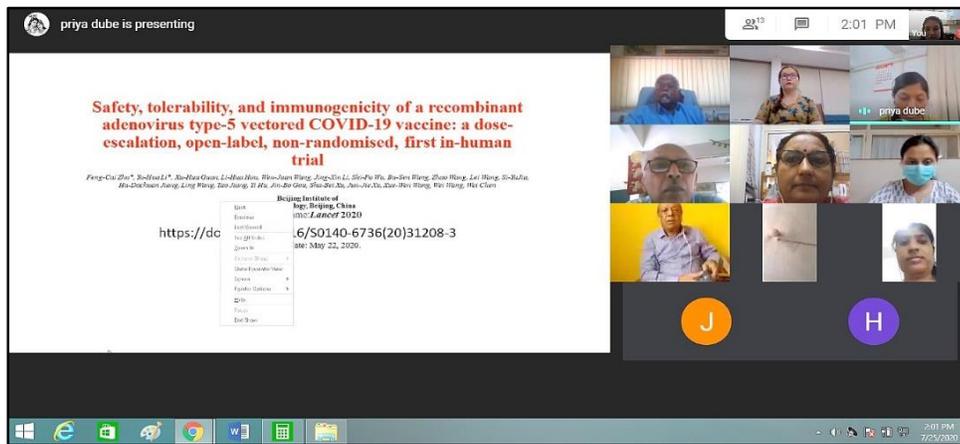


- As a part of XRF's healthy practices and keeping safety measures in mind, we continue with our Management meetings and Journal Club/ Research presentations *via Google Meet*. Higher level articles in good quality journals are encouraged to broaden the horizon of the scientists.

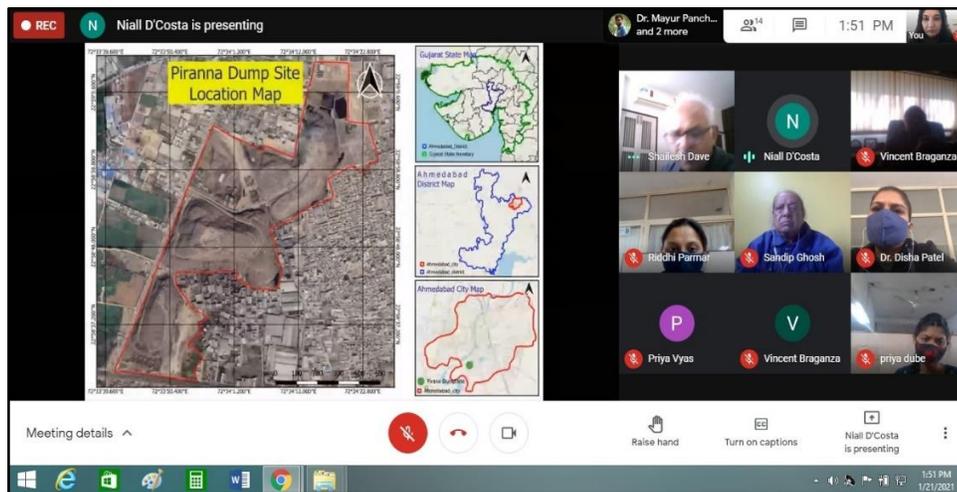
A few journal clubs presented during the year are listed below:

- Targeted delivery of nanomaterials with chemical cargoes in plants enabled by a biorecognition motif. (Nature Communications 11, 2020)
- *Lactobacillus rhamnosus* Reduces Blood Glucose Level through Downregulation of Gluconeogenesis Gene Expression in Streptozotocin-Induced Diabetic Rats. (International Journal of Food Science | Hindawi, 2020)
- Age-induced accumulation of methylmalonic acid promotes tumour progression. (Nature 585, 2020)

- SARS-CoV-2 mRNA vaccine design enabled by prototype pathogen preparedness. (Nature 586, 2020)
- A lipocalin mediates unidirectional heme biomineralization in malaria parasites. (Proceedings of the National Academy of Sciences of the USA, 2020)
- Safety, tolerability, and immunogenicity of a recombinant adenovirus type-5 vectored COVID-19 vaccine: a dose-escalation, open-label, non-randomised, first-in-human trial. (The Lancet, 2020)



Journal Club Presentation at XRF-LCRD



Research Work Presentation at XRF-LCRD

INFRASTRUCTURAL DEVELOPMENTS:

The following instruments have been added at the LCRD in the past year:

- Seed Cutter
- Hybrid Solar Dryer

The renovated XRF Greenhouse is now equipped for vertical farming to increase the yield of crop production. The development and maintenance of our Green House is an ongoing process, that continues with the help of **Mr. Parag Fatehpuria**.

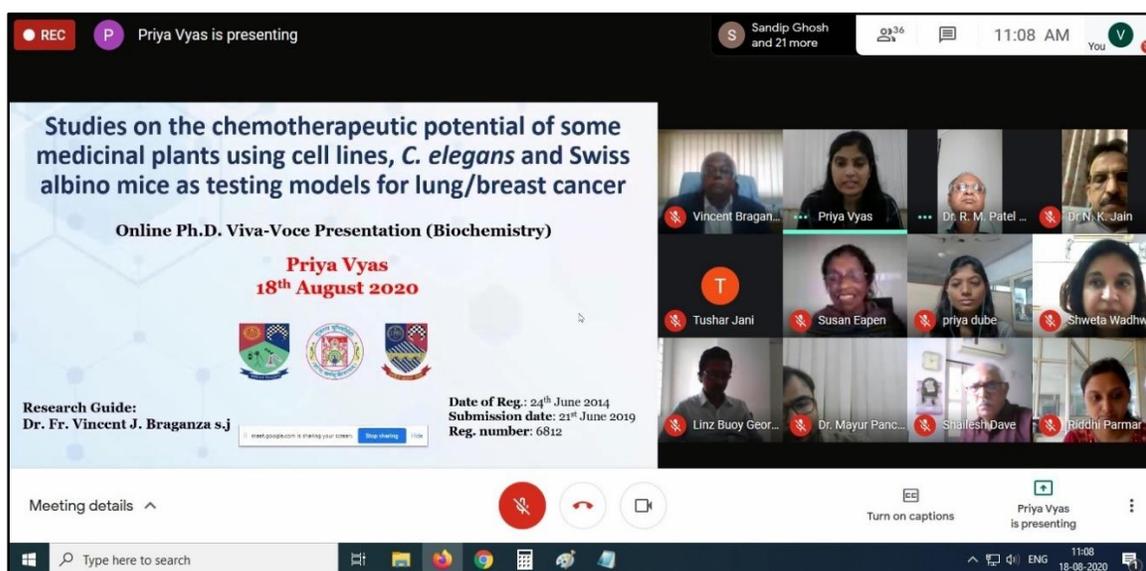


Renovated Greenhouse

5. ACHIEVEMENTS

- **Dr. Priya Vyas successfully defended her Ph.D. thesis** “Studies on the chemotherapeutic potential of some medicinal plants using cell lines, *C. elegans* and Swiss Albino mice as testing modules for Lung/Breast Cancer”. In keeping with the times, the open viva-voce examination was conducted online via Google Meet on **18th August 2020**.

The viva-voce exam was attended by many eminent scientists and professors besides the staff at XRF-LCRD; **Dr. Jitendra Khurana** (Vice-President (International Affairs) INSA, JC Bose National Fellow (SERB) & Professor, Department of Plant Molecular Biology, University of Delhi), **Prof. Susan Eapen** (Bhabha Atomic Research Centre (BARC) & ex-President, Indian Women Scientists' Association, Mumbai), **Dr. N.K. Jain** (Chairman, Research Advisory Committee, Gujarat University), **Dr. Harish Padh** (ex Vice-Chancellor, Sardar Patel University), **Dr. Hyacinth Highland** (Assoc. Prof., Biochemistry Dept., Guj. Univ.), **Dr. Linz-Buoy George** (Prof., Zoology Dept., Guj. Univ.), **Dr. Lancelot D’Cruz** (Principal, St. Xavier’s College), **Dr. Sebastian VA** (Assoc. Prof., Biochemistry Dept., SXCA), **Dr. Sudeshna Menon** (HOD Biochemistry Dept. SXCA), **Mr. Tushar Jani** to name a few.

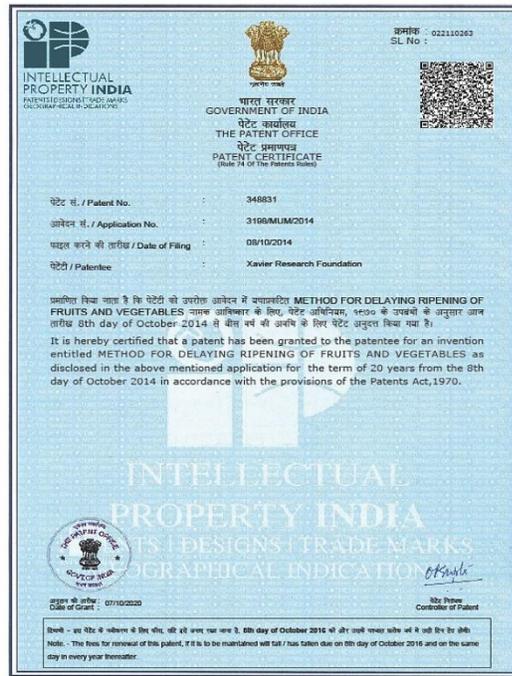


Dr. Priya was registered for her Ph.D. degree through St. Xavier’s College Ahmedabad, under the guidance of **Dr. (Fr.) Vincent Braganza** (Director, LCRD). **Dr. R.M. Patel**, Principal and Dean ASPEE SHAKILAM Biotechnology Institute, Navsari Agricultural University, Surat, was the external examiner.



Dr. Priya with (1) her guide Dr. Vincent Braganza (2) the XRF Staff

- On **7th October 2020**, a **patent has been granted to XRF** for the invention “**METHOD FOR DELAYING RIPENING OF FRUITS AND VEGETABLES**” in accordance with the provisions of the Patents Act, 1970.



Patent Certificate

- One of our **recent research publications in Current Science** (“Metagenomics-based bacterial community analysis: assessment by amplicon sequencing of Tuva Timba and Dholera hot-water springs, Gujarat, India”. Vol. 119, No. 10, November 2020), was **quoted in an article** “Hot waters of Dholera hotbed of microbes” in the **Times of India** on **9th of March 2021**.



Article in Times of India

Dr. (Fr.) Vincent Braganza:

- Appointed as a **faculty member/trainer** in February 2021 **with the IMC Ramkrishna Bajaj National Quality Award Trust (IMC-RBNQA)**, for the Certified Examiner for Quality Management programs which trains professionals from across the country in the criteria requirements of the IMC RBNQA Criteria for Performance Excellence.
- His **paper** “The Soul of the Matter and the Matter of the Soul: A Scientific Perspective” has been **published** in Fr. Job Kozhamthadam’s **latest 2021 edited book** “The Human Soul in a World of The Neurological Sciences”, based on the International Symposium held at St. Xavier’s College Mumbai in collaboration with Indian Institute of Science and Religion (IISR) Delhi on Neurosciences and Spiritual Dimensions of Humans, in February 2018.
- Invited to give an **oral presentation** on “*Curculigo orchioides*: Lab to Land; Lessons Learned” on **9th February 2021**, at the **International Symposium** on Advances in Plant Biotechnology and Genome Editing (APBGE-2021) organized by ICAR-Indian Institute of Agricultural Biotechnology, Ranchi.

Dr. S.R. Dave:

- **Member of the Selection Committee** at Gujarat State Biotechnology Mission (GSBTM) Gandhinagar, Gujarat Biotechnology Research Centre (GBRC) Gandhinagar, Indrashil University Rajpur, P P Savani University Surat.
- **Advisory Member and RPC Expert** for Silver Oak University, Ahmedabad.
- **Member** of Research and Development Committee (**RDC**) for P P Savani University, Surat.
- **Subject expert** for B.Sc. and M.Sc. syllabus in Vanita Vishram Women’s University, Surat.
- **Member of expert committee** for selection of innovative projects at Sankalchand Patel University, Visnagar, Mehsana.
- **Expert member** of Board of PG study (BPGS) at the Babasaheb Bhimrao Ambedkar (Central) University (BBAU), Lucknow.
- **Guided** the participants on “Potential of marine bacteria and their products” at the **international webinar** on Recent Trends in Applied Microbiology jointly organized by the Microbiology Department of Deogiri College Aurangabad and the Microbiology Society of India (MSI).
- **Invited lectures** at Institute of Science, Nirma University and Mahatma Gandhi Labour Institute (MGLI).

6. FINANCIAL INVESTMENTS

Investments	Amount	Period	Interest Rate
HDFC (Corpus)	20300000.00	For 3 years (in 2019)	8.08%
HDFC	500000.00	For 1 year (in 2020)	6.68%
HDFC	500000.00	For 1 year (in 2020)	6.68%
TOTAL	21300000.00		

7. INITIATIVES/PROJECTS IN THE PIPELINE

- Linkages for rice farming with MPSM farmers for increased yield through *Azolla pinnata*
- Patenting of Design of Make and Break Production (MBP) Unit
- Scale-up of isolation and production of phyto-chemo therapeutic agents for breast cancer and lung cancer
- Bacterial decontamination (sulphur, cyclic-ring compounds, hetero-cyclic ring compounds) of Industrial wastes
- Developing soil fertility enhancing microbiological products
- Upright food and flower gardening for organic farming
- Enzymes from Thermophilic bacteria of Gujarat
- DNA bar-coding – Mangrove vegetation
- Nutraceutical formulation from *Curcurligo Orchioides*
- Atomic Absorption Spectrophotometer based analysis for IFFCO
- Certificate/Diploma in Research Instrumentation and Methods
- Stevia production for sugar substitution through PTC
- Soap making and other value added products from oil of Mahua
- Plastic degradation through thermophilic organisms

8. OUR NETWORK PARTNERS & COLLABORATORS

- Rasna Pvt. Ltd., Ahmedabad
- Jay Chemicals Industries Limited, Ahmedabad
- National Forensic Sciences University (NFSU), Gandhinagar
- H.K. Acharya and Company, Ahmedabad
- MarkPatent.Org, Ahmedabad
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- National Bank for Agriculture and Rural Development (NABARD)
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- FARMKIDZ, Ahmedabad
- St. Xavier's College Kathmandu, Nepal
- Maharashtra Prabodhan Seva Mandal (MPSM), Nashik
- Social Centre's Xavier Institute of Natural Resource Management (XINRM), Ahmednagar
- ANANDI (NGO), Gujarat
- Jivan Vikas Kendra, Narukot
- The Sabarkantha Jesuit Education Society, Poshina
- Ekalavya Education Foundation, Ahmedabad

9. LIST OF BENEFACTORS

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- Natasha Maria D'souza
- Nicole D'souza
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- Xavier Kelavani Mandal

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