MACS

Annual Report 2019-2020

Maharashtra Association for the Cultivation of Science
Agharkar Research Institute

Vision

To excel as an internationally recognized centre of multi-disciplinary research in science and technology

Mission

a) Conduct basic and applied research in life and related sciences for human betterment

b) Explore the genetic diversity of microbes, plants and animals

c) Develop sustainable technologies for a cleaner environment, agriculture and better health

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Mr Abdul Rahman, Administrative Officer

Grievance Officer, ARI

Dr GK Wagh

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Foreword

Dr DR Bapat
President
Maharashtra Association for the Cultivation of Science
Pune

Dear Friends,

I have the pleasure of presenting to you the MACS-ARI annual report for 2019-20. I would like to touch upon the events that were organised for the benefit of the students, scientists and the society at large. Director, MACS-Agharkar Research Institute has summarised the research aspect in the Executive Summary.

To begin with, I would like to mention regarding the capacity building of scientific manpower. Participants from various parts of our country benefited from the training courses and workshops conducted at the institute. These programmes included: Exploration of plant life; Use of high-performance thin-layer chromatography; Taxonomy, biodiversity, ex-situ conservation and applications of fungi; Palaeontology; and Marker-assisted breeding programme in crops.

It is important to note that our institute trained Forest officials of the Government of Nepal, in Biodiversity and Conservation of Fungi. The training was sponsored by the Food and Agriculture Organization of the United Nations.

A Memorandum of Understanding was signed with the Savitribai Phule Pune University to recognize mutual interests in the fields of research, development, education, training, transfer of technology and dissemination of knowledge on a long term non-commercial basis.

On the occasion of International Yoga Day, Prof. (Dr) K Satya Lakshmi, Director, National Institute of Naturopathy (NIN), Ministry of AYUSH was invited. She delivered a lecture on the aspects of yoga and naturopathy. A yoga session was conducted in which staff and students of the institute participated.

Mrs. Swapna Gore, IPS, Deputy Commissioner of Police, Pune City was invited to speak on 'Integrity - A way of life', on the occasion of Vigilance Awareness Week.

The India International Science Festival (IISF) was held at Kolkata in which five young scientists and two women scientists from our institute participated. As a prelude to IISF a

public outreach day was organised showcasing the research at the institute. Chief Guest Mr Mukund Deshpande, Life-Member, Vijnana Bharati inaugurated the exhibition. School students and the public at large visited the exhibition. Grass root level science popularisers were felicitated on the occasion.

Every year, we organise Prof. SP Agharkar Memorial Oration, Dr GB Deodikar Memorial Oration, and Shri. GB Joshi Memorial Oration by inviting eminent personalities in science. This year the speakers included Dr Vijay M Chauthaiwale, In-Charge, Foreign Affairs Department and Member, National Executive, Bharatiya Janata Party; Dr Gyanendra P Singh, Director, ICAR-Indian Institute of Wheat and Barley Research, Karnal; and Dr Sanjay D Sawant, Vice-Chancellor, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. On the occasion of the Memorial Orations, the awards viz. Dr RB Ekbote Award, Shri VP Gokhale Award, and Dr PP Kanekar Award were presented to scientists who have done commendable work.

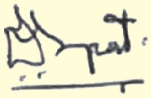
This year, we have explored the use of social media in publicising the fascinating research at the institute. We have launched 'ARI Vidnyan Vardhini' YouTube channel on the occasion of the National Science Day, wherein students and scientists of the institute have uploaded their research on this channel. Similarly, Facebook and Twitter are being used to publicise the research.

DSTs newly launched platform for popularising research, named DST Vigyan Samachar, has regularly featured the research at our institute.

Promotion of Rajbhasha Hindi has been a key feature at the institute. Special efforts were made to celebrate the Hindi Day by arranging a fortnight long programme. The use of Hindi in official work has been steadily increasing and correspondence in Hindi has seen a positive improvement. The institute jointly organised a Hindi sammelan in collaboration with National Centre for Cell Science and CSIR-National Chemical Laboratory.

The popularity of MACS' scientific promotion programmes like home gardening and field botany is growing. Enthusiasts in home gardening and plant taxonomy have been benefitting from the courses.

To conclude, MACS-ARI has had yet another fruitful year. I thank the Department of Science and Technology, Government of India, for the valuable guidance and financial support. I thank all the members of the Maharashtra Association for the Cultivation of Science for sharing their expertise in strengthening the organisation. I wish MACS-Agharkar Research Institute all the best in all its future research.



DR Bapat
27 August 2020

Executive Summary

Dr PK Dhakephalkar
Director (Officiating)
Agharkar Research Institute
Pune

The annual report (2019-20) of the Agharkar Research Institute (ARI) of Maharashtra Association for the Cultivation of Science (MACS) is presented at times when the impact of the pandemic of Covid-19 on the health of our fellow citizens and national economy has proven catastrophic. The Prime Minister of India, during these tough times, has appealed to us all to direct our efforts towards making our nation 'Atmanirbhar Bharat'.

At ARI, our research is focussed on needs of national importance such as (i) high yielding crop varieties for rainfed farming, (ii) biofortified crop varieties to alleviate malnutrition, (iii) sustainable bioenergy (biomethane/ biohydrogen) production from abundant and renewable agricultural waste, (iv) biodiversity documentation for conservation and also for the prevention of biopiracy, (v) bioprospecting for medicinally and industrially valuable biomolecules, (vi) nanotechnology in diagnostics and healthcare, and (vii) developmental biology to understand ageing and organ regeneration. The deliverable of each research project is a small contribution to make India 'self-sufficient'.

Such productive research is possible only because of continued patronage of the Department of Science and Technology, Government of India which is gratefully acknowledged. We take it upon us to contribute even more during the Golden Jubilee Year of DST. Several research projects at ARI were sponsored by the GoI funding agencies such as ICAR, DST/SERB, DBT, ICMR, CSIR, etc.; International funding agencies such as Wellcome Trust, and industries such as KPIT Technologies Ltd., ONGC, etc. We are indebted to all our sponsors for their financing support to our research programmes in all six thematic areas.

Our researchers have published important outputs of research projects in journals of high international repute, whereas intellectual properties developed were protected by filing patent applications. Several of our doctoral students who are among the best in the country and have played an important role in the research activities of ARI obtained their doctoral degrees during the year.

It is my pleasure and privilege to enlist some of the important achievements of ARI scientists during the year 2019-20.

Agriculture: Durum wheat variety MACS 4058 has been recommended by the Varietal Identification Committee for release in timely sown restricted irrigation conditions in the peninsular zone (Maharashtra and Karnataka) of India. It displays superior performance in yield and agronomic trials, disease resistance, and excellent grain quality. Soybean varieties, viz. MACS 1655 and MACS 1639 developed at MACS-ARI gave excellent performance in soybean trials throughout India in 2019. Grape variety ARI 516 was identified for release due to its higher yield, flavour and processing qualities, for cultivation in Maharashtra, Punjab, Telangana and Tamil Nadu. Hundreds of quintals of wheat and soybean breeder seed were supplied to different seed multiplying agencies and farmers.

Health: Two biopolymer based topical dressings namely a chitosan gauze and a chitosan xerogel were developed by the ARI scientists. These dressings have promising applications in halting blood loss and saving lives from death and disability. Silver and copper nanoparticles exhibiting broad-spectrum antimicrobial activity were developed by the ARI scientists. These nanoparticles were able to eradicate the biofilms and thus have potential to contain the development and spread of multidrug resistance in hospital acquired infections.

Bioenergy: A microbial process for the biomethanation of lignite, a low grade and abundant coal, was developed using specially established microbial consortia. The biomethane yield from lignite reported was among the highest ever reported. This process has potential to sustainably recover energy in the form of methane gas from lignite *in situ.*

ARI has established National culture collections namely National Fungal Culture Collection of India (NFCCI) and MACS Collection of Microorganisms (MCM) for collection, identification, preservation and distribution of fungal, bacterial, archaeal and other cultures. These are the only culture collections of its kind under the Department of Science and Technology, GoI. ARI culture collections have continued supplying cultures with performance guarantee to industry and academia at a reasonable rate. ARI has also established a drug repository which offered drug authentication services to industry and other entities. Services offered by our repositories as well as 'Sophisticated Analytical Instrumentation Facility (SAIF)' were availed by hundreds of academicians, researchers and industry personnel throughout the year. ARI scientists have also taken tremendous efforts in popularization of science by giving talks for school and college students, arranging 'hands-on training courses' for graduate, post-graduate and doctoral students as well as for college teachers, organising 'Kisan melas' to disseminate knowledge among farmers, etc.

Moving forward, ARI will continue to conduct basic and applied research in life sciences and harness the genetic diversity of microbes, plants and animals towards a cleaner environment, sustainable agriculture and better health of the masses. Our research will continue to contribute to making our nation 'Atmanirbhar Bharat' in agriculture, energy and health sector. I thank my fellow scientists, students and staff of ARI for their super efforts in trying times and contribution to the national cause.

PK Dhakephalkar
1 September 2020

ARI Scientists

Biodiversity and Palaeobiology Group


Dr Sanjay K Singh


Dr Bhaskar C Behera


Dr Kantimati G Kulkarni


Dr Paras Nath Singh


Dr Ritesh K Choudhary


Dr Karthick Balasubramanian


Dr Rajesh Kumar KC


Dr Abhishek Baghela


Dr Mandar N Datar


Dr Tushar Kaushik

Bioenergy Group


Dr Prashant K Dhakephalkar


Dr Monali C Rahalkar


Dr Sumit S Dagar


Mr Pranav R Kshirsagar

Bioprospecting Group

Dr Prasad P Kulkarni

Dr Pratibha Srivastava

Developmental Biology Group

Dr Surendra M Ghaskadbi

Dr Anuradha Ratnaparkhi

Dr Sachin H Jadhav

Dr Chinmoy Patra

Dr Bhupendra V Shravage

Nanobioscience Group

Dr Kishore M Paknikar

Dr Jyutika M Rajwade

Dr Dhananjay S Bodas

Dr Vandana Ghormade

Dr Virendra A Gajbhiye

Dr Yogesh A Karpe

Genetics and Plant Breeding Group

Dr Shubhada
A Tamhankar

Dr Manoj D Oak

Dr Sujata P Tetali

Dr Philips Varghese

Dr Ravindra M Patil

Mr Santosh A Jaybhay

Mr Ajit M Chavan

Dr Yashvanthakumar KJ

Dr VS Baviskar

Dr Sudhir Navathe

Biodiversity and Palaeobiology

Biodiversity

Archaea, Bacteria

Cultivation of methanotroph members from eight dominant genera detected in rice fields and comparison to the in-situ community revealed by V3-V4 metagenomics

Methanotrophs present in rice rhizospheres have been estimated to oxidize about 20 % of the produced methane (Conrad, 2009). Cultivation of dominant methanotroph members is crucial to understand their role in the environment and their methane mitigation abilities and other properties. We studied the methanotrophic diversity from Indian rice fields by cultivation and cultivation independent approaches.

We used V3-V4 region based metagenomics to study the *in-situ* community of methanotrophs sampled from two distant regions in Maharashtra, Kalbhorwadi, near Mulshi (Kb) (18.37° N, 73.45° E) and Chiveli, Ratnagiri, Konkan (KM) (17.54° N, 73.38° E). The Kb field has tropical dry weather whereas the KM sample has tropical wet climate and proximity to the coast. Culture independent method using 16S rRNA gene based metagenomics targeting the V3-V4 region indicated that members of 12-13 methanotroph genera were present in both the samples. Of these ~7-8 dominant lineages were detected in both the samples and were related to the genera: *Methylomicrobium*, *Methylobacter*, *Methylomonas* (Type Ia), *Methylolobus*, *Methylocaldum*, *Methylomagnum* (Type Ib) and *Methylocystis*, *Methylosinus* (Type II). All these genera have been also detected as the dominant genera in rice fields worldwide. Type I methanotroph abundance was more compared to Type II methanotrophs (2.3-2.4:1 Type I: Type II). In total, the methanotrophs contributed to ~0.1-0.2% of the total bacterial community.

Culture dependent studies using a unique cultivation approach

We used a unique cultivation approach for culturing dominant methanotrophs from rice fields (Rahalkar et al., 2019). This strategy comprises of dilution till end point followed by streaking of the positive samples on agarose media and purification of the cultures. One or more members from the following methanotroph genera indicated in () were cultured. These were: *Methylomonas* (12), *Methylobacter* (1), *Methylocucumis* (1), *Methylomicrobium* (3), *Methylomagnum* (1) and *Methylocaldum* (1) all belonging to Type I methanotrophs). *Methylocucumis* is a novel genus described by us from Indian rice fields (Pandit and Rahalkar, 2018, Pandit et al., 2018). *Methylolobus* (Rahalkar et al., 2020), a new genus recently described by us, contributed to a large percentage of sequences (21-30 %). Members from both the Type II genera, *Methylocystis* (3) and *Methylosinus* (8) were also cultured.

In conclusion, we report the cultivation of 30 methanotroph strains from eight different genera and most of them were detected as the dominant genera from rice fields in India and worldwide.

Discovery of novel genera and species of anaerobic fungi

We isolated and characterized 18 anaerobic fungal strains of phylum Neocallimastigomycota from faeces of wild and domesticated herbivores. Detailed morpho-microscopic characterisation revealed the presence of monocentric thalli and monoflagellate zoospores in all these strains. The phylogenetic assessment using the D1–D2 domain of 28S rDNA and ITS1 placed these strains into three distinct clades. Further analysis using amplicon-based diversity analysis indicated the absence of these lineages in any of the previous surveys. Based on these observations, we proposed two novel genera *Joblinomyces apicalis* (goat and sheep) and *Tahromyces munnarensis* (tahr), and one novel species *Capellomyces elongatus* (goat) (Figure 1).

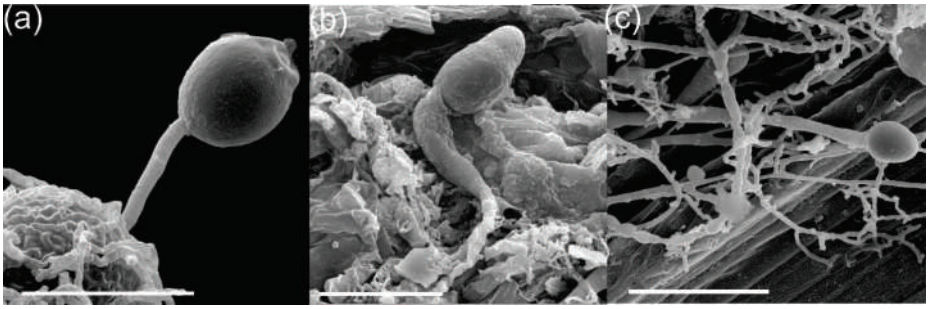


Figure 1
Scanning electron microscopy images of *Joblinomyces apicalis* (a), *Tahromyces munnarensis* (b), and *Capellomyces elongatus* (c). Bars = 20 µm

Metagenomic studies of the Indian hot springs

Metagenome based microbial diversity of the hot springs of Maharashtra (Chopada, Tural, Unhavare and Unkeshwar), Chhattisgarh (Tattapani), and Jammu & Kashmir (Chumathang and Puga) was studied using 16S amplicon sequencing. The results indicated a high abundance of *Firmicutes*, followed by *Proteobacteria, Bacteroidetes, Deinococcus-Thermus, Actinobacteria,* and some unclassified taxa. In the phylum Firmicutes, genera like *Bacillus, Butyricicoccus, Butyrivibrio, Caldicellulosiruptor, Caloramator, Cellulosilyticum, Clostridium, Ruminococcus, Tepidimicrobium, Thermoanaerobacter, Thermoanaerobacterium* etc. were dominant. The shotgun metagenome data further revealed the presence of genes related to cellulolytic and hemicellulolytic enzymes, carbohydrates, amino sugars, and fermentation. The presence of several glycoside hydrolases, carbohydrate esterases, and polysaccharide deacetylases confirmed active degradation of lignocellulosic biomass in these environments. Our study highlights the suitability of hot springs as a site for culturing anaerobes having potential applications in the development of thermophilic processes.

Fungi

Biodiversity, Systematics, Documentation and Conservation of Fungi & Yeasts

Fungal diversity has received considerable focus in recent years. The invisible mycoflora perform myriads of biochemical reactions, biotransformations and other potential activities during their metabolic activities, and are ultimately responsible for unique ecosystem services like recycling of organic matter. Screening of naturally occurring fungi is a continuous effort to understand the diversity and biosynthetic capabilities, and to obtain novel bioactive molecules and enzymes beneficial to mankind. Role of fungi in industrial biotechnology has gained momentum after their application to the manufacture of organic acids, enzymes and antibiotics. Presently, there is widespread interest in screening a wide range of fungal taxa for novel metabolites and enzymes having unusual properties. Such studies require isolation and exploration of hitherto unknown fungal taxa and maintaining them in germplasm banks to harness their metabolic potential.

Novel filamentous, fungal and yeast genera and species

During the course of our study, we have collected several filamentous, fungal and yeast genera, many of which have turned out to be novel. Novelty of these taxa is based on morphology and multigene phylogenetic analysis. In vitro pure cultures were raised, and taxonomic identities were confirmed based on morphological and molecular bases. The interesting and known genera of fungi were *Calonectria, Curvularia, Coprinus, Didymella, Ernakulamia, Leptoxyphium, Pseudotetraploa, Schizophillum, Tetraploa*. In addition, three novel genera of fungi, *Neoacladium (Botryobasidiaceae)*, *Srinivasanomyces (Vibrisseaceae)*, *Bhagirathimyces* (*Phaeosphaeriaceae*) were encountered and identity was confirmed by biphasic approaches, morphological, cultural and multigene phylogenetic analysis (Figure 2-3). After complete documentation, germplasms of these novel and interesting taxa of fungi have been deposited and maintained in the National Fungal Culture Collection of India.

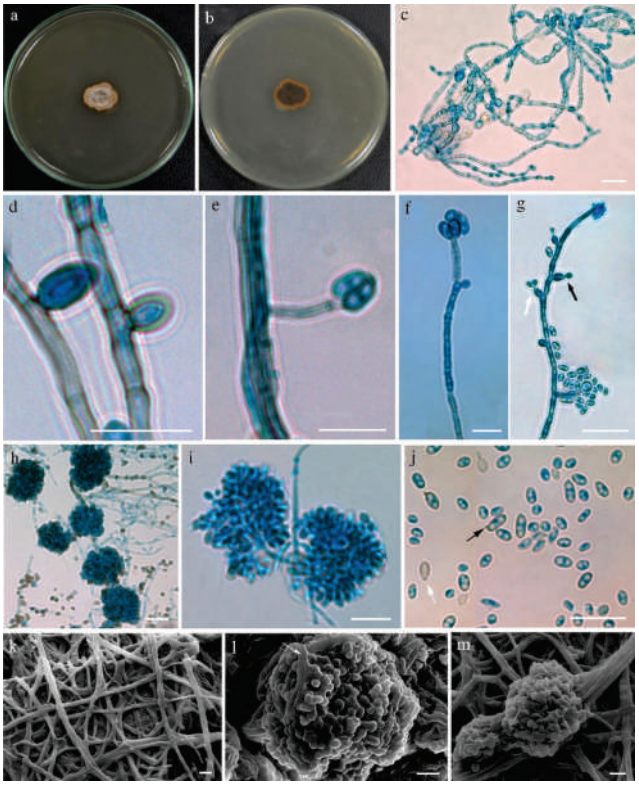


Figure 2

Srinivasanomyces kangrensis S. Rana & S.K. Singh, Placed under: Vibrisseaceae, Host: Dead bark of Prunus cerasoides, Area: Simbal Kangra, Himachal Pradesh. Citation: Fungal Diversity 100:5–277, 2020

Etymologically this generic epithet (*Srinivasanomyces*) is named after Dr MC Srinivasan, Ex-Head, Biochemical Science Division, National Chemical Laboratory, Pune, to commemorate his immense contribution in fungal research.

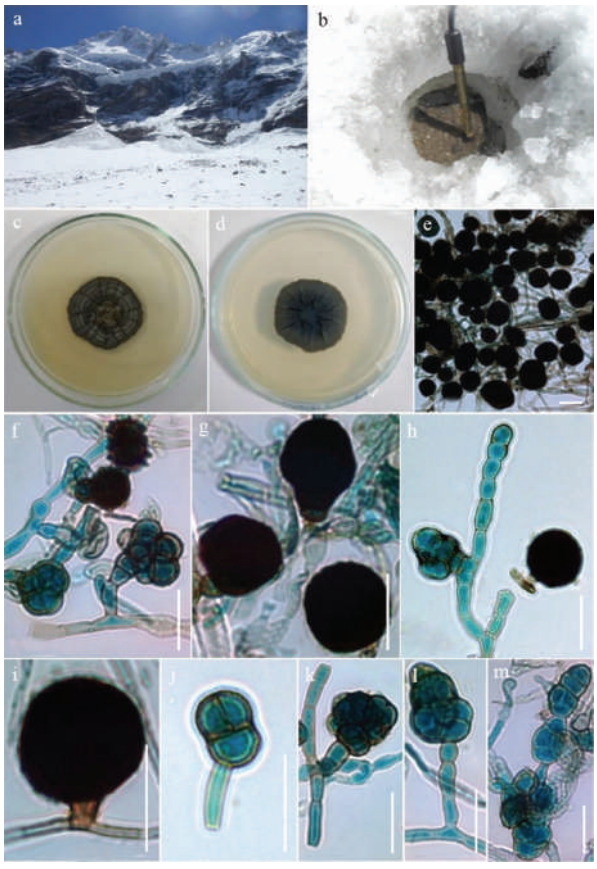


Figure 3

Bhagirathimyces himalayensis S.M. Singh & S.K. Singh, Placed under: Phaeosphaeriaceae, Host: Unconventional substrate, Cryconites, Area: Hamtah Glacier, Lahaul and Spiti, Himachal Pradesh. Citation: Fungal Diversity 100:5–277, 2020

Etymologically generic epithet refers to the Holy river "Bhagirathi" (a turbulent Himalayan River) originating in the Indian Himalayas, from where the sample was collected. This work was done in collaboration with the Department of Botany, Banaras Hindu University, Varanasi, Uttar Pradesh.

Novel thermotolerant yeast

A novel thermotolerant yeast *Wickerhamiella shivajii* R Avchar, M. Groenewald & A Baghela, was isolated from distillery effluent and studied in detail. To the best of our knowledge, this novel species, together with *W. cacticola*, is the only species in the genus *Wickerhamiella* that can grow at 42°C. Such thermotolerant yeasts have tremendous potential in high temperature ethanol fermentation (J. Syst. Evolutionary Microbiol., 69:3262–3267, 2019).

Revising/ updating the outline of classification of fungi and fungus-like taxa

In a joint effort with globally renowned institutions, we have contributed in revising/ updating the outline of classification of *Fungi* and fungus-like taxa including fossil fungi. Nineteen phyla of fungi, viz. *Aphelidiomycota*, *Ascomycota*, *Basidiobolomycota*, *Basidiomycota*, *Blastocladiomycota*, *Calcarisporiellomycota*, *Caulochytriomycota*, *Chytridiomycota*, *Entomophthoromycota*, *Entorrhizomycota*, *Glomeromycota*, *Kickxellomycota*, *Monoblepharomycota*, *Mortierellomycota*, *Mucoromycota*, *Neocallimastigomycota*, *Olpidiomycota*, *Rozellomycota* and *Zoopagomycota* are considered for revision. The placement of all fungal genera is provided at the class-, order- and family-level. Fungus-like taxa that were traditionally treated as fungi are incorporated in this outline (i.e. *Eumycetozoa*, *Dictyosteliomycetes*, *Ceratiomyxomycetes* and *Myxomycetes*). Four new higher taxa are introduced: *Amblyosporida* ord. nov. *Neopereziida* ord. nov. and *Ovavesiculida* ord. nov. in *Rozellomycota*, and *Protosporangiaceae* fam. nov. in *Dictyosteliomycetes*. Based on recent studies two different classifications are provided for *Glomeromycota* and *Leotiomycetes*. The phylogenetic reconstruction of a four-gene dataset (18S and 28S rRNA, RPB1, RPB2) of 433 taxa is presented, including all currently described orders of fungi. As such this the most updated outline of classification of fungi useful for present and next generation researchers.

Lichens

Lichens were collected from the Western Ghats (Medha Ghat, Gureghar, Lingmala, Kaas plateau etc.) at various altitudes. Members of family *Parmeliaceae*, *Collemataceae*, *Physciaceae, Graphidaceae*, *etc.* grow luxuriantly in the study area, ca. 120 lichen samples were collected. The specimens were segregated to their respective group depending upon their growth forms, genus and family. They were deposited and accessioned in Ajrekar Mycological Herbarium (AMH).

As a result of study of Indian genera of *Parmeliaceae,* two genera *Flavopunctelia* and *Punctelia* were identified on morphology, chemotaxonomy and molecular studies using a holistic approach including the mycobiont and the phycobiont phylogeny to understand their diversity and symbiosis from different microhabitats. Sequencing studies on phycobiont revealed the existence of different *Trebouxia* species lineages in Indian *Flavopunctelia* and *Punctelia*. The study also revealed the presence of cryptic and hidden species diversity of Indian *Parmeliaceae*. This was the first study for Parmeliaceae for *Trebouxia* species lineages.

Plants & diatoms

Molecular phylogeny of *Eriocaulon* L. of the Northern Western Ghats, India

A new *Eriocaulon* species, *Eriocaulon karaavalense* was discovered from Karnataka. The plastome of *Eriocaulon decemflorum* was sequenced, compared with other available plastomes to understand the gene content, structural rearrangements and genome evolution of order Poales. Loci based barcodes were identified for Indian endemic *Eriocaulon* species. Plastome based barcoding (Super barcoding) was also carried out by comparing two *Eriocaulon* plastomes.

Understanding the morphological evolution and ecological diversification of the forest dwelling capers in Indian subcontinent using molecular phylogenetic tools

The genus *Capparis* in India is represented by a total 35 taxa which include 34 species and one subspecies. The genus occupies both pan-tropical as well as evergreen land. Throughout India the *Capparis* samples were collected for their morphological as well as molecular studies. A book entitled "The Genus *Capparis* L. in India" is ready for publication. The book is a revisionary study of Indian *Capparis* with details of morphology and distribution data. The chloroplast genome of *Capparis spinosa* var. *herbacea* was generated and compared with its closest ally to understand the genetic organization (Figures 4, 5). This study reported the loss of *ndh* genes and pseudogenization in the family Capparaceae for the first time. Moreover, potential DNA barcodes for the genus *Capparis* were also proposed, which will help in correct identification and species delimitation.

Figure 4 (left)
Capparis spinosa var. *herbacea*

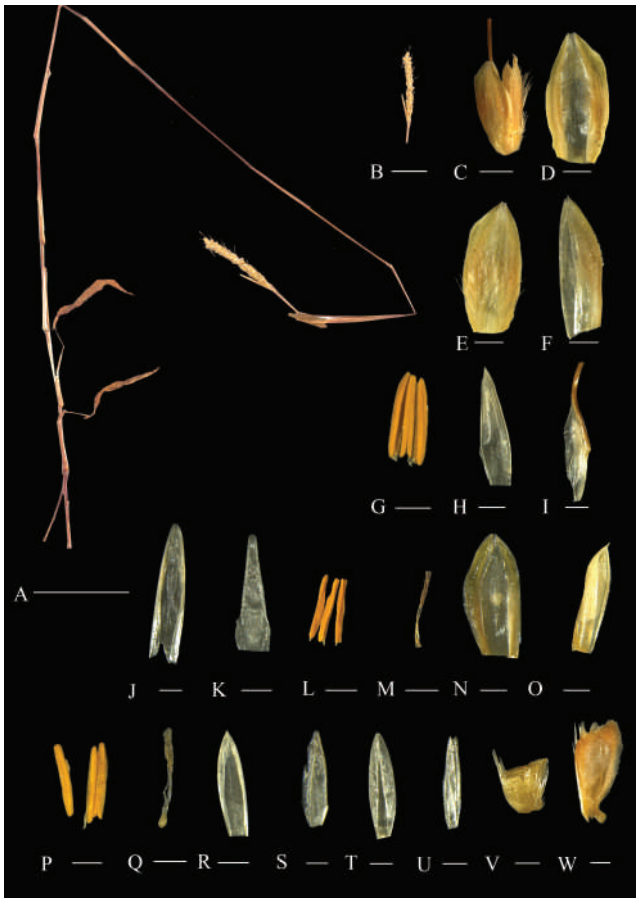
Figure 5 (right)
Capparis spinosa var. *spinosa*

Others: Lectotypes were designated for the two names of *Smithsonia* species viz. *Smithsonia viridiflora* (Dalzell) C.J.Saldanha and *Smithsonia maculata* (Dalzell) C.J.Saldanha. Second step lectotypification was carried out for the name *Wormia mansonii* and the lectotype was designated.

Unravelling the vascular plant endemism of Northern region of Western Ghats

Endemism is a phenomenon in which organisms occur in a particular area. The areas with high numbers of endemic species and greater degree of threats fall under the category of biodiversity hotspots of the world. The Western Ghats is one of the world's 36 biodiversity hotspots and amongst four in India. It is a treasure trove of various endemic species of flora and fauna. The Western Ghats is broadly categorized into northern, central and southern based on the climatic and geological features of the regions. In the current study, different habitats like plateaus, forests, cliffs, forts and wetlands were surveyed for endemic plants across Northern Western Ghats and Konkan (NWGK) region. Based on the literature survey and field surveys conducted during 2016 to 2019, a comprehensive checklist of local endemic plants was prepared. The present study resulted in a total 181 taxa (165 species, two subspecies, 13 varieties, one forma) of angiosperms belonging to 85 genera and 35 families. The family Poaceae was species rich followed by Apocynaceae and Eriocaulaceae. Further, analysis of the checklist supports the importance of rock outcrops by showing the occurrence of 59% of species along with a high number of geophytes and therophytes (Figure 6). The latitudinal study of plants revealed the highest endemism between 18° to 19°N, hence can be considered as the micro-hotspot for endemism. The study helped in understanding the characteristics of the habitat in which endemic species are sheltered. The study can also work as a proxy for prioritization of conservation efforts in the region.

Figure 6
Diversity of endemic plants species in NWGK



Muraina-grasses of India: Addressing the polymorphism and interspecific variation through morphological, ecological and molecular phylogenetic studies

Ischaemum is a genus of about 73% endemic species in India. It exhibits tremendous complexity and variability. For our study on this taxonomically complicated genus, we collected 355 accessions comprising 43 species across India. DNA extraction was performed for all collected species. Total of 26 sequences are submitted to NCBI. During our exploratory studies, an interesting accession of this grass genus was collected from Devsada, Goa, which after critical screening and careful morphological studies was found to be a novel species of *Ischaemum* (Figure 7) which we named as *Ischaemum janarthanamii.*

Figure 7
Ischaemum janarthanamii S. Bokil, Datar & R.K. Choudhary: Floral parts

Conservation of selected endemic species of orchids of Northern Western Ghats through ex-situ multiplication and reintroduction in wild

Orchids, a complex group of plants, require an association of fungal partners for successful completion of their life cycle. This dependency makes the wild populations sensitive to changes in their environment. Many species face the threat of extinction due to over-exploitation, deforestation, habitat destruction, and change in land-use patterns. In order to protect some such species from being further threatened, we have developed

an efficient propagation method for selected endemic species of orchids from Northern Western Ghats. Asymbiotic seed germination of five species of endemic orchids from Northern Western Ghats viz. *Rhynchostylis retusa* (L.) Blume, *Thunia alba* var. *bracteata* (Roxb.) N. Pearce & P.J.Cribb., *Smithsonia straminea* C.J.Saldanha, *Pecteilis gigantea* (Sm.) Raf., *Habenaria commelinifolia* (Roxb.) Wall. ex Lindl. were achieved successfully using plant tissue culture technique.

Nanoparticles are known to enhance the *in vitro* growth in various plant species. Therefore, the effect of silver nanoparticles coated with *Adiantum* sp. extracts was analysed on the growth of *Rhynchostylis retusa* . This work revealed the positive effect of nanoparticles on *in vitro* plantlets of *Rhynchostylis retusa*. As *in vitro* cultures of *Rhynchostylis retusa*, *Thunia alba* var. *bracteata* plantlets could not survive the standard hardening procedure, standardization of hardening and acclimatization was done using various other protocols. *In vitro* hardening using nurse technique was successfully used in case of *Rhynchostylis retusa* plantlets. *Rhynchostylis retusa* plantlets are maintained successfully using this method. This method will be further applied for all the remaining plantlets for successful hardening of orchid plants.

Twenty plantlets of *Rhynchostylis retusa* raised from asymbiotic seed germination method using tissue culture technique were transferred to the shade-net house of Tata Power Company's garden for acclimatization. Six *Rhynchostylis retusa* plants were established and planted at The Tata Power Company Ltd., Valvan, Lonavala. Based on further observations, it is planned to introduce them in the wild. Such effort will help in retaining the population of endemic orchids in nature and save them from becoming extinct.

Developing an online taxonomic guide for the diatoms of Peninsular India

This project is funded by the All India Coordinated Project on Taxonomy (AICOPTAX) program of the Ministry of Environment, Forest and Climate Change to document the diatom diversity. Diatoms are one of the best model organisms to study the microbial biogeographic patterns, due to their species richness, environmental specificity and ubiquitous distribution. This project aims to document the diatom diversity of three freshwater biogeographic regions of Peninsular India, to develop a comprehensive online taxonomic resource (Figure 17) for freshwater diatom flora of Peninsular India and to develop diatom collection at the Institute and to train next generation diatom taxonomists. As a part of this project, 73 samples were collected from 43 sites covering the states of Gujarat and Karnataka. 190 samples were added from 81 sites covering the entire Western Ghats. We enumerated 54 samples (out of 190 samples) by counting 600 diatoms per sample. More than 200 taxa were documented as a part of this study. This project helps to clear the taxonomic problems and supported to stabilise the taxonomy for further investigations. New species belonging to *Tabularia*, *Rhopalodia, Hippodonata* and *Gomphonema* were found from various parts of the Western Ghats. The morphological variability is documented using live and cleaned materials based on light and scanning electron microscopy (Figure 8).

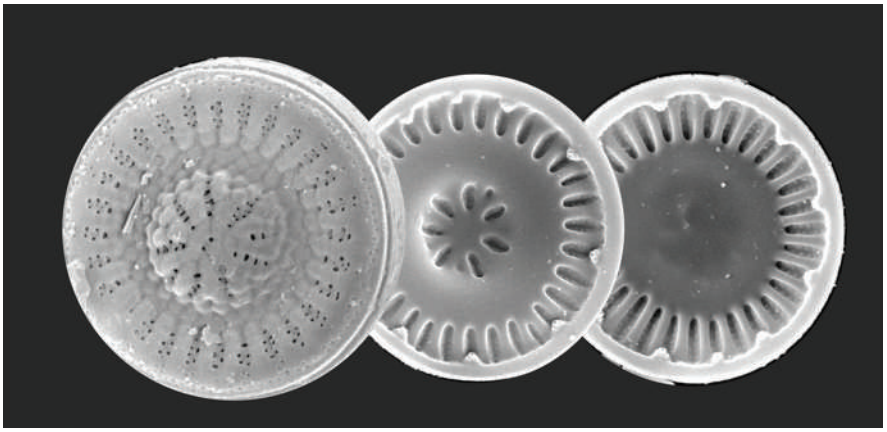


Figure 8
SEM image showing external and internal valves of a diatom. Scale bar = 2µm

Molecular evidence of the existence of semi-cryptic species in Gomphonema parvulum Kutzing complex from the Indian subcontinent

The diatom genus *Gomphonema* Ehrenberg is vast, with over 500 taxa worldwide. It is a commonly occurring freshwater genus that exhibits high morphological variability. It is well-known for many species complexes and causes a significant amount of confusion in the nomenclature for the morphological identification. This issue is severe, particularly for some of the more widespread and bioindicating taxa such as *Gomphonema angustatum* (Kutzing) Rabenhorst, *Gomphonema intricatum* Kutzing, *Gomphonema gracile* Ehrenberg and *Gomphonema parvulum* (Kutzing) Kutzing. Among these taxa, *Gomphonema parvulum* is a taxon of frequent occurrence and inhabits both temperate and tropical freshwater ecosystems. It is a familiar example of a freshwater benthic diatom with several varieties and forms described. The species is cosmopolitan and has been reported from all continents. From the Indian subcontinent, its appearance is frequent in all biogeographical zones. With this global framework, the current study aims to decipher the cryptic, semi-cryptic species complex using *Gomphonema parvulum* as a tool and compare them with the continental and island populations. For the study, we have isolated 14 strains of *G. parvulum* from different biogeographical zones of India. The strains were characterized by both morphological and molecular approaches. The preliminary LSU based phylogenetic tree highlights the existence of four distinct clades among the *G. parvulum* strains. Analyses have revealed that the strains of Clade D constitute both tropical and temperate strains, signifying that it is a widespread clade. Thus, the LSU rDNA marker was found to be useful in the detection of the *G. parvulum* group, making us understand that there are more geographical populations in the species complex. For the species complex, the morphological criterion can be tedious for the correct species identification. Hence, the addition of molecular data can benefit in overcoming many of the taxonomic difficulties and proposes new criteria for the delimitation of species.

Rocky pools of Western Ghats: An unexplored habitat for diatoms

The rocky plateaus of the Western Ghats are one of the unique isolated habitats having extreme environmental variability with high endemism. These habitats remain unexplored for the study of diatom floral composition and its diversity patterns. During the post-monsoon period more than 200 samples were collected from 23 rocky plateaus categorised into three main groups such as Low Level Ferricrete (LLF), High Level Ferricrete (HLF) and Basalt Mesa (BM). We documented around 280 species of diatoms belonging to 38 genera. Among 38 genera *Gomphonema, Chamaepinnularia, Brachycera, Eunotia, Nitzschia, Sellaphora* and *Pinnularia* are the genera which are present abundantly across all plateaus. Diatom species richness is high in the Manjare plateau and low in the Rivona plateau which comes under Basalt mesa and low level ferricrete respectively. The analysis supports that environmental variables (regional and local) are the determining factors that determine the diatom community structure across the plateaus.

Understanding the diversity of diatoms from North-East India

The Northeast region, spread across Indo-Burma and Himalaya biodiversity hotspots, is a vast region of untamed unique biodiversity. It is considered to be one of the most significant places to encounter diverse organisms, unique and unknown to science. The project documents the biodiversity of Northeast India, mainly focusing on understanding the diversity of diatoms thriving in the aquatic and semi-aquatic environments. More than 300 samples were collected (aquatic and semi-aquatic) along with water quality parameters. 52 samples were analysed and three new species belonging to *Pinnularia, Gomphonema and Encyonema* were discovered from Northeast India. 528 species belonging to 74 genera were enumerated which revealed the diatom diversity of Northeast India. Most commonly occurring genera were *Achnanthidium, Navicula, Gomphonema, Adlafia, Sellaphora, Encyonema, Nitzschia, Planothidium* and *Ulnaria* and many were putative novel species.

Diatoms as bioindicators in understanding the environmental impacts in the Myristica swamps, from the central Western Ghats region

Myristica swamps are one of the rarest ecosystems present on the earth and, as their name indicates, they are water-saturated regions predominantly covered with trees belonging to the ancient family Myristicaceae. Water quality analysis in these swamps indicated that in general these swamps are in slightly acidic conditions with low conductivity and having low nutrient/ oligotrophic conditions. The current study is first-ever attempt to understand the diatom diversity in the *Myristica* swamp region and it revealed 94 species belonging to 27 genera from which more than 50 % taxa are endemic to this region and new to science. The most dominant genera in these swamps include *Eunotia*, *Frustulia*, *Navicula*, *Gomphonema*, *Neidium*, *Brachysira, Ulnaria,* and *Achnanthidium*. The multivariate ecological analysis revealed that inside the swamps the diatom community varied across the various levels of human disturbance and activities. Swamps with high disturbance were recognized with altered diatom communities which reflected in the multivariate Canonical correspondence analysis. Thus the diatom community in the swamps was differentiated into four different groups based on their ecological conditions: (1) swamps having acidic environment were dominated by diatom taxa *Eunotia incisa*, *Eunotia bilunaris*, *Frustulia crassinervia, Humidophila content, Neidium sp.* and *Stauroneis sp.*, (2) swamps having pristine conditions with low electrolyte concentrations were indicated by *Navicula obtecta*, *Achnanthidium linannulum*, and *Gomphonema gandhii*, (3) swamps having well-oxygenated conditions were indicated by *Navicula nielsfogedii, Achnanthidium sp.* and *Planothidium sp.*, and (4) swamps facing high nutrient load under some anthropogenic or agricultural disturbance were dominated by taxa preferring increased conductivity, TDS and phosphate concentration like *Nitzschia clausii, Rhopalodia rupestris, Brachysira microcephala, Achnanthidium catenatum,* and *Adlafia bryophila.* Thus the environmental impacts in the swamps caused by various anthropogenic activities like agricultural runoff etc. were reflected by the endemic diatom flora.

Development of crude drug repository of genuine samples from Maharashtra

The crude drug repository holds samples collected from five regions of Maharashtra viz. Konkan, Western Maharashtra, Khandesh, Marathwada and Vidarbha. The repository was enriched in order to help crude drug authentication service and to bring out a comprehensive pictorial guide for identification of raw botanical drugs. A total of 793 specimens belonging to 192 species were collected across five years and deposited in the repository under eight categories. Field work involved photo-documentation of habit, habitat, fresh and dried samples and collection of locality data such as GPS coordinates while lab work involved documentation of macroscopic characters and evaluation of physicochemical parameters like ash and extractive values.

Palaeobiology

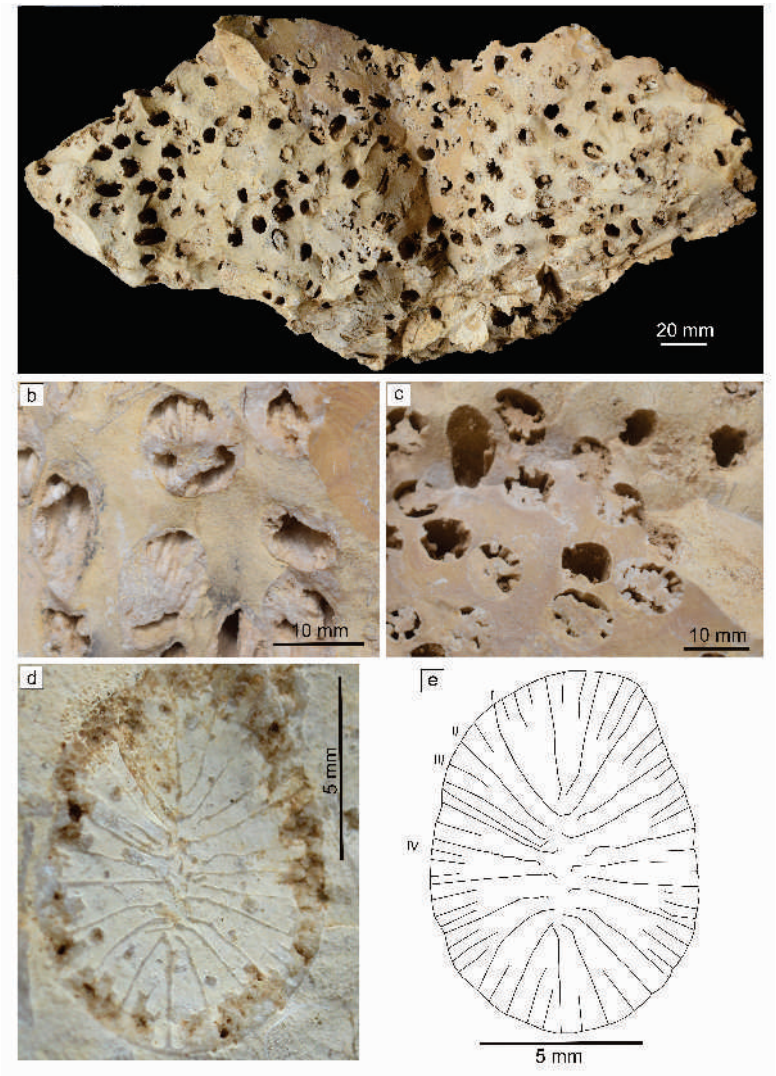
Ichnology and sedimentology

Detailed taxonomic studies of trace fossils from the Chhasra Formation (Burdigalian), Kachchh, Gujarat have resulted in the identification of ichnogenera *Cochlichnus* isp., *Gyrochorte comosa*, *Laevicyclus parvus*, *Ophiomorpha nodosa*, *Planolites beverleyensis*, *Protovirgularia dichotoma*, *Rhizocorallium commune*, *Skolithos linearis*, and *Thalassinoides suevicus*.

Graphic measures (Folk and Ward's 1957 values) were calculated for Chhasra sediments. The graphic mean grain size varies from 3.87 Φ to 7.37 Φ and averages to 4.90 Φ, hence can be described as fine grained sandstone and coarse to fine grained siltstone. The graphic standard deviation value varies from 0.39 Φ to1.07 Φ, averages to 0.61 Φ, and hence belongs to well-sorted to very well-sorted class. The graphic kurtosis

value varies from 0.69 Φ to 5.74 Φ and averages to 2.26 Φ indicating their platykurtic to extremely leptokurtic nature related with mixing of two or more sub-equal populations. The cumulative percentages (following Visher, 1969) were plotted on arithmetic log probability paper and different populations such as surface creep, saltation and suspension were distinguished. The grain size log probability plots of the samples reveal dominance of two well-developed populations viz., saltation (av. 56.89 %) and suspension (av. 42.94%); while the traction population, whenever present, is extremely negligible (av. 0.16 %).

Taxonomic revision of type specimens in the ARI Fossil Repository



Paralanicichnites conflueris, is a structure described by Ghare and Badve as a new ichnogenus and ichnospecies from the Palaeogene rocks of the Kachchh District, Gujarat. Restudy of the type specimens in the ARI Fossil Repository revealed that the form described as a burrow, in fact, is a scleractinian coral (Figure 9), as evidenced by its phaceloid morphology, septate calcareous exoskeleton, and twelve primary septa. It is proposed that the ichnotaxon *Paralanicichnites conflueris* should be considered as *nomen oblitum.*

Figure 9
Specimen of a coral, previously assigned to the ichnospecies Paralanicichnites conflueris Ghare and Badve, 1981

a. Top view of entire specimen exhibiting leached as well as recrystallized corallites (MACS G 1383). **b, c**. Moulds of the septa, as seen on the lower and upper surfaces. **d**. Septa seen in cross-section of a corallite. **e**. Line drawing of Figure 2d, showing arrangement of the septa

The Indo-pacific clam Dosinisca recorded from the Miocene rocks of Kachchh

Dosinisca is an extant subgenus occurring in the North and South Pacific. Taxonomic investigations during revision of the fossil molluscan fauna revealed that *Dosinisca* occurs in the Lower Miocene rocks of Kachchh. It is also proposed that *Dosinisca* evolved from some unidentified venerid stock during Aquitanian in the Kachchh epicontinental sea. The remarkable similarity with another genus *Asa* suggests that *Dosinisca* might have evolved from *Asa*.

Combined morphological and molecular taxonomic assessment of foraminifera

Foraminifera, a group of highly diverse single-cell eukaryotic protists, is extensively used as a proxy for past

and present changes in the marine environments. The presence of granuloreticulopodia is a characteristic of this group, and outer shell/test can be calcareous, agglutinated or organic in composition. The ongoing investigations are concentrated on documenting both benthic and planktic species dominating Indian sector of the Southern Ocean, as well as coastal habitats along the vast coastline of India, using an integrated taxonomic approach to re-construct their evolution, diversity and establish their classification.

Exploration of cryptic genetic diversity in planktic foraminiferal species from the Indian sector of Southern Ocean/ Antarctic Ocean

Twenty sampling stations located at various oceanographic fronts along the latitudinal transect were sampled for collection of living specimens of planktic foraminifera during the 11th Indian expedition to the Southern Ocean/ Antarctic Ocean (Figure 10). The study area encompasses the tropical/ sub-tropical/ sub-Antarctic and Antarctic zones, each of which have a distinct biological, chemical and physical oceanographic character. Preliminary results indicate presence of cryptic genetic diversity in various planktic foraminiferal species recovered and has significant impact on foraminiferal based past reconstructions.

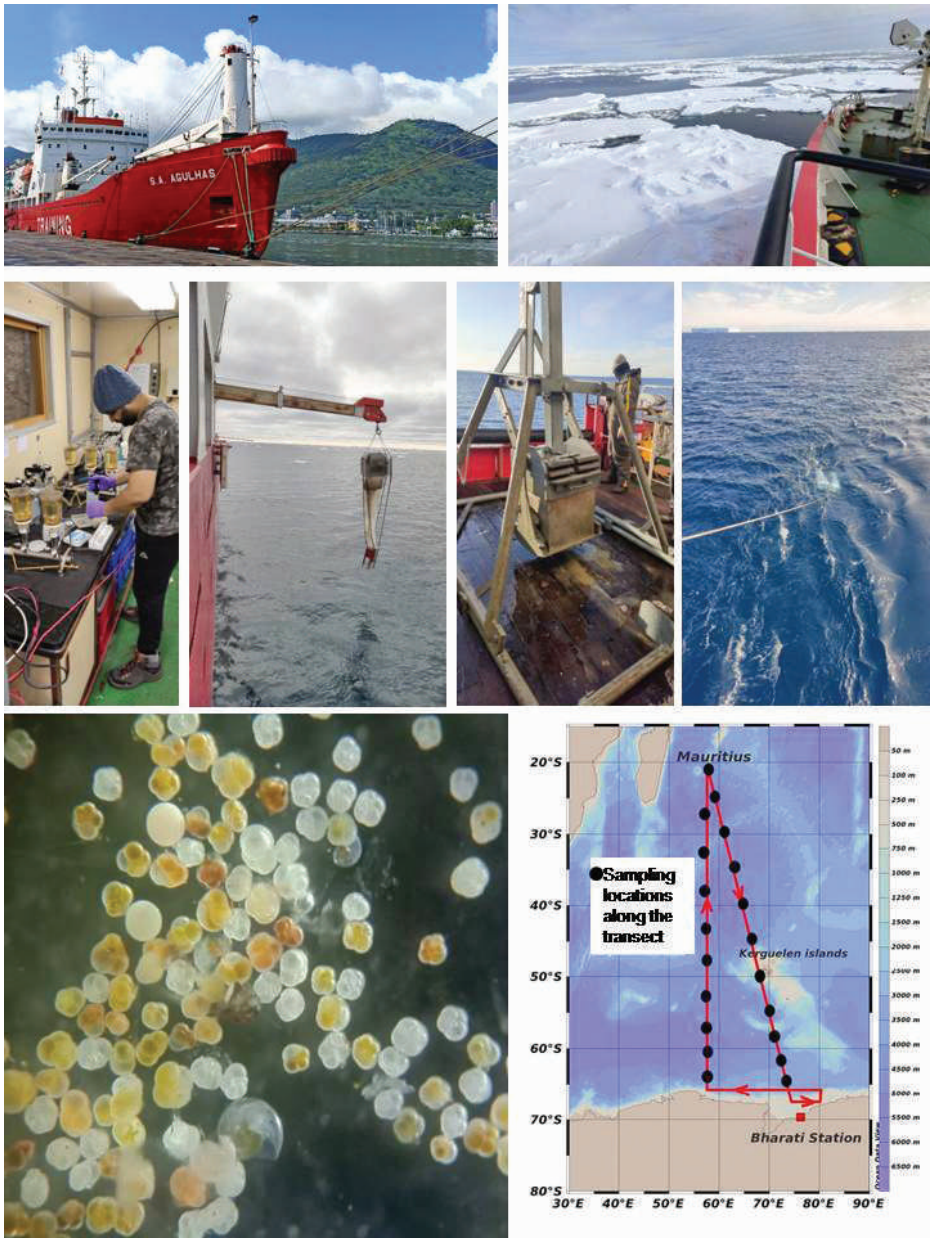


Figure 10
Various sampling and research activities carried out onboard SA Agulhas during 11th Indian Expedition to the Southern Ocean/ Antarctic Ocean

Bioenergy

Metagenomics aided augmentation of resident microbes and their metabolism to enhance oil recovery from depleted reservoirs

Increasing demand for crude oil and ever depleting reserves makes it essential to extract the last drop of crude oil. Although microbial enhanced oil recovery (MEOR) is a method of choice for the recovery of crude oil from depleted reservoirs, they come with massive failure rates. Mostly, the failure of MEOR methods is attributed to the inability of exogenous microbes to survive in the harsh *in-situ* reservoir conditions characterized by extremes of pH, temperature, pressure and salinity. Use of indigenous microbes, which are already adopted to the in-situ environment, is likely to enhance efficiency of tertiary oil recovery (EOR). However, the reservoir flora needs to be evaluated to ascertain its ability to thrive and produce desired metabolites. An analytical approach was designed to investigate the ability of resident microbial flora to produce metabolites desired for EOR under in-situ conditions. Such approach involved three steps, viz. 1) Metagenomic sequencing of a depleting oil reservoir, 2) analysis of the NGS data to gain insights in to the resident microbial community and their metabolism, and 3) designing a nutrient suite to augment the microbial growth and production of metabolites desired in MEOR.

Lab-scale studies were performed to obtain the proof of such a concept. Metagenome sequencing and data mining of community DNA from an oil reservoir in western India revealed the presence of starch-utilizing microbes with an ability to produce metabolites desired in the MEOR process and thrive at high temperatures (≥80 °C). The formation water samples from the reservoir were supplemented with a starch-based nutrient suite as per the data obtained after the metagenome data analysis. Ability of positive enrichment (PYS_80) capable of utilizing starch and producing metabolites desired in MEOR to enhance recovery of residual oil was confirmed by performing sand pack trials (in triplicates). PYS_80 enrichment facilitated recovery of 37 % of the residual oil which was significantly higher than that obtained with blank/ medium control (≤ 5 %) (Figure 11). This metagenome-based approach which analyzed the suitability of resident microbial flora to effect EOR is termed as '*Petrogenomics*'. This approach was used to design the economical and thermostable nutrient suite to support metabolite production and subsequently EOR in harsh in-situ conditions.

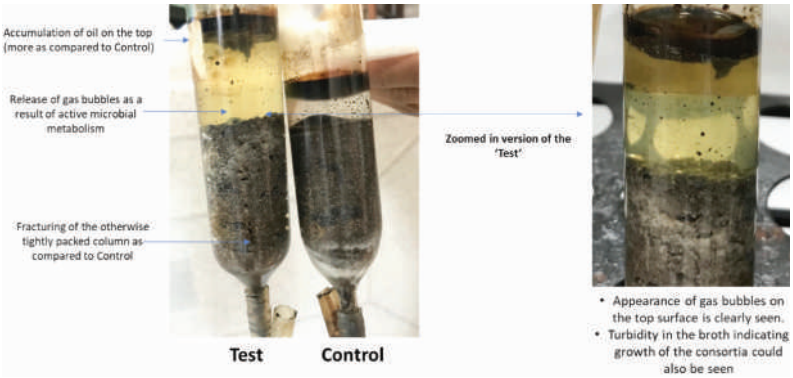


Figure 11
Sand pack column for conducting MEOR studies using PYS-anaerobic 80 °C consortium

Genomic insights into oil recovery potential of hyper-thermophilic archaeon *Thermococcus* sp. 101C5

Evaluation of oil recovery potential especially, of hyper-thermophiles is a difficult task, wherein genomic approach can prove to be instrumental in assessing the MEOR suitability of such microbes. In the present investigation, we report the genomic attributes and oil recovery potential of a hyper-thermophilic anaerobic archaeon, *Thermococcus* sp. 101C5 growing at 96°C -101°C. This hyperthermophilic archaeon was enriched and isolated from a high temperature oil well in India. The 1.92 Mb genome of 101C5 featured a GC content of 44.0 %. 101C5 displayed lower DDH and ANI homologies than the set threshold with the closest phylogenetic affiliates (*Thermococcus* sp. PK and *Thermococcus litoralis* DSM 5473). Further, the BLAST based comparison of the whole genome sequence of 101C5 with its closest phylogenetic neighbors (BRIG analysis) revealed significant gaps in the query genomes, highlighting the taxonomic uniqueness of 101C5. Further, the functional annotation of 101C5 revealed the presence of a genetic arsenal that included, heat shock proteins for thermo-adaptation, Trk potassium uptake system proteins for osmo-adaptation and superoxide reductases against oxidative stress, etc. The presence of such underscored the suitability of 101C5 to thrive the harsh in-situ reservoir conditions. MEOR potential of the strain was established by the presence of genes encoding enzymes involved in desired metabolite production like hydrogen (NiFe and membrane bound hydrogenases), acetate (Pyruvate:Ferredoxin oxidoreductase, acetyl-CoA synthetase), EPS (phosphomannomutase, algA), bio-emulsifier (Acyltransferase**,** AlgC, 3-oxoacyl-(acyl-carrier-protein reductase), etc., which was further experimentally confirmed and validated. Also, the presence of crude oil degradative genes (Rubredoxin, 4-oxalocrotonate tautomerase, putative dioxygenase) highlighted the potential of 101C5 to mobilize heavy residual oil from reservoir formation under simulated conditions. The genome sequence and annotation of *Thermococcus* sp. 101C5 might promote the further research in unraveling the ability of 101C5 to survive in harsh in-situ conditions and effect MEOR.

Biomethanation of lignite

India is blessed with large deposits of lignite, which is a soft brownish, low-ranked coal. Lignite is not a preferred source of fuel because of its low energy density, high moisture content and high emission of CO_2. Biomethanation of lignite is considered as an eco-friendly alternative for extraction of energy from such low-grade coal.

A microbial process for the biomethanation of lignite was developed using specially established microbial consortia (SP-55 & ST-37). SP-55 and ST-37 comprised of mesophilic/thermophilic hydrolytic bacteria and methanogens. Various process- and eco-physiological parameters were optimized for the efficient

Figure 12
Core-flood apparatus. **a** Complete set-up of core-flooding apparatus used in this study. **b** Control panel to monitor the confining upstream and back-pressure of the core-flooding system. **c** Cylinders containing ultrapure nitrogen gas (99.9% purity) to maintain the upstream and back-pressure into the core-flooding system. **d** Oven with core holder (containing lignite core) to maintain the temperature of incubation

biomethantion of lignite by SP-55 and ST-37 under thermophilic and mesophilic conditions, respectively. Biomethanation of lignite under in-situ simulated conditions (pressure and temperature) was studied using a specially designed core-flood apparatus (Figure 12). Ability of the SP-55 consortium to degrade crude lignite was evident from the production of intermediate metabolites such as di-, mono-saccharides, organic acids, VFA, CO_2, etc. Acetate, formate and CO_2 served as substrates for the subsequent methanogenic metabolism. The SP-55 consortium yielded 217 ml methane per gram lignite within 21 days at 68°C at a pressure of ≥ 900 psi. The biomethane yield from lignite reported in this study is one of the highest ever reported in the scientific literature.

Microbial community insights into biomethanation of rice straw under mesophilic conditions

Biomethanation process is a promising approach to convert various organic residues, such as rice straw into value-added products like biogas and nutrient-rich organic fertilizer. We developed a sustainable process for conversion of rice straw into methane without any thermo-chemical/ enzymatic pre-treatment. A methane yield of 274 ml g^{-1} volatile solids was obtained under mesophilic conditions (>80 % of the theoretical yield) from particulate rice straw (1 mm size, 7.5 % solids loading rate) at 37 °C, pH-7, when supplemented with urea (carbon: nitrogen ratio, 25:1) and zinc as trace element (100 µM) at 21 days hydraulic retention time (HRT). Investigation of the microbial community structure of the biogas digester under these conditions revealed the predominance of *Clostridium* (22.99 %), *Bacteroides* (9.36 %), *Ruminococcus* (2.66 %), *Bacillus* (2.52 %), *Eubacterium* (2.50 %); whereas *Methanosarcina* was the most abundant archaea (9.31 %). Although aceticlastic methanogenesis was dominant, genes for hydrogenotrophic and methylotrophic pathways were also active, indicating that the selected methanogens were metabolically versatile. Critical insights into the structure and function of key genera involved in efficient rice straw biomethanation can be used to design an efficient start-up inoculum for enhanced biomethanation of rice straw and also avoid initial lag in the acclimatization periods.

Bioprospecting

Bioprospecting is the process of discovery and commercialization of new products based on biological resources. The major focus of research is the isolation and synthesis of naturally occurring compounds, derivatives and their use in pharmaceuticals, nutraceuticals, agriculture and industries.

Natural Product Chemistry

Lichens as antioxidants

A great number of lichen species have proved to be a source of food and pharmaceuticals. Lichens have been attracting the attention of many researchers because of their diverse pharmaceutical potential as antioxidant, antiviral, anti-proliferative, anti-inflammatory, anti-cancer, anti-tumor and insecticidal activities.

We collected lichens from different forest localities of Western Ghats, Himachal Pradesh and Garhwal division of Uttarakhand. Morpho-anatomy and chemotaxonomic (TLC) studies of over 175 lichen specimens belonging to the different groups of lichens have been done. Seven lichen species (Figure 13) have been selected on the basis of their therapeutic effects on various diseases in the traditional system of medicine in order to find out possible candidate as a natural antioxidant.

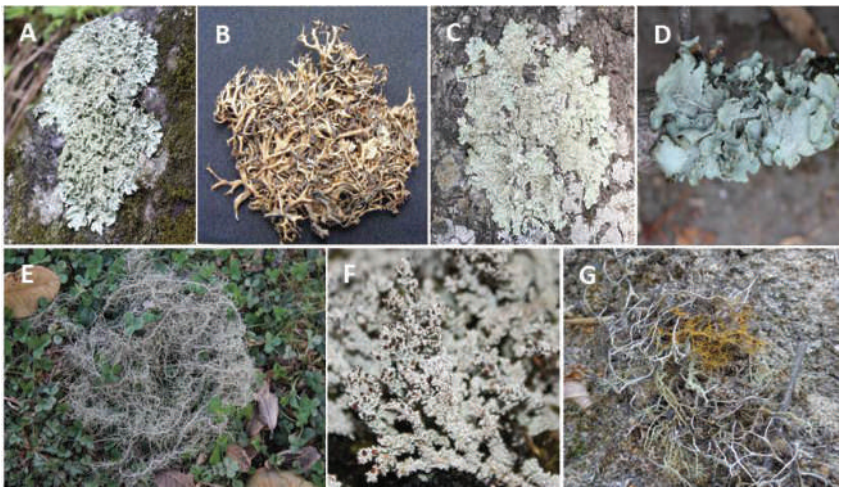


Figure 13
Species selected on the basis of their therapeutic effects.
A. *Flavoparmelia caperata*,
B. *Everniastrum nepalense*,
C. Flavopunctelia flaventior,
D. *Parmotrema nilgherrense*,
E. *Usnea longissima*,
F. *Stereocaulon foliolosum*,
G. *Heterodermia leucomelos*

The qualitative composition and the quantitative content of phenolic compounds in *Everniastrum nepalense, Flavoparmelia caperata, Flavopunctelia flaventior, Heterodermia leucomelos, Parmotrema nilgherrense, Stereocaulon foliolosum, Usnea longissima* was studied by HPLC. From the results of the chromatographic analysis, atranorin, barbatic, capretic diffractic evernic, fumarprotocetraric, lecanoric, lobaric, protocetraric, squamatic and usnic acid were identified.

Seven lichen species namely, *Everniastrum nepalense, Flavoparmelia caperata, Flavopunctelia flaventior, Heterodermia leucomelos, Parmotrema nilgherrense, Stereocaulon foliolosum, Usnea longissima* have been extracted individually by various solvents (Hexane, Ethyl acetate, Acetone, and Methanol). Each species'

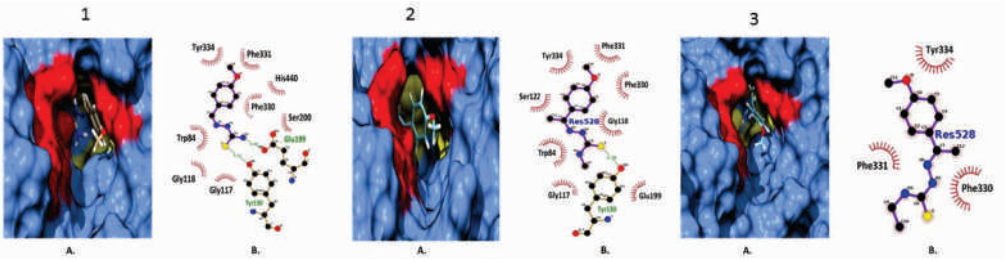
extract was subjected to analysis of their antioxidant potential in terms of scavenging of 1,1-diphenyl-2-picryl-hydrazil (DPPH), Hydroxyl radical scavenging activity, Scavenging of Nitric Oxide, Superoxide anion scavenging, Trolox equivalent antioxidant capacity (TEAC), Lipid Peroxidation Inhibition. Standard antioxidants Trolox, Butylated hydroxyl anisol (BHA), Butylated hydroxyl toluene (BHT), Quercetin were used as positive control.

All the seven species have shown antioxidative potential in terms of FRS, HRS, NOS, SOS, TEAC and ILP with respect to their IC_{50} value µg / mL indicated 50% scavenging or inhibition of the activities. The results indicate that these lichens can be used as possible candidates as a natural antioxidant for drugs and pharmaceuticals (health care), cosmetics, food additives and other industrially valuable chemical products.

Action of naturally occurring compounds for treatment of disorders such as Alzheimer's disease, anemia, diabetes, cancer, and chikungunya virus

4-Methoxybezaldehyde thiosemicarbazone and its derivatives as multi-target drugs for Alzheimer's disease

Alzheimer's disease (AD) is a multifactorial neurological disorder. We studied structural and biological properties of 4-methoxybezaldehyde thiosemicarbazone and its derivatives viz. MZT, MZMT, and MZET against AD. Molecular docking analysis of these derivatives with acetylcholinesterase enzyme (AChE) showed their effective interaction with the catalytic active site of AChE (Figure 14). At the concentration of 5 µM, the synthesized derivatives did not show cytotoxic effects against BV-2 cells. A considerable impact of the treatment of 4-methoxybenzaldehyde thiosemicarbazone derivatives on NO level was observed in BV-2 cells. In response to inflammatory triggers, activated microglia showed an enhanced level of NO in the LPS induced cells ($p<0.001$) than the control BV-2 cells. A significant reduction in NO level was observed in MZT pre-treated cells ($p<0.05$). No significant difference was found in nitrite production in MZMT and MZET pre-treated BV-2 cells. Thus thioamide-substituted groups on the thiosemicarbazone moiety modulate the anti-inflammatory effect of 4-methoxybenzaldehyde thiosemicarbazone derivatives in BV-2 cells, with the MZT having only H-atom at thioamide position exhibiting a significant inflammation inhibitory potential.



Docked image of AChE in the presence of MZT;(1), MZMT (2) and MZET (3) and respective Ligplot analysis of interaction of residues of AChE

Figure 14
Docking and ligplot analysis of AChE in the presence of MZT, MZMT and MZET

Effect of *Tinospora cordifolia* on inflammation associated anemia

Infection or inflammation associated anemia (AI) is the second most common form of anemia after iron deficiency anemia. In Indian traditional medicinal system, TC has been used for anti-inflammatory and immuno-modulatory purposes and have been evaluated for the same. Based on this lead we have studied the effect of *Tinospora cordifolia* (TC) for the treatment of AI.

We analyzed the effect of TC extract on LPS induced NO production in RAW 264.7 cells at 100 to 500 µg/mL concentration. The pretreatment of TC extract showed a significant reduction in NO production as compared to untreated cells indicating significant anti-inflammatory activity *in-vitro*.

In *in-vivo* studies, AI was induced in rats by repeated injections of heat killed *Brucella abortus*. After induction of AI, parameters like hemoglobin (Hb) levels, red blood cell (RBC) count, serum and tissue iron levels and gene expression studies were carried out. TC treated groups showed significantly higher levels of Hb and RBC count compared to the inflammatory control group.

Serum iron levels in IC group rats were found to be significantly lower than NC group rats at 3rd and 4th week. However, rats treated with TC showed higher serum iron levels compared to IC group in dose-dependent manner at 3rd and 4th week.

HKBA injections caused a significant reduction in liver and spleen iron stores as compared to control rats. Treatment with TC at a dose of 400 mg/kg body weight showed significantly higher liver and spleen iron content.

The gene expression of human anti-microbial peptide (HAMP which encodes hepcidin), TLR-4, tumor necrosis factor-alpha (TNF-α), and cyclooxygenase-2 (Cox-2) genes were found to be significantly up-regulated in rats from the IC group as compared to NC group. A dose-dependent down-regulation in human anti-microbial peptide (HAMP) gene expression was observed in rats treated with TC as compared to IC group rats. Moreover, the relative expression of the HAMP gene was found lower in rats treated with TC at a dose of 200 and 400 mg/kg body weight than NC group rats. Rats treated with TC at a dose of 200 and 400 mg/kg body weight showed significant down-regulation in the expression of TLR-4 compared to NC group rats. The relative expression of TLR-4 was found lower in rats treated with 200 mg/kg body weight of TC compared to control rats.

Overall results indicate that TC therapy was able to maintain circulating iron through suppression of inflammatory cytokines and expression of hepcidin in rats.

Quinone skeleton based redox active natural products as antimicrobial agent

The natural way by which microorganisms inhibit their competitor is by secreting redox-active natural products which are the secondary metabolites. These secondary metabolites by producing reactive oxygen species (ROS) helps in the functioning of many cellular processes such as gene expression, intraspecies communication, and defense. ROS are generated during aerobiosis fuelled oxygen metabolism thereby producing superoxide ($O2^-$), hydrogen peroxide (H2O2), and highly destructive hydroxyl radical ($^{\cdot}OH$) which can break the double strand of DNA, can damage macromolecules such as lipids and proteins resulting in cell death. By increasing the ROS level inside the bacterial cell, drug resistance can be overcome. Thus ROS generating small molecules can act as an adjuvant and can enhance the efficacy of existing drugs.

Quinone is a well-known natural product which in the biological system gets reduced to semiquinone radicals by the reductase enzyme. These semiquinone radicals react with dissolved oxygen to form superoxide anion, which reacts with biological molecules to cause oxidative stress which induces cell death. Novel Phenanthridine-1,4,6-trione epoxides molecule, a ROS generator with the basic quinone skeleton is synthesized in our lab via six-step synthesis.

Interactions analysis of the designed compounds with DNA Gyrase of *Streptococcus aureus* was performed. The compound showed H bond interactions with the binding pocket of DNA Gyrase. A series of compounds are being synthesized in the laboratory. Their antibacterial activity will be tested subsequently.

Comparative analysis of the antimicrobial activity of *Capparis divericata* and *Capparis grandis*

The fruits of *C. grandis* and *C. divericata* were extracted with water and alcohol for five consecutive days. The extracts obtained were concentrated and utilized for further screening for anti-inflammatory using RAW.264 cells and antimicrobial activity *Salmonella typhi* and *Streptococcus aureus*. The HPLC chromatograms of the extracts were recorded, The alcoholic extract of *C. divericata* showed better anti-inflammatory activity. The alcoholic extract at 200 ug/ml showed inhibition of *S. typhae*.

Developmental Biology

In the developmental biology group, model organisms such as Chick, *Drosophila,* Hydra and Zebrafish are used to study processes such as autophagy, cell-cell signaling and cell morphogenesis during development.

Role of VEGF and FGF signaling in head regeneration in hydra

The phenomenon of regeneration has always intrigued biologists. Hydra, a freshwater Cnidarian, possesses spectacular capacity for regeneration of lost body parts. Our lab has been engaged in deciphering roles of various signaling pathways in regeneration in hydra. Vascular endothelial growth factor (VEGF) and fibroblast growth factor (FGF) signaling pathways play important roles in the formation of the blood vascular system and nervous system across animal phyla. We have earlier reported VEGF and FGF from Hydra vulgaris Ind-Pune. We have now identified three more components of VEGF and FGF signaling pathways from hydra. These include FGF-1, FGF receptor 1 (FGFR-1) and VEGF receptor 2 (VEGFR-2). Expression patterns of these genes indicate possible interactions between FGF-1 and FGFR-1 and between VEGF and VEGFR-2. Experimental inhibition of FGFR-1 or VEGFR-2 function led to delayed head regeneration (Figure 15). This was accompanied by reduced expression of head specific genes HyBra1 and HyKs1 and tentacle specific gene HyAlx. Since many of the signaling pathways and pattern forming mechanisms are conserved through evolution, similar molecules are likely to participate in tissue and organ regeneration in structurally more complex organisms.

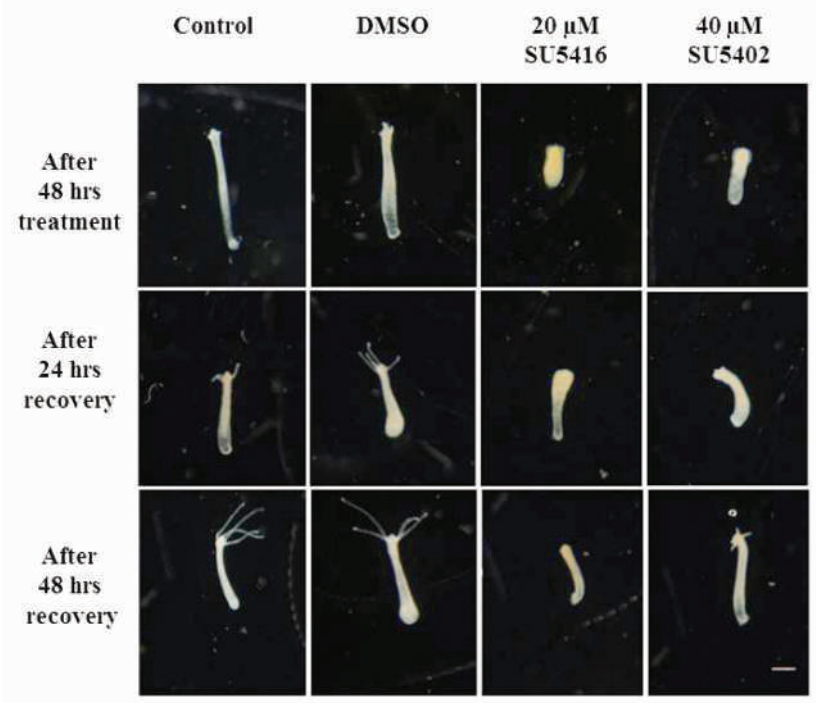


Figure 15
Delay in head regeneration due to SU5416 and SU5402 treatment. Upon 48 h treatment of decapitated hydra with VEGFR inhibitor (SU5416) (c) and FGFR inhibitor (SU5402) (d), head regeneration was inhibited. Medium control (a) and solvent control (b) hydra polyps showed normal head regeneration. After 24 h and 48 h recovery in fresh hydra medium, treated hydra showed signs of delayed head regeneration (g, h, k, l). Polyps used as medium control and solvent control showed complete head regeneration after 48 h in fresh hydra medium (e, f, i, j). Scale bar, 200 µm

Stress-induced autophagy in female Germline Stem Cells (GSCs) and their progeny in *Drosophila*

Autophagy, a conserved lysosome-mediated degradation process, is implicated in oogenesis and Germline Stem Cell (GSC) aging. We are interested in deciphering the molecular role of autophagy in oogenesis and GSC-aging using Drosophila. Germline-specific transgenic lines for autophagy marker, Atg8a (mCherry-Atg8a) and, autophagy receptor, Ref(2)P (GFP-Ref2P) were generated and validated. Co-expression of mCherry-Atg8a, GFP-Ref(2)P and CathepsinL in GSCs and their progeny was monitored to measure autophagy flux. Basal autophagy flux is low in the GSCs as compared to the cystoblasts and cysts (GSC-progeny). Starvation increases autophagy flux and this allows for recycling of nutrients necessary for cell-survival. Surprisingly, GSCs exhibited no significant change in autophagy flux upon amino-acid deprivation. In contrast, cystoblasts and cysts exhibited significantly higher levels of autophagy flux. Thus amino-acid deprivation does not affect autophagy levels in GSCs and these cells appear to be protected from starvation. Most organisms have limited availability of nutrients in the wild and our findings suggest that suppressing starvation-induced autophagy in stem cells could be a widespread mechanism to protect stem cells against cell death. Additional research is necessary to understand if this phenomenon is universal in adult stem cells. Our studies are currently focused on understanding the changes in autophagy flux due to aging and if aging of GSCs could be reversed by modulating autophagy flux.

Inter-organ signaling along the brain-gonad axis

The brain is known to harbor centers that sense and respond to metabolic cues from the periphery to maintain homeostasis and insulin signaling is one of the key pathways involved in regulating this process. The metabolic status of an organism is known to impact its reproductive function. This is well documented in *Drosophila* where, in the absence of nutrition, and in response to low insulin signaling, the ovaries fail to produce eggs due to an arrest in oocyte maturation.

Mon1 is a component of the GEF complex that regulates recruitment of Rab7 onto late endosomes. We have identified Mon1 as a molecular player in a neuronal circuit that regulates oocyte maturation in *Drosophila*. In *mon1* mutants, expression of a number of insulin-like-peptides (ilp) is affected including *ilp5*, accompanied by an arrest in oocyte maturation leading to sterility. Knockdown of *mon1* in octopaminergic-tyraminergic neurons (OPNs) that constitute a small cluster of 137 neurons phenocopies the mutant phenotype and restoring of *mon1* levels in these neurons rescues sterility and fecundity in these mutants. The OPNs make

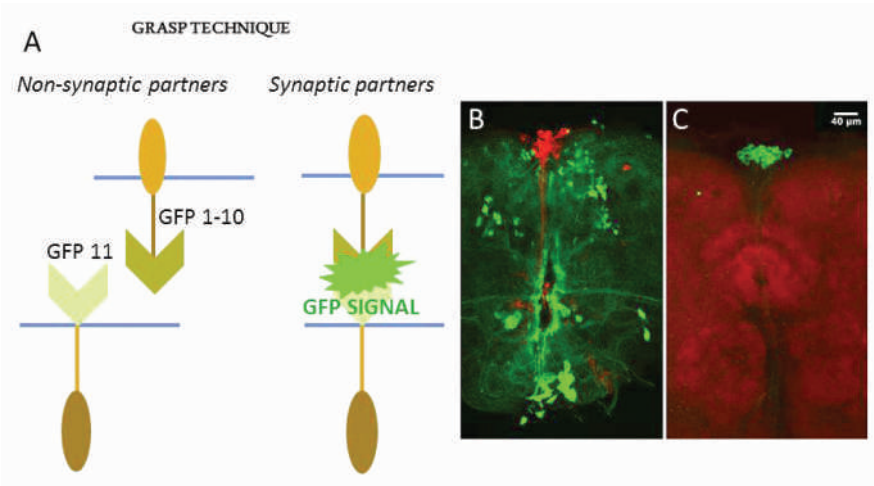


Figure 16
Octopaminergic-tyraminergic neurons (OPNs) form synaptic connections with insulin producing cells. (A) Schematic representation of the GRASP technique. (B) *Drosophila* adult brain showing medially located insulin producing cells (red) and clusters of Octopaminergic-tyraminergic neurons (green). (C) GRASP signal is detected in the insulin producing cells

direct synaptic contacts with the insulin producing cells indicating that they function in a circuit. Thus, Mon1 appears to be part of an inter-organ signaling network that controls egg maturation by regulating expression of ilps in insulin producing cells (Figure 16).

celsr genes are dynamically expressed in developing nervous system in zebrafish

Cadherin EGF LAG seven-pass G-type receptors (CELSR) -1, -2 and -3 belong to a sub-class of adhesion G-protein coupled receptor. In spite of a lot of research, still much is unknown about CELSR family expression and functional profile in vertebrate development. Here, we investigated the spatio-temporal expression pattern of *celsr* family members (*cels1a, celsr1b, celsr2, and celsr3*) during zebrafish development using semiquantitative PCR and in situ hybridization techniques. Our results showed *celsr1b* and *celsr2* are expressed maternally but not *celsr1a and celsr3*. *celsr1a* is predominantly expressed in the brain while its paralogue *celsr1b* is expressed throughout the central nervous system (CNS) till the early pharyngula period. In post pharyngula period celsr1b expression gets restricted to the brain. *celsr2* is expressed in CNS till the hatching period afterward its expression gets restricted to the brain. *celsr3* is expressed in very specific segments of the CNS viz. telencephalon, tegmentum, midbrain-hindbrain boundary, hindbrain, and spinal cord till early pharyngula period. In the juvenile brain both *celsr1a* and *celsr1b* transcripts overlap with the neural proliferation zone. Further, *celsr2* expression is visible in the optic tectum, while the brain remains devoid of *celsr3* in juvenile fish. Thus, our expression analysis indicates that *celsr* genes are likely to regulate nervous system development in zebrafish.

Genetics and Plant Breeding

ARI is engaged in improving productivity and profitability of crops on an ecological and economically sustainable basis. The institute is one of the leading centres for improvement of crops such as wheat, soybean and grapes under the All India Coordinated Research Projects funded by Indian Council of Agricultural Research, New Delhi.

Biotechnology

Marker assisted breeding

Using marker assisted breeding, lines with improved grain quality traits like protein content, gluten strength and yellow pigment content have been developed in the background of bread wheat cultivars MACS 2496 and NI 5439 as well as durum wheat cultivars MACS 3125 and HI 8498. Under a separate marker assisted breeding program, lines with improved leaf and stem rust resistance have also been developed in the background of bread wheat cultivars LOK 1 and NI 5439 as well as durum wheat cultivars MACS 3125. These lines can serve as genetic stocks for the improvement of other popular varieties in future breeding programs. To pyramid rust resistance genes into high grain quality wheat lines another marker assisted breeding program has been undertaken. Selected high grain quality lines in the background of MACS 2496 and NI 5439 were crossed with a donor line HD2967+Lr19-Sr25+Lr34+Yr10. In this season nearly 2000 F_2 plants were screened for the target alleles using molecular markers. Plants with maximum pyramided genes for quality and disease resistance were identified and individual plants were harvested.

The replacement of short arm of wheat 1B chromosome by short arm of rye 1R chromosome (1BL/1RS translocation) has been widely used around the world to enhance wheat yield potential, resistance to rust and mildew diseases and adaptation. Many popular Indian varieties also contain this translocation. The translocation is however, associated with inherent quality problems associated with reduced dough strength and dough stickiness. However, sticky dough problem of 1BL/1RS (*Glu-B3*$^-$/*Sec-1*$^+$) can be overcome by either removal of monomeric secalins and/or addition of polymeric glutenins by introgression of new 1BL/1RS (*Glu-B3*$^+$/*Sec-1*$^-$) translocation. Introgression of this translocation in the background of popular bread wheat varieties MACS 2496, MACS 6222 and MACS 6478 using marker assisted backcross breeding approach was undertaken. Plants with desired introgressed segment 1BL/1RS (*Glu-B3*$^+$/*Sec-1*$^-$) were identified in all the three backgrounds. The presence of *Glu-B3* locus was also confirmed by SDS PAGE analysis. Harvests of all the plants with desired allelic combinations were screened for micro-sedimentation test and thousand grain weight. Promising lines in each cross combination were identified based on presence of *Glu-B3*, high micro-sedimentation and high thousand grain weight and RBD trials were conducted for evaluation of grain yield and end use quality traits.

A study has been initiated to improve biscuit making quality of peninsular zone wheat varieties. A mutant population of a hard grain textured bread wheat MACS 6478 is being screened to identify null allelic mutants

for *Glu-A1*, *Glu-B1* and *Glu-D1* loci. Crosses for pyramiding of all the null mutants to generate less HMW-GS containing/ null HMW-GS bread wheat have been initiated. They are expected to have low gluten content and hence low protein content leading to low gluten, low protein soft bread wheat. Crosses to transfer grain softness proteins Pina and Pinb alleles from soft wheat HS490 to NI5439 have also been initiated to improve the biscuit making quality of NI5439.

The end use quality largely depends on grain protein content and quality which in turn depends on the supply of nitrogen, sulphur, nutrients, environment and genetics of the variety. To test the effects of nitrogen, sulphur, date of sowing, on end use quality, an experiment was designed in which three different nitrogen doses, three different sulphur doses with two different dates of sowing and three different bread wheat varieties released for PZ were included. The initial results showed protein content largely depends on all the three components i.e. nitrogen, sulphur and variety as well as their interaction. Increase in protein content enhances the gliadins and glutenins but does not increase omega gliadin content. Gluten strength as measured by microsedimentation is not affected by sulphur and nitrogen but largely depends on genetic composition of the variety.

Biofortification to enhance grain Zn and Fe in durum wheat

ARI is a participating centre, in the network programme on 'High resolution QTL mapping for iron (Fe), zinc (Zn), grain protein, and phytate content and their introgression in high yielding wheat cultivars'. Our objective is to identify QTL/Marker for high Zn, Fe and protein content in durum wheats.

TILLING resource in Indian durum wheat for forward- and reverse-genetic analysis

EMS-mutagenized TILLING (Targeting Induced Local Legions in Genome) population of durum wheat cultivar Bijaga Yellow is being screened by forward and reverse genetic approaches to identify improved phenotype for various agronomically important traits as well as novel mutant alleles in gibberellin biosynthesis genes. Identification of putative mutants for *GA20oxA1* and *GA20oxB1* genes by high resolution melt (HRM) analysis is in progress. DNA sequencing confirmed 23 mutants comprising one nonsense (stop codon) mutation in *GA20oxA1*, seven missense mutations in *GA20oxA1*, 11 missense mutations in *GA20oxB1* and two silent mutations each in *GA20oxA1* as well as *GA20oxB1*. A mutant line BYM2_545 showed C339T substitution which causes a premature stop codon in *GA20oxA1*. Each point mutation was analysed by the SIFT programme to predict the effect of mutation on protein function. SIFT score of BYM2_189 (T1127C in *GA20oxA1*), BYM2_3046 (G149A in *GA20oxA1*), BYM2_3214 (C10T in *GA20oxA1*), BYM2_627 (G951A in *GA20oxB1*), BYM2_3512B (C1192T) and BYM2_820 (G879T in *GA20oxB1*) suggested severe effect on protein function. Mutants with significant SIFT score carrying mutations in *GA20oxA1* and *GA20oxB1* were intercrossed to obtain double null for *GA20ox1*. Stacking the two homoeologous mutations of *GA20ox1* shall generate desired semidwarf phenotype with improved coleoptile length, and seedling vigour suitable for stubble-retained conditions.

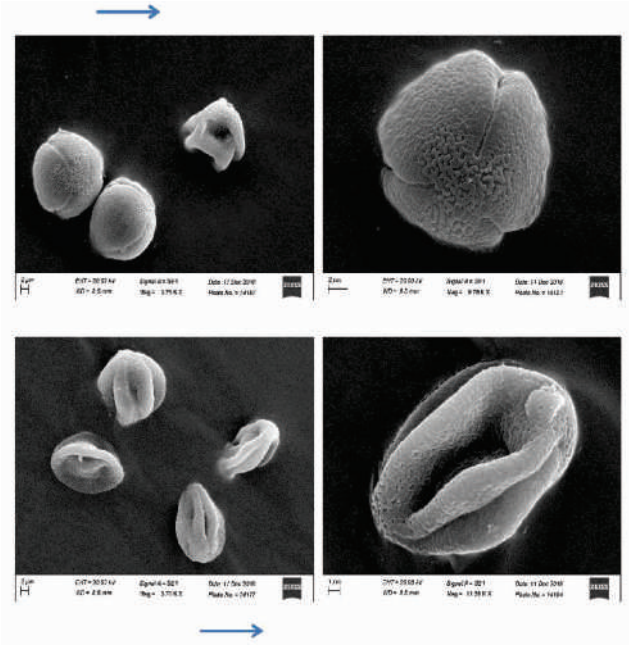
Water-stress tolerance in soybean

Soybean is the most important oilseed crop cultivated mainly under rainfed conditions. The erratic and uneven distribution of rain during the growth period causes reduction in yield of soybean and even complete crop failure. Therefore, identification of water-stress tolerant genotypes and study of molecular mechanisms underlying water-stress tolerance has gained importance in soybean improvement programmes. In the field experiment, soybean accessions RSC 1046, TAMS 98-21, EC 241780, MACS 1281, HARDEE, MAUS 612, DS 9814, MACS 1460 and KDS 753 were observed as water stress tolerant on the basis of minimum yield reduction under stress and drought tolerance indices. Water-stress tolerant soybean accession RSC-1046 was selected for comparative transcriptome analysis at late vegetative stage. Gene expression profiles were compared

under normal irrigation, mild water stress and severe water stress conditions. Total 23 genes and 6 transcription factors involved in ABA metabolism as well as flavonoid biosynthesis showed differential expression under mild as well as severe water stress conditions. These genes are being further studied for their usefulness in improvement of soybean for water-stress tolerance.

Seedless mutant of grape variety ARI 516

Seedlessness is a highly desirable agronomic trait in grapes as seedless variants are preferred for table grapes and raisin making. A stable seedless mutant of grape variety ARI 516, developed through mutagenesis is being investigated to understand the molecular basis for seedlessness. ARI 516 showed 74.3 % normal spherical shape fully developed pollen with 47.1 % germination. In contrast, the seedless mutant showed about 89 % pollen with non-spherical, shrunken, abnormal shape and only 6.3 % germination (Figure 17). The results indicated that the seedless mutant of ARI 516 was pollen sterile.



As compared to wild-type ARI 516, the seedless mutants showed reduction in berry length, width and 100-berry weight, therefore, response to growth promoters was tested in the mutant. Maximum gain in berry dimensions (length and width) and 100-berry weight was observed in treatment of GA_3 + 6BA (80 ppm) combination. It showed that the seedless mutant is responsive to GA_3 and 6-BA, while wild-type ARI 516 remained non-responsive to exogenous application of GA_3 and 6-BA. Application of growth promoters will help farmers to harvest maximum yield.

Figure 17
Pollen with non-spherical, shrunken, abnormal shape

Wheat Improvement

Wheat research is aimed at developing high yielding, disease resistant and end user quality wheat (*T. aestivum, T. durum* and *T. dicoccum*) varieties for India in general and peninsular zone in particular. Production of breeder seed is done as entrusted by ICAR/ Central or State Government. Dissemination of the latest technology of wheat production directly on farmer's field through field demonstration is also done.

New variety identified

Durum wheat variety MACS 4058 has been recommended by the Varietal Identification Committee for release in timely sown restricted irrigation conditions in the peninsular zone (Maharashtra and Karnataka) of India (Figure 18).

Important features of the variety are:

1. Superior performance in yield and agronomic trials: Average yield of 29.6 q/ha with a potential yield of 37.1 q/ha under restricted irrigation condition. Early maturing high yielding tall wheat genotype for timely sown restricted irrigation condition in Peninsular zone.

2. Disease resistance: Carries *Sr*13+, *Sr*11+ and *Lr*23+ gene combinations for brown and black rusts. Resistance to stem and leaf rust under both natural and artificial screening conditions.
3. Excellent grain quality: Amber colored bold lustrous grain, hard and oblong shape. High protein content (12.8 %) and better nutritional quality with zinc (37.8 ppm) and iron content (39.5 ppm).

Figure 18
Durum wheat variety MACS 4058

Biofortified variety MACS 4028

DARE-ICAR declared MACS 4028 as biofortified wheat variety. MACS 4028 variety was notified by CVRC GOI, 2018 Gazette. ARI wheat variety MACS 4028 is the only wheat variety credited to have all the three nutritional traits viz. protein, zinc and iron above the baseline levels (Figure 19).

Figure 19
A woman farmer Smt. Jayshri Govind Jadhav ensuring nutritional security of her family through cultivation of biofortified wheat variety MACS 4028 at Morgaon, district Pune

Promising wheat entries in pipeline and in advanced varietal trial

Currently, MACS 4087 (d) for restricted irrigation timely sown, MACS 6747 for irrigated timely sown and for irrigated late sown, MACS 6752 and MACS 6749 are in advanced varietal trials in the peninsular and central zone.

Progress in wheat improvement

ARI wheat breeding programme is targeted at four agro ecosystems viz., rainfed, irrigated full fertility, restricted irrigation, and late sown for the development of wheat varieties in all the three species under cultivation (*T. aestivum, T. durum* and *T. dicoccum*). 240 parental cross combinations were attempted. The 160 F_1, BC_1F and top cross combinations from the previous year were advanced and screened for their hybrid vigor and true F_1 behavior. Segregating breeding materials of about 1536 entries were subjected to precise phenotypic selection. Yield and yield contributing traits data were recorded for about 404 fixed (homozygous) cultures in augmented trial, 187 in initial station replicated trial and 123 in advance replicated plot trial.

This year eleven wheat entries are being evaluated in the national initial varietal trial. Among these, two were in restricted irrigation (one durum and one bread wheat), five in irrigated high fertility (three bread wheat and two durum wheat), two bread wheat entries in late sown and two dicoccum entries in irrigated special trials.

Based on three years yield and disease data for station trial, about 35 entries developed at ARI are promoted to the national programme on IPPSN (Initial Plant Pathology Screening Nursery). 419 genotypes from coordinated trials and 404 genotypes from the station trials were evaluated for brown rust, stem rust and leaf blight. Total 1841 entries from IIWBR coordinated trials and 1849 entries from institutional research material were tested for breeding components, disease resistance and agronomic performance. A field scouting for disease surveillance in wheat growing areas of Pune and Satara districts was undertaken and 60 disease samples submitted for race analysis at central rust laboratory in Flowerdale Shimla, Himachal Pradesh.

Agronomic research findings

Performance of new wheat genotypes under restricted irrigation conditions indicated that increasing irrigation frequency significantly increased the grain yield. Maximum grain yield (45.28 q/ha) was produced under two irrigations imposed at CRI and boot leaf stage followed by one irrigation (33.14 q/ha) and no irrigation (29.49 q/ha) levels. Among genotypes, maximum grain yield was produced by MACS 6695 (41.99 q/ha) followed by MACS 6696 (41.80 q/ha) and NIAW 3170 (39.57 q/ha). MACS entries were significantly superior to the best check. In evaluation of the performance of diverse varieties at different dates of sowing the result indicated that among dates of sowing, the first date (5th November) showed significantly higher wheat grain yield (51.19 q/ha) over all other dates of sowings and which showed decreasing trend. However, while comparing varieties, HI 1544 recorded significantly higher grain yield (38.73 q/ha) over all other varieties. The interaction of the first date of sowing (5th November) along with HS 562 recorded significantly higher grain yield (59.15 q/ha). Under precision nitrogen management, results revealed significant differences in grain yield due to different N application treatments. The maximum grain yield was recorded for the treatment of 75 kg basal + 37.5 kg N/ha at CRI and tillering (68.10 q/ha). Under dicoccum trial, various seed rates did not show significant differences in yield, whereas, significant differences were observed only for line spacing treatments. The highest yield was obtained in line sowing at 15 cm with seed rate of 75 kg/ha (52.25 q/ha) followed by same line spacing with seed rate of 125 kg/ha (51.81 q/ha) and these were at par.

Wheat breeder seed programme

246 quintal of breeder seed was supplied to different seed multiplying agencies and farmers. 203 quintal of breeder seed has been harvested, which would be available for sale during 2020-21 after processing.

Wheat front line demonstrations

During the *rabi* season of 2018-19, about 25 frontline demonstrations on wheat were carried out in cluster approach at various villages in Baramati taluka. The demonstration comprised of recently released improved varieties of wheat viz., aestivum, durum and dicoccum. Among all varietal demonstrations, MACS 6478 recorded higher average grain yield (4911 kg/ha) over other improved varieties including DBW 168, HW 1098, MACS 3949 (d) and HI 1605. The higher net income of Rs. 118400/ha was recorded under HW 1098 demonstration over farmers' field with higher benefit cost (B:C) ratio of 4.42 followed by MACS 6478 with net income and B:C ratio of Rs. 77414/ha and 3.35, respectively. Among improved varieties, MACS 6478 recorded higher average increase in wheat yield i.e. 29.9 % over farmers practice or variety. The grand average per cent increase in wheat yield by using improved variety was 18.9 % over farmer's varieties or practice which indicates the positive impact of frontline demonstration among farming the community. During the *rabi* season of 2019-20, total 25 frontline demonstrations on wheat were carried out. The recently released rainfed

durum wheat variety MACS 4028 was included in the FLD program along with MACS 6478, MACS 3949 and MACS 2971 to demonstrate on farmers' fields.

Wheat Mini Kit Trials (MKTs)

To promote the varieties 20 minikit trials of wheat comprising all three species aestivum, durum and dicoccum with 20 kg seed of latest high yielding, disease resistant and quality wheat varieties namely MACS 6478, MACS 6222, MACS 3949 and MACS 2971 were conducted on farmers' fields of different districts of Maharashtra. Minikit farmers were provided technical guidance digitally by telephone and also by circulating the improved wheat production techniques through WhatsApp and newspaper/ magazine articles.

Public Private Partnership (PPP)

In coordination with ITC Limited (ITC) Choupal Pradarshan Khets (CPK) were conducted for MACS 6222 and MACS 6478 (10 each) in Amravati hub of Maharashtra.

Farmers Mela

To share the knowledge of improved production technologies of wheat among the farming community, 'Kisan Mela' was organized at the Songaon farm on 28 February 2020. Thirty farmers and 80 students from Agriculture College, Baramati participated in the Mela. Farmers benefited by visiting the wheat crop cafeteria including popular varieties of Peninsular zone and also wheat breeder seed plots of improved MACS wheat varieties viz., MACS 6222, MACS 6478, MACS 2496 and MACS 3949 (d). Few farmers shared their experience about the new wheat varieties and seed production.

Soybean Improvement

Evaluation of MACS Soybean Varieties in All India Coordinated soybean trials

Soybean varieties developed at MACS-ARI, viz. MACS 1655 and MACS 1639 were tested in soybean trials throughout India in 2019. In second year of testing, AVT-I trial of Eastern Zone, MACS 1566 soybean variety gave the highest yield of 2255 kg/ha and ranked first in the zone giving 7 % higher yield than the best check variety. Another variety MACS 1620 was tested for the second year in AVT-I trial of North Eastern Hill Zone of the country and gave an average yield of 2222 kg/ha. MACSNRC 1667 a null trypsin soybean variety was tested in second year AVT-I trial of Southern Zone and gave a yield of 2148 kg/ha.

MACS 1493 with a yield of 2607 kg/ha ranked third in trials in the Southern Zone of India during three years of testing and gave 15 % higher yield than highest yielding check variety JS 335 (2264 kg/ha). The same variety ranked fourth in three years of testing in yield trials of Eastern Zone and gave 13 % higher yield than the highest yielding check variety JS 97-52 (1522 kg/ha). Five soybean varieties developed were also tested in Maharashtra through State Multi-location Varietal Trial.

Identification of Registration of Soybean Germplasm

A soybean germplasm line AGS 25 was identified for long juvenile character and was registered for the character by Plant Germplasm Registration Committee of Indian Council of Agricultural Research, New Delhi.

Station trials for soybean improvement

Sixty-seven elite breeding lines were developed and tested in four graded replicated trials. Of these, nine lines gave significantly more yield than the highest yielding control variety MACS 1188 and one line, MACS 1676, maturing in 96 days with a yield of 3995 kg/ha, was found promising.

Agronomy studies on soybean

Twelve soybean entries of AVT II were evaluated during kharif 2019 for their performance under different row spacing following the standard package of practices. The results revealed that sowing done at a spacing of 45 cm between two rows gave significantly higher yield (3030 kg/ha) over 30 cm (2788 kg/ha) row spacing. The yield obtained with sowing at 45 cm spacing between the rows was 8 % higher than 30 cm spacing. This translates to additional Rs. 7,986/- gross returns per hectare. Among the entries NRC 147 (3231 kg/ha), AMS 2014-1 (3159 kg/ha) and MACS 1493 (3041 kg/ha) gave significantly higher yield over the rest of the entries and check variety DSb 21 (2425 kg/ha). The partial factor productivity for soybean crop evaluated has shown that full package containing seed treatment, seed inoculation, RDF, weed management, insecticide treatment and sowing on ridges and furrow gave significantly higher seed yield (3670 kg/ha) of soybean over full package excluding RDF (2877) kg/ha and full package excluding weed management (3376 kg/ha). The differential yield was higher under the treatment where RDF (793 kg/ha) and weed management (294 kg/ha) was excluded from the full package of practices. Response of soybean crop to foliar application of water soluble fertilizer (WSF) grade 0:44:29 was evaluated, the results showed that soybean seed yield was significantly high under the treatment basal application of RDF and 0:44:29 WSF grade foliar application @ 10 g/ l at every 10 days interval from flowering to pod filling stage (2959 kg/ha) over RDF only (2563 kg/ha).

Mitigating drought stress in soybean

In an experiment on mitigating the drought stress in soybean through agronomic, physiological and molecular breeding, a set of 64 soybean genotypes along with five checks was evaluated for drought stress tolerance. Among them TAMS 98-23, RSC 10-46, EC 241780, MAUS 612 and MACS 1281 were observed to be better performing in drought situations in terms of yield. Similarly, these entries showed less yield reduction under drought stress conditions. The generation advancement of the breeding material obtained from crossing of two contrasting genotypes is in progress for further segregation studies.

Soybean breeder seed production

376 quintals of breeder seed of soybean, including MACS 1188, MACS 1281 and JS 335 varieties were supplied to public and private seed multiplying agencies and farmers in the year 2019. Likewise, 99 quintals of breeder seed of soybean has been produced during *kharif* 2019 season for further seed multiplication.

Grape improvement

In the grape hybridization programme, twelve cross combinations were attempted using eight female parents viz. Buckland sweetwater, Convent Large Black, Convent Large White, Catawba, James, Jawahar, Kishmish Maldeev, Madhoo angur and six seedless male parents (Nanasaheb purple, Sharad seedless, Sarita seedless, RK and Sonaka) to incorporate seedlessness and disease resistance in progenies. One thousand one hundred seeds derived from the crossing program are being given the chilling treatment for getting good germination. Forty-seven new hybrids developed earlier were evaluated for their fruit quality. Following promising hybrids were selected.

I) Seedless hybrids having potential as table varieties:

1. ARI 733: Bangalore Blue x Manik Chaman
2. ARI 909: Buckland sweetwater x Tas-A-Ganesh
3. ARI 1164: Gulabi x Beauty seedless
4. ARI 1179: Khalili x Jumbo

ii) Seeded hybrids having bold berries potential as monnuka:

1. ARI 787: Black Monnuka x Tas-A-Ganesh
2. ARI 1120: (Anab-e-Shahi x Catawba) x Tas-A-Ganesh

Evaluation of grape juice varieties

ARI 516 is performing better in terms of yield and berry quality (TSS 22^{0}B and unique musky flavour) in AICRP juice varietal experiment being conducted in five states viz. Karnataka (Vijayapura), Madhya Pradesh (Mandsaur), Telangana (Rajendra Nagar), Tamil Nadu (Periyakulam) and Maharashtra (NRCG, Pune and Hol farm) at seven locations. The trial comprised of six juice varieties including ARI 516 planted in randomized block design with four replications. Berry yield, juice recovery and quality were evaluated.

Identification of grape variety ARI-516

Grape variety ARI 516 was identified for release due to its higher yield, flavour and processing qualities, for cultivation in Maharashtra, Punjab, Telangana and Tamil Nadu at ICAR-AICRP (All India Coordinated Research Project on fruit) Group discussion meeting held in January 2020. The area under cultivation of this variety is increasing and has reached up to hundred acres. In the current year, twelve thousand three hundred three cuttings/ saplings of ARI 516 were distributed to different grape growers in Maharashtra and other states.

Nanobioscience

Antimicrobial nanomaterials and their effects on biofilm bacteria

The use of silver and copper nanoparticles in medical and consumer products is increasing each day and several products containing the same are available commercially. Both silver and copper nanoparticles exhibit a broad-spectrum antimicrobial activity, but the distinction between 'nanoparticle-specific' and 'ion-specific' effects on functional genes in microbial biofilms is still lacking. Biofilm of *Pseudomonas aeruginosa* PAO1 was used as a 'model' system because this microorganism is implicated in severe hospital acquired infections as well as several activities such as xenobiotic degradation, denitrification etc. which are of immense environmental significance. Results clearly show that nanoparticles cause physical damage to the biofilm community and adversely affect a multitude of functional genes, exhibiting pleiotropic effects. Thus, genome-wide transcriptional analysis provided insights into biofilm specific metabolic pathways, transporters, cellular replication, etc. These findings were supported by microscopic observations on nanoparticles treated biofilms. Our research establishes the fact that in medical settings, the use of silver, copper nanoparticles to eradicate biofilms would resolve the antibiotic crisis, reduce the emergence of drug resistance and control hospital acquired infections. However, use of silver and copper nanoparticles in consumer products needs to be regulated to prevent serious impacts on environmentally important processes in aquatic ecosystems such as nutrient cycling, bioremediation, degradation of xenobiotics, etc.

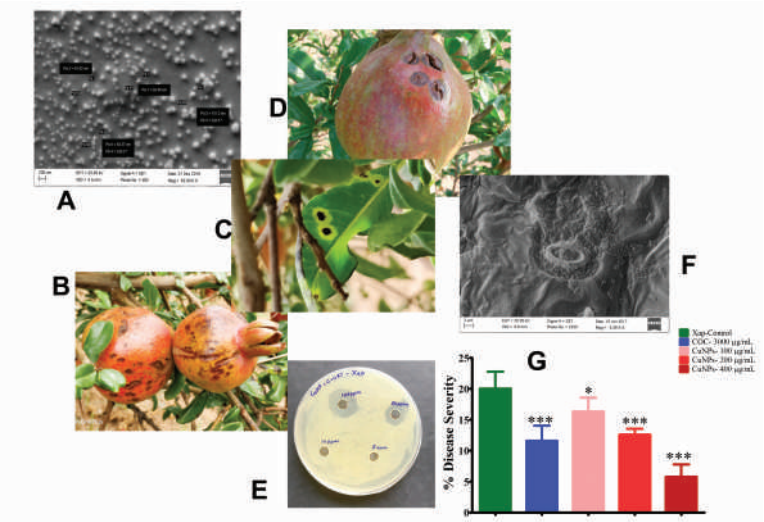
Copper nanoparticles: an effective nanoweapon against bacterial blight disease in pomegranate

Pomegranate (*Punica granatum* L), a fruit native to the Middle East, is highly popular all over the world because it is a rich source of nutraceuticals. The pomegranate plant can easily adapt to different agro-climatic conditions and shows drought tolerance. Other attributes such as the high yield and excellent keeping quality of fruit result in very high remunerative prices in both domestic and international markets. Hence, Indian farmers from Maharashtra, Karnataka, Andhra Pradesh, Gujarat, Himachal Pradesh, and Rajasthan practice pomegranate cultivation on a large scale. However, bacterial blight disease (*telya rog*, in vernacular; caused by *Xanthomonas axonopodis* pv. *punicae,* Xap) is a serious threat to commercially successful pomegranate cultivation (Figure 20). In absence of disease resistant varieties of pomegranate, farmers only manage the disease by changing the cultivating season, providing adequate nutrition and preventive sprays of bactericides and loss due to the disease continues.

We undertook systematic studies using metal based antimicrobial materials for control of Xap. The antimicrobial effectiveness was in the order Cu > ZnO > MgO > CuO and only 2.5 µg/mL copper nanoparticles (CuNPs) killed Xap cells within 30 min. Under controlled conditions (polyhouse), foliar application of CuNPs (400 µg/mL) resulted in ~ 90 and ~ 15 % disease reduction in 6-month-old infected plants at early (disease severity 10 %) and established (disease severity 40 %) stages of infection, respectively. Under field conditions,

Figure 20

Nanoweapon against bacterial blight disease in pomegranate. Copper nanoparticles (A), Symptoms of bacterial blight disease on fruits and leaves (B-D), in vitro antibacterial activity (E), stomata on leaf surface showing dead bacteria (F), control of BBD in field (G)



application of CuNPs reduced the disease incidence by ~ 20 % as compared to untreated control. Foliar applied CuNPs were effective at 8-fold reduced copper concentration as compared to copper oxychloride. Thus, early disease detection and application of effective dosage of copper nanoparticles can indeed help the farmers in achieving rapid infection control.

Chitosan nanoparticles inhibit and disintegrate β-amyloid peptide aggregates

Alzheimer's disease, a neurodegenerative disease affecting elderly population worldwide is caused by the aggregation of misfolded amyloid (1-42) β-peptides. Presently, therapies to halt the progression of this disease are lacking. To address this challenge, disease treatment strategies targeting the inhibition of peptide misfolding and the elimination of the pre-formed aggregates can be developed. Biopolymeric nanoparticles can provide a biocompatible treatment alternative. Our studies showed that biopolymeric cationic chitosan nanoparticles induced a conformational change from the random coil of Aβ (1-42) peptide to a more stable α-helical structure. Furthermore, these particles displayed the ability to disrupt the pre-formed Aβ mature fibrils. The effect of nanoparticles and their interaction with Aβ (1-42) peptides were governed by both, the surface charge and size of particles (100 nm size, +32 mV charge). Thus, development of biopolymeric nanoparticles based therapeutic strategies for treatment of amyloid-related neurodegenerative disease can prove to be promising.

New hemostatic dressings to halt uncontrolled bleeding

Hemorrhage or uncontrolled blood loss, due to accidents or injuries often leads to death. Severe hemorrhage triggers the trauma pathway through shock, inflammation, coagulopathy and organ failure causing mortality. In India, one trauma-related death occurs every 1.9 minutes (as per the Indian Society of Trauma and Acute Care). In such situations, rapid control of hemorrhage can prevent loss of lives. Critical care guidelines recommend early control of bleeding with topical hemostatic agents in the form of pads, patches, bandages or gels. Currently used gauze dressings are ineffective in halting hemorrhagic blood loss. To address this challenge, we have developed two biopolymer based topical dressings namely a chitosan gauze and a chitosan xerogel (patent no TEMP/E-1/41722/2019-MUM). Chitosan is a biopolymeric material that can interact with RBCs and is the second most abundant polysaccharide on earth after cellulose. These dressings were supplemented with agonist materials that further enhanced the blood clotting in vitro. The dressings halted blood loss rapidly in comparison to Celox®, a commercial dressing and Gauze when tested in vivo with lethal injury in rats (Figure 21). In addition, the developed dressing was easily removed from the injury, unlike Celox® that showed adherence. These dressings have promising applications in halting blood loss and saving lives from death and disability.

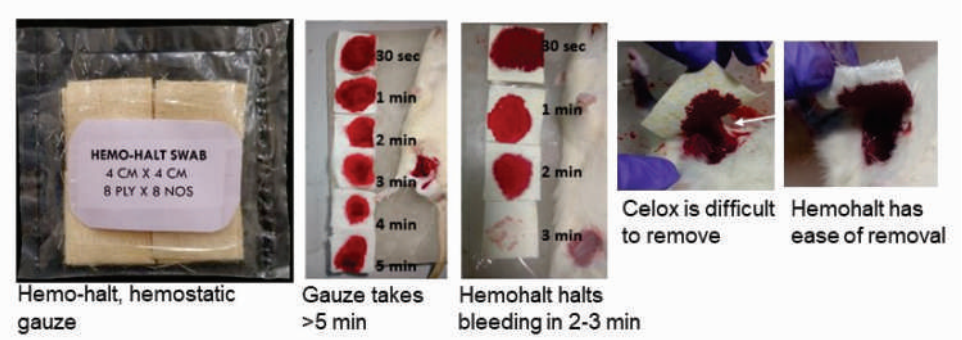


Figure 21
Study in animal model of hemorrhage proving the efficacy of 'hemohalt' dressing

Dendritic nanoparticles mediated miRNA delivery to prevent hypoxia/reperfusion-induced cardiomyocyte apoptosis

Myocardial infarction is a tissue injury that leads to apoptosis of cardiomyocytes. This can be prevented by using miRNAs, but its delivery to cardiomyocytes is a major hurdle. To address these issues, we developed poly(amidoamine)-histidine (PAMAM-His) nanocarriers to deliver miRNAs in cardiomyocytes for preventing apoptosis. The PAMAM-His nanoparticles were synthesized and assessed for their transfection efficiency of miRNAs to prevent apoptosis in hypoxia/reperfusion-induced H9c2 as well as primary cultured cardiomyocytes. miRNAs-nanoparticle complexes exerted a significant antiapoptotic effect on the H9c2 and primary rat ventricular cardiomyocytes. Enhanced expression of antiapoptotic genes and decreased expression of proapoptotic genes were observed. This study revealed that PAMAM-His nanoparticles effectively delivered miRNAs to the cardiomyocytes and prevented the hypoxia/reperfusion-induced apoptosis critical in myocardial infarctions. This study is the first of its kind reporting miRNA delivery via dendritic nanoparticles in cardiomyocytes. Our study could open a new horizon in the field of nanocarriers-based miRNA delivery for treating H/R injury in cardiomyocytes as well as regeneration/proliferation of cardiomyocytes and could play a significant role in prevention as well as treatment of myocardial infarction.

Non-nucleoside reverse transcriptase HIV-1 inhibitor shuttled by mesoporous silica nanoparticles effectively slows down HIV-1 replication in infected human cells

Highly Active Antiretroviral Therapy (HAART) is the primary treatment available for efficient control of HIV. Nevirapine (NVP) is a non-nucleoside reverse transcriptase inhibitor (NNRTIs) which is also a component of HAART. NVP exerts severe side effects on the central nervous system (CNS) like insomnia, confusion, memory loss, depression, rash, nausea, dizziness, severe hepatotoxicity, and Stevens-Johnson syndrome. In this study we synthesized and used mesoporous silica nanoparticles (MSNPs) to reduce the cytotoxic effect of NVP and to enhance its anti-HIV efficacy. Confocal microscopy and flow cytometry results exhibited efficient uptake of FITC-conjugated MSNPs in TZM-bl cells. The NVP was loaded within MSNPs, and its anti-HIV1 efficacy was assessed on HIV1 (R5 and X4 variants) infected TZM-bl cells and further confirmed on peripheral blood mononuclear cells (PBMCs). In vitro assessment of the anti-HIV1 potential of NVP and NVP-MSNPs in HIV1 infected TZM-bl cells and PBMCs showed increased efficacy of NVP upon loading within MSNPs with significant increase in therapeutic index. The increased efficacy against HIV1 was accompanied by reduced cytotoxicity to TZM-bl cells and PBMCs. Further, reverse transcriptase (RT) assay confirmed the inhibitory effect on RTase, which is a key enzyme in HIV-1 replication. The present study showed that entrapment of NVP within MSNPs led to an increased efficacy with reduced cytotoxic effect resulting in the enhanced therapeutic index (TI). Thus, MSNPs could effectively be used for delivery of antiviral drugs. This study could open new prospects in anti-HIV therapy wherein the advent of nanoparticles would help in developing novel treatment strategies.

Erlotinib-loaded carboxymethyl tamarind gum semi-interpenetrating nanocomposites for enhanced cytotoxic effect on human alveolar adenocarcinoma cells

The aim of this study was to develop an anti-cancer drug loaded nanocomposites for the treatment of non-small-cell lung cancer (NSCLC). Erlotinib-loaded carboxymethyl temarind gum-g-poly(N-isopropylacrylamide)-montmorillonite based semi-IPN nanocomposites were synthesized and characterized for their in vitro performances for lung cancer therapy. The placebo matrices exhibited outstanding biodegradability and pH-dependent swelling profiles. These formulations conferred sustained drug elution profiles with an initial burst release. The results of MTT assay, AO/EB staining and confocal analyses revealed that the Erlotinib-loaded formulation suppressed A549 cell proliferation and induced apoptosis more effectively than pristine drug.

Hepatitis E virus replication: Virus host interactions

Hepatitis E virus (HEV) is a hepevirus that is transmitted via contaminated drinking water to cause acute hepatitis in humans. HEV is a major public health concern in developing countries like India.

In order to better understand the HEV-host interface, we identified liver cell proteins interacting with the HEV polymerase and HEV putative promoters and generated a protein-protein interaction network. We further utilized a bioinformatics approach to analyze these interaction networks and assess their significance. Our study identified host proteins related to cellular processes like RNA metabolism, unfolded protein response, stress granules, secretory vesicles, endoplasmic reticulum protein processing, and innate immune pathways.

We observed a significant enrichment of heterogeneous nuclear ribonucleoproteins (hnRNPs) in the HEV interactome data, which was also evident from the highest representation of RNA binding proteins. The results obtained from HEV host interactions network analysis prompted us to study the roles of hnRNPs in HEV replication further. hnRNPs are the nuclear proteins that participate in the cellular transcription, post-transcriptional modification and maturation of pre-mRNA. We found that hnRNPK and hnRNPA2B1 are the virus-supportive factors interacting with HEV RNA at promoter regions along with HEV polymerase protein, which are essential for HEV replication in the cells. Contrarily, hnRNPH, PCBP1 and PCBP2 are the antiviral factors that interact exclusively with HEV genomic promoter and inhibit HEV replication in Huh7 S10-3 cells. In conclusion, our study highlights the importance of hnRNP proteins in HEV replication regulation.

Annexure

Repositories

Agharkar Herbarium at MACS (AHMA)

During the report period, 10,236 specimens were scanned. Around 500 specimens of various species belonging to genus *Eriocaulon* were accessioned. This makes AHMA as the most species rich herbarium for the Family Eriocaulaceae in India. Forty one specimens of genus *Ischaemum* were accessioned. Two type specimens were added to the herbarium. Currently the herbarium holds 33000 specimens.

Ajrekar Mycological Herbarium (AMH)

Ajrekar Mycological Herbarium holds 10226 exsiccate specimens including 106 specimens received from different centers in India for deposit and accession during the period of report.

Central Animal Facility

Animal Facility was established in 1999 and is registered with Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Environment and Forests, Government of India, New Delhi. The Registration No. of the Facility is 101/ GO/RRcBiBt/S/99/CPCSEA. The Facility has licenses for a) research and breeding of small animals, b) breeding of small laboratory animals (rats and mice) for trading purpose and c) research for commercial purpose.

The facility has a well-organized infrastructure and is equipped with IVC system, metabolic cages, bio-safety cabinet and instruments to conduct pharmacological studies. Routine genetic and biochemical monitoring of laboratory animals are carried out using microsatellite SSLP and biochemical markers The Facility supply quality animals for research by ensuring the persuasion of 4Rs (Replace, Reduce, Refine, Rehabilitate) of animal experimentation and ethical principles of animal use. The Facility provides the services such as supply of in-bred mice and rats, and pharmacological and toxicological testing on contract basis This year we a) conducted two Institute Animal Ethics Committee (IAEC) meetings and IAEC has provided approval for total 21 proposals b) provided healthy animals to conduct animal experimentation involved in 13 intra and extramural funding projects c) provided training for technical staff, students and scientists of different groups of Institute in ethical handling of laboratory animals and also assisted in conducting their animal experimentations d) generated revenue for the Institute by selling of the animals and performing projects on the contract basis e) developed animal models of various diseases that could be used to test various drugs and biologically active molecules.

Crude drug repository

Crude drug repository hosts 2,004 specimens {1973 plant originated (1940 organized and 33 unorganized), 19 animal originated, 12 mineral originated} of plant part used as/in medicine collected from the field and or market.

Diatom Collection

Currently our diatom collection holds around 3047 samples covering the present day to early Holocene time. The present culture collection holds 106 strains from various genera viz; *Gomphonema, Stauronies, Pinnularia, Tabellaria, Cymbella, Ulnaria, Hantzschia, and Achnanthidium*.

Fossil Repository

Fossil repository hosts over 8000 fossil type specimens of various animal and plant groups. Over 5000 megafossils, include phylum mollusca, brachiopoda, echinodermata, annelida, chordata, bryozoa, and various trace fossils, intertrappean fish, plant fossils as well as recent traces, collected from various localities of peninsular India. Over 2500 microfossils, including foraminifera, pollens and spores are also part of the collection. Revision of taxonomic status of certain specimens considered as trace fossils from the Paleogene of Kachchh and deposited as type specimens, completed.

MACS Collection of Microorganisms (MCM)

Under this project, specialized cultures of microorganisms used in various processes are being maintained in active form and supplied to researchers on demand. The specialized cultures include standard reference cultures, cultures used in metal-microbe interactions and industrial waste treatment, extremophiles such as halophilic, thermophilic and methanogenic archaea, alkaliphilic cultures.

Nation Fungal Culture Collection of India (NFCCI-WDCM 932) - National Facility

As a part of the conservation of fungal diversity, live, pure and authenticated cultures of interesting fungi received from various organizations in India were deposited and accessioned. The total accession of NFCCI comes to 4835. The fungal germplasm is being maintained in culture collection by following standard long-term preservation methods, like freeze drying, distilled water, glycerol and liquid nitrogen. A total 257 fungi were accessioned during period report and 93 authentic fungal strains were supplied to various academia, research institution, and industry.

Library & Information Centre

The library and Information Centre provides access to the several international online Full-Text resources as well as to the Databases like Web of Science, J-Gate and maintains the website of the institute. The detailed information about various services and activities of LIC is available on the institute's website www.aripune.org. The library is part of a CSIR-DST consortium known as the National Knowledge Resource Consortium (NKRC). The LIC maintains the web site of the institute. The current holdings of the library are:

Particulars	Total	Particulars	Total
Books / Bound Volumes	28548	Maps and Atlases	569
Reference Books	1134	Microfilms / Fisches	636
PhD Thesis	364	Annual Report	15
M Sc / M Phil Thesis	97	Journals	107
ARI Reprints	3531	Digital collection/Documents	3193

Services Rendered/Offered

Crude Drug Authentication Service

ARI has been rendering the authentication service of identification/ authentication of crude drug samples/ specimens for academic as well as industrial purposes. During the period of report total 177 authentication reports were generated; out of these, 37 were for industries.

Fungal Identification Service of NFCCI

382 fungal cultures, other samples received from academic, research institutions and industry were authenticated/ identified. 102 centers including 84 academic and research institutions and 18 private centers in India benefited from the services of NFCCI.

Consultancy service provided

Technical services

Analysis of biogas, total viable count, volatile fatty acids, total solids, volatile solids, soil probiotic formulations was done for industries, institutes and colleges

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Chitosan based dressing for rapid hemostasis. Provisional, TEMP/E-1/41722/2019/MUM, 30 September 2019, Inventors: V Ghormade

Development of an astute footwear with integrated sensors. Provisional, TEMP/E-1/28255/2019/MUM, July 2019, Inventors: D Bodas, P Kulkarni, A Jadhav, S Jadhav, P Inde, A Chaudhari, A Deshpande and A Zingade

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Papers Presented at Conferences/ Symposia/ Seminars

Oral Presentation

Biodiversity & Palaeobiology

Plants & diatoms

Darshetkar AM, Datar MN, Tamhankar S, Choudhary RK. Tracing evolutionary history of pipeworts and proposing superbarcodes for easier species discrimination. National Conference of Indian Association of Angiosperm Taxonomy (IAAT), Thiruvananthapuram, 11-13 November 2019 (Darshetkar AM. Young Scientist Award)

Kulkarni A, Datar MN. Patterns of diversity and endemism on rock outcrops of Western Ghats. XLII All India Botanical Conference of the Indian Botanical Society and National Symposium, Innovations and Inventions in Plant Science Research, University of Calicut, Calicut, 6-8 November 2019

Shigwan BK, Datar MN. Tree species diversity and plant community structure of fragmented forests from Northern Western Ghats. XLII All India Botanical Conference of the Indian Botanical Society and National Symposium, Innovations and Inventions in Plant Science Research, University of Calicut, Calicut, 6-8 November 2019

Thacker M, Karthick B. Modern diatom assemblages across environmental gradients of Myristica swamps in

the Western Ghats: An approach to develop bioindicator to infer present and past environmental conditions. 12th International Symposium on Fossil Algae, Birbal Sahni Institute of Palaeosciences, Lucknow, 16-18 September 2019

Vijayan S, Datar MN. Exploration of cliff habitat of Northern Western Ghats: Floristic and Ecological perspective. XLII All India Botanical Conference of the Indian Botanical Society and National Symposium, Innovations and Inventions in Plant Science Research, University of Calicut, Calicut, 6-8 November 2019

Bioenergy

Das A, Dhakephalkar PK, Mallik S, Yadav K, Kshirsagar PR, Paknikar KM et al. Geomicrobiological and astrobiological investigations at Ladakh – New insight. Theme 40: Planetary Sciences, Planetary habitability and Astrobiology, 36th International Geological Congress, Delhi, 2-8 March 2020

Das A, Dhakephalkar PK, Mallik S, Yadav K, Kshirsagar PR, Paknikar KM et al. Spectral signatures of thermophilic colourless sulphur-oxidizing microbial enrichments from hotsprings of Ladhak, Himalayas - Planetary analogies. Theme 40 : Planetary Sciences, Planetary habitability and Astrobiology, 36th International Geological Congress, Delhi, 2-8 march 2020

Engineer AS. Metagenomics aided augmentation of resident microbes and their metabolism to enhance oil recovery from depleted reservoirs. New Horizons in Biotechnology, Trivandrum, 20-24 November 2019

Pandit P, Khatri K, Mohite J, Rahalkar M. Methane-oxidizing bacteria (MOB) from Indian rice ecosystems: Diversity and cultivation. 60th Annual Conference of AMI, Central University of Haryana, Haryana, 15–18 November 2019

Genetics & Plant Breeding

Tetali S, Karkamkar SP, Phalake SV. Mutation breeding for genetic improvement of ARI 516. International Dialogue on Indian Viticulture: Way Forward, NRC-Grapes and Society for Viticulture and Oenology, 15-16 November 2019

Vikhe P, Venkatesan S, Patil R, Tamhankar S. 2019. Genetic studies on alternative dwarfing loci *Rht14* and *Rht18* in durum wheat. International conference, Genomics and breeding for crop improvement, Ch. Charan Singh University, Meerut, 4-6 December 2019

Venkatesan S, Vikhe P, Patil R, Oak M, Tamhankar S. 2019. EMS-induced mutations in *GA20ox1* homoeologues for wheat improvement and their detection by TILLING. International conference, Genomics and breeding for crop improvement, Ch. Charan Singh University, Meerut, 4-6 December 2019

Poster Presentation

Biodiversity & Palaeobiology

Lichens

Gaikwad S. Evaluation of antioxidant activity of lichen metabolites from Western Himalaya. National Symposium, Recent Advances in Fungal Diversity, Plant-Microbes Interaction and Disease Management (RFPIDM-2020), Institute of Science, Banaras Hindu University, Varanasi, 28-29 February 2020

Plants & diatoms

Bokil S, Choudhary RK, Tamhankar S, Datar MN. Systematic study of *Ischaemum* L. in India using molecular, ecological and morphological tools. 29th IAAT Annual Conference and National Symposium on Modern Trends in Biosystematics of Angiosperms, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram, Kerala, 11-13 November 2019

Cheran R, Karthick B. Are diatoms habitat specific? Documenting the diatom diversity from two habitats of the

wet wall ecosystem from Indo-Burma biodiversity hotspot. International Symposium on Biodiversity, Biology and Biotechnology of Algae. Centre for Advanced Studies in Botany, University of Madras, Chennai, 8–10 January 2020

Cheran R, Mulye K, Karthick B. Aerophilic diatom communities from the Blue Mountains, North-Eastern India. 12th International Symposium on Fossil Algae, Birbal Sahni Institute of Palaeosciences, Lucknow, 16-18 September 2019

Kulkarni A, Vijayan S, Shigwan BK, Dahanukar N, Padhye S, Datar MN. Do physico-chemical properties of water determine the plant species composition in rock pools? A case study from rock outcrops of Northern Western Ghats. National conference, Aquatic ecosystems: sustainability and conservation, Indian Institute of Science Education and Research, Pune, 20-21 December 2019

Maurya S, Datar MN, Tamhankar S, Choudhary RK. Morphological evolution and biogeography of *Capparis* L. from India. 29th IAAT Annual Conference and National Symposium on Modern Trends in Biosystematics of Angiosperms, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram, 11-13 November 2019

Pardhi S, Kociolek JP, Karthick B. Diatoms from Pliocene to Pleistocene freshwater sediments from Western India. 12th International Symposium on Fossil Algae, Birbal Sahni Institute of Palaeosciences, Lucknow, 16-18 September 2019

Thacker M, Karthick B. 2020. Is everything everywhere? No - not really! Identifying the narrow pockets of endemism using unicellular eukaryotic algae. National Conference, Aquatic ecosystems - Sustainability and Conservation, Indian Institute of Science Education and Research, Pune, 20-21 December 2020

Vigneshwaran A, Karthick B. 2020. Do environmental gradients drive the diatom community? A case study from the Northern Western Ghats. Aquatic ecosystems - Sustainability and Conservation, Indian Institute of Science Education and Research, Pune, 20-21 December 2019

Vigneshwaran A, Karthick B. 2020. East or West? - β (beta) diversity of diatoms across the mountain slopes of the Western Ghats. International Symposium on Biodiversity, Biology and Biotechnology of Algae. Centre for Advanced Studies in Botany, University of Madras, Chennai, 8–10 January 2019 (Vigneshwaran A. Best Poster Presentation Award)

Wadmare N, Karthick B. Natural history collection for microbes: Diatom collection at ARI and its application in biodiversity assessment and environmental monitoring. Aquatic ecosystems - Sustainability and Conservation, Indian Institute of Science Education and Research, Pune, 20-21 December 2019

Bioenergy

Deore K, Lanjekar VB, Dhakephalkar PK, Dagar SS. Cultivable diversity of methanogenic archaea from Indian hot springs. 8th Congress of European Microbiologists – FEMS 27-11, Glasgow, Scotland, July 2019

Kapse NG. Hyper-thermophilic archaea on *Thermococcus litoralis* 101 C5 enhances oil recovery under simulated reservoir conditions at 96 ^{0}C–101 ^{0}C. New Horizons in Biotechnology, Trivandrum, Kerala, 20-24 November 2019. Best Poster Award

Khatri K, Mohite J, Pandit P, Rahalkar MC. Isolation of novel methanotrophs for exploration of its biotechnological potential. 60th Annual Conference of AMI, Central University of Haryana, Haryana, 15–18 November 2019. Best Poster Award

Nagkirti P. Microbial consortium of *Bacillus* sp. and *Isoptericola* sp. for bioremediation of terrestrial oil spills. New Horizons in Biotechnology, Trivandrum, Kerala, 20-24 November 2019

Bioprospecting

Srivastava P, Puranik NV, Misar AV, Mamgain R. Unexplored flavones: Role in anticancer activity. World Congress on Cancer 2020, Mahatma Gandhi Medical College and Hospital, Jaipur, 3-5 February 2020

Developmental Biology

Basargekar A. Investigating the role of Dmon1 in regulating glutamate receptor levels at the Drosophila larval neuromuscular junction. 5th Asia-Pacific *Drosophila* Research Conference, IISER, Pune, 6-10 January 2020

Basargekar A. Investigating the role of Dmon1 in regulating glutamate receptor levels at the Drosophila larval neuromuscular junction. Symposium, Signals from the Gut, 5-6 January 2020 (Poster Award)

Kandroo M. Identification of cis-regulatory elements in folded gastrulation that regulate expression in different glial subsets. 5th Asia-Pacific *Drosophila* Research Conference, IISER, Pune, 6-10 January 2020

Murmu N, Shravage BV. Role of Autophagy in Germline stem cell aging in *Drosophila* ovary. Asia-Pacific Drosophila Research Conference, IISER, Pune, 6-10 January 2020 (Special mention for poster presentation)

Nilangekar K, Shravage BV. Role of Atg5 in Germline Stem cell maintenance in female *Drosophila.* Asia-Pacific Drosophila Research Conference, IISER, Pune, 6-10 January 2020 (Special mention for poster presentation)

Patra C. Ccn2a in zebrafish heart regeneration. 14th International Zebrafish Conference, Suzhou, China, 12-16 June 2019

Ratnaparkhi A. Attended 2nd NGN neuroscience meeting, IISER, Pune, 2-3 January 2020

Ratnaparkhi A. Understanding nervous system development using *Drosophila melanogaster*. India International Science Festival, Kolkata, 5-8 November 2019

Ratnaparkhi A. FGFR/Heartless as a novel regulator of GPCR signaling mediated by folded gastrulation. 5th Asia-Pacific *Drosophila* Research Conference, IISER, Pune, 6-10 January 2020

Ratnaparkhi A. Neuronal regulation of organ maturation: role of DMon1. International Conference on Autophagy and Lysosomes, IISc, Bangalore, 16-18 January 2020

Shravage BV. Is autophagy necessary for nutrient flow during oogenesis. Symposium, Signals from the Gut, NCCS, Pune, 5-6 January 2020

Genetics & Plant Breeding

Navathe S, Yadav PS, Vasishtha NK, Chand R, Mishra VK, Joshi AK, Gupta PK. 2019. A study of ToxA-Tsn1 interaction for spot blotch susceptibility in Indian wheats. 1st International Wheat Congress, Saskatoon, Canada, 21-26 July 2019

Nanobioscience

Kolge H, Kadam K, Ghormade V. Development of specific biopesticide for biocontrol of *Helicoverpa armigera*, chick pea pod borer by RNAi approach: lab to field. India International Science Festival, Kolkata, 7-9 November 2019 (Best Poster Presentation)

Kolge H, Kadam K, Ghormade V. Nanoparticles mediated delivery of dsRNA for effective silencing of acetylcholinesterase and juvenile hormone acid methyl transferase gene in *Helicoverpa armigera*. 8th Indian Chitin and Chitosan Society Meeting, Mumbai, 19-20 September 2019

Kolge H, Patil G, Ghormade V. Can effective antifungal polymeric nanoformulations contribute to reduction in the problem of resistance build up? 8th Indian Chitin and Chitosan Society Meeting, Mumbai, 19-20 September 2019

Rahi S, Ghormade V. Rapid detection of mycotoxin for ensuring food safety. INSPIRE Fellowship Review Meet, Pillai College of Engineering, Navi Mumbai, 1-3 August 2019

Rahi S, Ghormade V. Rapid detection of mycotoxin for ensuring food safety. National Conference, Recent advances in biodiversity, biology and biotechnology of fungi, and 46th Annual Meeting of the Mycological Society of India, Pondicherry University, 7-9 November 2019 (Best Poster Presentation - MJ Thirumalachar Award)

Keynote address, Invited/ Lead Lectures, Teaching, Resource person

Biodiversity & Palaeobiology

Fungi

Rajeshkumar KC

Modern taxonomy of Aspergillaceae. 11th National Level Workshop, Taxonomy, Biodiversity, Ex situ Conservation and Applications of Fungi. ARI, Pune, 20–29 November 2019

Singh PN

Use of biopesticides in agriculture. Production of biopesticides and their applications in agriculture. Design Innovation Centre, SPPU, Pune, 23 August 2019

Lead lecture. Fungal diversity: The past and present status of fungi, taxonomic studies, isolation and conservation. National conference, Current Trends & Future Prospects in Fungal Biotechnology. The Institute of Science, Mumbai, 8-9 February 2019

Isolation, identification and classification of fungi. Workshop, Mycological Techniques. SPD College Thane, Mumbai, 15-16 January 2020

Singh SK

Award lecture. Relevance of a new fungal Family to accommodate important plant pathogennicc genera *Diaporthella* and *Kamalia* under Diaporthales. 7th International conference, Phytopathology in Achieving UN Sustainable Development Goals, ICAR-IARI, New Delhi, 16-20 January 2020

Dr SK Shome Memorial Award Lecture. Studies on pathogenic and non-pathogenic isolates of *Fusarium oxysporum* to know their evolutionary lineages & its significance in Agriculture. National conference, Recent Advances in Biodiversity, Biology & Biotechnology of Fungi, and 46th Annual Meeting of the Mycological Society of India, Pondicherry, 7-9 November 2019

Keynote lecture. Relevance of fundamental approaches in enumerating mycological heritage of India and their future prospects. National conference, Futuristic Approaches in Transformation of Biological Research. Dr NGP Arts and Science College, Coimbatore, 6-7 March 2020

Role of fungi in eco-safety and environmental sustainability. Seminar, Emerging Environmental Challenges and its Sustainable Approaches. Pratibha College of Commerce and Computer Studies, Chinchwad, Pune and SP Pune University, 7-8 February 2020

Plants & diatoms

Choudhary RK

Six lectures. MSc Taxonomy, SPPU, Pune, 17-19 April 2019

Basics of Cladistics; Distance-based methods of tree construction. National workshop, Hands-on training in angiosperm taxonomy, Shivaji University, Kolhapur, 5-6 August 2019

Resource person. Workshop, Molecular Systematics: Concepts, Methods and Applications, Global Mansarovar University, Bhopal, 5-7 September 2019

National consultation meeting, Major Biodiversity Conservation Program, University of Trans-Disciplinary Health Sciences and Technology, Bengaluru, 19-20 December 2019

Trends in Plant Taxonomy. Seminar, Annasaheb Magar Mahavidyalaya, Pune, 31 January 2020

Datar MN

Resource person. Angiosperm phylogeny group classification: Concepts and structure. Workshop, Hands-on training in angiosperm taxonomy, Shivaji University, Kolhapur, 5-9 August 2019

Keynote speaker. Forests of Northern Western Ghats: New insights from the old habitat. National Seminar, Tree Ecology & Urban Forestry Management, St. Xavier's College and National Society of the Friends of the Trees, Mumbai, 13 February 2020

Speaker. History of food: a botanical perspective. Biodiversity day celebrations, Botanical Survey of India, Pune, 22 May 2019

Keynote speaker. Changing paradigms in plant classification. Advances in Botanical Science, Baburaoji Gholap College, Sangvi, 21 December 2019

Attended. Workshop on dissemination of S&T news. DST, New Delhi, 14 January 2020

Plants of the platter: looking through a historical lens. Sevasadan school, Pune, 16 April 2019

History of food plants. Granth Mahotsav, Satara, 3 January 2020

Plants of the platter: looking through a historical lens. Flame University, Pune, 11 January 2020

Plants, plant-eaters and pollinators: Co-evolution tales. Abasaheb Garware College, Pune, 4 February 2020

Exploring plants around us. Modern College, Ganeshkhind, Pune, 18 July 2019

Karthick B

Diatoms across water, land, and air: In search of extremists to infer the environment. INYAS National Frontiers of Science, Jaipur, 6–8 November 2019

Introduction to diatoms and its application in environmental monitoring. Department of Geology, Periyar University, Salem, 3 March 2020

Limnology. Wonders of Water, Certificate Course in Limnology, Department of Zoology, Modern College of Arts, Science and Commerce, Pune, 20 February 2020

Diatoms across land, water and air: In search of glass houses to infer the environment. Indian Institute of Science Education and Research, Pune, 20-21 December 2019

My Experiments with Truth - A Story of another Gandhi from India, and his glass houses. Ashoka Trust for Research in Ecology and Environment (ATREE), Bengaluru, 25 September 2019

Palaeobiology

Kulkarni KG

Resource person. International Earth Science Olympiad Training Camp, MoES, Anna University, Chennai, 29-31 May 2019

Palaeontology: Its division, scope, importance and applications from both research and industries point of view. Induction programme MSc Part I, Department of Geology, Savitribai Phule Pune University, Pune, 23.8.2019

Resolving Palaeontological Mysteries. National Workshop, Sedimentology, paleontology and stratigraphy, St. Xavier's College, Mumbai, 18-20 September 2019

Distinguished speaker. Application of Ichnology for interpreting depositional environments. GEOPIC, KDMIPE, ONGC, Dehra Dun, 15.11.2019

Women Trail-blazers in Geology. International Women's Day celebration, Department of Geology, Savitribai Phule Pune University, Pune, 9.3.2020

Bioenergy

Lanjekar V

Invited talk. Cultivating obligate anaerobic human gut microbiome for exploring their health beneficial potential. Workshop, Microbiome Matters: Data, Diet, and Treatment, Wellness Center, Shillim Institute, Shillim Hilton, Lonavala, Pune, 29 September-1 October 2019

Bioprospecting

Kulkarni P

Lecture. Role of Vitamin B-12 in the regulation of iron status among adolescent girls. Deenanath Mangeshkar Hospital, Pune, 19 February 2020

Srivastava P

Invited talk. Natural Product Chemistry: An important approach with inimitable quality of natural product analogues in Medicinal Chemistry. Training Programme, RC Patel Institute of Pharmaceutical Education and Research, Shirpur, 6 December 2019

Developmental Biology

Daware MB

Resource person. Workshop, Concepts in Developmental Biology, Developmental Biology Group, 27-31 May 2020

Ghaskadbi S

Nine lectures. Developmental Biology. MSc Zoology, Guwahati University, Guwahati, 2-8 May 2019

Five lectures. Developmental Biology. MSc Zoology, Dharwad University, Karnataka, 12-14 November 2019

Two lectures and hands-on demonstration. Workshop, Developmental Biology; Hands-on training, Hydra Biology. St. Xavier's College, Mumbai, 14-15 January 2020

Talk. Hydra: Genes, Signals and Stem Cells. Trends in Biochemistry: The turn of decade. Department of Biochemistry, MS University of Baroda, Baroda, 24-25 January 2020

Londhe RJ

Hydra cultivation and regeneration. Lecture and demonstration, BSc Biotechnology, Sinhgad College of Science, Ambegaon, Pune, 18 January 2020; BSc Biotechnology, Nowrosjee Wadia College, Pune, 11 February 2020

Resource person. Workshop, Concepts in Developmental Biology, Developmental Biology Group, 27-31 May 2020

Resource person. Workshop, Developmental Biology; Hands-on training, Hydra Biology, St. Xavier's College, Mumbai, 14-15 January 2020

Patra C

ILS Bhubaneswar, 3 June 2019

NISER Bhubaneswar, 5 June 2019

Modern College of Arts, Science and Commerce, Shivajinagar, Pune, 1,16 July 2019; December 2019

NMIMS Deemed to be University, Mumbai, August 2019

9th International Conference of LASA India, Laboratory animals in biomedical research - The way forward, IISER, Pune, November 2019

Modern College of Arts, Science and Commerce, Shivajinagar, Pune

Ratnaparkhi A

Talk. Speak your Science, NCCS, Pune, 26 July 2019

Regulation of inter-organ signaling: Insights from Dmon1. TIFR, Hyderabad, 29 August 2019 and CDFD, Hyderabad, 30 August 2019

Fog signaling in glial organization and morphogenesis. XL111 All India Cell Biology Conference, IISER, Mohali, 19-21 December 2019

Platform presentation. Neuronal regulation of organ maturation: role of DMon1. Symposium, Signals from the gut, NCCS, Pune, 5th-6th January 2020

Regulation of inter-organ signaling: Insights from Dmon1. 5th Asia-Pacific *Drosophila* Research Conference, IISER, Pune, 6-10 January 2020

Shravage B

Talk. ReDiscover Germany: Focus on Research, DAAD, Pune, 22 August 2019

Investigations of the role of autophagy in stem cell maintenance and aging. NBRC, Manesar, 10th RLS conclave, Gurugram, 29 April 2019

Genetics & Plant Breeding

Oak M

Wheat: The grain that provides our daily bread. Botanical Survey of India, Western Regional Centre, Pune, 22 May 2019

Patil R

Modern techniques in plant breeding. National seminar, Advances in Botanical Sciences, BG College, Pune, 21 December 2019

Advances in molecular breeding: Enhancing genetic diversity in wheat for better crop establishment. National seminar, Emerging and innovative trends in life sciences, ES Divekar College, Pune, 18 February 2020

Tamhankar S

Molecular markers: An overview and applications in crop improvement. National Conference, BIOFACETS Exploring Realms of Biological Sciences, Sir Sitaram and Lady Shantabai Patkar College of Arts and Science, Mumbai, 1 February 2020

Nanobioscience

Bodas DS

International conference, Emerging technology: Micro To Nano, SPPU, Pune, 4 December 2019

Ghormade V

Nanotechnologies in detection and treatment of human pathogenic fungus. Amity University, Delhi, 22 April 2019

Development of chitosan based hydrogels for rapid hemostasis. 8th Indian Chitin and Chitosan Society Meeting, ICT, Mumbai, 19 September 2019

Emerging stride in life sciences. Nanotechnology for human healthcare: detection of fungal disease biomarkers and harmful toxins. UGC-SAP Seminar, School of Life Sciences, KBC North Maharashtra University, 14 February 2020

Introduction to nanotechnology and nanobiosensors for plant protection; Nanoparticles as carriers for micronutrient delivery and nanoparticle risk assessment. Workshop, Effective use of Nanomaterials and Nanotechnology for Sustainable Agriculture, PES's RSN College of Arts and Science, 28-29 February 2020

Rajwade JM

Biomedical applications of bacterial cellulose. Winter training workshop, Modern College of Arts, Science and Commerce, Pune, 7-31 January 2020

Visits Abroad

Jaybhay SA. Workshop, Building climate resilience in agriculture. National Productivity Organization, Dhaka, Bangladesh and Asian Productivity Organization, Tokyo, Japan. Dhaka, Bangladesh, 5-9 May 2019

Kaushik T. 11th Indian expedition to the Southern Ocean/ Antarctic Ocean, National Centre for Polar and Ocean Research, MoES-ESSO, Goa, 6 January-11 March 2020

Navathe S. 11th annual training course, Standardization of stem rust note taking and evaluation of germplasm with emphasis on emerging threats of yellow rust and leaf rust. Kenya Agriculture and Livestock Research Organization, Njoro, Kenya, 5-13 October 2019

Patra C. 14th International Zebrafish Conference (IZFC), Suzhou, China, 12-16 June 2019

Honours

Biodiversity & Palaeobiology

Fungi

Singh SK

Conferred with Fellowship, Indian Phytopathological Society. ICAR-Indian Agricultural Research Institute, New Delhi, 16-20 January 2020

Conferred with Dr Shome Memorial Award. Mycological Society of India (MSI), Pondicherry, 7-9 November 2019

Plants & diatoms

Datar MN

Nominated as a member of International Union of Conservation of Nature's (IUCN) Western Ghats Plant Specialist Group

Developmental Biology

Patra C

WellcomeTrust-DBT Intermediate Fellowship, October 2019-October 2024

Japan Society for the Promotion of Science (JSPS) Invitational Fellowships for research in Japan

PhD degree award

Student, Subject	Thesis	Guide, Co-Guide
Chikte R Biotechnology	Development of nanomaterial based formulation for control of bacterial blight disease of pomegranate	Rajwade JM Paknikar KM
Dias L Botany	Studies on selected Indian medicinal plants used in oral care for prevention of teeth caries	Upadhye AS
Galande A Biotechnology	Analysis of the homologues of nucleotide excision repair in hydra	Ghaskadbi SM
Ghatpande N Chemistry	Development of nutraceuticals for the treatment of inflammation associated anemia	Kulkarni PP
Puranik N Chemistry	Synthesis and bio-evaluation of naturally occurring chromones and their analogues	Srivastava P
Rawal K Microbiology	Studies in immunodiagnosis of invasive aspergillosis	Paknikar KM, Ghormade V
Singh N Microbiology	Studies on transcriptome profiling of biofilm bacteria treated with silver and copper nanoparticles	Rajwade JM, Paknikar KM

Supervision of PhD students

(Guide, Co-Guide, Student, Thesis)

Biodiversity & Palaeobiology

Plants & diatoms

Choudhary RK, Tamhankar SA

Darshetkar A. Molecular phylogeny of the genus *Eriocaulon* L. from Western Ghats of India

Choudhary RK

Maurya S. Biogeography, diversification and molecular phylogenetics of genus *Capparis* L. in the Indian subcontinent

Vigneshwaran A. Diatom diversity across the streams and rivers of the Western Ghats and its application in water quality monitoring

Datar MN

Kulkarni A. Plant life between inundation and desiccation: a study on rock outcrops of Northern Western Ghats, India

Shigwan B. Forests of Northern Western Ghats: diversity, composition and effects of disturbance on tree vegetation

Vijayan S. Study of cliff dwelling vascular chasmophytes from Northern Western Ghats with special emphasis on desiccation tolerant species

Karthick B

Cheran R. Aerophilic diatoms of Eastern Himalayas: diversity and distribution across environmental gradients

Thacker M. Diatoms as indicators of environmental and climatic changes in the *Myristica* swamps of the Western Ghats

Wadmare N. Systematics and biogeography of the genus *Stauroneis* Ehrenberg (Bacillariophyceae) from the Indian Subcontinent

Palaeobiology

Kulkarni KG

Salunkhe SN. Ichnological studies of the late Oxfordian-Kimmeridgian Baisakhi Formation, Jaisalmer Basin, Rajasthan, India

Soman AC. Studies in Paleogene bivalvia from Kachchh with special reference to palaeozoogeographic considerations (Co-guide)

Bioenergy

Dagar SS

Deore K. Thermophilic methanogenic archaea from hot springs and oil reservoirs, and their application

Gaikwad S. Bacteriophages for inhibition of sulfate reducing bacteria associated with oil reservoir souring

Hivarkar S. Investigating diversity of thermophilic anaerobic bacteria from hot spring environments for utilization of agricultural biomass

Pore S. Biomethanation of rice straw at elevated temperature: Assessment of microbial community dynamics (Co-Guide)

Dhakephalkar PK

Kapse N. Influence of microbial metabolism and reservoir properties on enhanced oil recovery: Insights from simulated laboratory studies

Maheshwari S. Metagenome and metatranscriptome analysis to gain insights into biomethanation of rice straw

Nagkirti PD. A microbial process for decontamination of saturated and aromatic hydrocarbons associated with terrestrial oil spills

Dhakephalkar PK, Dagar SS

Pore SD. Biomethanation of rice straw at elevated temperature: Assessment of microbial community dynamics

Rahalkar MC

Khatri K. Conversion of methane to biodiesel using methanotrophs

Mohite J. Utilizing the potential of methane-oxidizing bacteria for methane mitigation and valorization

Pandit P. Exploration of taxonomic and functional diversity of methanotrophs associated with lowland paddy fields

Bioprospecting

Kulkarni PP

Suryavanshi K. Understanding the role of metal ions in neurodegeneration and inflammation in Alzheimer's disease

Varma M. Thiosemicarbazone derivatives as modulators of Aβ induced oxidative stress and toxicity in Alzheimer's disease

Developmental Biology

Ghaskadbi SM and Patwardhan VG

Turwankar A. Role of VEGF and FGF signaling in regeneration and pattern formation in hydra

Patra C

Daware M. Periostin in zebrafish development (Co-Guide)

Joshi B. Role of '*celsr1*' in morphogenesis using zebrafish as a model organism

Rayrikar A. Exploration the role of connective tissue growth factor a in zebrafish development

Ratnaparkhi A

Basargekar A. Investigation of the role of DMon1 in Drosophila nervous system

Shravage BV

Murmu N. Determine the role of autophagy in germline stem cell aging in *Drosophila*

Nilangekar K. Determine the role of autophagy in germline stem cell niche in *Drosophila*

Genetics & Plant Breeding

Oak MD

Kawade SS. Gluten protein dynamics and wheat end use quality

Methe PS. Development of wheat genotype with good biscuit making properties using marker assisted selection and mutation breeding

Patil RM

Mundhe S. Agronomic, physiological and transcriptomic response of soybean to drought stress at reproductive stage

Venkatesan S. EMS-induced mutations for wheat improvement and their detection by TILLING

Vikhe P. Genetic studies on gibberellin-responsive dwarfing loci Rht14 and Rht18 and their deployment in wheat improvement

Tamhankar SA

Chavan AM. Study of the diverse semi-dwarfing genes in durum wheat

Tetali SP

Bagwan JH. Elucidation of physiological mechanisms contributing to resilience of wheat under restricted moisture

Nanobioscience

Bodas DS

Pandey S. Synthesis of multicolour quantum efficient fluorescent nanocrystals using microreactor for the application in bioimaging

Gajbhiye V

Pramod Kumar. Nanoparticles mediated co-delivery of drug and siRNA for treatment of drug resistant cancer

Salwe Rajesh. Targeted co-delivery of siRNA for effective therapeutic outcome against metastatic ovarian cancer

Tambe P. Nanocarrier mediated siRNA delivery for targeting HLRH overexpressing cancer cells

Ghormade V

Kolge H. Silencing of lipase and juvenile hormone methyl transferase genes in *Helicoverpa armigera* via dsRNA nanoparticles

Patil G. Development of chitosan based hydrogel for rapid hemostasis

Rahi S. Rapid detection of mycotoxins for ensuring food safety

Jadhav SH

Kulkarni N. Studies on surface functionalized Lanthanum Strontium Manganese Oxide nanoparticles mediated hyperthermia for the treatment of breast cancer

Jha A

Khairnar B. Designing and synthesis of novel therapeutic beta sheet breaker peptides for Alzheimer's disease

Karpe YA

Kanade G. Role of non-coding regions in the Hepatitis E virus RNA genome

Patil R. Roles of microRNAs in Hepatitis E virus replication

Pingale K. Interaction of Hepatitis E virus RNA dependant RNA polymerase with host cell proteins

Salunke P. Exploring non-pathogenic protozoa as a eukaryotic platform for protein expression

Paknikar KM

Jamalpure S. Development of multiplexed, point of care (POC) diagnostics for detection of viral pathogens affecting shrimp and prawns

Madiwal V. Nanoscale surface modification of dental material for preventing implant related failures

Rajwade JM

Choudhary S. Increasing seedling vigor in oil-seeds via nano-priming

Padhye A. Evaluation of zinc oxide nanoparticles in delaying the development of diabetic nephropathy

Organization of Seminar/ Coursework/ Hands-on Training

Biodiversity & Palaeobiology

Plant & Diatoms

Micro to Macro: exploring plant life around us. Eleven participants from different parts of the country participated in the course. 27-31 May 2019

Hyphenated HPTLC. 20 December 2019

Fungi

Capacity Building National Workshop/ Summer Course organized

10th Workshop, Summer course. Taxonomy, Biodiversity, Ex situ Conservation and Applications of Fungi, ARI, Pune, 3-7 June 2019; 11th Workshop. Taxonomy, Biodiversity, Ex situ Conservation and Applications of Fungi, ARI, Pune, 20-29 November 2019

Capacity building training to Forest Officials

Fungal biodiversity and conservation of fungi. Five forest officials of the Government of Nepal were trained. The training was sponsored by the Food and Agriculture Organization. 20 November-2 December 2019

Palaeobiology

Workshop. Palaeontology: A window to ancient environment and life, Biodiversity and Palaeobiology Group, ARI, Pune, 10-14 June 2019

Genetics & Plant Breeding

Training course. Marker-assisted breeding in crops. Genetics and Plant Breeding Group, 1-5 July 2019

राजभाषा

विज्ञान एवं प्रौद्योगिकी विभाग के राजभाषा अनुभाग व्दारा समय–समय पर जारी विभिन्न आदेशों, निर्देशों का अनुपालन सुनिश्चित करने के लिए निरंतर प्रयास किए जाते है। राजभाषा संबंधित कार्यों के संपादन एवं राजभाषा विभाग से प्राप्त निर्देशों का सुचारु रुप से अनुपालन करने हेतु संस्थान में राजभाषा कार्यान्वयन समिति और राजभाषा अनुपालन समिति गठित की है। राजभाषा समिति की त्रैमासिक बैठकें नियमित रुप से आयोजित होती है। राजभाषा संबंधित निर्देशों से सभी कर्मचारियों को अवगत किया जाता है। संस्थान का नाम द्विभाषी में लिखा है। हिन्दी शब्दों से परिचित करवाने हेतू हररोज एक हिन्दी शब्द और उसका अंग्रेजी समशब्द लिखा जाता है। हर वर्ष वार्षिक प्रतिवेदन द्विभाषी में प्रकाशित किया जाता है। संस्थान की वेबसाइट द्विभाषी में है। सभी कम्प्यूटरों पर सारांष हिन्दी सॉफ्टवेअर का उपयोग किया जाता है। राजभाषा अधिनियम 1963 की धारा 3(3) के तहत परिपत्र, सामान्य आदेश, ज्ञापन, संकल्प, अधिसूचनाएं, नियम, करार, संविदा, टेंडर नोटिस, संसदीय प्रश्न आदि हिन्दीमें भेजे जाते है। संस्थान से भेजे जानेवाले पत्रों के उत्तर हिन्दी में दिए जाने पर विशेष प्रयास किया जा रहा है। हिन्दी शिक्षण योजना के अंतर्गत जनवरी–मई 2020 सत्र के लिए 17 कर्मचारियों को नामित किया गया। संस्थानको प्राप्त तथा संस्थानसे बाहर भेजे जानेवाले सभी पत्रोंकी प्रविष्टियाँ हिन्दी में की जाती है। क, ख, ग क्षेत्रों को भेजे जानेवाले पत्र तथा इन क्षेत्रों से प्राप्त हुए पत्रों की कुल संख्या जानने हेतु मोहर बनाई गयी है। सभी साइनबोर्ड, नाम–पट्टों तथा रबर की मोहोरें द्विभाषी में है। वैज्ञानिक, कर्मचारी अपनी टिप्पणियाँ हिन्दी में लिखते है। उपस्थिति रजिस्टर पर हिन्दी में हस्ताक्षर किए जाते है। सभी आवदेन पत्र हिन्दी में लिखे जाते है। मिसिलों पर संख्या और नाम हिन्दी में लिखे जाते है। सेवा–पंजी पुस्तिका में अर्जित अवकाश, चिकित्सा अवकाश, शिशु देखभाल अवकाश, वेतनवृध्दी, यात्रा अवकाश की प्रविष्टियाँ हिन्दी में की जाती है। प्रदर्शनी में हिन्दी का उपयोग अधिकाधिक किया जाता है। संस्थान में हिन्दी दिवस, हिन्दी पखवाडे का आयोजन किया गया। विभिन्न प्रकार की हिन्दी प्रतियोगिता का आयोजन किया गया और सफल प्रतिभागियों को नकद पुरस्कार और प्रमाण पत्र दिए गए। एक दिवसीय संयुक्त वैज्ञानिक संगोष्ठी का आयोजन किया गया।

हिन्दी पखवाड़ा

11–25 सितंबर 2019 दौरान हिंदी पखवाड़ा मनाया गया। 'एकता की जान है, हिन्दी देश की शान है', इस विचार को ध्यान में रख कर हिन्दी दिवस और हिन्दी पखवाड़े का आयोजन किया गया। संस्थान के वैज्ञानिकों, कर्मचारियों एवं समस्त शोध छात्रों ने इस में सहभाग दिया। व्याख्यान, शोधकार्यों का हिंदी में प्रस्तुतीकरण, निबंध प्रतियोगिता, वाद–विवाद, विचारोंकी अभिव्यक्ति, स्वरचित कविता पाठ, चुटकुले एवं हिंदी गानों पर अनेक कार्यक्रम आयोजित किए गए।

18 सितंबर 2019 को हिंदी शिक्षण योजना, पुणे के श्री. राजेन्द्र प्रसाद वर्मा, सहायक निदेशक को व्याख्यान आयोजित किया गया। सरकारी कामकाज में कंप्यूटर एवं मोबाइल की भूमिका तथा मोबाइल में डिक्टेशन, अनुवाद एवं टाइपिंग संबंधी जानकारी इस विषय पर श्री. राजेन्द्र प्रसाद वर्मा ने कंप्यूटर और मोबाईल पर उपलब्ध सुविधाओं से श्रोताओं को परिचित किया।

20 सितंबर 2019 को शोधकार्यो का हिन्दी में मौखिक प्रस्तुतीकरण हुआ। इस में पंद्रह छात्रों ने सहभाग दिया। प्रथम, व्दितीय और तृतीय विजेताओं को नकद पुरस्कार दिया गया। नैनोजीव विज्ञान समूह की डॉ. माधुरी पवार को प्रथम पुरस्कार, तथा जैवविविधता (वनस्पति एवं डायटोम्स) से अबोली कुलकर्णी को व्दितीय और जैवविविधता (कवक) से अजय लगशेट्टी को तृतीय पुरस्कार दिया गया। अन्य चार प्रतिभागियों को नकद प्रोत्साहन पुरस्कार दिये गये। वाद–विवाद प्रतियोगिता में भारत में बुनियादी बनाम अत्याधुनिक परिवहन व्यवस्था विषय पर प्रतिभागियोंने अपने विचार प्रस्तुत किए। प्रथम पुरस्कार आनुवंशिकी एवं पादप प्रजनन के प्रवीणकुमार मेथे, व्दितीय पुरस्कार जैवपूर्वेक्षण के डॉ. ऋतु ममगाई और तृतीय पुरस्कार जैवऊर्जा के ज्योति मोहिते को मिला। सभी विजेताओं को नकद पुरस्कार दिया गया। दोनों प्रतियोगिता के निर्णायक हेतु केंद्रीय जल एवं ऊर्जा अनुसंधान केंद्र, पुणे के सेवानिवृत्त वैज्ञानिक डॉ. कृष्ण कुमार गुप्ता को आमंत्रित किया गया। संस्थान के प्रशासनिक अधिकारी एवं हिंदी अनुपालन समिति सदस्य अब्दुल रहमान जी के हाथों निर्णायक डॉ. कृष्ण कुमार गुप्ता को सम्मानित किया गया। इसी दिन वाद–विवाद, काव्य वाचन, हिंदी फिल्मी गाने, हास्य–व्यंग, और चुटकुलों पर भी कार्यक्रम हुआ।

मूलभूत विज्ञान बनाम उपयोगी विज्ञान इस विषय पर निबंध प्रतियोगिता का आयोजन हुआ। इसमें बीस प्रतिभागियों ने हिस्सा लिया। निर्णायक के रूप में भारतीय फिल्म और टेलीविजन संस्थान, पुणे से हिंदी अधिकारी डॉ. अर्चना गौतम ने योगदान दिया।

आनुवंशिकी एवं पादप प्रजनन के कोमल तिकोने प्रथम, जैव विविधता (कवक) समूह से अजय लगशेट्टी व्दितीय और डॉ. पी जी गमरे को तृतीय पुरस्कार दिया गया। दो प्रोत्साहन पुरस्कार भी दिये गये।

हिंदी शिक्षण योजना, पुणे सहायक निदेशक के श्री. राकेश कुमार को हिंदी दिवस व्याख्यान और पुरस्कार वितरण के लिए आमंत्रित किया गया। श्री. राकेश कुमार ने राजभाषा नीति एवं हिंदी के कार्यालयीन प्रयोग में आनेवाली कठिनाइयां एवं उनका समाधान इस विषय पर व्याख्यान दिया। प्रतियोगिताओं के विजेताओं को डॉ.राकेश कुमार के हाथों पुरस्कार राशि, प्रमाण–पत्र, पेन ड्राइव और कप प्रदान किये गये।

सभी कार्यक्रम का सूत्र संचलन प्रशासन विभाग की श्रीमती मंजूषा तिवारी ने किया।

संयुक्त राजभाषा वैज्ञानिक संगोष्ठी

दिनांक 4 मार्च 2020 को पुणे स्थित राष्ट्रीय कोशिका विज्ञान केंद्र (एनसीसीएस), सीएसआईआर–राष्ट्रीय रासायनिक प्रयोगशाला (एनसीएल) तथा आघारकर अनुसंधान संस्थान (एआरआई) द्वारा संयुक्त राजभाषा वैज्ञानिक संगोष्ठी का आयोजन एनसीसीएस में किया गया।

राजभाषा का विज्ञान के क्षेत्र में प्रचार प्रसार करने एवं उपयोग बढ़ाने की दृष्टि से इस संगोष्ठी को आयोजित किया गया। उद्घाटन समारोह के मुख्य अतिथि के रूप में जानेमाने शिक्षाविद, मनोवैज्ञानिक, समाजशास्त्री, लेखक एवं संपादक तथा महात्मा गांधी अंतर्राष्ट्रीय हिंदी विश्वविद्यालय के पूर्व–कुलपति प्रो. गिरीश्वर मिश्र उपस्थित थे इस सम्मेलन में सम्पूर्ण भारत के केन्द्रीय संस्थानों से वैज्ञानिक, शोध छात्र तथा प्रशासनिक प्रमुख और हिन्दी अधिकारी उपस्थित थे।

इस संगोष्ठी में तीन तकनीकी सत्रों में वैज्ञानिकों तथा शोध छात्रों द्वारा बीस शोधपत्र हिन्दी भाषा में प्रस्तुत किए गए। संपूर्ण भारत से कुल 125 प्रतिभागियों ने हिस्सा लिया। सारांश पुस्तिका में कुल 43 शोधपत्र प्रकाशित किए गये।

राजभाषा कार्यान्वयन समिति

डॉ. संजय सिंह, वैज्ञानिक ई, जैव विविधता (कवक), अध्यक्ष

डॉ. अनुराधा रत्नपारखी, वैज्ञानिक ई, विकासात्मक जीवविज्ञान, सदस्य

डॉ. मनोज ओक, वैज्ञानिक डी, आनुवंशिकी एवं पादप प्रजनन विज्ञान, सदस्य

डॉ. रितेशकुमार चौधरी, वैज्ञानिक डी, जैव विविधता (वनस्पति), सदस्य

डॉ. विरेन्द्र गजभिये, वैज्ञानिक डी, नैनोजीव विज्ञान, सदस्य

डॉ. अभिषेक बाघेला, वैज्ञानिक डी, जैव विविधता एवं पुराजैविकी (कवक), सदस्य

डॉ. सुमित डागर, वैज्ञानिक डी, जैवऊर्जा, सदस्य

डॉ. प्रतिभा श्रीवास्तव, वैज्ञानिक सी, जैवपूर्वेक्षण, सदस्य

डॉ. तुषार कौशिक, वैज्ञानिक सी, जैव विविधता (पुराजैविकी), सदस्य

श्री. प्र.व. गोसावी, क्रय और भंडार अधिकारी, सदस्य

श्री. अ. रहमान, प्रशासनिक अधिकारी, सदस्य

डॉ. गुरुदत्त वाघ, तकनीकी अधिकारी डी, निदेशक कार्यालय, सदस्य

श्री. अ. व. चौधरी, तकनीकी अधिकारी डी, साधनविनियोग, सदस्य

श्री. आर.पी. जानराव, सहायक लायब्ररी एवं सुचना अधिकारी, सदस्य

श्रीमति. मंजूषा तिवारी, अधिकारी ए, प्रशासन, सदस्य

राजभाषा अनुपालन समिति

डॉ. संजय सिंह, वैज्ञानिक एफ, जैव विविधता (कवक), अध्यक्ष

श्री. अ. रहमान, प्रशासनिक अधिकारी, सदस्य

डॉ. गुरुदत्त वाघ, तकनीकी अधिकारी डी, निदेशक कार्यालय, सदस्य

डॉ. रितेशकुमार चौधरी, वैज्ञानिक डी, जैव विविधता (वनस्पति), सदस्य

डॉ. सुमित डागर, वैज्ञानिक डी, जैवऊर्जा, सदस्य

डॉ. प्रतिभा श्रीवास्तव, वैज्ञानिक सी, जैवपूर्वेक्षण, सदस्य

श्रीमति. मंजूषा तिवारी, अधिकारी ए, प्रशासन, सदस्य

Events

ARI-SPPU Memorandum of Understanding,

18 April 2019

Prof. Nitin Karmalkar, Vice-Chancellor, SPPU and Dr Prashant Dhakephalkar, Officiating Director, ARI signed the MoU to recognize mutual interests in the fields of research, development, education, training, transfer of technology and dissemination of knowledge on a long term non-commercial basis

National Technology Day lecture,

15 May 2019

Research publications vis-a-vis patent filing

Mr Rohit Deshpande
Director, Inventillect Consultancy Services Pvt. Ltd.

International Yoga Day,

21 June 2019

Yoga session and Lecture: Revisit to Yoga School

Prof. (Dr) K Satya Lakshmi
Director, National Institute of Naturopathy (NIN), Ministry of AYUSH, Government of India

Public Outreach Day,

18 October 2019

Chief Guest Mr Mukund Deshpande, Life-Member, Vijnana Bharati

More than 300 school children participated

Dr. Binita Phartiyal, Scientist, Birbal Sahni Institute of Palaeosciences, Lucknow

Shri Shriniwas Indapurkar, Mrs. Mangaltai Navsupe, Smt. Chaitrali Chandorkar and Shri Abhijit Ghorpade were felicitated.

Vigilance Awareness Week,

28 October - 2nd November 2019

Lecture: Integrity - A way of life, 1 November 2019

Mrs. Swapna Gore, IPS, Deputy Commissioner of Police, Pune City

5th India International Science Festival, Kolkata,

5-8 November 2019

Five young scientists Dr Tushar Kaushik, Shri Pranav Kshirsagar, Dr Sachin Jadhav, Dr Bhupendra Shravage and Dr Dhananjay Bodas participated in the Young Scientists' Conference. Two women scientists Dr Vandana Ghormade and Dr Anuradha Ratnaparkhi participated in the Women Scientists and Entrepreneurs Conclave.

Shri. GB Joshi Memorial Oration,

17 November 2019

Pesticide residue in fruits, a serious problem and strategies for production of 'zero residue' grapes - a success story

Dr Sanjay D Sawant, Vice-Chancellor
Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri

59th Prof. SP Agharkar Memorial Oration,

18 November 2019

Innovation ecosystem in India: Challenges and Opportunities

Dr Vijay M Chauthaiwale, In-Charge, Foreign Affairs Department & Member, National Executive, Bharatiya Janata Party

Dr GB Deodikar Memorial Oration,

18 November 2019

Wheat research in India: From shortage to surplus

Dr Gyanendra P Singh, Director
ICAR-Indian Institute of Wheat and Barley Research (IIWBR), Karnal

Shri. VP Gokhale Prize

Dr MS Saharan, Principal Scientist, Division of Plant Pathology, IARI, New Delhi

Dr RB Ekbote Prize

Dr Jai Prakash Jaiswal, Professor, GB Pant University of Agriculture & Technology, Pantnagar

Dr PP Kanekar Prize

Dr SS Dagar, Scientist, Bioenergy, ARI

Pune Science Film Festival

21-23 February 2020

Fossils were exhibited. National Film Archive of India, Pune

National Science Day

28–29 February 2020

Exhibition and launch of ARI Vidnyan Vardhini YouTube channel, ARI, 28.2.2020

Exhibition, GMRT, Khodad, Narayangaon, 28–29 February 2020

Agriculture students at the wheat experimental farm

Certificate course in Home Gardening. June 2019-January 2020

Institutional Research Projects

Sl no.	Project Code	Project title	Investigator(s)	Associated staff & students
Biodiversity & Palaeobiology				
Plants & Diatoms				
1	BOT-15	Digitizing Herbarium- AHMA	Datar MN	Joshi VN Karbelkar T
2	BOT-17	Repository of crude drugs, authentication service and development of HPTLC profile library of PRS (Phytochemical Reference Standard)	Choudhary RK Kulkarni PP	Kadu M Gaikwad NS
3	BD-1	Unraveling the vascular plant endemism of Northern region of Western Ghats	Datar MN	Shigwan B
4	BD-7	Diatom Herbarium and Culture Collection	Karthick B	Wadmare N
Fungi				
1	MYC-02	National Facility – repositories and service (NFCCI, AMH, Identification service)	Singh SK Singh PN Rajeshkumar KC Bahgela A	Maurya D Lad S
Lichens				
1	BD-06	Study of neuro-protective potential via antioxidant action and active constituents determination of parmelioid lichens from Western Himalayan Region	Behera BC	Sharma B Gaikwad S Mapari S
2	BD-08	Reappraisal of taxonomy of parmelioid lichens using morphological, molecular tools & phylogenetic analysis	Sharma B Rajesh Kumar KC	Gaikwad S Shahnoor F
Palaeobiology				
1	BD-03	Modernization of fossil repository	Kaushik T Kulkarni KG	Salve V Rana H
2	BD-04	Studying the diversity and taxonomy of modern foraminifera from coastal Maharashtra using morphological and molecular tools	Kaushik T	Thirumalai M
Developmental Biology				
1	ZOO-18	Identification and functional analysis of novel regulators during heart development and regeneration	Patra C	Mangade A
Genetics & Plant Breeding				
1	GEN-17	Mitigating the drought stress through agronomical, physiological and molecular breeding tools in soybean	Jaybhay SA Patil RM Varghese P	

Sponsored Research Projects

Sr. No.	Project Code	Project Title	Sponsor	Investigators
1	ARI/SP/001	All India Co-ordinated Research Project on Soybean (1.4.1968 onwards)	ICAR, New Delhi	Dr P Varghese
2	ARI/SP/002	All India Co-ordinated Fruit Improvement Project (1.10.1970 onwards)	ICAR, New Delhi	Dr S Tetali
3	ARI/SP/003	All India Co-ordinated Wheat Improvement Project (1.4.1972 onwards)	ICAR, New Delhi	Dr Yashavantha Kumar KJ
4	ARI/SP/033	Production of Soybean Breeder Seeds of Annual Oil Seed Crops (2.2.1988 onwards)	ICAR, New Delhi	Dr P Varghese
5	ARI/SP/034	Front-line Demonstrations of Annual Oil Seed Soybean (21.2.1989 onwards)	ICAR, New Delhi	Dr P Varghese
6	ARI/SP/043	Front-line Demonstrations in Wheat (1.4.1993 onwards)	ICAR, New Delhi	Dr VS Baviskar
7	ARI/SP/096	Wheat Breeder Seed Scheme (1995 Onwards)	ICAR, New Delhi	Dr Yashavantha Kumar KJ
8	ARI/SP/228	Cell-penetrating peptides as drug delivery agents for cancer & Alzheimer DST-INSPIRE Faculty Award (16.5.2014-15.5.2019) Extended up to 15.5.2020	DST, New Delhi	Dr A Jha
9	ARI/SP/229	Engineered nanocancer mediated targeted co-delivery of siRNA & anti-cancer drugs for effective gene silencing & tumor therapy DST-INSPIRE Faculty Award (1.7.2014-30.6.2019)	DST, New Delhi	Dr V Gajbhiye
10	ARI/SP/231	Development of crude drug repository of genuine samples from Maharashtra (16.8.2014-15.8.2019) Extended up to 31.3.2020	RGSTC, Mumbai	Dr MN Datar
11	ARI/SP/238	Improvement of end use quality of 1BL/1RS translocation containing wheat varieties by removing of Sec-1 loci and Glu-B3 using marker assisted back cross breeding (MABB) (26.3.2015-25.3.2020)	DBT, New Delhi	Dr M Oak
12	ARI/SP/239	Identification and analysis of extracellular matrix components important for heart development using zebrafish as model organism (12.3.2015-11.3.2020) Extended up to 30.6.2020	Max Planck	Dr C Patra
13	ARI/SP/239 A	Identification and analysis of extracellular matrix components important for heart development using zebrafish as model organism (9.2.2016-8.2.2019) Extended up to 18.7.2019	DST, New Delhi	Dr C Patra
14	ARI/SP/250	Marker assisted elimination of off-flavour generating lipoxygenase-2 gene from kunitz trypsin inhibitor free soybean genotypes (4.12.2015-3.12.2020)	DBT, New Delhi	Dr P Varghese

Sr. No.	Project Code	Project Title	Sponsor	Investigators
15	ARI/SP/251	Identification of enhancers regulating expression in glial subsets in Drosophila (15.2.2016-14.2.2019) Extended up to 14.6.2019	SERB, New Delhi	Dr A Ratnaparkhi
16	ARI/SP/256	Investigate the role of autophagy in stem cell maintenance and aging (25.5.2016-24.5.2021)	DBT, New Delhi	Dr BV Shravage
17		Role of BMP signaling inhibitors noggin and gremlin in pattern formation in hydra (2.5.2016-1.5.2019) Extended up to 30.09.2020	CSIR, New Delhi	Dr SM Ghaskadbi
18	ARI/SP/257	Active micromixer mediated controlled synthesis of polymeric nanoparticles, in situ drug loading and their effect on fungal cells (30.9.2016-29.9.2019)	SERB, New Delhi	Dr D Bodas
19	ARI/SP/258	Biomethanation under simulated Mars environment implies early life on planet Mars (1.9.2016-30.8.2019)	ISRO, Bangalore	Dr PK Dhakephalkar
20	ARI/SP/259	Deciphering the role of adhesion G protein-coupled receptors during heart developing using zebrafish as a model organism (22.9.2016-21.9.2019)	SERB, New Delhi	Dr C Patra
21	ARI/SP/260	Determine the role of autophagy in germline stem cell aging in Drosophila (21.9.2016-20.9.2019)	SERB, New Delhi	Dr BV Shravage
22	ARI/SP/261	Delivery of miRNA-nanoparicle complex to promote cardiac repair and regeneration after myocardial injury (26.12.2016-25.12.2019) Extended up to 31.3.2020	DST, New Delhi	Dr V Gajbhiye
23	ARI/SP/262	Understanding the morphological evolution and ecological diversification of the forest dwelling Capers in Indian subcontinent using molecular phylogenetic tools (18.10.2016-17.10.2019) Extended up to 17.1.2020	SERB, New Delhi	Dr RK Choudhary, Dr SA Tamhankar, Dr MN Datar
24	ARI/SP/263	Candidate Chikungunya virus vaccine: Nanoparticle mediated delivery of recombinant antigen presenting cells (18.3.2017-17.3.2020)	DST, New Delhi	Dr Y Karpe
25	ARI/SP/264	Development of TILLING resource in Indian durum wheat Bijaga Yellow for forward-and reverse-genetics analysis (17.3.2017-16.3.2020) Extended up to 16.7.2020	SERB, New Delhi	Dr RM Patil
26	ARI/SP/265	Muraina-grasses of India: addressing the polymorphism and interspecific variations through morphological, ecological and molecular phylogenetic studies (23.3.2017-22.3.2020) Extended up to 22.6.2020	SERB, New Delhi	Dr MN Datar, Dr RK Choudhary, Dr SA Tamhankar

Sr. No.	Project Code	Project Title	Sponsor	Investigators
27	ARI/SP/266	Deciphering the past environmental conditions of freshwater myristica swamps of Western Ghats using Diatom assemblages (17.4.2017-16.4.2020)	Ministry of Earth Sciences	Dr Karthick B
28	ARI/SP/268	Conservation of selected endemic species of orchids of northern western ghats through ex-situ multiplication and reintroduction in wild (3.5.2017-2.5.2020)	TATA Power Corporation	Dr MN Datar, Dr AS Upadhye
29	ARI/SP/269	Scale-up synthesis of Jasada bhasma inspired zinc oxide, development of formulation(s) thereof, and validation of their biological activity (1.6.17-31.5.2019)	In collaboration with Pitambari	Dr R Umrani, Dr KM Paknikar
30	ARI/SP/270	Exploring non-pathogenic protozoa as a eukaryotic platform for protein expression (15.6.2017-14.6.2020)	DBT, New Delhi	Dr Y Karpe
31	ARI/SP/271	Study role of Untranslated Regions (UTR) in the genome of Chikungunya virus (5.5.2017-4.5.2020)	CSIR, New Delhi	Dr Y Karpe
32	ARI/SP/272	Ichnological and sedimentological evaluation of the Chhasra Formation (Burdigalian), Kachchh, Gujarat (1.5.2017-30.4.2020)	CSIR, New Delhi	Dr KG Kulkarni
33	ARI/SP/274	Diatom and cyanobacteria flora of Peninsular India: Molecular reinvestigation of endemic and cosmopolitan taxa across biodiversity hotspot (Western Ghats) (16.8.2017-15.8.2019)	DST, New Delhi	Dr Karthick B
34	ARI/SP/275	Metagenomics aided augmentation of resident microbes and their metabolism to enhance oil recovery from depleted reservoirs (2.8.2017-1.8.2020)	DBT, New Delhi	Dr A Engineer
35	ARI/SP/276	Elucidating the potential of anaerobic rumen fungi for enhancing biomethanation in anaerobic digesters fed on agricultural wastes (29.11.2017-28.11.2020)	DBT, New Delhi	Dr SS Dagar
36	ARI/SP/277	Development and demonstration of bioconversion process for generation of methane from subsurface lignite deposits (9.1.2018-8.2.2020)	OECT, New Delhi	Dr PK Dhakephalkar
37	ARI/SP/278	Determine the role of autophagy in germline stem cell maintenance (31.1.2018-30.1.2021)	DBT, New Delhi	Dr BV Shravage
38	ARI/SP/279	Freshwater diversity of Peninsular India (excluding Tamil Nadu): Taxonomic enumeration and development of online flora (18.1.2018-17.1.2021)	Ministry of Environment, Forest and Climate Change	Dr Karthick B
39	ARI/SP/280	Role of Dmon 1 at the synapse and regulation of glutamate receptors (21.3.2018-20.3.2021)	DBT, New Delhi	Dr A Ratnaparkhi
40	ARI/SP/281	Pyramiding of rust resistance genes into high grain quality wheat lines developed through marker-assisted selection (19.3.2018-18.3.2021)	DBT, New Delhi	Dr SA Tamhankar

Sr. No.	Project Code	Project Title	Sponsor	Investigators
41	ARI/SP/282	Bioresource and Sustainable livelihoods in North East India (29.3.2018-28.3.2021)	DBT, New Delhi	Dr Karthick B
42	ARI/SP/283	Digitization and dissemination of lichen specimens at Ajrekar Mycological Herbarium (AMH) (5.5.2018-4.5.2021)	RGSTC, Mumbai	Dr B Sharma
43	ARI/SP/284	Community structure and ecology of diatoms in the rocky pools of the Western Ghats (2.4.2018-1.4.2020)	SERB, New Delhi	Dr S Roy
44	ARI/SP/285	Methane oxidizing bacteria : Community structure, elucidation and cultivation from Indian lowland rice ecosystems for future applications (5.9.2018-4.9.2021)	DST, New Delhi	Ms P Pandit
45	ARI/SP/286	Valorization of methane from biogas to biodiesel and single cell proteins using methanotrophs (methane oxidizing bacteria) (15.9.2018-14.9.2021)	SERB, New Delhi	Dr M Rahalkar
46	ARI/SP/287	Nanoparticles mediated dsRNA delivery for biocontrol of the polyphagous insect pests, *Helicoverpa armigera* (armyworm) and *Scirtothrips dorsalis* (thrips) (2.11.2018-1.11.2021)	SERB, New Delhi	Dr V Ghormade
47	ARI/SP/288	Effect of amyloid beta peptide on intracellular copper metabolism: Implications to inflammation and neuro-degeneration (12.3.2019-11.3.2022)	SERB, New Delhi	Dr PP Kulkarni
48	ARI/SP/289	Microbial production of hydrogen from rice straw (Up to 6.3.2020)	KPIT Engineering Ltd., Pune	Dr PK Dhakephalkar
49	ARI/SP/290	Engineering multitalented nanotheranostics for silencing the malignant gene in multiple cancers to accomplish eradication of tumor burden (22.3.2019-21.3.2021)	SERB, New Delhi	Dr V Gajbhiye
50	ARI/SP/291	Understanding the conidial anastomosis tube (CAT) fusion dynamics and its role in generating genetic diversity in a fungal pathogen *Colletotrichum gloeosporioides* (30.3.2019-29.3.2022)	SERB, New Delhi	Dr A Baghela
51	ARI/SP/292	Mapping genes/QTL for resistance to spot blotch and stem rust in durum wheat (26.3.2019-25.3.2022)	SERB, New Delhi	Dr SA Tamhankar
52	ARI/SP/293	High resolution QTL mapping for iron (Fe), zinc (Zn), grain protein, and phytate content and their introgression in high yielding wheat cultivars (25.3.2019-24.3.2022)	DBT, New Delhi	Dr SA Tamhankar
53	ARI/SP/294	Development, evaluation and molecular characterization of a seedless mutant in grape variety ARI 516 (30.3.2019-29.3.2022)	SERB, New Delhi	Dr S Tetali

Sr. No.	Project Code	Project Title	Sponsor	Investigators
54	ARI/SP/295	A chromogenic immunosensor for rapid detection of *Vibrio* spp. in aquaculture (25.3.2019-24.3.2021)	SERB, New Delhi	Dr MK Pawar
55	ARI/SP/296	Strengthening of seed infrastructure facilities at soybean breeder seed production centers under the component creation of seed infrastructure facilities of sub-mission on seed and planting material (SMSP)	ICAR-Indian Institute of Seed Science, Kushmaur	Dr P Varghese
56	ARI/SP/297	Crispr- Cas9 based genome-editing approach to explore functions of actin binding proteins in zebrafish: Unravelling F-actin regulation underlying behaviour of cells, tissues and animals (17.5.2019-16.5.2022)	DBT, New Delhi	Dr C Patra
57	ARI/SP/298	Exploration of cryptic genetic diversity in extant planktic foraminiferal morphospecies from the Southern Indian Ocean (21.8.2019-20.8.2022)	National Centre for Polar and Ocean Research, Goa	Dr T Kaushik
58	ARI/SP/299	Microchip for bacterial separation, DNA extraction and multiplexed detection using LAMP (28.8.2019-27.8.2022)	ICMR, New Delhi	Dr D Bodas
59	ARI/SP/300	Production, nano-delivery and validation of viral vaccine against nodavirus of fish (30.9.2019-29.9.2022)	DBT, New Delhi	Dr KM Paknikar, Dr JM Rajwade
60	ARI/SP/301	Synthesis of small molecules based on redox active natural products and their evaluation as antimicrobial agents (15.10.2019-14.10.2022)	DST, New Delhi	Dr R Mamgain
61	ARI/SP/302	Exploration of pro-regenerative secreted molecules and their mechanistic details in heart regeneration using zebrafish as a model organism (31.10.2019-30.10.2024)	India Alliance, DBT Wellcome, Hyderabad	Dr C Patra
62	ARI/SP/303	Understanding enzymatic mechanism of fungal and algal growth on paint film (15.11.2019-14.11.2020)	Asian Paints Limited, Navi Mumbai	Dr SK Singh
63	ARI/SP/304	Validating the performance of pharmaceutical aerosols by multi-scale simulations and analytical experiments (11.11.2019-10.11.2022)	SERB, New Delhi	Dr B Chellampillai
64	ARI/SP/305	Augmentation of Cordycepin by optimizing in vitro culture conditions of caterpillar fungi (30.10.2019-29.10.2022)	SERB, New Delhi	Dr MY Borde
65	ARI/SP/306	Exploring the role of Chemokine Receptor 3.1 (Cxcr3.1) in zebrafish heart regeneration using genetic and chemical tools (31.12.2019-30.12.2021)	SERB, New Delhi	Dr Himanshu
66	ARI/SP/307	Revisiting the traditional biomethanation: Replacing cattle dung with fibrolytic anaerobic fungi and methanogenic archaea in light of multi-omics approaches (9.1.2020-8.1.2022)	SERB, New Delhi	Dr K Sengupta

Sr. No.	Project Code	Project Title	Sponsor	Investigators
67	ARI/SP/308	Development and demonstration of process for extraction of Azolla protein (10.2.2020-9.8.2020)	Biome Technologies, Ahmednagar	Mr PR Kshirsagar
68	ARI/SP/309	Understanding the regulation of Fog dependent GPCR signaling in the Drosophila CNS (15.2.2020-14.2.2023)	SERB, New Delhi	Dr A Ratnaparkhi
69	ARI/SP/310	Characterisation of genetic resources: Germplasm characterization and trait discovery in wheat using genomics approaches and its integration for improving climate resilience, productivity and nutritional quality Sub Project-3: Evaluation of wheat germplasm for abiotic stresses (31.3.2020-30.3.2025)	DBT, New Delhi	Dr Yashavantha Kumar KJ

Personnel (List of Staff Members as on 31.03.2020)

Director (Officiating)

Dr. P.K. Dhakephalkar, Sci. G

Biodiversity & Paleobiology Group

Biodiversity - Fungi

Dr. S.K. Singh, Sci. F

Dr. Rajesh Kumar K.C., Sci. D

Dr. Abhishek Baghela, Sci. D

Dr. P.N. Singh, Sci. D

Mr. S. B. Gaikwad, Technical Officer A

Mr. D.K. Mourya, Lab Assistant C

Ms. S.S. Lad, Lab Assistant C

Biodiversity - Lichens

Dr. B.C. Behera, Sci. E

Dr. (Ms.) B.O. Sharma, Technical Officer B

Biodiversity – Plants and Diatoms

Dr. R.K. Choudhary, Sci. D

Dr. M.N. Datar, Sci. C

Dr. Karthick B, Sci. D

Mr. V.N. Joshi, Technical Officer A

Mr. M.H. Mhetre, Lab Assistant D

Ms. N.S. Gaikwad, Lab Assistant C

Mr. S.A. Pardhi, Lab. Assistant A

Garden

Ms. K.H. Sable, Technical Officer B

Mr. S.N. Gajbhar, Attendant D

Mr. M.T. Gurav, Attendant D

Biodiversity - Palaeobiology

Dr. (Ms.) K.G. Kulkarni, Sci. E

Dr. T. Kaushik, Sci. C

Dr. P.G. Gamre, Technical Officer A

Mr. S.S. Deshmukh, Lab Assistant E

Bioenergy Group

Dr. P.K. Dhakephalkar, Sci. G

Dr. (Ms.) M.C. Rahalkar, Sci. D

Dr. S.S. Dagar, Sci. D

Mr. P.R. Kshirsagar, Sci. D

Dr. (Ms.) D.C. Kshirsagar, Technical Officer C

Ms. A.S. Kelkar, Technical Officer B

Dr. V.B. Lanjekar, Technical Officer B

Bioprospecting Group

Dr. P.P. Kulkarni, Sci. E

Dr. (Ms.) P. Srivastava, Sci. C

Dr. R.J. Waghole, Technical Officer A

Dr. (Ms.) A.V. Misar, Technical Officer A

Developmental Biology Group

Dr. (Ms.) A. Ratnaparkhi, Sci. E

Dr. C. Patra, Sci. D

Dr. B.V. Shravage, Sci. D

Mr. M.B. Daware, Technical Officer B

Ms. R.J. Londhe, Technical Officer A

Ms. A.A. Nikam, Lab. Assistant A

Genetics & Plant Breeding Group

Dr. (Ms.) S. A. Tamhankar, Sci. G

Dr. M.D. Oak, Sci. D

Dr. Philips Varghese, Sci. D

Dr. R. M. Patil, Sci. D

Dr. (Ms.) S. P. Tetali, Sci. C

Mr. S.A. Jaybhay, Sci. C

Mr. A.M. Chavan, Sci. C

Dr. Y. Kumar K.J., Sci. C

Dr. V.S. Baviskar, Sci. C

Mr. S.P. Nawathe, Sci.B

Mr. V.M. Khade, Technical Officer B

Ms. S.P. Karkamkar, Technical Officer B

Mr. V.D. Surve, Technical Officer B

Mr. J.H. Bagwan, Technical Officer B

Mr. B.D. Idhol, Technical Officer A

Mr. S.V. Phalake, Technical Officer A

Mr. V.D. Gite, Technical Officer A

Mr. B.N. Waghmare, Technical Assistant B

Mr. S.S. Khairnar, Technical Assistant B

Ms. A.A. Deshpande, Technical Assistant B

Ms. J.S. Sarode, Lab Assistant D

Mr. D.H. Salunkhe, Laboratory Assistant C

Mr. D.N. Bankar, Laboratory Assistant C

Mr. P.G. Lavand, Technician A

Mr. S.L. Bhandalkar, Attendant C

Mr. S.R. Kachhi, Attendant B

Mr. S.V. Ghadge, Attendant B

Mr. D.L. Kolte, Attendant A

Mr. T.B. Dhurve, Attendant A

Mr. G.S. Rajguru, Attendant A

Nanobioscience Group

Dr. (Ms.) J.M. Rajwade, Sci. E

Dr. D.S. Bodas, Sci. E

Dr. (Ms.) V Ghormade, Sci. D

Dr. V Gajbhiye, Sci. D

Dr. Y.A. Karpe, Sci. D

Ms. R.G. Bambe, Technical Assistant B

Mr. A. Dwivedi, Technical Assistant A

Mr. S.S. Waghmare, Lab Assistant C

Animal House

Dr. S.H. Jadhav, Sci. D

Mr. K.V. Tiwari, Attendant B

Mr. V.M. Gosavi, Attendant B

Director's Office

Dr. G.K. Wagh, Technical Officer D

Dr. (Ms.) P.P. Apte, Technician C

Mr. S.P. Balsane, Attendant A

Administration Unit

Mr. A. Rahman, Administrative Officer

Mr. V.B. Bhalerao, Officer B

Mr. C.D. Nagpure, Officer B

Mr. A.G. Dhongade, Sr. Pvt. Secretary

Ms. J.V. Deshpande, Pvt. Secretary

Ms. M.B. Tiwari, Officer A

Ms. T.V. Kurhade, Assistant A

Ms. D.V. Gawade, Assistant A

Mr. R.B. Dhobale, Assistant A

Ms. S.S. Shah, Assistant A

Ms. R.S. Shinde, Assistant A

Mr. R.M. Dhandhore, Attendant C

Mr. A.B. Kusalkar, Driver

Mr. G. H. Agawan, Driver

Accounts Unit

Ms. S.A. Ashtaputre, Finance & Accounts Officer

Ms. S.A. Tembe, Officer B

Ms. U. Kulkarnii, Officer A

Mr. A.D. Joshi, Officer A

Mr. A.D. Patil, Officer A

Ms. M.C. Ranjane, Assistant B

Ms. M.V. Patake, Assistant A

Mr. S.S. Chavan, Assistant A

Mr. R.G. Birwadkar, Assistant A

Ms. S.R. Murade, Assistant A

Mr. K.R. Sathe, Attendant B

Purchase Unit

Mr. P.V. Gosavi, Stores & Purchase Officer

Mr. H.N. Mate, Officer B

Ms. S.S. Kalekar, Assistant B

Ms. P.D. Gagare, Assistant A

Mr. A.V. Wable, Assistant A

Mr. A.T. Salvi, Attendant C

Store Unit

Ms. V.G. Tallu, Officer A

Mr. S.A. Shaikh, Assistant A

Ms. P.S. Welankar, Assistant A

Mr. R.M. Salunke, Attendant C

Engineering Unit

Mr. A.V. Chaudhari, Technical Officer D

Ms. Manisha Kharade, Technical Officer C

Mr. P.V. Sawant, Technical Officer A

Mr. D.S. Shinde, Technician B

Mr. Nayankumara D, Technician A

Mr. S.B. Karanjekar, Attendant D

Library & Information Center

Mr. R.P. Janrao, Asst. Lib. & Info. Officer

Ms. S.A. Deshmukh, Sr. Lib. Assistant

Mr. R.R. Kale, Library & Info. Asst.

Other Technical Staff

Mr. B.A. Kawthekar, Technician D

Appointments

Sr. No.	Name & Designation	Group / Unit	Date of Joining
1	Ms. S.R. Murade, Assistant A (On Compassionate grounds)	Accounts	21.1.2020

Promotions

Scientific Staff

Dr. S.A. Tamhankar, Sci. G

Dr. S.K. Singh, Sci. F

Dr. (Ms.) K.G. Kulkarni, Sci. E

Mr. P.R. Kshirsagar, Sci. D

Dr. R.M. Patil, Sci. D

Dr. S.H. Jadhav, Sci. D

Dr. Y. Kumar K.J., Sci. C

Dr. V.S. Baviskar, Sci. C

Technical Staff

Dr. (Ms.) A.V. Misar, Technical Officer A

Mr. V.D. Gite, Technical Officer A

Ms. J.S. Sarode, Lab Assistant D

Dr. (Ms.) P.P. Apte, Lab Assistant C

Mr. D.S. Shinde, Technician B

MACP

Dr. P.N. Singh, Sci. D

Mr. S.R. Kachhi, Attendant B

Superannuation

Mr. D.S. Zade, 30.11.2019

Dr. (Ms.) H.M. Puntambekar, 30.11.2019

Resignation

Dr. (Ms.) R.D. Umrani, 30.4.2019

Deceased

Mr. R.G. Murade, 15.8.2019

Reservation & Concessions

To provide adequate representation of SCs, STs and OBCs in direct recruitment posts, instructions given by the Govt. of India, Dept. of Per. & Trg. OM No.36012/2/96-Estt. (Res.), dated 2 July 1997 have been implemented.

Details of posts filled during 2019-2020

Group	SC	ST	OBC	General	Total
A	--	--	--	–	–
B	--	--	--	--	--
C	1	--	--	--	1
Total	1	--	--	–	1

Prof. Agharkar Chair

Dr. K.M. Paknikar

CSIR Emeritus Scientist

Dr. S.M. Ghaskadbi

Fellows

Dr. Anjali Jha, DST Inspire Scientist

Dr. Anupama Engineer, DBT Project Scientist

Dr. Surajit Roy, SERB-NPDF

Ms. Pranitha Pandit, DST WOS-A

Dr. Madhuri Pawar, SERB-NPDF

Dr. Himansu, SERB-NPDF

Dr. Kriti Sengupta, SERB-NPDF

Dr. Ritu Mamgain, DST WOS-A

Dr. Mahesh Y Borde, SERB-TARE, (Botany, SPPU, Pune)

Dr. Bothiraja Chellampillai, SERB-TARE, (Poona College of Pharmacy)

Research Associates

Dr. Gauri Katre, DBT

Dr. Pradnya Kedari, Tata Power

Research Associates - Sponsored Projects

Dr. Nidhi P Raval

Research Associates - ARI Projects

Dr. Deepa Shetty

Senior Research Fellows - Sponsored Projects

Dr. Leena Kulkarni

Junior Research Fellows - ARI Projects

Shahnoor Fatima

Kunal Kishor Yadav

Monali S. Kadu

Junior Research Fellows - Sponsored Projects

Mital G. Thacker

Komal Timane

Ganesh Sanjay Kakde

Tanvir Rajoddin Shaikh

Minal Sunil Ayachit

Jyoti Arun Mohite

Komal Suryavanshi

Prakash Choudhary

Reshma Jadhav

Manisha Kandroo

Chayan Mukherjee

Bhagyashri Y. Chaudhari

Priyanka Jagdish Pawar

Aditya S. Eklare

Siddhi K. Chavan

Rohini A. Nansare

Mangesh S. Rajguru

Tejal Madalkar

Snehal Kulkarni

Shubha Manvi

Swetali Dambre

Research Students - ARI Projects

Tanvi Telang Karbelkar

Harshita Rana

Research Students - Sponsored Projects

Sushen Lomte

Sarang Bokil

Kartiki Kadam

Suhasini Venkatesan

Project Fellows - Sponsored Projects

Vigneshwaran A.

Project Assistant - ARI Projects

Aishwarya Mangade

Project Assistant - Sponsored Projects

M. Yogeshwaran

Saurabh P. Aher

Kokila T.

Radhakrishnan Cheran

Shivani Soni

Mali - Sponsored Project

Shivaji Parvate

CSIR Senior Research Fellows

Gokul D. Patil

Smrithy Vijayan

Kunal D. Pingale

Kumal Khatri

Neelam G. Kapse

Anagha Basargekar

Nidhi Nirola Murmu

Bhagyashri Joshi

Rameshwar Avchar

Ajay Lagashetty

Nikita Mehta

Ashwini Darshetkar

Saurabh Gaikwad

UGC Senior Research Fellows

Bhushan Khairnar

Rajashree Patil

Pradnya D. Nagkirti

Kasturi Shrish Deore

CSIR Junior Research Fellows

Pooja Salunke

Snehal Jamalpure

Ganesh Wagh

Pravinkumar Methe

Neha Wadmare

Payal Deshpande

Malika Suthar

UGC Junior Research Fellows

Deepika Choudhary

Vaibhav Madiwal

Shiwali Rana

Rajesh Salve

Sonali Kawade

Snigdha Tiwari

Kalyani Deshmukh (Ms. Kalyani K. Kamble)

Padmaja Anil Shete

Guru Govind Vaidu

Kadambari Pawar

Sneha H. Deshmukh

Ruchira R. Sutar

Pooja G. Suryavanshi

DBT Senior Research Fellows

Amey Rayrikar

Parimal Vikhe

DST-INSPIRE Senior Research Fellows

Shraddha Rahi

DST-INSPIRE Junior Research Fellows

Sonali Mundhe

Aishwarya Padhye

ICMR Senior Research Fellows

Neha Kulkarni

Gayatri Kanade

Sulaxna Pandey

SARTHI Junior Research Fellows

Bhushan K. Shigwan

Audit Report 2019-20

Maharashtra Association for the Cultivation of Science

Auditors Report

We have audited the attached Balance sheet of Maharashtra Association for the Cultivation of Science, Pune as at 31st March, 2020 and the Income and Expenditure Account for the year ended on that date annexed to.

These financial Statements are responsibility of the Institute's Management. Our responsibility is to express opinion on these financial statements based on our Audit. We conducted our Audit in accordance with Auditing Standards generally accepted in India & Provisions of Bombay Public Trust Act, 1950 (Wherever Necessary). Those standards require that we plan and perform the Audit to obtain reasonable assurance about whether the financial statements are free of material misstatements. An Audit includes examining on test basis, evidence supporting the amounts and disclosures in the financial statements. An Audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statements presentation & reporting. We believe that our Audit provides reasonable basis of our opinion.

Subject to above, we report that:

1. We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our Audit.
2. In our opinion, proper books of accounts as required by law have been kept by the institute so far as it appears from our examination of those books.
3. The Balance Sheet and Income and Expenditure Account dealt with by the report are in agreement with the books of accounts.
4. In our Opinion and to the best of our information and according to the explanations given to us, subject to our comments in annexure to this report, the said accounts give a true and fair view.
   i) In the case of the Balance Sheet, of the state of affairs of the Centre as at 31st March, 2020.
   ii) In the case of the Income and Expenditure Account, of the Surplus for the year ended on the date.

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

HON. F.& A.O.	**HON. Treasurer**	**HON. Secretary**	**Saideep Dhoble Patil**
M.A.C.S.	M.A.C.S.	M.A.C.S.	Partner

Place: Pune
Date: 28/08/2020

REPORT OF AN AUDITOR RELATING TO ACCOUNTS AUDITED UNDER SUB-SECTION (2) OF SECTION 33 & 34 AND RULE 19 OF THE BOMBAY PUBLIC TRUSTS ACT

Name of the Public Trust:- MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE For year ending: 31st March, 2020

Sr. No.	Particulars	Remarks
A	Whether accounts are maintained regularly and in accordance with the provisions of the Act and the rules.	YES
B	Whether receipts and disbursements are properly and correctly shown in the accounts.	YES
C	Whether the cash balance and vouchers in the custody of the manager or trustee on the date of audit were in agreement with the accounts.	YES
D	Whether all books, deeds, accounts, vouchers or other documents records required by the auditor were produced before him.	YES
E	Whether a register of movable and immovable properties is properly maintained, the changes therein are communicated from time to time to the regional office and the defects and inaccuracies mentioned in the previous audit report have been duly complied within.	YES
F	Whether the manager or trustee or any other person required by the auditor to appear before him did so and furnished the necessary information required by him.	YES
G	Whether any property or funds of the Trust were applied for any object or purpose other than the object or purpose of the Trust.	NO
H	Whether tenders were invited for repairs or construction involving expenditure exceeding Rs. 5000/-	YES
I	Whether any money of the public trust has been invested contrary to the provisions of Section 35	NO
J	Alienation, if any of the immovable property contrary to the provisions of Section 36 which have come to the notice of the auditor.	NO
K	All cases of irregular, illegal or improper expenditure or failure or omission to recover monies or other property belonging to the public trust or of loss or waste of money or other property thereof and whether such expenditure, failure, omission loss or waste was caused in consequence of breach of trust or misapplication or any other misconduct on the part of the trustees or any other person while in the management of the trust.	NO
L	Whether the minutes books of the proceedings of the meeting is maintained.	YES
M	Whether any of the trustees has any interest in the investment of the trust.	NO
N	Whether the irregularities pointed out by the auditors in the accounts of the previous year have been duly complied with by the trustees during the period of audit.	YES
O	Any special matter which the auditor may think fit or necessary to bring to the notice of the Deputy or Assistant Charity Commissioner.	NO

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

HON. F.& A.O.	**HON. Treasurer**	**HON. Secretary**	**Saideep Dhoble Patil**
M.A.C.S.	M.A.C.S.	M.A.C.S.	Partner

Place: Pune
Date: 28/08/2020

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004.

Balance Sheet as on 31.03.2020

Amount - Rs.

FUNDS AND LIABILITIES	SCH.	CURRENT YEAR	PREVIOUS YEAR
CAPITAL ACCOUNTS	**A**	1,07,61,721	1,07,61,721
CURRENT LIABILITIES	**B**	27,26,828	34,49,063
INCOME & EXP.A/C		1,69,65,088	1,68,27,030
(Sub Schedule 4)			
TOTAL		**3,04,53,637**	**3,10,37,814**

PROPERTY AND ASSETS	SCH.	CURRENT YEAR	PREVIOUS YEAR
FIXED ASSETS	**C**	92,58,897	93,35,788
INVESTMENTS	**D**	1,71,05,429	1,63,02,069
DEPOSITS & ADVANCES	**E**	27,31,652	39,66,883
CASH & BANK BALANCES	**F**	13,57,659	14,33,074
TOTAL		**3,04,53,637**	**3,10,37,814**

The above Balance Sheet to the best of our knowledge and belief contains a true account of the Funds, Liabilities and of the Property and Assets of the Association.

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

HON. F.& A.O.	**HON. Treasurer**	**HON. Secretary**	**Saideep Dhoble Patil**
M.A.C.S.	M.A.C.S.	M.A.C.S.	Partner

Place: Pune
Date: 28/08/2020

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Income and Expenditure Account for the Year Ended on 31.03.2020

Amount - Rs.

EXPENDITURE	CURRENT YEAR	PREVIOUS YEAR	INCOME	CURRENT YEAR	PREVIOUS YEAR
Depreciation : Immovable Properties (By way of provision or adjustment)	2,965	2,965	Interest (Realised)		
			On S.B. A/c	95,748	1,53,681
			On Investments	7,20,469	9,49,955
Establishment Expenses (As per Schedule H)	2,69,851	2,80,973	Donation	-	30,000
Audit fees	3,540	3,630	Income from other Sources (As per Schedule L)	2,16,000	2,25,000
Legal Fees	36,000	39,000			
Professional fees	5,000	20,195	Income tax refund received (Interest)	2,25,877	-
Depreciation : Furniture & Dead Stock	73,927	73,932			
Expenditure on the object of The Trust (As per Schedule I)	7,28,752	3,45,807			
Surplus carried over to Balance sheet	1,38,058	5,92,134			
TOTAL	**12,58,094**	**13,58,636**	**TOTAL**	**12,58,094**	**13,58,636**

We hereby certify that the above income and Expenditure Account is correct to the best of our knowledge and belief.

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

HON. F.& A.O.	**HON. Treasurer**	**HON. Secretary**	**Saideep Dhoble Patil**
M.A.C.S.	M.A.C.S.	M.A.C.S.	Partner

Place: Pune
Date: 28/08/2020

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Statement of Receipts & Payments for the Year Ended on 31.03.2020

Amount - Rs.

RECEIPTS	SCH.	CURRENT YEAR	PREVIOUS YEAR	PAYMENTS	SCH.	CURRENT YEAR	PREVIOUS YEAR
Opening Balances	F	14,33,074	17,77,981	Establishment Expenses	H	1,81,107	2,27,377
Interest Received				Expenditure on Object of Trust	K	80,638	2,71,207
On Savings Bank A/c		95,748	1,53,681				
Interest on Investments		10,28,703	4,15,399	Audit Fees & Creditors		7,30,529	2,30,451
Encashment of Fixed Deposit		1,11,04,819	-	Income tax refund paid share of ARI & Scheme		20,29,362	-
Income tax refund received with interest		24,04,046	-				
				Legal Fees		36,000	39,000
				Professional fees		5,000	5,000
Donation Received				Fixed Deposit with Banks		1,19,08,180	5,00,000
Yogamaya Devi Award		-	30,000	Indirect Receipt & Payment	J	21,67,42,073	14,77,61,022
C.M. Relief Fund		1,000	-				
Income from Other Sources	G	2,16,000	2,25,000	Closing Balances	F	13,57,660	14,33,073
Indirect Receipt & Payment	J	21,67,87,159	14,78,65,070				
TOTAL		**23,30,70,549**	**15,04,67,132**	**TOTAL**		**23,30,70,549**	**15,04,67,132**

We hereby certify that the aforesaid statement to be true and correct to the best ofour knowledge and belief.

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

HON. F.& A.O.
M.A.C.S.

HON. Treasurer
M.A.C.S.

HON. Secretary
M.A.C.S.

Saideep Dhoble Patil
Partner

Place: Pune
Date: 28/08/2020

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE-411 004

Schedules to and forming part of Balance sheet as on 31.03.2020

Schedule "A" : Capital Account

Amount - Rs.

PARTICULARS	SUB-SCH	CURRENT YEAR	PREVIOUS YEAR
TRUST FUND OR CORPUS	1	1,03,77,874	1,03,77,874
OTHER EARMARKED FUNDS	2	3,83,847	3,83,847
TOTAL(RS.)		**1,07,61,721**	**1,07,61,721**

Schedule "B" : Current Liabilities

Amount - Rs.

PARTICULARS	SUB-SCH	CURRENT YEAR	PREVIOUS YEAR
OTHER LIABILITIES	3	27,26,828	34,49,063
TOTAL(RS.)		**27,26,828**	**34,49,063**

Schedule "C" : Fixed Assets

Amount - Rs.

PARTICULARS	SUB-SCH	CURRENT YEAR	PREVIOUS YEAR
IMMOVABLE PROPERTIES	5	91,29,444	91,32,407
FURNITURE AND DEAD STOCK	6	1,29,453	2,03,381
TOTAL(RS.)		**92,58,897**	**93,35,788**

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE-411 004

Schedules to and forming part of Balance sheet as on 31.03.2020

Schedule "D" : Investments

Amount - Rs.

Sr. No.	Name of the Company	Particulars	Date of Investment	Date of maturity	Current Year	Previous Year
	SHARES				1325	1,325
1	Central Potteries Ltd.	Share of Rs. 25 each				
	Nagpur	Certificate No.1343 bearing Sr.No.29114 to 29126 13 ordinary	21.01.1949			
		Certificate No. 551 bearing Sr.No. 3717 to 3756 40 ordinary	10.06.1940			
2	HINDUSTAN MOTORS LTD.	Shares of Rs. 10 each 50 ordinary	-	-	500	500
		Share certificate No.33932				
		bearing Sr. No.4632651-4632700				
	FIXED DEPOSITS					
1	BANK OF MAHARASHTRA	60307790389	24.05.2018	24.05.2020	5,00,000	5,00,000
		60088467793	30.12.2017	30.12.2020	3,00,000	3,00,000
		60088467534	30.12.2017	30.12.2020	3,00,000	3,00,000
		60126451909	01.03.2020	31.03.2020	2,00,000	2,00,000
		60152059714	08.11.2017	08.11.2019	*	16,60,000
		60150708401	23.10.2017	23.10.2019	*	8,00,000
		60161620207	06.02.2018	06.02.2020	*	4,00,000
		60137302953	05.07.2017	05.07.2019	*	17,88,432
		60137302238	05.07.2017	05.07.2019	*	38,52,010
2	INDIAN BANK	6019228988	05.03.2018	03.03.2021	8,57,788	8,57,788
		6019228671	05.03.2018	03.03.2021	8,57,788	8,57,788
		6056528884	03.08.2018	31.08.2021	2,00,000	2,00,000
		6201547509	24.02.2019	24.02.2020	**	10,00,000
		6201547485	24.02.2019	24.02.2020	*	5,00,000
		6201547532	24.02.2019	24.02.2020	*	10,00,000
3	BANK OF BARODA	906244	02.03.2019	02.03.2020	*	1,04,377
4	BANK OF INDIA	50345110007246	24.11.2018	24.11.2020	19,79,848	19,79,849
5	HDFC	50300352429665	08.07.2019	09.07.2020	63,08,180	
		50300377850429	25.10.2019	26.10.2021	10,00,000	
		50300381999484	11.11.2019	12.11.2021	17,00,000	
		50300403645600	11.02.2020	12.02.2022	4,00,000	
		50300405767617	24.02.2020	25.02.2022	5,00,000	
		50300405767962	24.02.2020	25.02.2022	10,00,000	
6	IDFC	10053500553	27.02.2020	11.07.2021	10,00,000	
	GRAND TOTAL				**1,71,05,429**	**1,63,02,069**

*Fixed Deposit closed and transferred to **HDFC**
Fixed Deposit closed and transferred to **IDFC

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Balance sheet as on 31.03.2020

Schedule "E" : Deposits & Advances

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	AMOUNT	AMOUNT	AMOUNT	AMOUNT
DEPOSITS :				
Telephone Deposit	10,000		10,000	
Deposit with Court	15,000	25,000	15,000	25,000
ADVANCES :				
Advance to Staff	5,000		-	
Income Tax Deducted at Source	24,51,120	24,56,120	33,44,610	33,44,610
Interest accrued on Investments				
(Subject to confirmation from bank & other agencies)				
As per last Balance Sheet)	5,97,273		5,77,592	
Less Realised during the year	4,56,017		3,46,192	
	1,41,256		2,31,400	
Accrued Interest during the year	1,09,276	2,50,532	3,65,873	5,97,273
TOTAL Rs.		**27,31,652**		**39,66,883**

Schedule "F" : Cash & Bank Balances

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	OPENING BALANCE	CLOSING BALANCE	OPENING BALANCE	CLOSING BALANCE
CASH IN HAND	19,356	10,647	35,344	19,356
BANK :-				
With Bank of Maharashtra	12,54,208	10,14,710	16,88,994	12,54,208
Erandwana Branch in Savings A/c No.9709				
With Union Bank of India,	1,59,509	2,20,446	53,643	1,59,509
F.C.Road Branch in S.B.A/c 48941261091951				
With HDFC SAVING BK A/C NO.50100304122670	-	1,11,857	-	-
TOTAL (RS.)	**14,33,074**	**13,57,659**	**17,77,981**	**14,33,074**

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Statement of Receipts & Payments
and Income & Expenditure Account for the year ended on 31.03.2020

Schedule"G" : Income From Other Sources

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	INCOME & EXP. ACCOUNT	RECEIPT & PAYMENT ACCOUNT	INCOME & EXP. ACCOUNT	RECEIPT & PAYMENT ACCOUNT
Fee for Home Gardening course	1,98,000	1,98,000	2,25,000	2,25,000
Claim received against loss due to flood	16,000	16,000	-	-
Life Membership Fees	2,000	2,000	-	-
TOTAL (RS.)	**2,16,000**	**2,16,000**	**2,25,000**	**2,25,000**

Schedule "H" : Establishment Expenses

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	INCOME & EXP. ACCOUNT	RECEIPT & PAYMENT ACCOUNT	INCOME & EXP. ACCOUNT	RECEIPT & PAYMENT ACCOUNT
Honorarium to Staff	1,62,035	1,62,035	1,79,225	1,79,225
Meeting Expenses	4,287	4,287	14,857	14,857
Miscellaneous Expenses	73,315	5,900	33,699	2,655
Hospitality Expenses	5,347	5,347	7,195	1,690
Travelling & Conveyance	11,901	312	14,428	529
Printing & Stationery	4,405	2,540	12,149	12,149
Advertisement charges	7,875	-	15,375	15,375
Bank charges	686	686	897	897
Repairs & Maintenance	-	-	3,148	-
TOTAL (RS.)	**2,69,851**	**1,81,107**	**2,80,973**	**2,27,377**

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules forming part of Receipt & Payment Account for the year ended on 31.03.2020

Schedule "I" : Expenditure on the Object of the Trust

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Expenditure out of Earmarked Donations		
Prof. V.P Gokhale Award Expenses	5,000	9,700
Dr. R.B.Ekbote Award Expenses	5,000	15,900
Dr. A.D Agate Award Expenses	2,500	2,500
Donation Expenses Prof. P.V.Sukhatme	2,500	2,500
Yogmaya Devi Award Expenses	-	25,000
Prof.S.P.Agharkar Chair Expenses	6,00,000	1,40,000
Home Garden Course Expenses	78,552	69,733
Smt. Parvatibai Agharkar Fellowship Award	35,200	80,474
TOTAL (RS.)	**7,28,752**	**3,45,807**

Schedule "J" : Indirect Receipts & Payments

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	RECEIPTS	PAYMENTS	RECEIPTS	PAYMENTS
ARI Account	21,09,14,000	21,09,14,000	14,24,17,000	14,24,17,000
Schemes Account	56,91,073	56,91,073	52,20,363	52,20,363
Advance to staff	48,886	77,000	90,000	90,000
TDS Professional fees & Contractor	3,600	60,000	3,900	33,659
Telephone Deposit un-clear ch.	-	-	4,207	-
Testing fees (Smartchem Tech)	1,29,600	-	1,29,600	-
TOTAL	**21,67,87,159**	**21,67,42,073**	**14,78,65,070**	**14,77,61,022**

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Receipts & Payments for the year ended on 31.03.2020

Schedule "K" : Expenditure on the Object of the Trust

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Expenditure out of Earmerked Donations		
Prof. V.P Gokhale Award Expenses	5,000	5,000
Dr. R.B.Ekbote Award Expenses	5,000	5,000
A. D. Agate Award Expenses	2,500	2,500
Yogamaya Award Expenses	-	25,000
Donation Expenses Prof. P.V.Sukhatme	2,500	2,500
Prof.S.P.Agharkar Chair Expenses	-	81,000
Home Garden Course Expenses	30,438	69,733
Smt. Parvatibai Agharkar fellowship award	35,200	80,474
TOTAL (RS.)	**80,638**	**2,71,207**

Schedule"L" : Income From Other Sources

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Fee for Home Gardening Course	1,98,000	2,25,000
Claim received against loss due to flood	16,000	-
Life Membership Fees	2,000	-
TOTAL (RS.)	**2,16,000**	**2,25,000**

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

HON. F.& A.O.	**HON. Treasurer**	**HON. Secretary**	**Saideep Dhoble Patil**
M.A.C.S.	M.A.C.S.	M.A.C.S.	Partner

Place: Pune
Date: 28/08/2020

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Balance Sheet as on 31.03.2020

Sub Schedule "1" Trust Fund or Corpus

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Trust/Corpus Fund	1,03,77,874	1,03,77,874
TOTAL(RS.)	**1,03,77,874**	**1,03,77,874**

Sub Schedule "2" Other Earmarked Funds

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Reserve Fund (Created vide resolution No. 16 dated 12.4.1984)	36,926	36,926
Museum Fund (As per Last Balance Sheet)	888	888
Prof. S.P. Agharkar Fund (As per Last Balance Sheet)	14,000	14,000
Prof. S.P. Agharkar Birth Centenary Fund (As per last Balance Sheet)	3,32,033	3,32,033
TOTAL (RS.)	**3,83,847**	**3,83,847**

Sub Schedule "3" Other Liabilities

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Audit fees payable	7,080	3,540
Medclin Research Pvt. Ltd	2,70,992	2,70,992
TDS Payable	24,03,756	31,19,531
Sundry Creditors	45,000	55,000
TOTAL (RS.)	**27,26,828**	**34,49,063**

Sub Schedule "4" Income & Expenditure Account

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
Opening Balance	1,68,27,030		1,62,34,896	
Surplus carried over to Balance sheet	1,38,058		5,92,134	
		1,69,65,088		1,68,27,030
TOTAL (RS.)		**1,69,65,088**		**1,68,27,030**

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Balance Sheet as on 31.03.2020

Sub Schedule "5" : Immovable Properties

Amount - Rs.

SR No	Particulars	Rate of Depreciation	GROSS BLOCK			DEPRECIATION BLOCK					WDV as on 31.03.2020
			Cost as on 01.04.19	Additions during the year	Total Cost as on 31.03.2020	Up to 31.3.2019	Dep. On opening Balance	Dep. On the Additions during the year	Total Dep.for the Year	Total as on 31.03.2020	
1	Land at Pune		96,500	-	96,500	-	-	-	-	-	96,500
2	Land at Songaon		88,19,437	-	88,19,437	-	-	-	-	-	88,19,437
3	Land Development Expenses at Hol		2,02,583	-	2,02,583	-	-	-	-	-	2,02,583
4	Biometry Building	2.50%	1,15,200	-	1,15,200	1,01,630	2,880	-	2,880	1,04,509	10,691
5	Microbiology Building	2.50%	3,389	-	3,389	3,072	85	-	85	3,156	233
	TOTAL (RS.)		**92,37,109**	**-**	**92,37,109**	**1,04,702**	**2,965**	**-**	**2,965**	**1,07,665**	**91,29,444**

Sub Schedule "6" : Furniture and Dead Stock

Amount - Rs.

PARTICULARS	GROSS BLOCK			DEPRECIATION BLOCK						
	Cost as on 1.4.2019	Additions during the year	Total cost as on 31.03.2020	Rate of Depreciation	Up to 31.3.2019	Dep. On opening Balance	Dep. On the Additions during the year	Total Dep. for the Year	Total as on 31.03.2020	WDV as on 31.03.2020
1	2	3	4	5	6	7	8	9	10	11
A) (I) GENERAL										
1. Office Equipment's & Furniture & Sports Items	6,04,287	-	6,04,287	10%	5,28,080	60,429	-	60,429	5,88,509	15,778
2. Apparatus & Equipment's	3,15,076	-	3,15,076	20%	2,89,836	-	-	-	2,89,836	25,240
3. Electric Fittings	9,870	-	9,870	10%	9,869	-	-	-	9,869	1

Amount - Rs.

PARTICULARS	GROSS BLOCK			DEPRECIATION BLOCK						
	Cost as on 1.4.2019	Additions during the year	Total cost as on 31.03.2020	Rate of Depreciation	Up to 31.3.2019	Dep. On opening Balance	Dep. On the Additions during the year	Total Dep. for the Year	Total as on 31.03.2020	WDV as on 31.03.2020
1	2	3	4	5	6	7	8	9	10	11
4. Books	1,19,522	-	1,19,522	20%	1,16,442	-	-	-	1,16,442	3,080
5. Y -Type System for Grapes- Hol	1,10,497	-	1,10,497	10%	99,450	11,046	-	11,046	1,10,496	1
6. Construction of Statue	98,090	-	98,090	2.5%	14,712	2,452	-	2,452	17,164	80,926
SUB TOTAL (A)(I)	**12,57,342**	**-**	**12,57,342**		**10,58,389**	**73,927**	**-**	**73,927**	**11,32,316**	**1,25,026**
A) (II) SPECIAL PUBLICATIONS										
1. Marathi Publication by Prof. M.N. Kamat (Cost of Rs. 1.54)	4,428	-	4,428	0%	2,367	-	-	-	2,367	2,061
2. Enumeration of Plants from Gomantak by Dr. V.D. Vartak (Cost of Rs. 3.60)	3,154	-	3,154	0%	1,100	-	-	-	1,100	2,054
SUB-TOTAL (A)(II)	**7,582**	**-**	**7,582**	**0%**	**3,467**	**-**	**-**	**-**	**3,467**	**4,115**
TOTAL A (I+II)	**12,64,924**	**-**	**12,64,924**	**0%**	**10,61,856**	**73,927**	**-**	**73,927**	**11,35,783**	**1,29,141**
B) UNIVERSITY OF PUNE										
1. Office Equipment & Furniture	1,300	-	1,300	0%	1,242	-	-	-	1,242	58
2. Books	25,538	-	25,538	0%	25,341	-	-	-	25,341	197
3. Aparatus & Equipments	9,914	-	9,914	0%	9,891	-	-	-	9,891	23
TOTAL (B)	**36,752**	**-**	**36,752**	**0%**	**36,474**	**-**	**-**	**-**	**36,474**	**278**
C) GOVT.OF MAHARASHTRA										
1. Office Equipment & Furniture	1,008	-	1,008	10%	993	-	-	-	993	15
2. Apparatus & Equipments	21,363	-	21,363	20%	21,345	-	-	-	21,345	18
3. Books	1,210	-	1,210	20%	1,209	-	-	-	1,209	1
TOTAL (C)	**23,581**	**-**	**23,581**		**23,547**	**-**	**-**	**-**	**23,547**	**34**
GRAND TOTAL (A+B+C)	**13,25,257**	**-**	**13,25,257**		**11,21,877**	**73,927**	**-**	**73,927**	**11,95,804**	**1,29,453**

Agharkar Research Institute of Maharashtra Association for the Cultivation of Science

Auditor's Report

We have audited the attached Balance Sheet of **Agharkar Research Institute of Maharashtra association for the Cultivation of Science**, situated at Gopal Ganesh Agharkar Road, Pune as at 31 March, 2020 and Income and Expenditure Account for the year ended on that date annexed to.

These Financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our Audit. We conducted our Audit in accordance with Auditing Standards generally accepted in India & Provisions of Bombay Public Trust Act, 1950. Those standards require that we plan and perform the Audit to obtain reasonable assurance about whether the financial statements are free of material misstatements. An Audit includes examining on a test basis, evidence supporting the amounts and disclosures in the financial statements. An Audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation & reporting. We believe that our Audit provides a reasonable basis for our opinion.

Emphasis of Matter

We draw your attention to following matter.

1. Fixed Assets and Closing Stock as on 31 " March, 2020 has been included in the financial statements as taken, valued and certified by the management of the Institute. Valuation has not been verified by us and reliance has been placed on the value of Fixed Assets and Closing Stock certified by the management.

Subject to above, we report that:

1. We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our Audit.
2. In our opinion, proper books of accounts as required by law have been kept by the institute so far as it appears from our examination of those books.
3. The Balance Sheet, Income and Expenditure Account and the Receipts and Payments Account dealt with by the report are in agreement with the books of accounts.
4. In our opinion and to the best of our information and according to the explanations given to us. subject to our comments in annexure to this report, the said accounts give a true and fair view.

    i) In the case of the Balance Sheet, of the state of affairs of the Centre as at 31st, March 2020

    ii) In the case of the Income and Expenditure Account of the Deficit for the year ended on the date.

5. In our opinion, the Balance sheet & Income & Expenditure Account dealt with by this report, are in compliance with the accounting standards prescribed by the Institute of Chartered Accountants of India except the Accounting Standards - 1 "Disclosure of Accounting Policies", Accounting Standards - 2 "Valuation of inventories ", Accounting Standards - 5 "Net Profit or Loss for the Period, Prior Period items and changes in Accounting Policies", Accounting Standards - 11 "The effects of changes in Foreign Exchange Rate", Accounting Standards - 12 Accounting for Government Grants". Exceptions can be referred to Significant Accounting Policies & Notes to Account followed by the Institute and impact of the same on Financial Statement cannot be quantified.

Suggestions

- The Institution is holding numerous fixed deposits. We suggest to consolidate all the fixed deposits so the tax deducted at source (TDS) on fixed deposits can be matched and audited with better correctness.

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

Saideep Dhoble Patil
Partner

Place: Pune
Date: 28/08/2020

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Balance Sheet as on 31.03.2020

Amount - Rs.

Particulars	Sch	Current Year	Previous Year
CORPUS/CAPITAL FUND AND LIABILITIES:			
CORPUS/CAPITAL FUND	1	9,60,79,363	9,75,71,363
RESERVES AND SURPLUS	2	-	-
EARMARKED/ENDOWMENT FUNDS	3	16,48,04,811	13,18,05,478
SECURED LOANS AND BORROWINGS	4	-	-
UNSECURED LOANS AND BORROWINGS	5	-	-
DEFERRED CREDIT LIABILITIES	6	-	-
CURRENT LIABILITIES AND PROVISIONS	7	17,26,62,277	18,06,06,637
TOTAL		**43,35,46,451**	**40,99,83,478**
ASSETS:			
FIXED ASSETS	8	19,78,88,888	19,79,07,987
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9	10,08,48,939	9,58,60,318
INVESTMENTS-OTHERS	10	-	-
CURRENT ASSETS,LOANS,ADVANCES ETC.	11	13,48,08,624	11,62,15,173
MISCELLANEOUS EXPENDITURES (to the extent not written off or adjusted)			
TOTAL		**43,35,46,451**	**40,99,83,478**
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

The above Balance Sheet to the best of our knowledge & belief contains a True Account of the Funds and Liabilities of the Property and Assets of the Agharkar Research Institute.
Note : Previous year's figures are regrouped wherever necessary

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

Saideep Dhoble Patil
Partner

Place: Pune
Date: 28/08/2020

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Income & Expenditure Account for the Year ended 31.03.2020

Amount - Rs.

Particulars	Sch	Current Year	Previous Year
Income			
Income from Sales/Services	12	29,87,451	31,97,715
Grants/Subsidies	13	20,45,79,378	18,26,01,984
Fees/Subscriptions	14	8,11,569	2,42,956
Income from Investments(Income on Invest. From earmarked/endowment Funds transferred to Funds)	15	-	-
Income from Royalty,Publications etc.	16	31,260	21,340
Interest Earned	17	24,43,071	1,66,371
Other Income	18	9,79,254	9,51,288
Increase/(decrease) in stock of Laboratory consumables	19	(76,328)	53,818
Donation Received in kind (Equipment)		-	-
Total (A)		**21,17,55,655**	**18,72,35,472**
Expenditure			
Establishment Expenses	20	17,91,15,592	15,02,34,360
Other Administrative Expenses etc.	21	4,57,92,666	4,95,29,258
Expenditure on Grants, Subsidies etc.	22	-	-
Interest	23	-	-
Depreciation (Net Total at the year-end- corresponding to schedule 8)	8	89,03,530	73,09,035
Total (B)		**23,38,11,788**	**20,70,72,653**
Balance being excess of Income over Expenditure (A-B)		(2,20,56,133)	(1,98,37,181)
CORPUS/CAPITAL FUND		**(2,20,56,133)**	**(1,98,37,181)**
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

The above Balance Sheet to the best of our knowledge & belief contains a True Account of the Funds and Liabilities of the Property and Assets of the Agharkar Research Institute.
Note : Previous year's figures are regrouped wherever necessary

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

Saideep Dhoble Patil
Partner

Place: Pune
Date: 28/08/2020

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2020

Schedule 1: Corpus/Capital Fund

Amount - Rs.

Particulars	Current Year		Previous Year	
Corpus Fund				
Balance as the beginning of the year	7,79,08,146		7,43,11,087	
Add : Contributions towards Corpus/Capital Fund (Schedule D)	52,01,303		2,34,34,240	
Add/ (Deduct) : Balance of Net Income/ (Expenditure)	(2,20,56,133)	6,10,53,316	(1,98,37,181)	7,79,08,146
Capital Fund				
Balance as the beginning of the year	1,96,63,217		3,66,77,457	
Add: Capital Grant during the year	2,18,63,000		64,20,000	
Add: Interest Earned F.Y 2019-20 (Cap)	2,56,084		-	
Less: Interest Paid F.Y 2018-19 (Cap)	15,54,951		-	
Less: Expenditure during the year	52,01,303		2,34,34,240	
		3,50,26,047		1,96,63,217
Balance at the end of the year		**9,60,79,363**		**9,75,71,363**

Schedule 2: Reserves & Surplus

Amount - Rs.

Particulars	Current Year		Previous Year	
1. Capital Reserve				
As per last Account	-		-	
Addition during the year	-		-	
Less:Transfer to Establishment expenses	-	-	-	-
2. Revaluation Reserve				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deductions during the year	-	-	-	-
3. Special Reserve : A.R.I. Reserve Fund				
As per last Account	-		-	
Addition during the year	-		-	
Add: Interest accrued	-		-	
Less: Deductions during the year	-	-	-	-
4. General Reserve				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deductions during the year	-	-	-	-
Total (Rs.)	-	**-**		**-**

*Interest earned on capital payable to DST

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2020

Schedule 3 : Earmarked/Endowment Funds

Amount - Rs.

PARTICULARS	FUND-WISE BREAK UP				TOTALS	
	Lab. Res. Fund (Tech.Dev.Fund)	Dr. A. B. Joshi	Dr. A. D. Agate	Welfare fund	Current Year	Previous Year
a> Opening balance of the funds	8,12,50,751	6,96,227	2,060	1,26,939	8,20,75,977	8,44,27,530
b> Additions to the funds:	-	-	-	-	-	-
i) Donations/grants	-	-	-	-	-	-
ii) Income from investments made on account of funds.	43,31,997	16,252	-	-	43,48,249	58,00,739
iii) Culture Identification Charges	-	-	-	-	-	-
iv) Overhead Charges from Scheme	55,19,865	-	-	-	55,19,865	33,48,984
v) Interest received on Funds from various projects	-	-	-	-	-	-
vi) Other Misc.	95,32,328	-	-	-	95,32,328	10,51,999
TOTAL (a+b)	**10,06,34,941**	**7,12,479**	**2,060**	**1,26,939**	**10,14,76,419**	**9,46,29,252**
c>Utilisation/Expenditure towards objectives of funds	-	-	-	-	-	-
I> Capital Expenditure	-	-	-	-	-	-
Fixed Assets	-	-	-	-	-	-
Others	-	-	-	-	-	-
ii> Revenue Expenditure	-	-	-	-	-	-
Salaries, Wages and allowances etc.	-	-	-	-	-	1,24,89,878
Rent	-				-	-
Other Administrative Expense	-	-	-	-	-	63,397
TOTAL (c)	**-**	**-**	**-**	**-**	**-**	**1,25,53,275**
NET BALANCE AS AT THE YEAR-END (a+b-c)	**10,06,34,941**	**7,12,479**	**2,060**	**1,26,939**	**10,14,76,419**	**8,20,75,977**
Add: Balance as per Schedule 3A	-	-	-	-	6,33,28,391	4,97,29,501
Total Balance as on 31.3.2020	**10,06,34,941**	**7,12,479**	**2,060**	**1,26,939**	**16,48,04,811**	**13,18,05,478**

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2020

Schedule "3-A" : Unspent Balance of Scheme-Grant

Amount - Rs.

SR. NO.	PATICULARS	OPENING BALANCE		DURING THE YEAR		CLOSING BALANCE	
		DEBIT	CREDIT	DEBIT	CREDIT	DEBIT	CREDIT
1	DBT GENETIC SCREEN-197		9,150	9,150			
2	S/APL/SP-303 - Dr. S.K.Singh			2,48,225	8,76,768		6,28,543
3	S/ARP ENVIRONMENT		7,892				7,892
4	S/Biome Tech/SP-308 - Mr. P.R. Kshirsagar			20,000	1,00,000		80,000
5	S/CSIR/ Leather Additional COMP	800				800	
6	S/CSIR/SP 271- Dr. Yogesh Karpe		6,116				6,116
7	S/CSIR/SP 272- Dr. K.G. Kulkarni		2,04,849	2,55,836	1,03,290		52,303
8	S/DBT/ SP 185	1,71,438				1,71,438	
9	S/DBT/SP 188- Dr. Ghaskadbi	2,41,502				2,41,502	
10	S/ DBT/ SP 189-Dr. Ghaskadbi		17,479				17,479
11	S/DBT/ SP 199	60,303				60,303	
12	S/DBT/SP 207-Dr. Behera		14,32,670				14,32,670
13	S/DBT/SP 218-Dr. Honrao		7,26,667	7,26,667			
14	S/DBT/SP 232-Dr. Ghormade		13,118	13,118			
15	S/DBT/ SP 234-Dr. Paknikar Dr. Ghormade		2,20,459				2,20,459
16	S/DBT/ SP 238-Dr. Manoj Oak		2,74,023	11,67,644	9,93,642		1,00,021
17	S/DBT/ SP 250- Dr. Varghese		1,38,712	4,62,250	4,15,847		92,309
18	S/DBT/SP 256-Dr. Shravage		19,680	4,46,541	4,98,554		71,693
19	S/DBT/SP- 270- Dr. Yogesh Karpe		10,35,723	22,34,723	15,16,677		3,17,677
20	S/DBT/SP-275-Dr. Anupama Engineer		3,65,607	8,18,989	8,88,808		4,35,426
21	S/DBT/SP 276-Dr. Sumit Dagar		19,94,686	17,96,121	52,590		2,51,155
22	S/DBT/SP-278-Dr. Shravage		1,63,427	10,79,319	10,62,077		1,46,185
23	S/DBT/SP 280-- Dr. Ratnaparkhi		23,61,116	21,93,426	9,10,386		10,78,076
24	S/DBT/ SP 281-Dr. Tamhankar		4,49,722	10,36,056	8,01,027		2,14,693
25	S/DBT/ SP 282- Dr. Karthick B.		1,68,907	15,77,974	15,57,441		1,48,374
26	S/DBT/SP-293 - Dr. S.A. Tamhankar		34,43,302	7,48,736	1,16,666		28,11,232
27	S/DBT/SP-297 - Dr. Chinmoy Patra			18,99,461	42,07,147		23,07,686
28	S/DBT/SP-300 - Dr. J.M. Rajwade			4,49,501	40,97,072		36,47,571
29	S/DBT/SP-310 - Dr. Yashavanthakumar				2,50,000		2,50,000
30	S/DBT/ SP 70		242				242
31	S/DBT/ Wheat Molecular Seminar		976				976
32	S/DST/ Anaemia Workshop		91,595				91,595
33	S/DST/ GLV Meeting		11,845				11,845
34	S/DST Inspire/SP 228- Dr. Anjali Jha		3,52,169	4,03,845		51,676	
35	S/DST Inspire/SP 229- Dr. Gajbhiye		3,79,375	3,79,375			
36	S/DST/SP 230-Dr. Bodas		1,107	2,86,018	2,84,911		
37	S/DST/SP 239A- Dr. Patra	3,68,472		5,80,319		9,48,791	
38	S/ DST/ SP 255- Dr. Rajwade		2,44,755				2,44,755
39	S/DST/ SP 261- Dr. Gajbhiye		83,981	16,82,778	16,74,230		75,433

Amount - Rs.

SR. NO.	PATICULARS	OPENING BALANCE		DURING THE YEAR		CLOSING BALANCE	
		DEBIT	CREDIT	DEBIT	CREDIT	DEBIT	CREDIT
40	S/DST/SP 263- Dr. Yogesh Karpe		2,96,208	10,88,193	8,47,559		55,574
41	S/DST/SP 267-Dr. Ghormade		3,21,930	3,21,930			
42	S/DST/SP-274- Dr. Karthick		75,164	2,65,571	4,00,984		2,10,577
43	S/DST/SP-285 - Ms Pranitha Pandit		2,76,210	6,07,751	3,094	3,28,447	
44	S/DST/SP-301 - Dr. Ritu Mamgain			5,32,166	11,21,983		5,89,817
45	S/ DST WOS-B/ SP 152	3,19,195				3,19,195	
46	S/DYPatil/SP 273 New D.Y. Patil		12,877				12,877
47	S/GCP/SP 166	33,379				33,379	
48	S/GCP WORKSHOP		2,26,032				2,26,032
49	S/HTBSIL/ SP 243		2,47,542				2,47,542
50	S/ICAR/SOYBEAN WORKSHOP		15,634				15,634
51	S/ICAR/ SOY CONTRACT SCH		5,872				5,872
52	S/ICAR/SP 001		3,58,561	35,00,725	70,01,439		38,59,275
53	S/ICAR/SP 002		10,80,469	32,62,677	32,40,672		10,58,464
54	S/ICAR/SP 003		5,42,939	83,43,186	92,77,752		14,77,505
55	S/ICAR/SP 033		56,85,581	27,76,392	55,29,911		84,39,100
56	S/ICAR/SP 034		1,030				1,030
57	S/ICAR/SP 043		59,988	25,850	28,512		62,650
58	S/ICAR/SP 096		57,71,696	10,71,573	18,71,445		65,71,568
59	S/ICAR/SP 183		8,457				8,457
60	S/ICAR/SP 211		4,24,762				4,24,762
61	S/ICAR/SP-296- Dr. Philips Varghese		5,58,000				5,58,000
62	S/ICAR/WHEAT TRIAL		125				125
63	S/ICMR/SP-299 - Dr. Dhananjay Bodas			3,25,949	26,77,834		23,51,885
64	S/IndiaAlliance DBT Wellcome/SP-302 - Dr. Patra			16,70,521	1,31,25,429		1,14,54,908
65	S/INDO SWISS BIOTECHNOLOGY	10,014				10,014	
66	S/INDO-US BIOREMEDIATION	818				818	
67	S/ISRO/SP-258		2,23,017	2,44,528		21,511	
68	S/KPIT/SP-289 - Dr. P.K. Dhakephalkar			5,14,737	11,86,440		6,71,703
69	S/LSRB/SP 145		1,204				1,204
70	S/MAX PLANCK/SP 239		21,48,914	18,14,831	6,34,046		9,68,129
71	S/MOEF/SP-279- Dr. Karthick		8,69,211	12,37,175	4,61,990		94,026
72	S/MoES/SP 266	2,59,122		4,05,198		6,64,320	
73	S/MoES/SP-298- Dr. Tushar Kaushik			8,01,924	13,36,413		5,34,489
74	S/OECT/SP 241		3,17,627	6,49,596	1,38,184	1,93,785	
75	S/OECT/SP 246		6,76,166	10,03,307	2,01,620	1,25,521	
76	S/OECT/SP 277- Dr. Dhakephalkar		28,45,138	66,03,842	38,79,970		1,21,266
77	S/ONGC/SP 205	4,53,731				4,53,731	
78	S/ONGC/ SP 235	12,68,258		1,38,184	12,66,165	1,40,277	
79	S/ONGC/ SP 236	11,41,777			13,50,224		2,08,447
80	S/Pitambari Products Pvt Ltd/SP 269		2,61,819	2,49,344			12,475
81	S/RGSTC/SP 168- Dr. Upadhye		19,442				19,442
82	S/RGSTC/SP 231- Dr. Upadhye		9,02,343	6,50,385			2,51,958

Amount - Rs.

SR. NO.	PATICULARS	OPENING BALANCE		DURING THE YEAR		CLOSING BALANCE	
		DEBIT	CREDIT	DEBIT	CREDIT	DEBIT	CREDIT
83	S/RGSTC/SP-283- Dr. Bharati Sharma		4,44,482	5,20,814	7,08,000		6,31,668
84	S/SERB/SP 220- Dr. Gargee Pandit		31,957				31,957
85	S/SERB/ SP 242- Dr. Anindita Das		1,40,297	1,40,297			
86	S/SERB/ SP 244- Dr. Vidya Patwardhan	2,92,489			2,92,489		
87	S/SERB/SP 245- Dr. P.P. Kulkarni		76,581	76,581			
88	S/SERB/SP 247- Dr. Abhishek Baghela		40,642	40,642			
89	S/SERB/SP 248- Dr. Roshni Khare		1,32,612	1,32,612			
90	S/SERB/SP 249- Dr. Sumit Singh Dagar		86,410	86,410			
91	S/SERB/SP 251- Dr. A. Ratnaparkhi		2,37,845	72,848	1,683		1,66,680
92	S/SERB/ SP 252- Dr. Karthick Balsubramanian		12,616				12,616
93	S/SERB/SP 253- Dr. Rajesh Kumar K C		51,755				51,755
94	S/SERB/SP 254 - Dr. Vikram Lanjekar		41,155				41,155
95	S/SERB/ SP 257- Dr. Bodas		2,93,649	6,82,816	8,14,873		4,25,706
96	S/SERB/ SP 259 - Dr. Chinmoy Patra		1,38,552	7,68,395	6,33,105		3,262
97	S/SERB/ SP 260 - Dr. Shravage		1,67,508	5,63,963	4,03,056		6,601
98	S/SERB/ SP 262- Dr. R. K. Choudhary		2,01,299	5,38,130	4,04,421		67,590
99	S/SERB/SP-264-Dr. R.M. Patil		38,849	7,36,020	7,81,101		83,930
100	S/SERB/SP 265- Dr. Mandar Datar		2,17,771	6,74,129	7,14,249		2,57,891
101	S/SERB/SP-284 Dr. Surajit Roy		14,453	10,22,181	10,41,186		33,458
102	S/SERB/SP-286 Dr. Monali Rahalkar		5,09,286	9,84,176	7,16,819		2,41,929
103	S/SERB/SP-287 - Dr. Vandana Ghormade		16,24,392	15,48,607	42,477		1,18,262
104	S/SERB/SP-288 - Dr. Prasad Kulkarni		15,35,910	13,56,826	1,06,311		2,85,395
105	S/SERB/SP-290 - Dr. Virendra Gajbhiye		12,43,777	12,10,476	26,075		59,376
106	S/SERB/SP-291 - Dr. Abhishek Baghela		16,24,926	15,75,572	1,41,782		1,91,136
107	S/SERB/SP-292 - Dr. S.A. Tamhankar		20,88,433	10,43,667	68,567		11,13,333
108	S/SERB/SP-294 - Dr. Sujata Tetali		13,20,368	6,25,966	40,757		7,35,159
109	S/SERB/SP-295 - Dr. Madhuri Pawar		8,60,541	10,50,437	1,77,823	12,073	
110	S/SERB/SP-304 - Dr. Bothiraja & Dr. Rajwade			25,000	3,38,552		3,13,552
111	S/SERB/SP-305 - Dr. Mahesh Borde & Dr. Singh			68,914	3,38,354		2,69,440
112	S/SERB/SP-306 - Dr. Himanshu			3,03,819	11,26,528		8,22,709
113	S/SERB/SP-307 - Dr. Kriti Sengupta			2,87,000	11,26,857		8,39,857
114	S/SERB/SP-309 -			1,00,000	19,07,949		18,07,949
115	S/ SP 171-B		72,149				72,149
116	S/Tata/SP-268- Dr. M. N. Datar		3,35,497	8,43,595	10,18,800		5,10,702
117	Vishwadeep Pressparts Pvt Ltd		3,52,185				3,52,185
118	CSIR ALL SCHEMES		78,608				78,608
119	F/CSIR/Ajay Lagashetti				10,000		10,000

Amount - Rs.

SR. NO.	PATICULARS	OPENING BALANCE		DURING THE YEAR		CLOSING BALANCE	
		DEBIT	CREDIT	DEBIT	CREDIT	DEBIT	CREDIT
120	F/CSIR/ANAGHA BASARGEKAR		4,062		15,938		20,000
121	F/CSIR/Bhagyashri Joshi				11,694		11,694
122	F/CSIR/CONSOLIDATED		2,72,122				2,72,122
123	F/CSIR/Darshetkar Ashwini				20,000		20,000
124	F/CSIR/Deshpande Payal				20,000		20,000
125	F/CSIR/Dr. Ghaskadbi CSIR		9,493	2,98,619	3,31,667		42,541
126	F/CSIR/Gaikwad Ramesh		20,000				20,000
127	F/CSIR/Gulshan Walke		403				403
128	F/CSIR/Kumal Kaatri		3,918		6,667		10,585
129	F/CSIR/Kunal Pingale		113		16,608		16,721
130	F/CSIR/Neelam Kapse		2,300		17,700		20,000
131	F/CSIR/Nidhi Murmu				20,000		20,000
132	F/CSIR/Nikita Mehta				10,000		10,000
133	F/CSIR/Patil Gokul		29		16,692		16,721
134	F/CSIR/Pooja Salunke				14,372		14,372
135	F/CSIR/ Prajakta Tambe		468		6,199		6,667
136	F/CSIR/Pravinkumar Methe				19,727		19,727
137	F/CSIR/ Rameshwar Avchar		360		6,307		6,667
138	F/CSIR/Saurabh Gaikwad				18,361		18,361
139	F/CSIR/Smrithy Vijayan				16,667		16,667
140	F/CSIR/Snehal Jamalpure				16,721		16,721
141	F/CSIR/ Soham Pore		1,438				1,438
142	F/CSIR/ Sweta Malik		10				10
143	F/CSIR/Wadmare Neha				20,000		20,000
144	F/CSIR/Wagh Ganesh				19,071		19,071
145	F/DBT/DBT JRF Vikhe Parimal		20,227	5,21,925	5,09,640		7,942
146	F/DBT JRF/ Ameya Rayrikar	47,305		5,41,800	6,21,720		32,615
147	F/DBT JRF/ Pramod Kumar		80,182	4,01,900	2,09,225	1,12,493	
148	F/DBT/RA- Dr. Gouri Katre		1,52,403	8,23,329	7,08,300		37,374
149	F/DST INSPIRE/Aishwarya Padhye- JRF			7,15,824	9,53,712		2,37,888
150	F/DST INSPIRE/ Mayuri Shah		2,50,400				2,50,400
151	F/DST INSPIRE/ Pankuri K	23,558				23,558	
152	F/DST INSPIRE/Shradhha Rahi		3,181	4,04,346	4,11,339		10,174
153	F/DST INSPIRE/Sonali Mundhe		1,88,945	4,18,878	5,67,208		3,37,275
154	F/ICMR/ Gumaste U	42,498				42,498	
155	F/ICMR/ Neha Kulkarni		3,671	5,59,909	5,61,800		5,562
156	F/ICMR/Niraj Ghatpande		2,39,763	4,92,340	2,56,813		4,236
157	F/ICMR/ Nishikant Dixit	81,454				81,454	
158	F/ICMR/ Prabir Kumar		5,000				5,000
159	F/SRF/ICMR/Gayatri Kanade		1,37,480	5,41,499	5,88,220		1,84,201
160	F/SRF/ICMR/Sulaxna Pandey		1,55,821	5,52,021	5,89,800		1,93,600
161	UGC ALL SCH.		5,26,013				5,26,013
	Grand Total	**48,16,113**	**5,45,45,614**	**8,19,73,891**	**9,55,72,781**	**40,37,585**	**6,73,65,976**
			4,97,29,501				**6,33,28,391**

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2020

Schedule 4: Secured Loans and Borrowings

Amount - Rs.

Particulars	Current Year		Previous Year	
1. Central Government		0.00		0.00
2. State Government (Specify)		0.00		0.00
3. Financial Institutions				
a> Term Loans	0.00		0.00	
b> Interest Accrued and due	0.00	0.00	0.00	0.00
4. Banks:				
a> Term Loans	0.00		0.00	
- Interest accrued and due	0.00		0.00	
b> Other Loans (Specify)	0.00		0.00	
- Interest accrued and due	0.00	0.00	0.00	0.00
5. Other Institutions and Agencies		0.00		0.00
6. Debentures and Bonds		0.00		0.00
7. Others (Specify)		0.00		0.00
TOTAL Rs.		**0.00**		**0.00**

Note: Amounts due within one year Nil

Schedule 5: Unsecured Loans and Borrowings

Amount - Rs.

Particulars	Current Year		Previous Year	
1 Central Government		0.00		0.00
2 State Government (Specify)		0.00		0.00
3 Financial Institutions		0.00		0.00
4 Banks		0.00		0.00
a) Term Loans	0.00	0.00	0.00	0.00
b) Other Loans (Specify)	0.00	0.00	0.00	0.00
5 Other Intitutions and Agencies		0.00		0.00
6 Debentures and Bonds		0.00		0.00
7 Fixed Deposits		0.00		0.00
8 Others (Specify)		0.00		0.00
TOTAL Rs.		**0.00**		**0.00**

Schedule 6: Deferred Credit Liabilities

Amount - Rs.

Particulars	Current Year		Previous Year	
a) Acceptance secured by hypothication of capital equipment and other assets	0.00	0.00	0.00	0.00
b) Others	0.00	0.00	0.00	0.00
TOTAL Rs.		**0.00**		**0.00**

Note: Amounts due within one year Nil

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2020

Schedule 7: Current Liabilities & Provisions

Amount - Rs.

Particulars	Current Year		Previous Year	
A. Current Liabilities :-				
1. Acceptances	-		-	
2. Sundry Creditors:				
a) For Goods		4,93,810		75,488
3. Advances Received	-		-	
4. Interest Accrued but not due on:	-		-	
a) Secured Loans/borrowings	-		-	
b) Unsecured Loans/borrowings	-		-	
5. Statutory Liabilities:	-		-	
a) TDS Payable	10,36,469		4,27,234	
b) Service Tax Output Payable	-		5,27,391	
c) PF Commissioner A/c	3,12,181		7,57,289	
d) P.F.New Pension Scheme	88,991		4,85,191	
e) State Profession Tax	25,200	14,62,841	25,000	22,22,105
6. Other current Liabilities	75,34,386	75,34,386	50,95,764	50,95,764
7. Unspent Balance of Grant	40,12,916		2,03,91,856	
8. Earnest Money Deposit	10,51,087		10,65,430	
9. Security deposit	7,53,794		15,61,490	
10. Other Tution Fees & University Share	4,10,828		1,78,524	
11. Recovery of Bank Loan	3,700		3,700	
12. Workshops Meetings etc.	18,13,534		16,84,507	
13.Interest Earned Payable to DST	-		48,09,214	
14. Retention Money	1,52,967	81,98,826	1,52,967	2,98,47,688
Total (A)		**1,76,89,863**		**3,72,41,045**
B. PROVISIONS				
1. For Taxation				
2. Gratuity	8,88,04,180		7,96,49,036	
3. Superannuation/Pension	-		-	
4. Accumulated Leave Encashment	6,02,46,494		5,39,79,410	
5. Trade Warranties/Claims	-		-	
6. Others	-		-	
- Salary payable for March	40,51,031		82,34,085	
- Audit fees	12,000		11,800	
- Electricity & Power	6,69,724		6,97,048	
- Postage & Telephone	50,843		62,816	
- Campus maintainance	2,27,390		-	
- Security Service Charges	5,34,966		3,36,259	
- Hired Labour Charges	3,75,786		3,95,138	
Total (B)		15,49,72,414		14,33,65,592
Total (A+B)		**17,26,62,277**		**18,06,06,637**

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2020

Schedule 8 : Fixed Assets

Amount - Rs.

	DESCRIPTION	GROSS BLOCK						DEPRECIATION					NET BLOCK	
		Cost/ valuation As at beginning of the year	Rate of Dep.	Deletions during the year	Net cost as on 31.3.2020	Additions during the year	Cost value tion at the year-end	As at the beginning of the year	Dep. on the opening cost	Dep. On Additions during the year	Total dep. during the year	Total up to the Year-end	As at the Current year-end	As at the Previous year-end
A	**FIXED ASSETS:**													
1	**LAND**													
	a> Freehold- Land at Hol	1,70,514	-	-	1,70,514	-	1,70,514	-	-	-	-	-	1,70,514	1,70,514
	Land at Hol (Donated by G.O.M)	4,400	-	-	4,400	-	4,400	-	-	-	-	-	4,400	4,400
	b> Leasehold													
2	**BUILDINGS:**			-	-	-	-	-	-	-	-	-	-	-
	a> On Freehold	8,01,93,041	-	-	8,01,93,041	6,72,356	8,08,65,397	2,42,34,529	20,04,826	16,809	20,21,635	2,62,56,164	5,46,09,232	5,59,58,511
	b> On Leasehold	-		-	-	-	-	-	-	-	-	-	-	-
	c> Ownership Flats/Premises	-		-	-	-	-	-	-	-	-	-	-	-
	d> Superstructures on Land and not belonging to the entity	-		-	-	-	-	-	-	-	-	-	-	-
	e> Temporary Structures	23,12,701	2.5%	-	23,12,701	21,195	23,33,896	8,48,793	57,802	530	58,332	9,07,125	14,26,771	14,63,908
3	**PLANT MACHINERY & EQUIPMENT**	31,22,01,100	10% / 20%	23,750	31,21,77,350	39,06,643	31,60,83,993	22,36,82,687	26,13,343	4,95,101	31,08,444	22,67,91,132	8,92,92,861	8,85,18,413
4	**VEHICLES**	32,28,380	20%	-	32,28,380	-	32,28,380	22,11,233	1,55,905	-	1,55,905	23,67,138	8,61,242	10,17,147
5	**FURNITURE,FIXTURES**	3,39,06,945	10%		3,39,01,045	2,04,115	3,41,05,160	1,92,00,892	8,62,887	10,761	8,73,648	2,00,74,540	1,40,30,620	1,47,06,053
6	**COMPUTER/PERIPHERALS**	2,04,94,783	20%	-	2,04,94,783	7,500	2,05,02,283	1,89,15,830	75,809	1,500	77,309	1,89,93,139	15,09,144	15,78,953
7	**COMPUTER SOFTWARE**	38,62,612	60%	-	38,62,612	2,60,568	41,23,180	24,98,645	4,38,157	87,757	5,25,914	30,24,559	10,98,621	13,63,967
8	**ELECTRIC INSTALLATIONS**	2,01,53,374	10% / 15%	-	2,01,53,374	-	2,01,53,374	91,54,297	16,53,658	-	16,53,659	1,08,07,955	93,45,419	1,09,99,078
9	**LIBRARY BOOKS**	1,08,86,950	20%	-	1,08,86,950	1,28,926	1,10,15,876	90,13,538	1,59,291	15,017	1,74,308	91,87,846	18,28,030	18,73,412
10	**OTHER FIXED ASSETS**	1,01,75,046	-	-	1,01,75,046	-	1,01,75,046	29,21,416	2,54,376	-	2,54,376	31,75,792	69,99,254	72,53,630
	TOTAL OF CURRENT YEAR	**49,22,61,704**		**23,750**	**-**	**52,01,303**	**50,27,61,499**	**31,26,81,860**	**82,76,055**	**6,27,474**	**89,03,530**	**32,15,85,390**	**18,11,76,109**	**18,49,07,987**
	PREVIOUS YEAR	**47,41,83,565**		**27,960**	**-**	**2,34,34,241**	**49,22,61,704**	**30,53,72,825**	**43,57,698**	**29,51,337**	**73,09,035**	**31,26,81,859**	**18,49,07,987**	**16,88,10,742**
	TOTAL (A)	**49,22,61,704**		**23,750**	**-**	**52,01,303**	**50,27,61,499**	**31,26,81,860**	**82,76,055**	**6,27,474**	**89,03,530**	**32,15,85,390**	**18,11,76,109**	**18,49,07,987**
B	**CAPITAL W.I.P**													
	CENTRAL PUBLIC WORKS DEPT	1,30,00,000		-	-	37,12,779	-	-	-	-	-	-	1,67,12,779	1,30,00,000
	TOTAL (A+B)												**19,78,88,888**	**19,79,07,987**

Note : The afforsaid expenditure is incurred out of Govt. Grants, disposal of which is subject to conditions attached to these Grants

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2020

Schedule 9: Investments from Earmarked/ Endowemwnt Funds (Long Term)

Amount - Rs.

Particulars	Current Year	Previous Year
1. In Government Securities	-	-
2. Other approved Securities	-	-
3. Shares	-	-
4. F.D.R. with Indian Bank (Dr.A.B.Joshi Donation)	2,50,000	2,50,000
5. Subsidiaries and Joint Ventures	-	-
6. Others (Fixed Deposits) (Dr. A.D.Agate Donation)	5,001	5,001
7. Others Fixed Deposits from Lab. Reserve Fund (Tech. Dev. Fund A/c:SBI & UBI)	8,79,31,781	7,67,42,840
8. Others (Fixed Deposits from Regular Grant-SBI & UBI)	1,26,62,157	1,88,62,477
TOTAL (Rs.)	**10,08,48,939**	**9,58,60,318**

Schedule 10: Investments - Others

Amount - Rs.

Particulars	Current Year	Previous Year
In Government Securities	0.00	0.00
Other approved Securities	0.00	0.00
Shares	0.00	0.00
Debentures and Bonds	0.00	0.00
Subsidiaries and Joint Ventures	0.00	0.00
TOTAL Rs.	0.00	0.00

Schedule 11: Current Assets, Loans & Advances

Amount - Rs.

Particulars	Current Year		Previous Year	
A. CURRENT ASSETS:				
1. Inventories:				
a> Stores and Spares				
b> Publications	20,525		20,525	
c> Stock-in-trade of consumables (as taken valued and certified by the Management)	2,47,518	2,68,043	3,23,846	3,44,371
2. Sundry Debtors:				
a> Debts Outstanding for a period exceeding six months				
3. Cash balances in hand(including cheques/drafts and imprest)	49,805	49,805	38,542	38,542

Amount - Rs.

Particulars	Current Year		Previous Year	
4. Bank Balances:				
a> With scheduled Banks				
-On Current Accounts	1,55,84,740		1,82,82,266	
-On Deposit Accounts	-		-	
-On Savings Accounts	3,15,76,471		2,78,64,698	
- On Current Accounts(TDF)	1,23,09,097	5,94,70,308	60,84,211	5,22,31,175
b> With non-Scheduled Banks:				
-On Current Accounts	-		-	
-On Deposit Accounts	-		-	
-On Savings Accounts	-		-	
TOTAL (A)		**5,97,88,156**		**5,26,14,088**
B.LOANS,ADVANCES AND OTHER ASSETS				
1. Loans:				
a> Staff (For HBA, Vehicle Advance and Computer)	10,800		54,725	
d) Amount receivable from Schemes	27,67,005	27,77,805	17,68,813	18,23,538
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a> On Capital & Revenue Expenditure	-		-	
b> Prepayments(Cash Insurance)	-		-	
c> Advances to staff (For TA etc.)	2,57,898		1,41,334	
e> Festival Advance	-		-	
f> Deposits kept with Govt. Agencies (MSEB, Telephone, Gas Cylinder etc.)	11,09,413	13,67,311	9,81,823	11,23,157
3.Income Accrued:				
a> On Investments from Earmarked/ Endowment Funds	17,02,457		28,14,731	
b> On Loans and Advances(HBA, Vehicle Adv. & Computer Adv.)	9,625		8,950	
4. Sundry Debtors	62,340		14,85,566	
5. Advance to Suppliers (Prior to 2013-14)	6,87,528		6,87,528	
6. Income Tax (TDS)	16,04,342		16,76,151	
7. Income Tax (TDS) (Prior to 2010)	6,21,213		6,21,213	
8. GST Input /Service Tax Input	28,28,175		35,99,469	
9. Kumar Krishi Mitra Fellowship	31,281	75,46,961	31,281	1,09,24,889
Total (B)		**1,16,92,077**		**1,38,71,584**
C. NET CURRENT ASSETS AGAINST SPONSORED SCHEMES		6,33,28,391		4,97,29,501
TOTAL (A+B+C)		**13,48,08,624**		**11,62,15,173**

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2020

Schedule 12: Income From Sales/Services

Amount - Rs.

Particulars	Current Year	Previous Year
1. Income from Sales		
a) Sales of Finished Goods (Farm Produce)	9,65,161	7,76,497
b) Sale of Raw Material	6,300	4,560
c) Sale of Scraps	-	17,665
2. Income from Services		
b) Cultural Identification Charges/ Analytical Services	14,76,119	21,58,061
d) Others	1,54,371	99,332
e) Testing fees-Soyabean/Wheat	-	1,41,600
f) Course Fees- Summer 2019	3,85,500	-
Total (Rs.)	**29,87,451**	**31,97,715**

Schedule 13: Grants/Subsidies

Amount - Rs.

Particulars	Current Year	Previous Year
1. Central Government	18,90,51,000	19,09,97,000
Add: Unspent balance at the beginning of the year	2,03,91,856	1,19,96,840
Add: Interest Earned on Grant	6,34,746	-
Less: Unspent balance at the year end	40,12,916	2,03,91,856
Less: Interest refund back to DST	14,85,308	-
	20,45,79,378	**18,26,01,984**
2. State Government	-	-
3. Government Agencies	-	-
4. Institutions/Welfare Bodies	-	-
5. International Organisations		
6. Others (Specify)	-	-
Net Surplus of sale of Assets	-	-
Total (Rs.)	**20,45,79,378**	**18,26,01,984**

* Unspent balance of grant is against recurring balance & non-recurring balance is regrouped under Schedule I Capital Fund

Schedule 14: Fees/Subscriptions

Amount - Rs.

Particulars	Current Year	Previous Year
1. Entrance Fees (Library Membership fees)	1,00,000	29,000
2. Annual Fees (Licence fees)/Subscriptions	22,369	11,056
3. Seminar/Program Fees	-	-
4. Others (Ph.D. Tuition fee, Ph.D. Provisional Admission fee)	6,89,200	2,02,900
Total (Rs.)	**8,11,569**	**2,42,956**

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2020

Schedule 15: Income From Investments

Amount - Rs.

INCOME FROM INVESTMENTS: (Income on Invest. From Earmarked/ Endowment Funds transferred to Funds.)	INVESTMENT FROM EARMARKED FUND		INVESTMENT - OTHERS	
	Current Year	Previous Year	Current Year	Previous
1. Interest				
a> On Govt. Securities	0.00	0.00	0.00	0.00
b> Other Bonds/Debentures	0.00	0.00	0.00	0.00
2. Dividends.				
a> On Shares	0.00	0.00	0.00	0.00
b> On Mutual Fund Securities	0.00	0.00	0.00	0.00
3. Rents	0.00	0.00	0.00	0.00
4. Others (Interest on bank deposits)	0.00	0.00	0.00	0.00
TOTAL Rs.	**0.00**	**0.00**	**0.00**	**0.00**
TRANSFERRED TO EARMARKED/ ENDOWMENTFUND	**0.00**	**0.00**	**0.00**	**0.00**

Schedule 16: Income from Royalty, Publications, etc.

Amount - Rs.

Particulars	Current Year	Previous Year
1. Income from Royalty	-	-
2. Income from Publications	910	190
3. Others (Sale of Tender Forms/I Cards)	3,500	7,100
4. Application Money	26,850	14,050
Total (Rs.)	**31,260**	**21,340**

Schedule 17 : Interest Earned

Amount - Rs.

Particulars	Current Year	Previous Year
1. On Term Deposits		
a) With Scheduled Banks	-	-
b) With Non-Scheduled Banks	-	-
2. On Saving Accounts		
a) With Scheduled Banks	23,45,953	-
b) With Non-Scheduled Banks	-	-
c) Post Office Savings Accounts	-	-
3. On Loans		
a) Employees/Staff (On HBA, Vehicle and Computer Advance)	97,118	1,66,371
b) Interest Received on L.C	-	-
4. Interest on Debtors and Other Receivables	-	-
Total (Rs.)	**24,43,071**	**1,66,371**

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2020

Schedule 18 : Other Income

Amount - Rs.

Particulars	Current Year	Previous Year
1) Profit on Sale/Disposal of Assets:		
a) Owned Assets	-	-
b) Assets acquired out of grants, or received free of cost		
2) Export Incentives realized	-	-
3) Fees for Miscellaneous Services	7,83,396	6,00,220
4) Miscellaneous Income	1,95,858	3,51,068
Total (Rs.)	**9,79,254**	**9,51,288**

Schedule 19: Increase/(Decrease) In The Stock Of Finished Goods & Work In Progress

Amount - Rs.

Particulars	Current Year	Previous Year
a) Closing stock		
- Laboratory Consumables	2,47,518	3,23,846
- Finished Goods	-	1,16,561
- Publications	20,525	20,525
	2,68,043	4,60,932
b) Less: Opening Stock		
- Laboratory Consumables	3,23,846	3,65,819
- Finished Goods	-	-
- Publications	20,525	41,295
	3,44,371	4,07,114
Net Increase/(Decrease)	**(76,328)**	**53,818**

Schedule 20 : Establishment Expenses

Amount - Rs.

Particulars	Current Year	Previous Year
1) Salaries and Wages	13,84,06,883	10,60,49,312
2) Allowances and Bonus	24,66,512	2,31,367
3) Contribution to Provident Fund & New Pension Scheme	1,33,62,835	1,04,35,039
4) Contribution to Other Fund (D.L.I.F.)	2,95,576	1,88,350
5) Staff Welfare Expenses	12,59,401	22,66,219
6) Expenses on Employees Reitrement and Terminal Benefits	1,96,39,856	2,69,62,283
7) Stipend to Research & Fellowship Students	27,91,510	30,80,976
8) Encashment of Earned Leave for LTC	8,93,019	10,20,814
TOTAL	**17,91,15,592**	**15,02,34,360**

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2020

Schedule 21: Other Administrative Expenses

Amount - Rs.

Particulars	Current Year	Previous Year
ADVERTISEMENT & PUBLICITY	35,525	5,50,764
AUDITORS REMUNERATION	47,400	10,100
ELECTRICITY & POWER	83,97,089	77,44,011
FARM EXPENSES	33,65,248	35,37,519
HOSPITALITY EXPENSES	1,83,847	3,42,739
INSURANCE	3,735	5,019
LEGAL & PROFESSIONAL FESS	7,81,774	4,28,515
OTHER OFFICE EXPENSES	4,94,610	3,02,148
POSTAGE, TELEPHONE & COMMUNICATION	7,96,795	7,25,282
PRINTING & STATIONERY	7,88,610	8,21,486
PURCHASES OF CHEMICALS & GLASSWARE	88,95,817	62,98,331
RENT RATES & TAXES	16,38,307	16,94,131
REPAIRS & MAINTENANCE	79,33,303	1,33,22,524
RETIRED STAFF MEDICAL EXPENSES	4,41,285	9,44,405
SECURITY & LABOUR EXPENSES	91,57,175	78,55,021
SEMINAR /WORKSHOP EXPENSES	8,25,275	9,25,110
SUBSCRIPTION FEES	1,77,339	22,72,494
TRAVELLING & CONVEYANCE	5,45,985	9,31,719
VEHICLE RUNNING AND MAINT EXPS	1,51,134	2,25,231
WATER CHARGES	11,32,414	5,92,709
TOTAL (Rs.)	**4,57,92,666**	**4,95,29,258**

Schedule 22: Expenditure on Grants, Subsidies etc.

Amount - Rs.

Particulars	Current Year		Previous Year	
a) Grants given to Institutions/Organisation	0.00	0.00	0.00	0.00
b) Subsidies given to Institutions/Organisations	0.00	0.00	0.00	0.00
TOTAL Rs.		**0.00**		**0.00**

Schedule 23 : Interest

Amount - Rs.

Particulars	Current Year		Previous Year	
a) On Fixed Loans	0.00	0.00	0.00	0.00
b) On Other Loans (including Bank Charges)	0.00	0.00	0.00	0.00
c) Others (Specify)				
TOTAL Rs.		**0.00**		**0.00**

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2020

Schedule D: Transfer to Capital Fund

Amount - Rs.

Particulars	Current Year		Previous Year	
Other Fixed Assets				
Books	1,28,926		7,96,455	
Buildings	6,72,356		27,91,960	
Computer / Peripherials/Softwares	2,68,068		11,09,305	
Office Furniture & Dead Stock	2,04,115		3,89,112	
App. & Equipments	39,06,643		1,27,75,709	
Electrical Installation	-		47,92,177	
Vehicles	-		7,79,523	
Temporary Structures	21,195		-	
		52,01,303		**2,34,34,240**

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

Saideep Dhoble Patil
Partner

Place: Pune
Date: 28/08/2020

FORM OF FINANCIAL STATEMENTS: Non –profit making organization

Name of Entity: M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of the Accounts for the period ended 31.03.2020

Schedule 24: Significant Accounting Policies

a. Accounting Convention

The Financial statements are prepared under the historical cost convention and in accordance with the applicable Accounting Standards except where otherwise stated. Accrual system of accounting is generally followed to record the transaction in the financial statements.

b. Fixed Assets

Fixed assets are stated at their original cost of acquisition, less depreciation.

c. Method of Depreciation

Depreciation on fixed assets has been provided on straight line basis (SLM) as per the rates prescribed under the Bombay Public Trust Act, 1950.

It is not possible for us to verify the actual date of asset put to use and hence the same has been taken on the basis of information and explanation given by the management. Accordingly depreciation is calculated irrespective of put to use for the whole year.

d. Extra-ordinary Items, Prior Period Items, Changes in Accounting Policies :

On the basis of information and explanation given by the management Extra-ordinary Items, Prior Period Items, Changes in Accounting Policies are separately disclosed in the financial Statement but are integrated through various items appearing under the same.

e. Foreign Currency Transactions:

Transactions denominated in foreign currency are accounted as the exchange rate prevailing at the date of the transaction; however foreign exchange gain loss is not calculated and accounted for.

f. Investments:

1. Long term investments are valued at cost and where required, provision is made for permanent diminution in the value of such investment.
2. Investment classified as "Current" is valued at cost and market value.
3. Cost means acquisition cost which includes acquisition expenses like brokerage, transfer stamp, etc.

g. Revenue Recognition:

1. All Revenue receipts are on accrual basis.
2. All Expenses are generally accounted on accrual basis.

h. Accounting for Government Grants:

1. Government grants of the nature of contribution towards capital cost of setting projects as capital reserve

i. Retirement Benefits:

1. Generally, liability towards gratuity payable on death/retirement and leave encashment of the employees is provided based on Actuarial Valuation.
2. Provision for accumulated leave encashment benefit to the employees is accrued and computed on the assumption that the employees are entitled to receive the benefit as each year end which is also done on Actuarial Valuation.

j. Capitalization:

1. All direct expenses attributable to fixed asset acquired are capitalized.

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

Saideep Dhoble Patil
Partner

Place: Pune
Date: 28/08/2020

FORM OF FINANCIAL STATEMENTS: Non –profit making organization

Name of Entity: M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of the Accounts for the period ended 31.03.2020

Schedule 25: Contingent liabilities and Notes on Accounts (Illustrative)

1. Contingent liability

a) Claims against the entity not acknowledge as debts-Nil (Previous Year-Nil)

b) In respect of:

- Bank guarantee given by on behalf of the entity -N.A.(Previous Year-Nil)
- Letter of credit. opened by bank behalf of the entity -Nil(Previous Year- Nil)
- Bill discounted with banks -Nil (Previous Year-Nil)

c) Disputed demands in respect of:

- Income tax -Nil (previous Year-Nil) Sales tax -Nil (Previous Year-Nil)
- Municipal Taxes -Nil (Previous Year-Nil)

d) In respect of claims from parties for non-execution of orders, but contested by the entity Nil (Previous Year-Nil)

2. Capital Commitments

Estimated value of contracts remaining to be executed on capital account and not provided for (Net of Advances)-Nil (Previous Year)-Nil

3. Lease obligation

Further obligation for rental under finance lease arrangements for plant and machinery is Nil (previous Year Nil)

4. Current Assets, Loans and Advances

In the opinion of the management, the current assets, loans and advances have a value on realization in the ordinary course of business, equal to the aggregate amount shown in the Balance Sheet. Some of balance of sundry debtors, deposits, loans and advances are subject to confirmation from the respective parties and consequential reconciliation adjustments arising there from, if any.

5. Taxation

In view of there being no taxable income under Income Tax Act 1961, No provision for income tax has been considered necessary. In view of this, no disclosure is required as per accounting standards -22 issued by The Institute of Chartered Accountants of India (ICAI).

6. Grants

Grants are recognized on receipts. Grants received from Department of Science & Technology (DST) for Creation of Capital Assets are treated as Capital Fund of the Institute. Grants received for General, Salaries and Salaries-SC are treated as of revenue nature and shown under Income & Expenditure Account.

7. Retirement Benefit

Generally, liability towards gratuity payable on death/retirement of employees is provided based on Actuarial Valuation and provision for accumulated leave encashment benefit to the employees is accrued and computed on the assumption that employees are entitled to receive the benefit at each year end which is also done on Actuarial Valuation.

The principle assumption used in determining the gratuity obligation are as below:-

Sr. No.	Particular	For year ended 31st March 2020
1	Withdrawal Rate	2.00%
2	Discounting Rate	6.83%
3	Future Salary Rise	5.00%

The position of gratuity payable on death/retirement of employees and leave encashment as on 31st March, 2020 is as below

Particulars	Provision for Gratuity	Provision for Leave Encashment
Opening balance as on 1st April 2019	7,96,49,036	5,39,79,410
Add:- Addition during the year 2019-20	91,55,144	62,67,084
Less:- Deduction during the year 2019-20	.....	.....
Closing Balance as on 31st March 2020	8,88,04,180	6,02,46,494

8. Impairment of Assets:

As per Accounting Standard-28 "Impairment of Assets" issued by the institute of Chartered India, comes in to effect, in respect of accounting commencing on or after 1st April, 2005. We have relied upon the management on the matters related to impairment of assets, in view of management there are no impairment losses.

9. Previous year figure are rearranged, recast or regrouped wherever necessary, to make them comparable which those of the year under audit.

10. Third party confirmation is necessary for confirming the balances appearing in the books of account and also long outstanding of balances as at the Balance Sheet date hence, we are unable to comment on the accuracy of such third party balances**.**

11. Provisions are recognized when the firm has present obligation as a result of past event; it is more likely that an outflow resources will be required to settle the obligation; and the amount has been reliably estimated.

12. In case of items debited to Income and Expenditure account, it was informed to us that the expenditure is not of capital nature.

13. Depreciation on fixed assets has been provided on straight line basis (SLM) as per the rates prescribed under the Bombay Public Trust Act, 1950.

As per our report of even date
For **DCRK & ASSOCIATES**
Chartered Accountants
FRN:127831W

Saideep Dhoble Patil
Partner

Place: Pune
Date: 28/08/2020

National Science Day

Maharashtra Association for the Cultivation of Science
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