Department of Biotechnology
STAR COLLEGE SCHEME

Sanction no.: BT/HRD/11/09/2014; dated 06 August, 2014

Progress Report

(2014-2017)

Upgradation to Star College status/continuation at existing level under Star College Scheme 2018

Submitted by

Hindi Vidya Prachar Samiti's

RAMNIRANJAN JHUNJHUNWALA COLLEGE OF ARTS, SCIENCE AND COMMERCE

(RJ College of Arts, Science and Commerce)

Ghatkopar (West), Mumbai - 400 086

NAAC Reaccredited 'A' Grade, CGPA 3.50 (3rd Cycle)

Department of Biotechnology
Star College Scheme

1. **Name of the College:** Hindi Vidya Prachar Samiti's Ramniranjan Jhunjhunwala College of Arts, Science and Commerce, Ghatkopar West, Mumbai 400086.
   NAAC Accredited 3rd cycle A grade CGPA 3.50
2. **Year of Support:** BT/HRD/11/09/2014 dated 06.08.2014

3. **Total Grant Received during the Period of Support:**

Year	**Non-Recurring**	**Recurring#**	**Total**
2014-15	2000000.00	900000.00	2900000.00
2015-16	Nil	719600.00	719600.00
2016-17*	Nil	835600.00	835600.00
Total	20,00,000.00	24,55,200.00	44,55,200.00

(**released in 2017-18; # includes funds for travel grant)*

4. **Recognition by other funding agency:**

Recognition	**Agency**
FIST	DST
Career Oriented Courses	UGC
Bachelor of Vocation	UGC
Research Programs	UGC, DST, CSIR, University of Mumbai, Hindustan Unilever Ltd.

Details of extramural projects received from different funding agencies

No.	**Academic Year**	**Project**	**Type (Major/Minor) and Funding Agency**	**Grant Amount Sanctioned**	**Status (Ongoing/ Completed)**
1.	2015-18	Analysis of Synchronization in Coupled Nonlinear Systems using Invariant Measures *Dr. Kiran Kolwankar*	Major DST	18,54,370/-	Ongoing
2.	2013-17	Disruption of microstructure of tea using exogenous enzymes *Dr. Usha Mukundan*	Hindustan Unilever	13,02,000/-	Completed
3.	2015-18	Maintenance and analysis of tea culture *Dr. Usha Mukundan*	Hindustan Unilever	1,50,000/year	On going
4.	2014-15	Tree census and effective CO_2 sequestration at 'N ward, BMC' Mumbai region *Dr. Anil Avhad*	Minor, UGC	2,00,000/-	Completed
5.	2014-15	Investigation and evaluation of haemostatic properties of some ethnobotanicals *Dr. Jahnavi Bhagwat*	Minor U.G.C.	2,40,000/-	Completed
6.	2016-18	Forensic study of CNS drugs in food samples in duping cases by using TLC, HPTLC and HPLC *Dr. Abhay Sawant*	Minor U.G.C.	2,85,000/-	Ongoing

7.	2016-18	Effect of solvent on micelles of binary surfactant systems *Dr. Manisha Bhattacharya*	Minor U.G.C.	1,60,000/-	Ongoing
8.	2016-18	Synthesis, characterization & Evaluation of new triazole derivatives and evaluation of their antimicrobial activity *Dr. Asawari Mokal*	Minor U.G.C.	4,00,000/-	Ongoing
9.	2016-18	Improving Management and trade of ornamental fish keeping by early diagnosis and treatment of diseases *Dr. Geeta Joshi*	Minor U.G.C.	2,35,000/-	Ongoing
10.	2016-17	Theanine production from tea callus *Dr. Usha Mukundan*	HUL	4,00,000/-	Completed
11.	2016-18	Unraveling physical chemistry of drug-DNA interaction: essential steps towards rational drug design *Dr. Palak Chawla (nee Dr. Neelam Keshwani*)	DST	35,97,000/-	Ongoing
12.	2016-18	Development of local fractional calculus or fractals *Dr. Kiran Kolwankar*	CSIR	15,00,000/-	Ongoing

Minor Projects

No.	Funding Agency	Name	Sanction Date	Sanction Amount
1.	UoM MRP	Chemistry Dept. Mr. Jitendra D Girase	17.10.2014	25,000
2.	UoM MRP	Chemistry Dept. Mr. Pratap P Kamble	17.10.2014	25,000
3.	UoM MRP	Chemistry Dept. Dr. Sandesh K Divekar	15.02.2016	25,000
4.	UoM MRP	Chemistry Dept. Dr. Abhay D Swant	15.02.2016	25,000
5.	UoM MRP	Physics Dept Mrs. Vaishali Raikwar	15.02.2016	32,000
6.	UoM MRP	Zoology Dept. Mrs. Sushma V Singh	15.02.2016	25,000
7.	UoM MRP	Zoology Dept. Mrs. Sanika Gupte	15.02.2016	25,000
8.	UoM MRP	Botany Dept. Dr. Dan Bahadur R Singh	15.02.2016	25,000
9.	UoM MRP	Botany Dept. Mr. Pravin G Nayak	15.02.2016	25,000
10.	UoM MRP	Botany Dept. Dr. Anil E Avhad	16.01.2017	35,000
11.	UoM MRP	Botany Dept. Dr. Nisha Muni	16.01.2017	30,000

UoM = University of Mumbai

5. Name/s of Departments supported:

- Botany
- Chemistry
- Physics
- Zoology

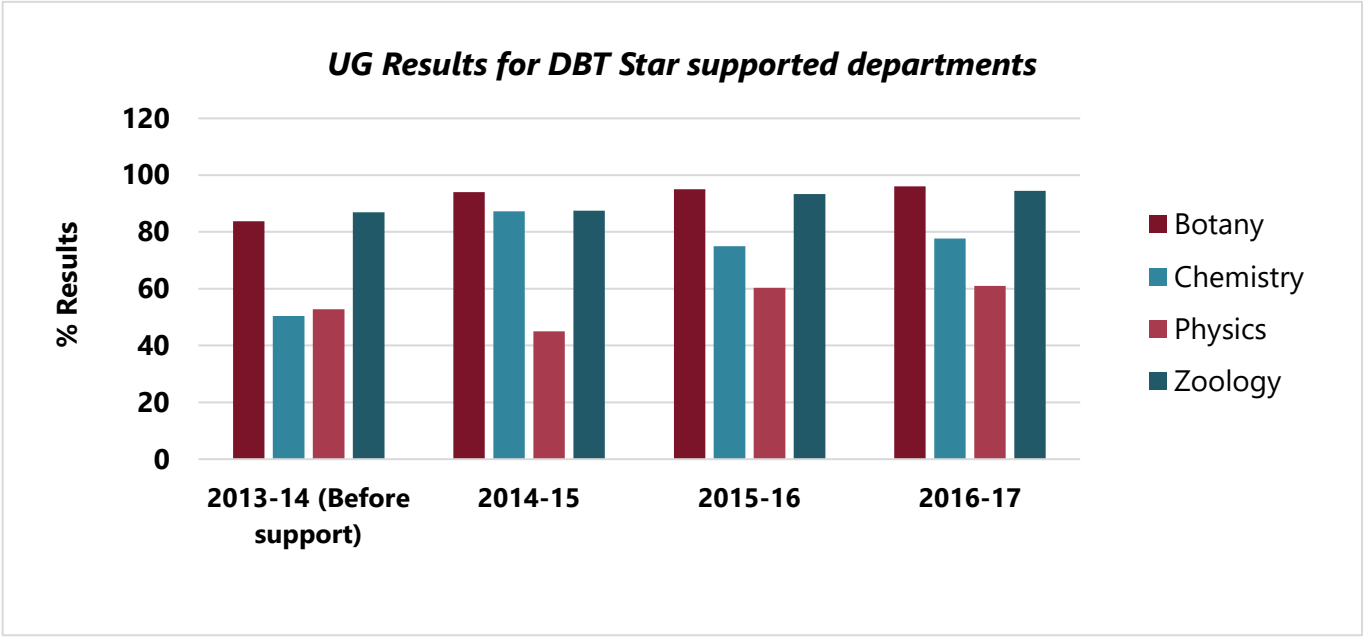
6. **Department-wise Performance during the Period: (only graphical representation)**
Comparative analysis prior to support and after the support in terms of:

a. Cut off percent for admission Bachelor of Science (B.Sc.) 2014-15

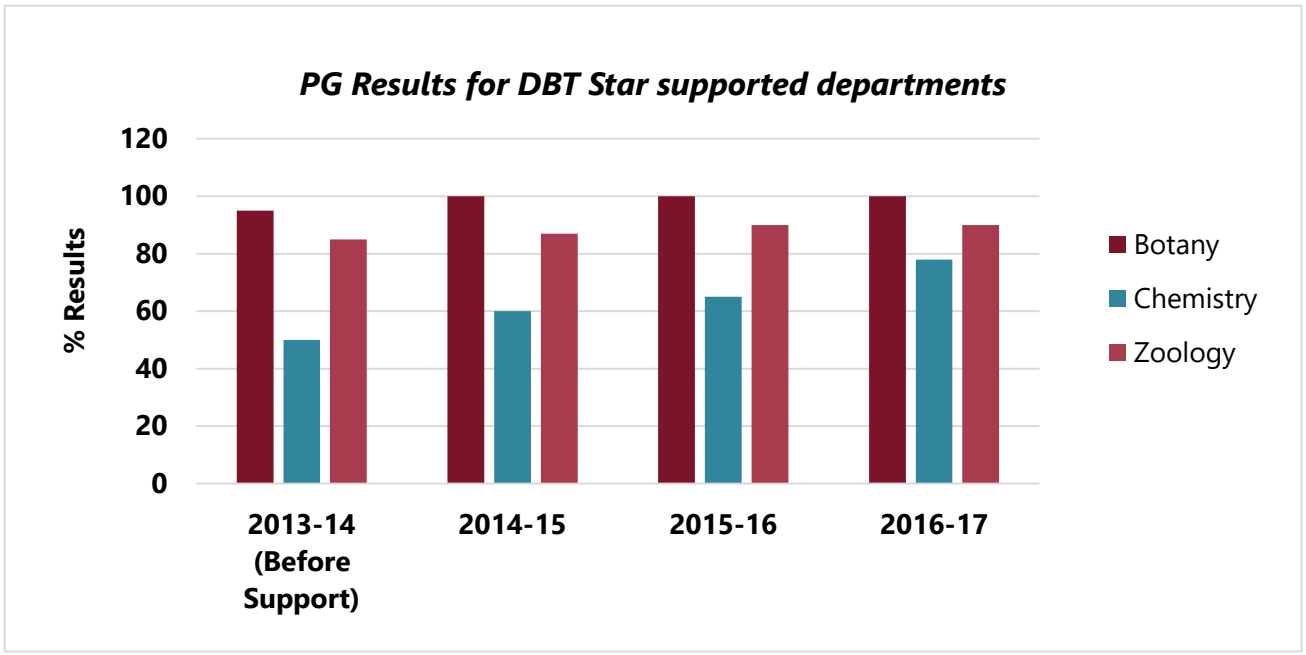
	Before Support	After Support			Remarks
	2013-14	2014-15	2015-16	2016-17	
Botany	50%	55%	60%	60%	Incremental change
Chemistry	55%	65%	65%	65%	Significant increase
Physics	55%	60%	60%	60%	Significant increase
Zoology	50%	55%	55%	55%	Significant increase

***Significant observation from 2014-15 the demand ratio for FYBSc Science admissions has seen on increase due to which we have been requesting University for 10% increase in total number of seats and all seats are filled. There are no drop-outs after student enrollment.**

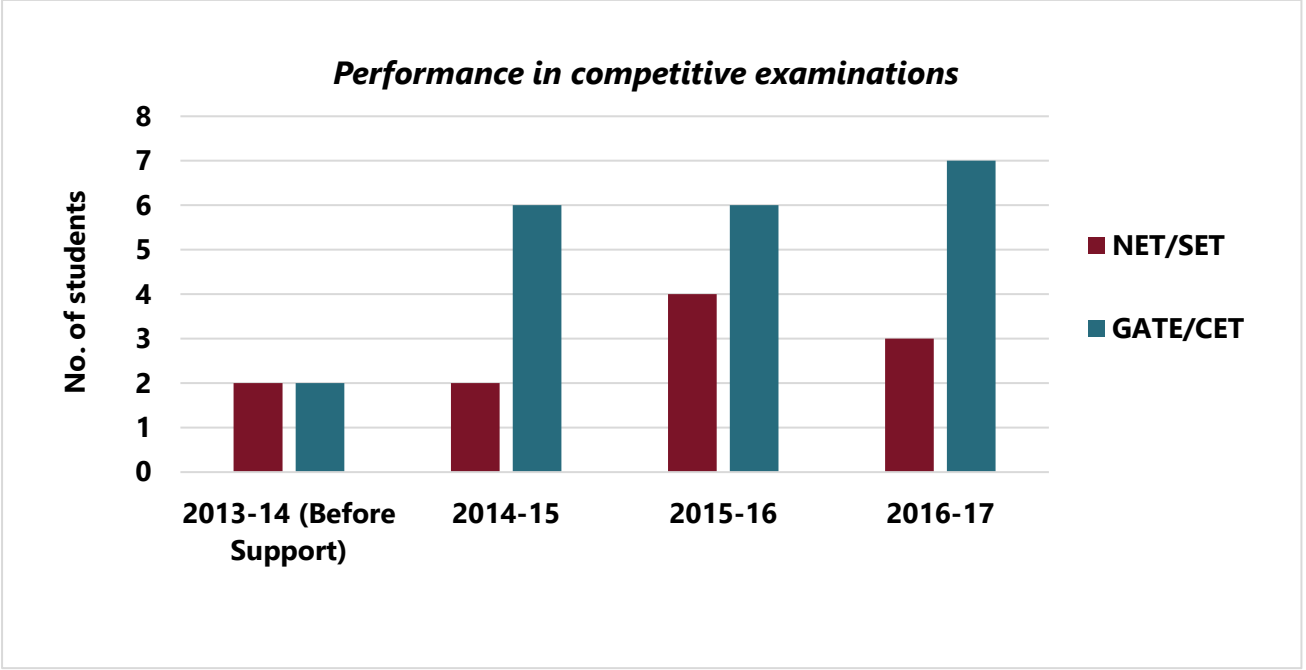
Drop-out percentage: NIL



Department	Before Support	After Support			Remarks
	2013-14	2014-15	2015-16	2016-17	
Botany	17	17	17	17	Seats are filled by University through Centralized admission
Chemistry	12	12	12	12	Seats are filled by University through centralized admission
Physics	0	0	0	20	M.Sc. Physics was introduced in 2016-17 and in 2017-18 the enrollment was 22 (10% additional seat)
Zoology	10	10	10	10	Seats are filled by University through centralized admission



(NOTE: Dept. of Physics started the PG program in 2016-17 so first batch will pass out in June 2018)



7. Number of workshops held for teachers and students (with title, duration and number of participants):

BOTANY:

For students

No.	Title	Duration	No. of participants
	2014-2015		
1.	Bioinformatics: hands on training on computer to study biological data bases	6 days 6/04/2015 - 11/04/2015	120
2.	Basics of Biostatistics		
3.	Preparation of standard solutions		
4.	How to design an experiment, writing of lab book, results, calculation and documentation		
5.	Workshop on different techniques of flower arrangement (Interdepartmental)	1 day 10/12/2014	40
6.	Workshop on bio jewelry, technique of drying and crafting of plant material (Interdepartmental)	1 day 10/12/2014	25
7.	Workshop on Plant tissue culture technique	6 days 10/1/2015- 15/1/2015	10
	2015-2016		
1.	Workshop on plant tissue culture techniques	6 days 2/5/2015 to 7/5/2015	30 (2 batches of 15 each)
2.	Experimental design , documentation	1 day 10/6/2015	35
3.	Training in growing plants using Hydroponic and aquaponics	2 days 15/6/2015	15
4.	Workshop on identification and exhibition of wild vegetables	1 day	45
	2016-2017		
1.	Workshop on identification of wild vegetables along with exhibition of wild vegetables (Interdepartmental)	1 day 30/7/2015	40
2.	Waste Management include e waste management (Interdepartmental)	1 day 1/10/2016	79
3.	Workshop on micro propagation (Interdepartmental)	6 days 20/4/2017 to 25/4/2017	30 (2 batches of 15 each)
4.	Climate Mapping hands on training using maximum and Minimum thermometer, Barometer, Rain Gauge and Hygrometer	1 day 3/7/2017	55 students 20 students visited 10 schools and created awareness among school children about climate change

For Teachers

No.	Title	Duration	No. of participants
	2014-2015		
1.	Workshop on Trimble Hand Held GPS system for tree census	1 26/8/2014	2
2.	Hands on training in using, maintenance, care to be taken, trouble shooting of instruments purchased from DBT Star College funds. Preparation of SOP's for these instruments	2 2/1/2015	9
3.	Workshop on how to write a research proposal creating awareness among faculty members about various funding agencies, thrust areas of research, call for proposals, websites. (Interdepartmental)	1 5/1/2015	50
4.	Evaluation techniques and how to make practicals more interesting (POGIL)	1 10/1/2015	9
	2015-2016		
1.	Workshop on separation of plant proteins by PAGE	1 day 23/7/2016	2 teachers in house were resource persons 16 teachers and 9 students from other colleges attended the workshop
2.	GHG Accounting including topics like carbon credits, action plan for global warming, measurement of carbon sequestration	1 day 12-13/10/2015	9
3.	Vein Islet number and its utility in segregation of pharmacological material	1 day 11/7/2015	9
	2016-2017		
1.	Post-harvest technology under skill India theme (Interdepartmental)	2 26-27/04/2017	20
2.	Workshop on revised syllabus in Botany of TY B Sc. (Botany)	1 day 11/7/2016	130 teachers from all colleges affiliated to University of Mumbai. New Practicals were also done by the teachers due to the equipments and chemicals purchased from DBT star College funds

3.	Refresher course for Junior college teachers (Lectures on emerging areas in Biological science) Botany and Zoology Department organized it under the aegis of University of Mumbai HRDC and was possible only due to availability of instruments like pH meter, colorimeter, electrophoresis units in multiple numbers	20 days	40 teachers from different colleges and our teachers were resource persons

Workshops held after completion of three years

1. Histochemical localization of secondary metabolites
2. Tissue printing as a tool for localization of proteins
3. Exhibition cum workshop on Bonsai and landscape preparation was conducted on 3rd and 4th March, 2018. The exhibition was open to general public. 40 students and teachers were trained in the art of making a Bonsai, in addition the event was webcasted live through Facebook
4. Making a Terrarium workshop one day (25 students) March 2018

CHEMISTRY

For students

No.	Title	Duration	No. of participants
	2014-2015		
1.	Workshop on understanding the basic concepts in chemistry.	6 days 20th to 25th April, 2014	100
2.	Workshop on GLP and Green Chemistry	2 days 12th to 13th June, 2014	100
3.	Workshop on Basic techniques and safety aspects in Laboratory	5 days 15th to 20th June, 2015	220
4.	Workshop on referring Indian Pharmacopoeia (I.P) vol I, vol II, vol II. 2010 edition for FY, SY and TYBSc. Students	6 days all batches 20th to 25th November 2014	550+255+123 students
5.	Hands on training and standardization of instruments purchased from DBT funds PH meter, precision balances Colorimeter, conductometer U V Visible spectrophotometer	2 days 20th and 21st June, 2015	100
	2015-2016		
1.	Basic Techniques and safety aspects in Laboratory (Interdepartmental)	6 days 20th July to 25th July 2015	520
2.	Basic Techniques and safety aspects in Laboratory. Handling, care and troubleshooting, calibration of instruments purchased from DBT star college funds: Potentiometer, Conductometer, Colorimeter and pH meter.	6 days 15th to 20th June 2015	250
3.	Basic Techniques of safety aspects in Laboratory. Hands on training in using the instruments purchased from DBT star college funds. Principle, working, graphical methods used in detection of equivalence points, calibration of instruments TY BSc	2 days 12 & 13th June 2015	120
4.	Introduction to Indian Pharmacopoeia Vol I, II, III 2010 Edition	6 days 26th July to 1st August, 2015	400
	2016-2017		
1	Workshop on GLP and Green Chemistry	6 days 27th June to 2nd July, 2016	120
2	Basic technique and safety aspects in laboratory	6 days 27th June to 2nd July 2016)	224
3	Safety Aspects in Laboratory	6 days 25th July to 30th July, 2016	400
4	Introduction to Indian Pharmacopoeia Vol I, II, III 2010 edition	6 days 1-5th August, 2016	400

5	Workshop on Mass Spectrometry in association with ISMAS (Indian Society for Mass Spectrometry)	1 day 9th December, 2016	120

For teachers

No.	Title	Duration	No. of participants
	2014-2015		
1.	Research methodology	6 days 15/10/2015-21/10/2015	2
2.	Handling, maintenance, care and troubleshooting, preparation of SOP's for instruments purchased from grants received from DBT Star College funding	2 days	21
3.	Transforming Indian to transform India, Physical, emotional, intellectual, social, cultural, spiritual transformation care of IQ, EQ and SQ.	19, 15, 26th July, 2/8/2014, 7/2/2015, 15/4/2015	100 (25 staff and 75 students) for our college and neighboring colleges
4.	Safe handling of chemicals and disposal of chemical waste	27/6/2015	Teaching and supporting staff (21+ 20)
	2015-2016		
1.	Research methodology	6 days 14/12/2015 to 19/12/2015	2
2.	Firefighting and safety film show live demonstration types of fire extinguishers, precautionary measures to be taken. (Interdepartmental for teaching and non-teaching staff of college)	1 day 7/12/2015	100
3.	Safe handling of laboratory glasswares in collaboration with Borosil glass works-Ltd.	1 12/1/2016	21+20
4.	Workshop on green synthesis	27/7/2016	20
	2016-2017		
1.	Green Chemistry		
2.	Operation and maintenance of analytical instruments with WRIC Mumbai (Intercollegiate)	5 days 17/10/2016 to 21/10/2016	23 (11 colleges)
3.	Workshop on using & demonstration on recording and spectral analysis on FTIR instrument (Brucker, Germany)	1 day 28/2/2017	12
4.	Mass Spectrometry (ISMAS) (Intercollegiate)	1 day	21
5.	Refresher course for Junior college teachers under aegis of HRDC University of Mumbai theory and practical session our teachers were resource persons	10 days 14/12/2016 to 24/12/2016	32 teachers from various colleges

After completion of three years

Workshop on careers in Chemistry 8th to 14th March 2018 for final year students

Workshop on preparing table reagents and using them in micro quantities (green chemistry)

PHYSICS

No.	Title	Duration	No. of participants
2014-2015			
	For Students		
1	Understanding the basics and application of Physics	7 days 10th to 16th March, 2015	50
2	Enhance your Employability skills	1 day 9th March, 2015	45
3	Power point presentation skills on various " Sky Objects"	31/3/2015	14
4	Telecommunication in Computers	11/3/2015	65
	For teachers		
1	Setting up of experiments using instruments purchased from DBT grants	Spread out over a period of 30 days	15
2	Physics of optical communication	1 day 16th March, 2015	15
2015-2016			
1	Workshop on telescope handling and sky observation	I day 5/1/2015	10
2	Mobile Planetarium to introduce students to COSMOS (Interdepartmental activity). Secrets of Sun, Black hole were screened	1 day 2/1/2015	630 students+ 30 staff
	For teachers		
1	Workshop on Advanced Excel	3 days	12 teaching and 4 supporting staff
2	Night sky observation	1 day	41 students and 4 staff members
2016-2017			
	For Students		
1	Introduction to basics of Physics and fun of Physics	6 days	
2	A voyage from circuits to system Electronics	1 day 16/7/2016	72+10 teachers
3	Yes! You can do: Keen observation and critical analysis during exploration in science by Dr Anand Ghaisas (Interdepartmental)	1 day 3/12/2016	100 students + 20 teachers
4	Managing Gmail and Google Drive	1 day 19/8/2016	40 students and 9 teachers
	For teachers		
1	Refresher course for Junior College teachers (Intercollegiate). Was possible only because of apparatus and consumables procured from DBT star college funds	10 days 14/12/2016 to 24/12/2016	29 teachers from various colleges

After completion of three years: Designing innovative experiments to explain basic of physics. IIT students demonstrated interesting experiments related to Physics for the students of our college. The IIT student demonstration was streamed live at Devrukh College, Ratnagiri.

ZOOLOGY

No.	Title	Duration	No. of participants
2014-2015			
	For Students		
1	Nature Photography (Interdepartmental)	1	40
2	Identification of shell	1	100
3	Good laboratory practices in collaboration with Geochem lab	1 day 10th June 2015	50
4	Basic Laboratory skills and hands on training on instruments	2 days 12th and 13th June, 2015	40
	For Teachers		
1	Computational Biology	1	9
2	*Paramoecium* culture and design of experiments	1	9
3	Biostatistics	3	9
4	Workshop for supporting staff (Interdepartmental) on communication and management, health safety and environment, Psyche management, stress management, sleep management, diet and nutrition for wellness	6	50
2015-2016			
	For students		
1	Handling, calibration of instruments, purchased from DBT star College funds. SOP's	2	40 students+9 staff
2	Good laboratory practices	2 days, 12 and 13 July 2016	40
3	Training in first aid (Interdepartmental) in collaboration with personnel from Civil Defense	1 day 12 February, 2016	150+ 20 staff
	For teachers		
	2015-2016		
1	Use of digital multimeter for water analysis (Interdepartmental)	1, 25/6/2015	12
2	Research methodology (Intercollegiate)	6 days	25
3	Research Avenues in Ornithology (Intercollegiate)	1, 10/9/2015	80 staff and students
4	Identification of venomous and non-venomous snakes	1 20/1/2016	60
2016-2017			
	For students		
1	Blood measurement by Sphygmomanometer	1	40
2	Detection of blood sugar by glucometer	1	42
3	Workshop on basic satellite imagery and hands on training on basic map making (Interdepartmental)	1day 14/7/2016	50 students and teachers
4	Hands on training on use of spreadsheet for Biostatistics	1 day 25/2/2017	50 staff and students
5	Preparation of herbaria to preserve marine algae	1 day 21/2/2017	20 students
6	Identification of Avifauna in Keola Deo Ghana National Park Rajasthan	2 days 6th and 7th Jan, 2017	37 students+ 4 staff

2016-2017			
	For teachers		
1	Refresher course for Junior college biology teachers along with Botany Department. Experiments were done by teachers and this was possible only because of availability of multiple units of equipments and consumables from DBT star college funds	10 days 14/12/2016 to 24/12/2016	30 teachers
2	To make power point more effective as a presentation skill (staff and students	1 day 14/2/2017	9+80
3	Microtomy why and how (tissue processing, embedding, ribbon and staining)	3 days 15/6/2017	10

After completion of three years: Identification of insects and hands of training in pinning dead insects in field one day (18/1/2018) by Mr Parag Rangnekar at Tambdi-Surla Goa

Note: It has been observed that there is a significant increase in the number of workshops being organized by all departments after implementation of the star college scheme.

8. Number of Students undertaking Project vs. Total Number of Students. Please give list of Department-wise Projects that were carried out during the Support Period.

BOTANY

No.	2014-2015	No. of students who completed projects
	Title	
	FY BSc students (267 students)	
1.	Pharmacognosical studies of leaves and fruits of *Moringa*	3
2.	Pollen morphological studies of plants from RJ College Campus by acetolysis. Preparation of pollen calendar	10
3.	Permanent slide preparation and double staining	10
4.	**SY BSc 100% students given group projects and they were given prizes under the banner of DBT star college (125)**	
5.	Preparation of terrariums	10
6.	Preparation of bottle gardens using soft drink bottle (depicting reusing waste)	10
7.	Preparation of grandmas pouch for common ailment s like cold, cough, headache, aid for digestion, constipation, loose motions etc.	20
8.	Antioxidant properties of tea	03
9.	Collection identification of ornamental ferns and gymnosperms	10
10.	Collection, identification of algae from water bodies	10
11.	Preparation of health drinks and documentation about its nutraceutical value	10
12.	Collection of major forest products source (botanical names), and identification	10
13.	Collection of minor forest products Botanical source and importance of forest	10
14.	Study of genetic variants in *Mirabilis jalapa* with reference to flower color	02
15.	Collection and compilation of Plants in Mythology	10
16.	Collection of fungi from local areas and identification. Saprophytic and parasitic fungi	10
17.	Careers in Botany students conducted aptitude test and created awareness among aspiring students about the career opportunities in Botany	10
	TY BSc 38 students 100% did project work	
1.	Water sample analysis	07
2.	Identification of Mangroves using vegetative characters	06
3.	Composting of waste generated in kitchen, temples (floral)	10
4.	Identification and labeling of plants in R J Campus	05
5.	Mushroom cultivation (*Pleurotus*)	10

No.	2015-2016	No. of students who completed projects
	Title	
	FY BSc students (251 students)	
1.	Bio Indicator of genotoxicity: The *Allium cepa* test	03
2.	Effect of pH on catalase extracted from purple cabbage	01
	SY BSc (125)	
1.	Study of soil collected from different areas	10
2.	Soil profile of different areas	10
3.	Poor man's food rich man's diet: collection and display of grains like	10

	quinoa, duckweed, amaranthus, ragi, oats nutritive value	
4.	Amazing plants collected, identified an described identification by smell and touch	10
5.	Growing common vegetable like spinach growth parameter using hydroponics	10
6.	Growing cucumber using aquaponics	05
7.	Mushroom cultivation and nutritive value of mushrooms	10
	TY BSc (45)	
1.	Identification and labeling of trees in Naval stores, Ghatkopar	10
2.	Preparation of herbal products by purchasing raw material and authenticating by pharmacognostical tools	35
2016-2017		
	FY BSc (250)	
1.	All students collected sample from water from their areas, wall scrapings, scrapping from wells etc. and microscopically identified the algae, type of thallus, genus with help of key, documented the chloroplast type, pyrenoids and other cell contents if any	All
	SY BSc (125)	
1.	To find BMI of the student and suggest a diet plan (interdepartmental)	15
2.	Know your institution ICRISAT (Arid crops in view of drought in Maharashtra)	
3.	Pulse research Institute (International year of pulses)	10
4.	Collection of Yams and tubers from field and market botanical names, nutritional value recipes	10
5.	Exotic fruits botanical names and nutritional value	10
6.	Unconventional pulses and common pulses	
7.	Recycle and make it green: Banana peels/orange peels/lemon p eels	10
8.	Tissue printing for localizing mechanical tissues in coleus stem	06
	TY BSc (35)	
1.	Tissue printing localization of H_2O_2	02
2.	Study of enzyme tyrosinase	02
3.	To find out the moisture content in commercial moisturizer using Rose petals (interdepartmental)	02
4.	Phytochemcial analysis of *Syzgium jambolina* leaves	02
5.	Estimation of vitamin C content from *Moringa* leaves	02
6.	Separation of seed proteins using PAGE	02
7.	Study of enzyme peroxidase from *Trigonella foencum-graecum*	02
8.	Study of Tyrosinase activity from Mushroom (Interdepartmental)	02
9.	Pollen viability in different varieties of Bougainvillea	02
10.	Pollen morphology of Bignoniaceae members	02
11.	Study of SOD activity extracted from *Portulaca* leaves (Interdepartmental)	
12.	Estimation of polyphenol content in *Emblica* fruits obtained from garden and market (Interdepartmental)	02
13.	Extraction of pectin from orange peels using microwave and its estimation of pectin	02
14.	Study of absorption pattern of betalains using spectrophotometer	02
15.	Study of antimicrobial activity of coconut oil (Interdepartmental)	02
16.	Extraction of essential oil from *Anethum graveolens* and separation by TLC	01
17.	Histochemical localization of storage content of Maize grain	02
18.	Arrangement of mechanical tissues in leaves	02

CHEMISTRY

	2014-2015	
	FY BSc	
	Every student did project on preparing reagent paper to be used as sensors for detection of metal ions.	420
	Detect adulteration in the food sample brought by individual student. Principle and test involved documentation and conclusions drawn. Tea powder, milk sweets, dried chili powder, coffee powder, sugar, turmeric powder, jalebi	
	SY BSc	
	To determine the percentage composition of mixture of strong acid and weak acid by titrating against strong base using conductometer	225
	TY BSc	
	Students brought various soup powders available in the market and determined the chloride content using argentimetric method (this project could be carried out by students individually due to $AgNO_3$ purchased from DBT funds)	120
	2015-2016	
1.	FY BSc project done individually and results obtained were analyzed Assay of sodium carbonate (Na_2CO_3) by I P method and comparing the purity of L R and AR grade Na_2CO_3	420 (subjects offered by students Chemistry, Botany, Zoology, Physics, Maths and Statistics)
2.	SY BSc project done individually students to analyse the mixture of two different metal ions (Cu II & Fe II) from a given mixture Part I separation of two metal ions by solvent extraction Part II Estimation of each metal ion separated by titrimetric method	200
3.	TY BSc Students carried out individually pH metric titrations of i) dibasic acid (maleic acid) and ii) tribasic acid (phosphoric acid) followed by determination of equivalence point graphically and to calculate pK_1, pK_2 and pK_3 values.	120
	2016-2017	
1.	Project on understanding the principle of slow burning of firecrackers FY BSc	420
2.	To estimate the acid value of vegetable oil brought by individual student purchased from the market (SYBSc)	225
3.	Milk testing in association with consumer guidance society of India (Interdepartmental project), fat%, solid non-fat%, density, protein, lactose, water content temperature, freezing point, salts% statistical analysis of data	146 students, branded and non-branded milk
4.	To record IR spectrum on FTIR of the given compound and to do the spectral analysis from the spectrum obtained Students were given unknown compounds for recording of the spectra (TYBSc)	120 students

PHYSICS

2014-2015		
	SYBSc and TYBSc (220)	
1.	Fibre Optics	10
2.	Measuring speed of light	10
3.	Chaos on oscilloscope	10
4.	Playing with angles	10
2015-2016		
	SYBSc and TYBSc (200)	
1.	Water level Indicator	10
2.	Burglar alarm for safety	10
3.	Resonance waves demonstration	10
4.	3-dim hologram	10
5.	Visualizing sound on the oscilloscope	10
2016-2017		
	SY BSc and TY BSc (200)	
1.	Clap switch	10
2.	The proportional counter	10
3.	The Gauss Gun	10
4.	Sterling Engine	10
5.	Motion sensor using LDR	10
6.	Easy D C generator	10
7.	A simple radio set	10
8.	Dark sensors	10
9.	Hover Board	10
10.	Human body as battery	10
11.	Laser sensor security alarm	10
12.	Optical fibre	10
13.	555 timer chip musical instruments	10
14.	Perpetual motion (impossibility of) wheel	10
15.	Total internal reflection	10
16.	Free energy and conductivity	10
17.	To demonstrate Newton's third Law	10
18.	Automatic street light	10
19.	Hydraulic Bridge	10
20.	Free energy and conductivity	10

ZOOLOGY:

2014-2015		
1.	*Paramoecium* culture to study the effect of nutrients on population dynamics (FYBSc)	30/225
2.	Aquarium maintenance and fish diseases (SYBSc)	60/100
3.	To find the blood group of donors in blood donation drive and counseling session on importance of blood groups	260 (SY and FY BSc students)
4.	Measurement of blood pressure and glucometer of teaching and non-teaching interpretation of results, counseling on life style management assisted by alumni doctors	40 (All TY BSc students)
2015-2016		
1.	Study on water sample analysis (seasonal two-year project) (TYBSc)	4
2.	Sediment analysis of Thane creek (One-year project) (TYBSc)	4
3.	Project on Dairy Science : an Economical aspect survey and data analysis about economical aspect (TYBSc)	10
4.	Study of haematin crystals of different vertebrates (TYBSc)	5

2016-2017		
1.	Separation of plasma proteins by PAGE (TYBSc)	5
2.	Comparative study on the effect of commercial products on hair keratin (TYBSc)	5
3.	Study of nematodes from different soil sample (TYBSc)	5
4.	Study of Ecological status of Bhandupeshwar kund (TYBSc)	5
5.	Comparative studies of nutrient contents of health drinks (FYBSc)	5
6.	Electrophoresis of haemoglobin in alkaline gel (TYBSc)	5
7.	Study of pre- and post-monsoon physiochemical parameter of Ulhas River (TYBSc)	5

Major Project Highlights done by all departments in collaboration with each other and student participation in research meet, Avishkar (University of Mumbai intercollegiate research meet), paper/poster presentation in seminars, conferences and continued project work from FY BSc till date and many students have progressed to MSc

1. Pharmacognostical studies of *Moringa*: Mr Anika Yadav, Mr Vijay Gupta, Ms Namrata Jaiswal
2. Akshay Dange and Mr Vinay Dubey first prize in poster competition Soil profile 2015
3. Namrata Jaiswal and Ankit Yadav research paper presentation "Strategies to conserve wetlands – a case study of Kala Talo, Kalyan-Maharashtra" In International conference on "Science sustainability and the society challenges and opportunities 2016
4. B Deshmukh, A Pawar and S Kamble. Bioindicator of genotoxicity The *Allium sativum* test Avishkar 2016
5. Vijay Gupta Antioxidant studies of miracle tree: *Moringa oleifera* Avishkar 2016
6. Ankit Yadav Forensic Palynology-Nature's finger prints of plants Avishkar 2016
7. Sandhya Santosh and Ganesh Singh B Purohit: Study of endophytic fungi associated with mangroves presented paper at Wetlands for future for a sustainable livelihood 2016
8. Candida Vaz and Royston Rogers Study of ecological status of Thane creek published paper 2016
9. Sunil Chaurasia Effect of different sources of light on photochemical reaction between (NH4)2C2O4 and Iodine (I2). Avishkar 2016, DBT Research Convention 2016, VES College Chembur intercollegiate research meet
10. Sayali Parab Cleaning waste by waste Avishkar 2017, National convention held at Maitreyi College, New Delhi 2017
11. Vrushali Ingole Study of starch grains in different pulses and development of a key for identification of pulses. Participated in Avishkar 2016
12. Susmita Gudulkar Plant system as a tool for validating ethnobotanical claims for kidney stone presented paper/poster at Avishkar 2016, Presented paper at National convention held at Maitreyi College, New Delhi and won first prize, 2017. Presented paper at DBT research convention 2016, VES College, Chembur intercollegiate research meet. Continues the project by doing the phytochemical analysis of plants claimed to be having lithotropic properties
13. Ankit Nayak Dye removal using *Oscimum basilicum* seeds Avishkar 2017
14. Trimple Pandey Characterisation of enzyme catalase extracted from purple cabbage Avishkar 2017
15. Rishab Mishra Characterisation of enzyme tyrosinase extracted from banana peels
16. Susmita Gudulkar Extraction of shikimic acid from star anise using kitchen appliances (microwave, expresso coffee machine) presented at Avishkar 2017
17. Upasana Gupta did a year-long project on nonlinear stiffness properties of plants at different branching levels presented at competitions St Xavier's College 2017

Projects in progress

1. Interdisciplinary project: Dendritic patterns formed in biological fluids as a result of irradiation by low powered laser in collaboration with TIFR four students are working with highly sophisticated instruments. Pattern analysis by measuring the distribution of angles in different patterns.
2. Extraction of secondary metabolites using kitchen appliances characterization by HPTLC
3. Dyeing of fabrics using natural dyes extracted from teak leaves
4. Purification of proteins by ion exchange chromatography

9. List of new practical/demonstrations introduced for UG students for each class in different departments supported under Star College Scheme during the period which were not conducted prior to the DBT support: Practicals are for FY, SY and TY BSc all batches and all students performed the new practicals

BOTANY

No.	Title
	2014-15
1	To study the change in color of anthocyanin pigments depending on pH of the medium
2	Study of leaf morphology, preservation in the form of herbarium
3	Determination of stomatal frequency
4	DNA isolation and estimation from different plant materials
5	Identification of body types by Prakruti Nidan
6	Preparation and sterilization and plate pouring of medium for bacterial and fungal cultures
7	Study of aeromycoflora using plate exposure technique
8	Study of plant tissue by double staining technique: safranin and haematoxylin and differential staining using single stain Toluidine blue O
9	Use of micrometry to measure length of plant fibre, stomatal measurement
10	Separation of amino acids by paper chromatography
	2015-2016 **The above mentioned practicals were carried out and new practicals mentioned below were added**
1	To study inflorescence of the specimen collected by each student Identification and documentation
2	The practical of change in Anthocyanin pigment depending on pH medium New dimension addition of anthocyanin pigment extracted from purple cabbage and addition to different liquid like fruit juice, milk, rancid oil and conclusion to be drawn
3	Study of plant community by quadrat method (field based experiment) List quadrat and chart quadrat
4	Data analysis using statistical tools
5	Use of GPS and carbon sequestration rate of a tree
6	Identification and preparation of key for identification of plants in R J College campus
7	Study of cell contents (Ergastic matter) in different plant cells: starch grains, aleurone grains, oil globules, raphides, spaeraphide, cystoliths, plasmodesmata.
8	Statistical analysis of data using Excel
9	Study of enzyme amylase and use of POGIL
	2016-2017 **The above mentioned practicals were carried out and new practicals mentioned below were added**
1	Separation of plant pigments using paper chromatography
2	Measurement of Q10 of germinating seeds using anthocyanin (instead of phenol red indicator)
3	Extraction and estimation of proteins using Lowry's method. Standard graph and quantification of plant protein (students could do it individually due to availability of multiple instruments and consumables from DBT star college funds)
4	Study of Pollen morphology of different flowers collected by the students (good microsope purchased from DBT star college funds)
5	Morphological study of different types of fruits (visit to vegetable and fruit market) Botanical names and type of fruit to be identified and described by the student.

CHEMISTRY:

No.	Title
	2014-15
1	Determination of percentage purity of AR and LR grade Na_2CO_3 by using IP assay
2	To study the effect of heat on hydrated $CuSO_4$ crystals
3	Preparation of different types of papers used in chemistry laboratory: DMG paper, ferrocyanide paper, potassium dichromate paper and potassium thiocyanate paper

4	Detection of Ni^{2+}, Fe^{2+}, Cu^{2+}, Fe^{3+}, SO_3^{2-} ions
5	To prepare acetanilide from aniline using microwave
6	Potentiometric titration of HCl v/s NaOH
7	To determine percentage of chloride present in the given sample
8	To determine calcium content in market samples of calcium tablets
9	To make use of quinhydrone electrode for emf measurement
10	To determine percentage composition of strong acid and weak acid in the given mixture
2015-2016 The above mentioned practicals were carried out and new practicals mentioned below were added	
1	To prepare solutions concentrations from the given stock solution
2	To check the concentration of various solutions prepared by diluting stock solution by titrating against primary standard
2	To estimate the amount of vitamin C in the given sample using ceric ammonium sulphate
3	To estimate the amount of lead in the given sample using EDTA
4	To study the inversion of cane sugar using polarimeter
5	To study the effect of separation of Cu(II) and Fe(II) from a given mixture using solvent extraction
6	Seperation of Ternary mixture
7	Estimation of paracetamol by Indian Pharmacopoeia (I P)
8	Molecular modeling exercise in stereochemistry
9	Synthesis of coumarin using microwave
10	Titartion of maleic acid against NaOH pH metrically
11	Titration of phosphoric acid against NaOH using pH meter
2016-2017 (The above practicals were consolidated)	

PHYSICS:

No.	Title
2014-15	
	FY BSc (378 students)
1	Newtons rings
2	Lissajous Figures (was possible due to DBT star college funds)
3	Surface tension of different liquids
	SY BSc (184 students)
1	Laser attached Spectrometer
2	Fibre optics
3	Ultrasonic Interfermeter (was possible due to purchase of instrument from DBT star college funds)
4	Chaos circuit
	TYBSc (45 students)
1	Speed of light
2	Michelson Interferometer (was possible only due to purchase of instrument from DBT star college funds)
2015-2016 The above mentioned practicals were carried out and new practicals mentioned below were added	
	FYBSc (358) students
1	Newton's Rings with least aberration effects (was possible due to purchase of equipment form DBT Star college funds)
2	Variation of intensity with distance using cylindrical wave front
3	Determination of low resistance using bridge network with post office box
4	Characteristics of solar cell
	SYBSc (111) students
1	Launching of light in an optical fibre
2	Determination of i) Angle of Prism ii) wavelength of LASER USING laser attached Spectrometer
	TYBSc (42) students
1	Hands on training on instruments used for synthesis of nano-materials

2	Four probe method for characterization of nano materials
3	Low cost experiment on measuring speed of light
4	Detection and comparison of positive and negative crystals using double refraction
2016-2017 (The above practicals were refined and consolidated)	

ZOOLOGY:

No	Title
2014-15	
1	Identification of sugars using Thin-layer chromatography
2	Culture of *Paramoecium*
3	Observation of succession of microzoons in stagnant pond water
4	Estimation of proteins and lipids from milk samples brought by students
5	Detection of adulterants in milk brought by students
6	Technique of separation of proteins using PAGE (was possible only because multiple electrophoresis units purchased from DBT star college grants)
7	PAGE electrophoresis of plasma samples obtained from different individuals during blood donation drive
8	Trypsinization and viable count cells
9	Preparation and standardization of reagents
10	Estimation of amylase effect of pH
2015-2016 The above mentioned practical's were carried out and new practical's mentioned below were added	
1	To study the section of kidney, liver, ovary, thyroid, stomach, thymus, bone and cartilage (Microscope purchased in DBT grant was extensively used)
2	To determine water quality of water samples collected from Thane creek (possible due to consumable purchased from DBT star college fund) Before and After Ganesh festival
3	To determine blood group and counsel students the importance of knowing your blood group, importance of blood donation and creating awareness about blood banks
4	Study of genetic traits in human population
5	Technique of media preparation, culturing and maintenance of Drosophila cultures
6	Study of morphological characters of Drosophila normal and mutants
7	To determine the quality of sediments collected from Thane creek
8	Use of Bioinformatic tools in sequence analysis
2016-2017 The above mentioned practicals were carried out and new practicals mentioned below were added	
1	Studies on cyclosis and irratibility in *Paramoecium*
2	Estimation of calcium and silica content from sand samples
3	Identification of blood cells by differential staining technique
4	Study of population density by capture-recapture method
5	Study of DNA hyperchromocity

10. Inter-departmental Activities Conducted:

	2014-2015	Participating Departments
1	His-Tree: a heritage walk to learn about the heritage of South Mumbai, biodiversity Flora and fauna	History, Botany, Zoology conducted the walk and 30 staff members from various departments joined and enjoyed the study tour
2	Use of ICT in teaching learning process	30 teachers from science departments
3	Technique of crafting of plant material and bio jewellery making	40 students from arts, science and commerce
4	How to write a research proposal creating awareness among faculty members about funding agencies, thrust areas of research, call for proposals, websites	50 teachers of Chemistry, Botany, Zoology, Statistics, Physics, Maths, Biotechnology, IT and Computer Science Departments
5	Enhance your employability	100 students from all departments
6	Communication skills, stress management, diet	30 support staff from various departments.
7	Poster competitions organized by Zoology department on awareness of Ebola virus, Hibernation, dengue, pharmacognosy, radiations, food toxicity, effects of smoking in pregnancy, gut bacteria, birds of Mumbai. Domestic pest and their control, personal and social hygiene, Malaria, Tuberculosis	200 Students from all departments participated Students from 5 schools visited the event and best 5 were given prizes and all were given participation certificates under the DBT star college scheme
8	Poster competition on " Chemistry of domestic products" : Deodorant, table salt, shoe polish, cold drinks, talcum powder, Dettol, insecticides, Lithium battery, cosmetic kajal, shampoos, toothpaste, polythene, detergents, soap, hair color, chocolate, Vicks, antacids, crying while cutting onions, methyl salicylate	Students from all departments participated
	2015-2016	**Participating Departments**
1	Basic techniques and safety aspects in laboratory	Staff and students from all Science departments
2	Firefighting and safety, film show live demonstration types of fire extinguishers, precautionary measures to be taken to prevent man made calamity Fire	Staff and students of R J College in batches
3	Make your Presentations powerful	50 staff of science department
4	Training in first aid	All departments
5	Wild vegetables identification and competition on recipes using wild vegetables	All departments
6	Mobile Planetarium	All departments
7	Poster competition Physics in everyday life International year of Light. Games involving intellectual, numerical, promptness and steadiness	Physics, Chemistry, Maths and Statistics
8	ICT enabled teaching	All departments
	2016-2017	**Participating Departments**
1	Identification of medicinal plants	Chemistry, Botany, Zoology, Physics
2	Solid waste and e-waste management	Chemistry, Botany, Zoology, Physics, IT, Computer Science, Biotechnology
3	Workshop in spectroscopy	RJ College students and other college students
4	Optics revisited	Botany, Zoology, Physics
5	Preparation of nanoparticles and characterization	Botany, Zoology, Chemistry, Physics and Maths
6	Cleaning of Juhu beach and creating awareness about marine ecosystem	RJ college students and other college students

Major Impact of DBT Star College is all departments started working together and every year in November to December One week iSYear marked for DBT Star College Science Week and each department organizes interdepartmental activities which are also visited by school children thus creating interest among school children, these include the fests Botanica, Chem Bond, Chem Carnival, Zoofest, Tech fest, Physitech. These activities have also seen participation from Arts and Commerce students creating awareness among them about energy saving, environmental issues, water conservation, biodiversity, scientific explanation for prevailing myths

COURSE / TRAINING FOR NON-TEACHING/ LABORATORY STAFF UNDER DBT STAR COLLEGE SCHEME

1. Twice a year training in computers for members of supporting staff in computer literacy
2. Training in Lab safety procedures, firefighting, disaster management
3. Training of laboratory staff in using balances, pH meter, colorimeter, potentiometer, conductometer
4. Maintenance of microscopes
5. Proper handling and storage of chemicals, preparation of standard solutions.
6. Use of spread sheet for maintaining stocks
7. Yoga and meditation, stress management and healthy eating

11. Resources Generated: SOPs, Lab manuals, teaching kits etc.:

No	Title
2014-2015	
Botany Department	
	SOPs of instruments (All the standard operating procedures are reviewed every year)
1	Autoclave
2	Laminar air flow
3	Colorimeter
4	Analytical balance
5	Centrifuge
6	Refrigerated centrifuge
7	Electrophoresis unit
8	Spin win
9	HPTLC Linomat
	Publications
	Lab manuals: FY, SY and TY BSc
	Manual for preparation of standard solutions, stains, indicators and reagents
2015-2016	
	SOPs of Instruments
1	UV Visible Spectrophotometer
2	Lab Manual FY, SY and TY BSc
2016-2017	
1	Manual for bridge course in Botany
2	Lab manual SY BSc
Chemistry Department	
2014-2015	
1	Safe Laboratory Practices and procedure. Rules to be followed while working in Chemistry laboratory
	SOPs for following instruments
1	Conductometer
2	pH meter
3	Potentiometer
4	Colorimeter
5	Spectrophotometer
6	Flame Photometer
7	Qualitative aspects in Organic chemistry
8	Qualitative aspects in gravimetric analysis
2015-2016	
1	Green Chemistry
2	Manual for all the reagents used in chemistry practicals (new practicals and those in syllabi)
2016-2017	
1	Manual for FY, SY, TY BSc
2	Manual for fire safety
Physics	
2014-2015	
1	Manual of newly introduced practical's
2	Lab manual for FY, SY and TY BSc
3	Manual for maintenance of Instruments

Web page created on RJ College website for all the above-mentioned SOPs and Lab Manuals
(accessed at: http://www.rjcollege.edu.in/dbt-star-college/)

12. Collaborative Activities with Neighboring Colleges:

BOTANY:

No.	Title	Neighboring college/ Institution/Laboratory	No. of participants
		2014-2015	
1	Mangrove awareness Program	Vanshakti NGO working towards conservation of mangroves	40 (students from 5 different college and few citizens)
2	Dr DV Amonkar Memorial Intercollegiate elocution competition	Students from different colleges	50
3	Wild Vegetables exhibition	Paryavaran Dhakshata Manch	100
	Intercollegiate competition Biojewelery	10 different college	83
4	Short term course in research methodology	HRDC University of Mumbai	40 teachers from different colleges in Maharashtra
5	Botanica 2014	Neighboring school and college children	About 1000
6	Tree appreciation walks	Citizen group	40 students and citizens
		2015-2016	
1	Setting up of Butterfly and medicinal plant garden	Rotary club	25 students from different colleges
2	Botanica 2015	Neighboring schools and college	About 1000
3	Workshop on PAGE	Teachers from various college	16 teachers+9 students
4	Wild vegetable identification and preparation of recipes from them	Shristigyan an NGO students from 3 colleges and 5 schools	100
5	Short term course in research methodology	HRDC University of Mumbai	40 from different parts of Maharashtra
6	Tree appreciation walks	Citizen group	60 students and citizens
		2016-2017	
1	Botanica 2016	Neighbouring schools and colleges	About 800
2	Solid waste management in Sweden	Mrs Anna Daneberg, Future Earth (Climate Ambassador), Sweden	100 students from different colleges
3	Soft skill development training students for Avishkar	Research lab	10 students from 2 colleges
4	Visit and training in plant tissue culture laboratory	Plant tissue culture lab	Batches of 20 students from Somaiya College, Wilson College and one student from IISER Mohali spent one month for a short term project
5	Mangrove awareness trail	In collaboration with Soonabai Pirojsha Godrej Marine Ecology Centre, Mumbai	40 participants from various colleges

CHEMISTRY:

No.	Title	Neighboring college/ Institution/Laboratory	No. of participants
2014-2015			
1	Chem Bond	Various colleges	200
2	Safe laboratory practices	Students from various colleges	100
2015-2016			
1	Fire fighting	CIPLA company,	40 staff from different colleges
2016-2017			
1	Operations and maintenance of Analytical Instruments	WRIC, Mumbai	23 teaching and non-teaching staff members from 11 colleges
2	Special lectures : Innovations, Radioactivity, misconcepts in organic chemistry, chemical kinetics, Practicals Paper chromatography, polyacrylate superabsorbent , fire without match stick concept of density, conductometric titrations, complexometric tirtrations, determination of equivalence point Industrial visit to Centre for excellence in basic-DAE, sciences and HBCSE	HRDC University of Mumbai 10 days	32 teachers from different colleges, special lectures by eminent scientist and lab sessions

PHYSICS

No.	Title	Neighboring college/ Institution/Laboratory	No. of participants
2014-2015			
1	Night sky observations	Mamnoli, Kalyan	40 students
2	Mobile planetarium	Various colleges and neighbouring schools	600 students
2015-2016			
1	Night sky observations	Various colleges; in collaboration with Akash Mitra Mandal	40
2	Mobile planetarium	Various colleges and neighbouring schools	520
3	Refresher course in Physics Lecture by eminent scientist Prof Arvind Paranjape, Dr Arnab Bhattacharya, Dr Vijay Singh, Dr Shirish Pathare Practical sessions on learning science through experiments, semiconductors, PC based electronic experiments, Physics in real life. P N Junction diode, Transistor, LDR characteristics, Y by bending.	University of Mumbai	29 teachers from various colleges

2016-2017			
1	Mumbai Area Physics meet	TIFR, IISER, BARC, IITB	70 students and teachers from various colleges
2	Seminar on Anderson localization in random lasers	TIFR	50 students from various colleges
3	Nonlinear dynamics	In collaboration with Ruparel College	60 staff and students from various colleges

ZOOLOGY:

No.	Title	Neighboring college/ Institution/Laboratory	No. of participants
2014-2015			
1	Juhu beach cleaning	Coast guard zoology students spread awareness about fragile marine life	50 students
2	Zoofest	Neighbouring school students attend the fest to observe the exhibits created by the students	More than 500 students
2015-2016			
1	Organ donation drive	National Burns Hospital, various colleges	40 for 12 days creating awareness about skin donation
2	Wetland for our future: Sustainable livelihood	Paryavarhan Dakshata Mandal, ATBS, Mangrove society of India, Salim Ali Centre for Ornithology and Natural Resources, and Bandokar College, & University of Mumbai	2 days 100 staff and students from various colleges
3	Juhu beach cleaning	Coast Guard	50 students
4	Zoofest	Neighbouring school students attend the fest to observe the exhibits created by the students	More than 500 students
2016-2017			
1	Refresher course for Junior college teachers Lectures by eminent scientists Dr Krishna Iyer, Dr Shyam Kishore (KEM hospital), Dr Keti Ghate (ecologist), Dr Deepak Modi. Practical sessions paper chromatography for separation of plant pigments, amino acids, Hands on training on extraction of DNA and agarose gel electrophoresis , separation of proteins by PAGE, plant tissue culture technique, microtomy animal tissue, designing of experiments using *Paramoecium,* concept of science through investigation	University of Mumbai Departments of Botany and Zoology	40 participants from various colleges
2	Zoofest	Neighbouring school students attend the fest to observe the exhibits created by the students	

The DBT Star college supported departments help train the teacher mentors and students to conceptualize research projects to be carried out by the school children and help them to compete at various science fairs at national and international levels. Noteworthy achievements are:

2015: Plantservatives – Plant extract infused antimicrobial wipes by Chimay Kshirsagar and Sarvesh Sawant, Std 9th from Dr. AJP Kalam School (North Bombay), Mumbai. They won gold medal at regional level science fair and bronze medal at national level.

2016: Detection of vitamin C in natural fruit juices and comparison with commercially branded fruit juices by Aishwarya Patil and Anushka More, Std 7th from Dr. APJ Kalam School (North Bombay), Mumbai. Won silver medal at INSEF regional level science fair.

2016-17: Mr. Subarnonath Roy from Pawar Public School, Bhandup received gold medal at International Chemistry Olympiad, trained by our teachers in the practicals

In addition to the above lectures, general public lectures were organized for students and staff of different college numbers. More than 600 participants attended the lectures. Some of the lectures were:

1. Padma Vibhusan Dr Jayant Naralikar: Science popularization through regional languages
2. Dr Lalit Kumar Ananda, Chief Medical Officer, Sewri Tuberculosis hospital: How to control the spread of TB and role of nutrition along with medicine to cure TB
3. Dr Avani M Ghuri, Rotarian: Say no to tobacco
4. Dr Deepak Dalvi: Control of Malaria and Dengue in the city of Mumbai
5. Dr Amit Gandhi, Onco-surgeon, Zynova hospital: Cancer detection and care

Guest Lectures organized by the department – Other neighboring colleges invited for participation

No	Title	Name of the Expert
BOTANY		
2014-2015		
1	Intellectual Property Rights, Protection of traditional Knowledge	Dr Priya Chatterjee, Director, Regulatory Affairs Merck India
2	Personality development, grooming communication skills	Mr Nagesh Pai, Consultant/Trainer
3	Nanosciences: Magic with colors	Dr Mugdha Ambatkar, Research Scholar
4	Ikebana	Ms Jyoti Dakshikar, Horticulturist
5	RAPD, Molecular marker Assisted breeding	Dr T G Gopalakrishnan, Former Scientist, BARC
6	Careers in Horticulture, Green buildings	Mr Ranjan Karulkar, Horticulturist, Hiranandani Garden
7	Herbal cosmetics and skin care	Dr Patel, Dermatologist
2015-2016		
1	Vein Islet number and its utility in segregation of pharmacological material	Dr Meenakshi Vaidya, Mithibai College
2	Hydroponics and Aquaponics	Mr Sameer Pokle, Director Texcellence India
3	Interesting facts in Botany	Dr Behnaz Patel, Former HOD, Botany, R Ruia College
4	Carbon credits	Dr Dhaniya Nambiar,
5	Science Education in School	Ms Vidya Phalke (President's Award for Best teacher) Headmistress Prabodini High School Kurla
6	Careers for science graduates, Institutions of repute for research	Dr Usha Mukundan, Principal R J College
2016-2017		
1	Green Buildings	Dr Anjana Dewasthale, Horticulturist
2	DNA barcoding in Plants	Dr Shashi Babbar, Professor University of Delhi
3	Landscape gardening	Mr Ramnivas Rathore, Deputy General Manager, Landscape and Horticulture Raheja Universal Pvt Ltd. Mumbai
4	Wild vegetables in Maharashtra	Mr Bharat Godambe, Paryavaran Dakshata Manch
5	Managing domestic waste	Mr Akshay Hudar, Triton Technology
6	Segregation of processing of waste	Mrs Poonam Hudar, Environmental Green Lines
7	An overview of LC-MS	Mr Subodh Chavan, Scientia Life Technologies
CHEMISTRY		
2014-2015		
1	Naomaterials – Dream realized	Dr Shivaram Garje, Prof of Inorganic Chemistry, Univ of Mumbai
2	Popularizing Science education	Dr K K Bhasin, former Dean University of Punjab
3	Studies abroad	Dr Piyus Deokar, University of Southern California, USA
4	Preparation for entrance examinations after BSc	Mr Abhishek Dubey, research scholar, ICT Mumbai
2015-2016		
1	Regulatory affairs	Dr Lalita Rege, Glenmark and Dr Dilip Tirpathi, Johnson and Johnson
2	Drug development and discoveries	Dr Anuradha Majumdar, Associate Professor, Bombay College of Pharmacy
3	Spectroscopy	Dr RK Vatsa, Scientist, BARC
4	Molecular fluorescence spectroscopy	Dr Sharmistha Choudhary, Scientist BARC

5	Film show on fire fighting	Mr Manoj Kadam, Administrative Office, Civil Defence
6	Handling of laboratory glasswares	Mr Save, Manager, Borosil Glasswares
7	Basics of organic chemistry	Dr SD Samant Professor of Chemistry, ICT Mumbai
2016-2017		
1	Safety in chemistry laboratory	Dr Pramod Chaube, Former scientist BASF, Regional Director YCMOU
2	Misconcepts in chemistry	Dr B Samant, ICT Mumbai
3	Electrochemistry	Dr PA Sathe, R Ruia College
4	Chemical Boding	Dr Balakrishnan, Professor, IIT Mumbai
5	Drug Discovery	Dr Krishna Iyer, Bombay College of Pharmacy
6	Thermodynamics	Dr Radha Jairam ICT Mumbai
7	EDTA - A wonder reagent	Prof VB Kulkarni, R J College
PHYSICS		
2014-2015		
1	Enhance your employability	Mr GD Sharma Beeline Advisory committee
2	Telecommunications in computers	Mr R Naphade, NTT Communications
3	Physics of optical communication	Dr MR Shenoy, IIT-Delhi
2015-2016		
1	A New Era in Lighting (International year of light)	Dr Devayani Awade, Prof G N Khalsa
2	Quantum Mechanics through computational Physics	Dr Sarmistha Sahu, Professor Maharani Ammaanni Science, Bengaluru
3	Principles of Thermodynamics	Dr Shirish Pathare, HBCSE
4	Complex systems	Dr Sudhir Jain, BARC
5	Science of Colour	Dr Vinita Deshpande, ICT Mumbai
2016-2017		
1	Appreciating 100 years old modern Physics	Dr Mahesh Shetty
2	Nuclear properties and radioisotopes	Dr Reddy, Former Head ACD BARC
3	Golden ratio and centre mass	Dr Vijay Singh, Raja Ramanna Fellow faculty CBS,Mumbai University
4	Particle accelerators : engine of discovery	Prof Siddharth Kasturirangan, Indian Institute of Geomagnetism
5	Space research at IIGM and future perspectives	Dr Bharati Kakad, Indian Institute of Geomagnetism
6	A voyage from circuits to system in Electronics	Prof Rajan Chitale, Faculty, Centre for Basic Science Univ of Mumbai
7	Yes! You can do it	Mr Anand Ghaisas, HBCSE
8	Non-linear dynamic and brain functioning	Dr Kiran Kolwankar, Faculty, R J college
ZOOLOGY		
2014-2015		
1	Opportunities Abroad. Comet Assay	Dr Rajendra Gopalan, Professor Bradford University, UK
2	Environmental Ethics	Dr Amita Valmiki , HOD Dept. of Philosophy, R J College
3	Good laboratory practices	Mrs Ashwini Jadhav, Assistant Manager GeoChem Lab
4	Biodiversity	Dr Parvish Pandya, Bhavan's College
2015-2016		
1	Opportunities in wild life research	Mr Manas Manjerkar, Research scholar, Wild Life Institute, Dehradun

2	Research avenues in Ornithology	Dr Sanjay Kumar, Associate Professor, Meerut University
3	Avenues in biodiversity research, *Chironomus* larva model system	Prof BB Nath, Zoology Dept, University of Pune
4	Hydra "Model" based research	Surendra Ghasgadbi, Agarkar Research University
5	Introduction to toxicology	Dr Shashi Menon, IATRIS, Sion
2016-2017		
1	Human Genome sequencing	Dr Krishna Iyer, Bombay College of Pharmacy
2	Animal breeding	Dr Arjun Shinde, Veterinary doctor, ATRECT
3	Polymerase chain reaction	Dr Deepak Modi, Scientist, NIRRH
4	Research Inquiry	Dr PG Kale, HOD Zoology
5	Molecular diagnostics	Dr Savita Kulkarni, BARC

Field trips/ excursions/ Industrial visits:

BOTANY	
2014-2015	
1	Jeejamata Udyan, Bycullla - interdepartmental activity for students from Botany & Chemistry
2	Hiranandani Garden, Powai
3	Mahabeleshwar: Visit to Wheat Rust Research Centre, Mapro factory, Mapro garden, Madhusagar, strawberry fields, Old Mahabaleshwar
4	Mangrove awareness trail to Bhandup Pump Station area conducted by Vanashakti - interdepartmental activity
5	Mineral Museum at University of Mumbai
6	Kaas plateau, Satara (UNESCO heritage biodiversity park)
2015-2016	
1	Jeejamata Udyan, Bycullla
2	Suyojit Biotech company and farm for mushroom cultivation
3	Sula Wines
4	Mahabaleshwar, Kaas plateau and Panchagani
5	Jummapatti, Neral
6	BPT Garden, Colaba
2016-2017	
1	Jummapatti, Neral
2	Kaas Plateau and Panchagani
3	Delphi Terrace Garden and Hiranandani Gardens, Powai
4	Ankur Theme Park, Kalwa
5	Wai: visit includes a trip to the Sugar factory, horticulture park, Nakshatra garden, turmeric processing units, field cultivation of broccoli, fish breeding, sericulture, apiary
6	Soonabai Pirojsha Godrej Marine Ecology Centre, Mumbai
CHEMISTRY	
2014-2015	
1	"Minerals" exhibit displayed at University of Mumbai, Kalina Campus, organized by the Department of Geology & Extra Mural Studies Centre
2	CIPLA Industries
2015-2016	
1	CIPLA Industries, included a fire safety demonstration and lecture
2016-17	
1	Universal Health Care, Silvassa
2	Parle G Factory, Silvassa
PHYSICS	
2014-2015	
1	Sar Koneect Electra Pvt. Ltd., Igatpuri
2	Parveen Industries, Igatpuri
3	Arihant Industry Vasai
4	Neelam Steels, Vasai
5	Homi Bhabha Centre for Science Education, Mumbai - included a practical session
6	Sophisticated Analytical Instrumentation Facility, IIT-Bombay
7	Night sky observation, Mamnoli (Kalyan), in collaboration with Akash Mitra Mandal
2015-2016	
1	Centre for Development of Advanced Computing (CDAC), Pune
2	Homi Bhabha Centre for Science Education, Mumbai
3	Night sky observation, Mamnoli (Kalyan), in collaboration with Akash Mitra Mandal
2016-2017	
1	Nehru Science Centre, Worli

2	Indian Institute of Geomagnetism, Panvel
3	Night sky observation, Mamnoli (Kalyan), in collaboration with Akash Mitra Mandal
4	Tata Institute of Fundamental Research
ZOOLOGY	
2014-2015	
1	Marine biodiversity study at Alibag
2	Bandhavagad Sanctury and Jabalpur
3	Neral
2015-2016	
1	Marine biodiversity study at Alibag
2	Bhuvaneshwar, Orissa
3	Sanjay Gandhi National Park, Mumbai
4	Biogas plant & sewage water treatment plant, Thane
2016-2017	
1	Chatrapati Shivaji Vastu Sangrahalaya
2	Vivek Agro Farm, Virar
3	Ankur Theme Park, Kalwa
4	Marine biodiversity study at Alibag
5	Bhartpur Bird Sanctuary and Ranthombore Sanctuary, Rajasthan

Training/seminar /workshop attended by the faculty member of the college

BOTANY

No.	Name of the faculty	Title	Venue/trained by
		2014-2015	
1	Dr Anil Avhad	Trimble hand held GPS	Aimi Ltd Mumbai, 26/8/2014
2	Dr Anil Avhad	Research Methodology	HRDC University of Mumbai, RJ College, 14 to 19 Dec, 2015
3	Dr M K Date	Electron microscopy	IIT-Bombay, Powai
4	Dr Veena Kelkar	New Trends in Biosciences	University of Mumbai, Dec 2014
		2015-2016	
1	10 faculty	GHG Accounting	Centre for Environment Education and Development, 12-13th Oct, 2015
2	Dr Nisha Muni	Research methodology	UGC HRDC University of Mumbai RJ College, 13-19th Dec, 2015
3	Capt Pravin Nayak		
4	Dr A K Bhatnagar	Curriculum implementation	Pendharkar College, 22/6/2015
5	Dr D B Singh	Curriculum implementation	Pendharkar College, 22/6/2015
6	Capt Pravin Nayak, Dr Anil Avhad	HPTLC	Institute of Science, 14/8/2015
7	Capt Pravin Nayak, Dr Anil Avhad	Techniques in Molecular Biology	Metropolis Central Reference Laboratory, 19/2/2016
8	Dr Anil Avhad	National seminar on "Conservation of trees – Perspectives"	Bhavan's college, Andheri, 2/2/2016
		2016-2017	
1	Capt Pravin Nayak and Dr Anil Avhad	Remote Sensing	RJ College, 14/7/2016
2	Dr Veena Kelkar	HPTLC and Nano particle characterization	Institute of Science in collaboration with ANCHROM , 5/10/2016
3	Capt Pravin Nayak and Dr Anil Avhad and	National seminar on " Know your Pulses"	Guru Nanak College, 11/7/2016
4	Dr Anil Avhad	Standardisation of medicinal plants	Agarkar Research Institute, Pune, 8th and 9th Nov, 2016
5	Capt Pravin Nayak	Statistical tools in research	RJ College, 30th to 31th Oct, 2017

CHEMISTRY

No.	Name of the faculty	Title	Venue/trained by
		2014-2015	
1	Mr V B Kulkarni	Chemistry – Sustainability and environment	Ruia College, 20-21st Feb, 2015
2	Dr Deepali Pimple	Research methodology	R J College, 15-21 Oct, 2014
3	Dr R S Dubey	National conference on frontiers in chemical ad materials science	Shivaji University, 15-17th Jan, 2015
4	Dr R S Dubey	National conference on Advances and Innovations In Chemical Sciences	University of Mumbai12-13 Feb, 2015
6	Dr Abhay D Samant	International conference	8-9th Dec, 2014
7	Dr Vaishnavi Sridhar	Research methodology	HRDC University of Mumbai, R J College, 15-21 Oct 2014
8	Mr Mandar Medhi	Research Methodology	BAMU Aurangabad, 7-12th July, '14
		Computer assisted teaching	IIT-Bombay, Powai, 29/11/2014
		Teaching techniques chemistry	Karjat College
9	Dr Charu Vatsa	Research Methodology,	HRDC University of Mumbai, RJ College, 15-21 Oct, 2014

10	Dr Manisha P Bhattacharya	Recent trends in Chemistry	Acharya Marathe College, 6/9/2014
11	Dr Asawari Mokal	Recent trends in Chemistry	University of Mumbai, 10-11/2/2015
12	Mr Prabijna Babu	Special Summer school (3 weeks) Computer Assisted teaching in Chemistry	University of Calcutta, Kolkata, 12th June to 2nd July, 2014 IIT-Bombay, 29/11/2014
2015-16			
1	Mrs P T Singh	Train the trainers	IBS Powai 11/7/2015
2	Dr Manisha Bhattacharya	E content development and e learning	Sardar Patel University Gujarat, 17/22/8/2015
3	Dr Abhay Sawant and Dr Asawari Mokal	Seminar on "Scientific writing"	K J Somaiya 16/12016
4	Mr Jitendra Girase and Mr Pratap Kamble	Research methodology	R J College 14/12/2015to 19/12/2015
6	All staff members	Safety handling of glasswares	R J College, 12/1/2016
9	Dr R S Dubey	International conference on Corrosion and Its Control	NACE International Gateway section, CORCON 2015, Chennai
10	Dr R S Dubey	Geriatric concerns of India	RJ College, 8 January, 16
2016-2017			
1	Dr R S Dubey	Recent advances in microfluides & SAW sensors for human health care	19-25th Oct, 2016
2	Mr P P Kamble		
3	Mr J D Girase		
4	Mr Prabijna Babu	Refresher Course in chemistry	HRDC Ravi Shankar University, 2-22nd July, 2016
5	Mr Amol Kadam	Refresher Course in chemistry	
6	Dr Vaishnavi Sridhar	Research Methodology	HRDC University of Mumbai RJ College, 20th Nov to 25th Nov, 2017
7	Dr Asawari Mokal	Research Methodology	HRDC University of Mumbai RJ College, 20th Nov to 25th Nov, 2017
8	Dr Abhay Sawant	Role of Marathi terminology in Science Education	Commission scientific and technical terminology (HRD), 8th and 9th Dec 2017
9	All staff member (21)	Training in recording spectrum on FTIR	ISMAS 28/2/2017

PHYSICS

No.	Name of the faculty	Title	Venue/trained by
2014-2015			
1	Mr Devraj Pawar	School of Modern Astrophysics (SOMA-2014)	St Petersburg Russia 15-26 July, 2014
2	All faculty members	Physics of Optical communication	R J College, 16/3/2015
3	Ms Rekha Ghorpade	Resource generation and predeparture training International Physics Olympiad academic team member IPHO 2015	HBCSE , Mumbai
4	Mr Sandip Hinge	Computational methods	HRDC Univ of Mumbai, Dec 2015
2015-2016			
1	Dr Vaishali Raikwar	International conference on Nanomaterials	5 & 6th January, 2015, K V Pendarkar College, Dombivli
2	Dr Vaishali Raikwar	National Seminar on Nanomaterials	22nd January, 2015, M D College, Mumbai

3	Ms Rekha Ghorpade	Resource generation and predeparture training International Physics Olympiad	HBCSE, Mumbai 15-19Jan, 2016 OCSC : 24th May, 6th June, 2016 PDT: 27th June, 8th July visit to Switzerland scientific observer for Indian team
4	Dr Devraj Pawar	Jet triggering mechanism black hole sources workshop	TIFR, Jan 20-23, 2016
2016-2017			
1	Ms Ratna Jadhav, Dr Neeta Srivastava and Dr Vaishali Raikwar	Training in curriculum upgradation and new practicals	Jai Hind College, Mumbai 7/7/2017
2	Ms Rekha Ghorpade	Resource generation and predeparture training International Physics Olympiad	HBCSE RGC March 17th to 20th 2017 OCSC May 24th to June 5th PDT : 3rd July -14th July
3	MS Rekha Ghorpade	Curriculum upgradation	10th July, 2017, Pali, Raigad 30Th July , 2017, Gogate Joglekar Ratnagiri
4	Dr Devraj Pawar	Data Intensive Science workshop	IUCAA, Pune, 13-18th February, 2017
5	Dr. Devraj Pawar	Visit for data collection	Bera Observatory, Milan, Italy 30th September to 10th October, 2017

ZOOLOGY

No.	Name of the faculty	Title	Venue/trained by
2014-2015			
1	Dr Janhavi Bhagwat	Training on use of HPTLC CAMAG HPTLC system	Anchrome, 1st -3rd April, 2015
2	MS Sanika Gupte	UGC sponsored Regional workshop on Advance microscopy	22/11/2014 Wilson college
3	Dr P G Kale	Resource generation and Pre-departure training International Biology Olympiad	HBCSE, Mumbai
2	Ms Sanika Gupte	Culturing of Hydra in Lab conditions	Agharkar Research Institute, Pune, 2/6/2015
3	Ms Sanika Gupte	Research Methodology	16-21th Oct, 2014, HRDC, University of Mumbai
2015-2016			
1	Ms Sanika Gupte	Bee keeping workshop	Central University Kerala 10th to 14 August, 2015
2	Dr P G Kale	Team Lead for 27th International Biology Olympiad	Held at Hanoi, Vietnam
2	Ms Sanika Gupte	Soft Skill Development	HRDC University of Mumbai,
3	Dr Bindu Achary	Research Methodology	HRDC University of Mumbai, R J College, 14-19th Dec 2015
4	Dr P G Kale, Dr S T Ingale, Dr Bindu Achary, Dr Geeta Joshi	Basic course Yoga	Basic course in Yoga
5	Dr Bindu Achary	Certificate course in Yoga	Ambika Yog Kutir 5th July to 20/9/2015 3 hrs/day
6	Dr Geeta Joshi and Mrs Sushma Singh	Techniques in Aquatic Animal Health	ICAR central Institute of Fisheries , Versova, 7-12th Sept 2015

7	Dr Janhavi Bhagwat and Mrs Sushma Singh	Molecular Biology techniques	Metropolis Health Care Ltd. 19/2/2016
8	All staff member	10th Annual conference on wetlands for our future sustainable livelihood	RJ College and Bandokar College, 31/1/2016
9	Dr PG Kale	DBT-British Council-IISER Teacher Training Workshop to develop research Pedagogical tools	IISER, Pune 10-12th March, 2016
2016-2017			
1	Dr Geeta Joshi	Curriculum implementation	Kirti College, 10/7/2016
2	All faculty members	Basic course in remote sensing with hands on training on map making and interpretation	RJ College, 14/7/2016
2	Mr Deepak Poojary	Molecular Biology techniques in diagnostics	R Ruia College , 19-30th Sept, 2016
3	Mrs Sushma Singh	Training on DNA barcoding	PHCDBS Aurangabad, 10-17th June, 2016
4	Dr Bindu Achary and Ms Sanika Gupta	Concept of Science through Investigation	R J College in collaboration with HBCSE 14/12/2016
5	Ms Sanika Gupte and Ms Sushma Singh	Statistical tools in Data analysis	R J college 23rd Oct to 30/10/2017

12. Qualitative Improvements due to DBT Support (please highlight 5 salient points):

Botany

1. The department with a strong research culture was enthusiastic in implementation of new practicals which enabled students in learning by doing
2. Practicals during field trips made learning botanical names easy. More number of students could join the field trip since some funds were available from DBT Star College Scheme.
3. Visiting premier institutes motivated students to pursue higher studies. Students have a sense of pride especially when they receive the DBT star award during competitions.
4. Students could perform all molecular biology and biochemistry practical's individually due to purchase of multiple units of electrophoresis, pH meters, balances, micropipettes, colorimeters from DBT Star College Scheme funds and they were motivated to take up project work.
5. Students from star college scheme have given feedback as to how UG projects have helped them in PG project work since. Increase in PG progression increased from 50% to 70%

Chemistry

1. Purchase of chemicals enabled the students to perform practicals individually. Student number being large all of them had the opportunity to perform practicals and at least one project individually due to availability of instruments and consumables procured from DBT star college funds.
2. Purchase of instruments in multiple numbers like colorimeter, pH meter, conductometer, potentiometer helped each student to handle the instrument and do the practical
3. Teachers were trained in emerging areas and were enthusiastic about designing new practicals. Environmental awareness through implementation of green chemistry was done.
4. Guest faculty from industry also helped in developing project based learning skills since we could pay the resource persons. This motivated students to join PG programs.
5. UG to PG progression has increased from 50 to 70%

Physics

1. Purchase and fabrication of new instruments from DBT star college funds enabled introduction of new practical's
2. These new practical's helped students in critical thinking and setting up of experiments and led to project design. Students showed more readiness to do project work and team work for problem solving, since resources were not a limiting factor.
3. Faculty involvement in practicals and projects created a congenial learning environment
4. Students were motivated for progression to PG studies and in view of the demand the department applied to the Government and University of Mumbai and started MSc in Physics.
5. The department with high level research culture established a research center for enrolling students for doctoral programs

Zoology

1. DBT Star college scheme enabled teachers to design new experiments bypassing animal dissections
2. Molecular biology experiments could be done individually because of procurement of many small electrophoresis units and availability of micropipettes, chemicals.
3. Students learn to standardize instruments individually and research culture percolated to under graduate section of the college.
4. Interdepartmental activities and sharing of resources enabled optimum utilization funds and resources
5. Student involvement increased in all areas. New practicals and projects done in field studies made learning enjoyable.

Overall Impact

The DBT Star College Scheme has generated a renewed interest in the subjects of general sciences amongst the students and the teachers. It has allowed for the free flow of information and resources between the departments due to the encouragement to work on interdepartmental activities. The allure to learn from eminent guest lectures brought students of different subjects under one roof. This pushed the students to think of research ideas that incorporated interdisciplinary studies.

Availability of new and more instruments, glassware and chemicals allowed for students to performs practicals and projects that were previously only demonstrations due to limitations of resources. This created an enthusiasm amongst students to more engaged in practicals and projects as they could get hands-on experience. This enthusiasm for practicals also translated into the theoretical studies as they could better understand the concepts as they could perform the practicals. The students at lower levels worked on projects in teams, creating a spirit for team work and helped improve communication skills.

The requirement to do referencing and read research articles for their project work created a curiosity in the students. This lead to students reading up on topic beyond their classes and approaching the teachers with doubts and difficulties about the same. The enthusiasm from the student populace has in turn made the teachers getting more involved with the students and establishing better channels for student-teacher communication.

The publication of SOPs and manuals by all the participating departments has standardized the protocols enabling students to be industry ready. Departments have adopted ecofriendly ways and green chemistry is widely practiced by staff and students. This has been possible due to repeated workshops being organized to emphasize and reemphasize the urgent need to follow green practices.

Students were desirous to showcase their projects to the staff and students of other colleges. There has been a marked increase in the participation of our students in seminars, research events and various competitions, and they have won prizes for their projects. The increased interest in presenting their work in front of peers has improved self-confidence and public speaking skills amongst the students.

The ultimate outcome of DBT Star College Scheme is clear inculcation of research culture in undergraduate students and total involvement of teachers in designing new practical's and readiness to be a lifelong learner.

13. Strengths and Weaknesses of Each Department (3 each)

BOTANY

Strength	Weakness (Challenge)
• Committed and highly motivated staff members	• Very high student teacher ratio
• Research culture prevalent from the inception of the college. Recognized research centre. Total staff involvement in star college activities	• Diverse student population in terms of academics, medium of study, economically challenged
• Laboratories and departmental library open on all days and extended timing	• Space constraint

CHEMISTRY

Strength	Weakness (Challenge)
• Illustrious faculty some them with industry experience	• Very high student teacher ratio
• Mixed age group of staff and all specialization are available. All the staff members contribute to new practical's designed	• Diverse student population in terms of academics, medium of study, economically challenged
• Highly supportive non-teaching staff members	• Non availability of online research articles due to their high cost.

PHYSICS

Strength	Weakness (Challenge)
• Committed staff members department has an Humboldt fellow and a IUCA Associate	• Low commitment level of students
• Starting of PG and research centre	• Diverse student population in terms of academics, medium of study, economically challenged
• Highly supportive and talented non-teaching staff members	• Non availability of online research articles due to their high cost.

ZOOLOGY

Strength	Weakness (Challenge)
• Committed faculty members	• Very high student teacher ratio
• Symbiotic relationship with Botany department for sharing of resources	• Diverse student population in terms of academics, medium of study, economically challenged
• Laboratories and departmental libraries open all days for extended hours	• Space constraint

List of Instruments Purchased under DBT STAR COLLEGE SCHEME (Botany)

1	2	3	4	5	6	7	8
Sr. No.	**Instrument Name**	**Make (if any)**	**Rate**	**Quantity (Nos.)**	**Total Cost**	**College Voucher No. or Dept. Statement No.**	**Date of purchase**
1.	PLS Smart 3 Trinocular Microscope with LCD Screen for Microscope	Pulse	120000	1	135000	3011	13/02/2015
2.	Equiptronics Digital Calorimeter Model EQ 650 A	Equiptronics	8200	8	68265	3023	11/03/ 2015
3.	7020 Mini Submarine Electrophorosis Unit	Tarson	12696	6	77128	3036	21/03/2015
4.	Vertical Electrophoresis Unit	Slimpage D	9350	4	58523	3046	19/03/2015
5.	Power Supply (power pack for electrophoresis units)	Electravolt	5100	4			
6.	Microcentrifuge Spinwin	Tarson	28800	1	159889	3037	20/03/2015
7.	Digital pH Meter	Equiptronics	7990	1			
8.	Ultrasonic Bath Complete	Dakshin	12400	5			
9.	Glass Thermometer	Zeal	225	1			
10.	Digital Balance EWT 223	Eureka	28000	1			
11.	Digital Balance EWT 610	Eureka	19000	1			
12.	Digital Balance EWT 5000	Eureka	22500	1			
13.	Hair Drier		1200	1			
14.	Digital Colorimeter Model 253	Hans Vidyut	8100	1			
15.	Laboratory Air Oven	Metalab	21700	1	26480	3071	25/03/2015

16.	Bacteriological Incubator Digital Temp	Metalab	21700	1	26480		
17.	Revolutionary General Centrifuge R-8c	Remi	30519	1	30900		
18.	Visi Cooler 2^{o}C to 8^{o}C	Blue Star	45970	1	46545		

List of Instruments Purchased under DBT STAR COLLEGE SCHEME (CHEMISTRY)

1	2	3	4	5	6	7	8
Sr. No.	**Instrument Name**	**Make (if any)**	**Rate**	**Quantity (nos)**	**Total Cost**	**College Voucher No. or Dept. Statement No.**	**Date of purchase**
1.	3 Phase 10 KVA Servo Stabilizer	Automate Instruments	26500	1	29812.5	3047	5/3/2015
2.	Platinum electrode	Equiptronics	1140	4	5130	3048	16/3/2015
3.	Digital Polarimeter with electronic sensor and unbreakable 20 cm & 10 cm tubes EQ/801	Equiptronics	21600	2	48600	3049	19/3/2015
4.	Drying Cabinate fitted with R.I. Heating bulb & dimmer		3400	6	22950	3050	21/3/2015
5.	Medico centrifuge with 8 x 15 ml tube adopter model R - 303 (Sr. No. 2 BAN.1163, 1164, 1165, 1166, 1168, 1178)	Remi	5040	6	34020	3051	25/3/2015
6.	Premier Electronic Balances Model : PSP103 Capacity : 100 g Accuracy : 0.001 g Sr. No.:15034008,9,11,12, 13 Ver. Q. : A/15	Premier	18000	5	101250	3056	30/3/2015
7.	Multiparameter meter for water analysis supplied with required electrodes & a stand model CMP - 01	Contech	98800	1	111150	3057	30/3/2015
8.	Digital colorimeter with disc type 8 built in filters EQ/650 A	Equiptronics	6764	1	7609.5	3058	30/3/2015
9.	Digital conductivity meter with cell K = 1 EQ/660 B	Equiptronics	6262	1	7044.75	3058	30/3/2015

10.	Digital potentiometer EQ/603	Equiptronics	4230	1	4758.75	3058	30/3/2015
11.	Digital pH meter with built in mag. Stirrer supplied with electrode EQ/614 A	Equiptronics	6973	2	15689.25	3058	31/3/2015
12.	Spare Filters for Flame Photometer (a) Calcium (b) Lithium (c) Strontium (d) Magnesium	Equiptronics	 3472 3472 3472 3472	 1 1 1 1	15624	3059	30/3/2015
13.	Digital pH meter with built in mag. Stirrer supplied with electrode EQ/614 A	Equiptronics	6973	1	7844.625	3062	31/3/2015
14.	Atharva Water Ring Vacuum Pump Model AWR - 75	Atharva	95000	1	97988	3070	30/3/2015
15.	Pen Drive	Transcend	260	1	260	3004	9/1/2015

List of Instruments Purchased under DBT STAR COLLEGE SCHEME (PHYSICS)

1	2	3	4	5	6	7	8
Sr. No.	**Instrument Name**	**Make (if any)**	**Rate**	**Quantity (nos)**	**Total Cost**	**College Voucher No. or Dept. Statement No.**	**Date of purchase**
1.	500 Gm Electronic Balance	-	25500	1	58500	3024	12/02/2015
2.	Single Phase 10 kva Servo Stabilizer	Servo	26500	1			
3.	CIE Brand Digital Multimeter Model 122	CIE	21500	10	21500	3025	16/02/2015
4.	Hall Effect Apparatus		5000	2	219712	3026	28/02/2015
5.	Travelling Microscope 3 Motion SS Scale	Ajanta	8000	4			
6.	Spectrometer 7" PC SS Scale 1 min	Ajanta	8500	5			
7.	Signal Generator 2MHz with digital display Vavcord GSS2 MD		7800	5			
8.	LVDT Trainer		10000	2			
9.	Starin Guage Trainer		10000	2			
10.	Newton's Ring Microscope cat. No. 1573		8500	1			
11.	Newton's Ring Apparatus cat. No. 1571		800	1			
12.	Newton's Ring Apparatus cat. No. 1572		500	1			
13.	Nicol Prism		4000	2			
14.	Calcite Prism		6000	1			
15.	Quartz Prism		4000	2			
16.	Microprocessor KIT ANSHUMAN-8085		6500	2	13650	3027	17/02/2015
17.	Travelling Microscope		8500	1	23062.50	3028	05/03/2015
18.	SCMOS 2MP		12000	1			
19.	Optical Bench 11/2 Mtr long Complete		69500	1	78187	3032	07/03/2015

	Set						
20.	Kater's Pendulum with brass square rod		16500	2	56812.50	3042	14/03/2015
21.	Kater's Pendulum with SS square rod		17500	1			
22.	Startracker 150/750 EQ2 Carry bag Padded for Ota Carry bag Padded for EQ		17778 1560 750	1 1 1	22599	3043	20/03/2015

List of Instruments Purchased under DBT STAR COLLEGE SCHEME (ZOOLOGY)

1	2	3	4	5	6	7	8
Sr. No.	**Instrument Name**	**Make (if any)**	**Rate**	**Quantity (nos)**	**Total Cost**	**College Voucher No. or Dept. Statement No.**	**Date of purchase**
1.	BOD Incubator 5°C to 6°C	Metalab	81300	1	80030	3071	25/03/2015
2.	Printer Laserjet	Canon	7523	1	7900	3001	18/09/2014
3.	PLS LCD 450 with 3.6" LCD Display Monitor Digital Screen Microscope	Pulse	26000	1	29250	3010	15/02/2015
4.	pH Meter EQ610	Equiptronics	6800	1	64204	3020	8/03/2015
5.	Calorimeter EQ650	Equiptronics	7170	1			
6.	Pan Type pH Meter	Hanna	900	1			
7.	Digital Sound Level Meter 35 to 130 DB		5800	1			
8.	UV Cabinet	Bioethinics	5500	1			
9.	Dissecting Microsope Brass Parts Superior	MVTEX	975	12			
10.	Muffle Furnace Digital	Bioethinics	16500	1			
11.	Bunsen Burner	Bioethinics	2700	1			
12.	Camera Nikon 229 with 8Gb Card	Nikon	4619	1	4850	3044	20/03/2015
13.	Ecopage-D Ready Vertical Electrophoresis Unit		11110	5	148635	3045	23/03/2015
14.	Ecosub–D Electrophoresis Unit with UV Transparent Tray		12250	5			
15.	Slimsub-D Electrophoresis Unit with UV Transparent Tray		9600	1			

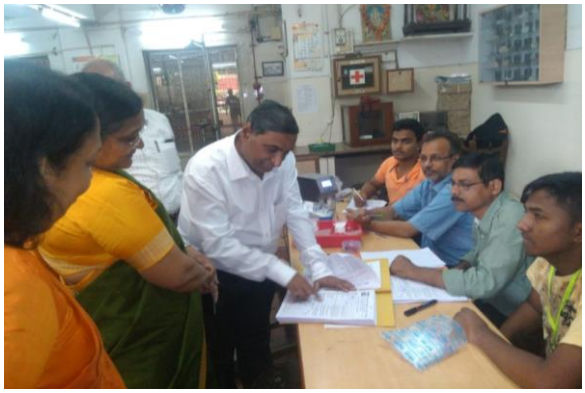
16.	Electravolt Power Supply		5100	4			
17.	UCONCAL5 Analab Conductometer	Analab	11800	1	10620	3052	26/03/2015
18.	LG Microwave Oven 32 L with Convection	19000	19000	1	21375	3068	31/03/2015
19.	Digital Lux Meter		1500	1	-	3035	16/03/2015
20.	Digital Sound Level meter		5800	4			
21.	Calorimeter EQ650		7170	4			
22.	pH Meter EQ610		6800	4			
23.	Pen Type pH Meter		900	4			
24.	Haemocytometer Set		1100	20			
25.	Gel Rocker		21080	1			
26.	Dissecting Microscope		975	12			

List of Advisory Committee Members

Dr Suman Govil	DBT Representative: Adviser DBT
Dr Sandhya Shenoy	DBT Representative: Scientist DBT
Dr Garima Gupta	DBT Representative Scientist DBT
Dr Usha Mukundan	Principal Chairman
Dr Suhas Pednekar	External Expert, Member, Principal R Ruai College
Dr K K Rao	External Expert, Member, I I T Mumbai
Dr Mrunalini Date	Coordinator Botany Department-Member
Dr P G Kale	Cordinator HOD Zoology, Member
Mr V B Kulkarni	Coordinator HOD Chemistry, Member
MS Maneesha Oak	Coordinator Physics department
Dr Bindu Achary	Zoology Department-Member
Mr Raghu Pillai	HOD Physics Department, Member
Mr P N Anchaliya	Coordinator Physics Department-Member
Dr Himanshu Dawda	Overall coordinator

Dates of meeting: 12/1/2015, 22/3/2016 and 21/10/2016

Visits by Dr. Suman Govil, DBT Star College Co-ordinator



Dr. Suman Govil interacting with staff and students

Dr. Suman Govil interacting with the staff and students of Botany department

Dr. Govil interacting with the staff and students of Zoology department

Chemistry department staff with Dr. Govil

Non-teaching staff interacting with Dr. Govil

Dr. Govil interacting with the staff and students of Physics department

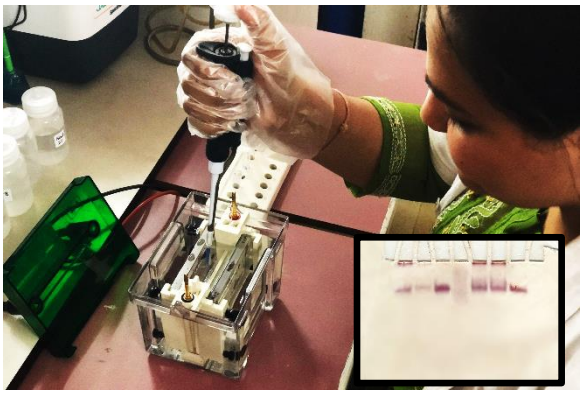
Dr. Suman Govil interacting with the staff of Physics department

Glimpses of the departmental activities – Botany

Inauguration of annual Botany exhibition 'Botanica'

Dr. D. V. Amonkar Memorial elocution competition

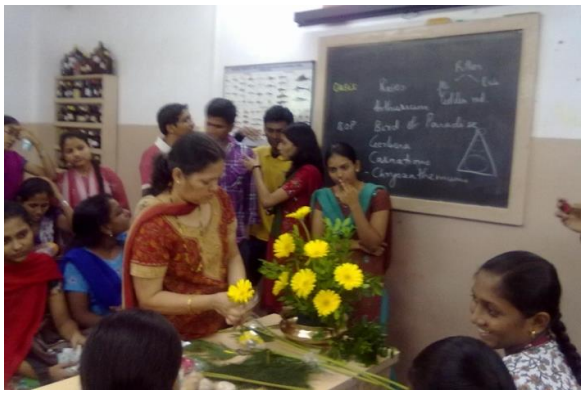
School students visiting Botanica exhibition



Students performing electrophoresis experiments

Skincare awareness campaign

Students learning micropropagation during a hand-on workshop



Flower arrangement workshop

Floral rangoli showcase

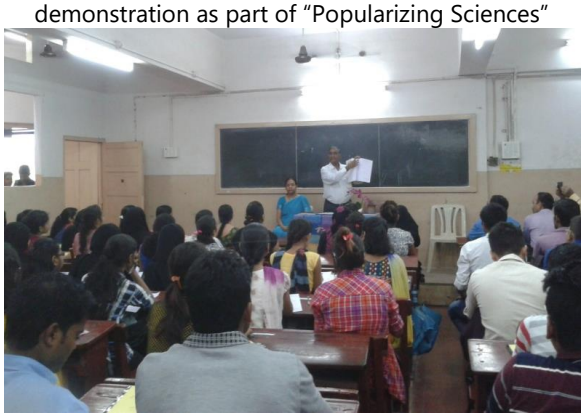
Glimpses of the departmental activities – Chemistry

Students engrossed in Chemistry practicals

Prof. K.K. Bhasin delivering a lecture on "Popularizing Sciences"

Prof. K.K. Bhasin and students performing a demonstration as part of "Popularizing Sciences"

Poster presentation on 'Cold drinks' by S.Y. B.Sc. students



Workshop on 'Good Laboratory Practices and Green Chemistry'

Workshop on 'Basic Techniques & Safety Aspects in Laboratory'

Eloquotion competition 'Chem Talk' in progress

Interactive session between students and past chemistry alumni

Glimpses of the departmental activities – Physics

Mr. GD Sharma conducting a student workshop

Students learning about telescopes

School children from nearby schools attending Physi-Fest project exhibition

Students partaking in a quiz contest

Students in Physics practcials

Physi-Fest in progress

Students from IIT-Bombay demonstrating experiments for UG students

Mobile planetarium created by the department of Physics

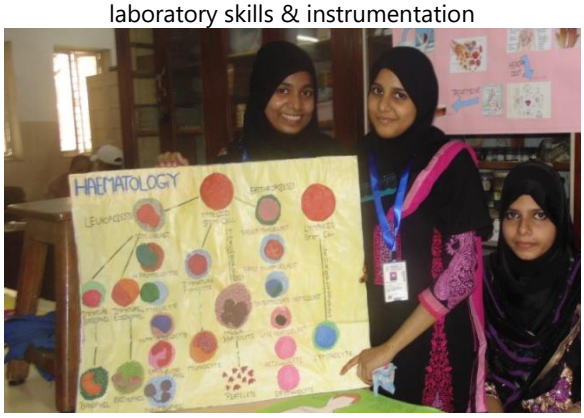
Glimpses of the departmental activities - Zoology

Inauguration of Zoofest

Neighbouring school children attending Zoofest exhibition

Dr Janhavi Bhagwat conducting a lecture on basic laboratory skills & instrumentation

Dr. PG Kale conducting a lecture on lab safety protocols



Students showcasing projects at Zoofest

Students performing practicals

Informative posters created by students highlighting wildlife issues

Field trips and industrial visits

Botany field trip to BPT Garden, Mumbai

Botany field excursion to Kaas Plateau, Satara

On-site entomology training during Zoology excursion

Visit to Parveen Industries, Igatpuri

Visit to Indian Institution of Geomagnetism, Panvel

Beach cleaning drive underway at Juhu Beach

Field trip to Hiranandani Gardens (Powai), Mumbai

Interdepartmental Activities

College teachers workshop on electrophoresis

Non-teaching staff workshop on lab skills & safety

Refresher course for neighbouring college teachers

Exhibition on wild vegetables

Workshop on post-harvest storage of produce

Students engrossed in practicals during DBT-sponsored interdepartmental workshop

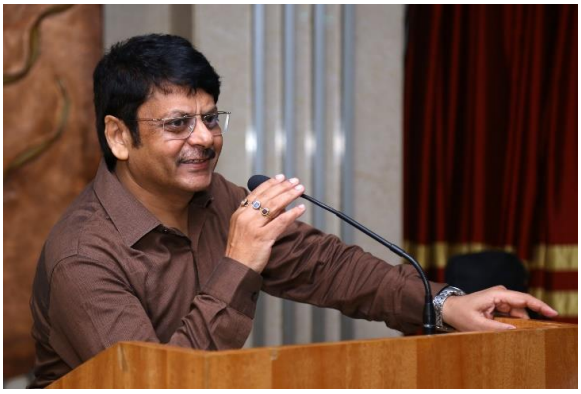
A guided walk through Fort area of Mumbai highlighting the plants and heritage structures

Fire safety demonstration for college staff, students, and neighbouring school students

Esteemed invited lecturers

Dr. Hemchandra Pradhan, DAE Rajaraman Fellow at HBCSE

Dr. Anjana Devasthale, Consultant Horticulturist



Dr. Shashi Babbar, Delhi University

Dr. MR Shenoy, IIT-Delhi

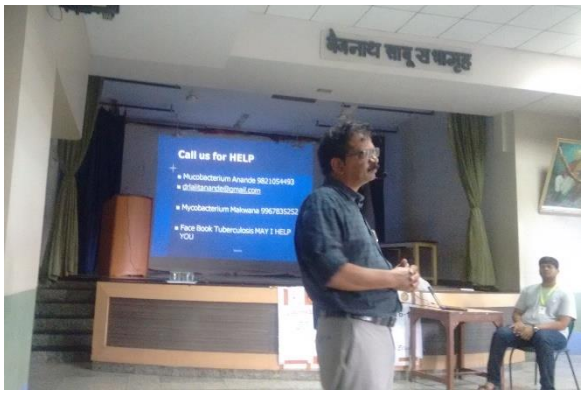
Dr Kedar Damle, TIFR (Mumbai)

Dr. Sushil Mujumbar, TIFR (Mumbai)

Dr Mustanir Barma, Former Director, TIFR (Mumbai)

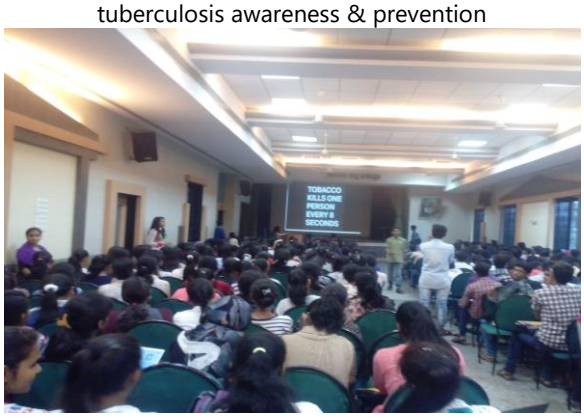
Dr. S.S. Garje, Dept of Chemistry, Univ. of Mumbai

Activities with neighbouring colleges & Inter-collegiate competition winners



Dr Lalit Kumar Ananda conducting a lecture on tuberculosis awareness & prevention

Dr. Jayant Narlekar delivering a lecture on popularizing science through regional languages



Lecture on tobacco-related issues awareness

Lecture on importance of wetlands conducted in collaboration with University of Mumbai

First Prize for Research Presentation at National-level conference at Maitreyi College, Delhi

TY Students won first prize at intercollegiate competition at St. Xavier's College, Mumbai

Winners of multiple intercollegiate competitions at KC College, Mumbai

SYBSc students won silver at research poster competition at RD National College, Mumbai

ACKNOWLEDGEMENT

Our sincere thanks to the Department of Biotechnology (Government of India) for the financial assistance provided to the departments of Botany, Chemistry, Physics and Zoology. This gave an opportunity to our college to strengthen the basic sciences at undergraduate level and a forum for carrying out interdepartmental and intercollegiate activities. We would like to place on record the deep sense of appreciation to the members of the advisory committee, Dr Suman Govil for her encouragement and timely directions for new initiatives, Dr Suhas Pednekar and Dr K K Rao for their valuable inputs. We are thankful to the scientists and advisory committee members, Dr Garima Gupta (Scientist E), Dr Sandhya Shenoy and Dr Padma Singh, for their continuous support.

Dr Himanshu Dawda
Coordinator
DBT Star College Scheme

Dr Usha Mukundan
Principal

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PLANT SYSTEM AS A TOOL FOR VALIDATING ETHNOBOTANICAL CLAIMS FOR KIDNEY STONE TREATMENT

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ABSTRACT

A renal calculus or kidney stone is one of the most prevalent and widespread conditions in the world, without a guaranteed cure. None of the known and available treatments prevent the recurrence of kidney stone formation. Hence, new and improved treatment methods are constantly being developed. This study claims to use plant systems as tools to provide a scientific basis for ethnobotanical treatments for kidney stones using *Ficus elastica* cystolith and *Colocasia esculenta* raphides as targets and *Tectona grandis* fruit and *Bryophyllum pinnata* leaf extracts as treatments. In addition, the phytochemical analysis of these extracts is also proposed. Observation was performed by photomicrograph of cell cystolith and raphides before and after treatment. The method was specifically used to study dissolution of calcium oxalate crystals and can provide a potential alternative to animal testing. This article emphasizes a method to validate the efficacy of ethnobotanical herbal remedies which show *in vitro* anti-urolithiatic activity. They can be further taken up for *in vivo* studies by treating plant cells containing calcium oxalate crystals as a model to study the effect of plant extracts. An ethical consideration on this alternative method offers a more humane approach to *in vivo* testing for biomedical science.

KEYWORDS: Animal testing, alternative, cystolith, ethnobotany, raphides.

INTRODUCTION

The instinctive behaviour of primitive man helped to associate the beneficial action of plants in the treatment of various ailments. From approximately 11th to 18th centuries, it was assumed that the colour, shape, habitat or other physical characteristics of a plant were

indicative of its medicinal value, for instance, the worm-shaped embryo of *Chenopodium* (worm seed) indicated it to be of value as an anthelmintic, the yellow colour of saffron suggested a possible use in liver disorders and *Rauwolfia serpentina* roots (snake root) should be useful in treating snake bite. However, the use of plants by such inferences was established through trial and error. Later on, a better understanding about the medicinal properties of the plants was gained through rational thought and action.

Herbs and spices have been used since ancient times for their flavouring qualities and also for their preservative and medicinal properties. Approximately two-third of the drugs of the modern medicine system have been developed from natural resources - largely from plants - and are used by people all over the world in the form of folk remedies, traditional or ethnic medicine.[5, 6, 9]

Plants act as an additional lifeline for mankind and in one way or another help various organisms to live and survive. Ethnobotanical studies are often significant in revealing locally important plant species, especially for the discovery of crude drug. Considerable research on pharmacognosy, chemistry, pharmacology and clinical therapeutics has been carried out on native medicinal plans. Traditional knowledge-driven drug development can follow a reverse pharmacology path and thereby reduce time and cost of development. Herbal medicine has gained much popularity because, herbal medicines are effective, and have fewer side effects. Herbal extracts have been used to cure various disorders, spasmodic gastric-intestinal complains, cough, bronchitis, laryngitis, tonsillitis and act as carminative and diuretic agents. Therefore, the demands for these plants are increasing in industrialized and non-industrialized countries. This has lead to an increase in their prices.[5, 6]

Accumulation of calcium to form calcium oxalate is an interesting phenomenon. Cell-mediated crystallization of calcium oxalate in plants includes biomineralization of calcium oxalate crystals in plants. Biomineralization fulfills a variety of crucial functions, including important skeletal and protective roles. In higher plants, calcium oxalate typically develops within intravacuolar membrane chambers of specialized cells. The complex cellular features associated with calcium oxalate crystallization indicate that it constitutes a biologically controlled process, analogous to calcification processes that shape bones, teeth, and shells in animals. Crystals have been observed in members of more than 215 plant families and occur in about 74% of angiosperm families, and are found in almost all organs and tissues of plants. The crystalline form can constitute to about 1% to over 90% of a plant's dry mass.[7, 10] The

formation of calcium oxalate crystals is genetically controlled and the crystals are usually formed in a defined shape and spatial location. Calcium oxalate crystals in higher plants occur in five major forms, namely raphides (acicular crystals that form in bundles), styloids (acicular crystals that form singly), prisms (consisting of simple regular prismatic shapes), druses (a spherical aggregates of crystals) and crystal sand (small tetrahedral crystals that form in clusters). The form, shape and occurrence of calcium oxalate crystals in plants are species- and tissues specific. Calcium oxalate exists in two chemical forms, monohydrate and dihydrate, and both of these occur in plants. The observed morphologies represent elaborations and modifications of basic crystal structure for either the monohydrate or dihydrate form. The monohydrate is more stable and is more commonly found in plants than is the dihydrate. The presence or absence of a particular type of crystal is used as a taxonomic character.[7, 10]

Innovation of new and novel therapeutics is a multi-step process involving drug design, synthesis and its pharmacological screening. Drug development mainly deals with three phases, *viz.* identification of lead compound amongst the million compounds, preclinical studies by *in vitro* and *in vivo* experiments, and clinical studies. Selection of an animal model, cell and tissue culture is one of the most important steps in any of the experimental pharmacological study. A number of other pharmaceutical products, including vaccines, antibiotics, and therapeutic proteins are also made because of them.[8] But this method needs many instruments, chemicals, funds, time, and legal issues are involved. In this paper we are predicting that a plant cell can be used as a dummy or model to study preliminary investigation and even effects efficiency of drugs on a disorder/ diseases. Naturally occurring crystal of calcium oxalate are synthesised by the pathway of oxalate biosynthesis which utilizes ascorbate as the primary precursor. Ascorbate utilized is produced directly within the crystal idioblast itself. Plant crystals are formed from endogenously synthesized oxalic acid, which combines with calcium from the environment. Even in animals the biochemical process involved in calcium oxalate stone formation is super-saturation, nucleation, aggregation, crystal growth, crystal retention and formation of stone granules and finally development of stone.[6]

Many plants with the property of disintegrating and dissolving kidney stones are listed in Ayurveda. In the Indian system of medicine, several herbal remedies have been used for the treatment of kidney failure since the time of Charka and Sushruta. New approaches of using plant extract on plant calcium oxalate crystal will improve and accelerate the discovery of the

right cure. Traditional knowledge serves as a powerful search engine and greatly facilitates intentional, focused and safe natural products research to rediscover the drug discovery process.[9]

Herbal medicines have many phytoconstituents which exert their beneficial effect in kidney stone treatment. Plant extracts contain phytochemicals that inhibit stone formation by inhibiting synthesis and agglomeration of crystals and even dissolve it. Herbal extracts may prevent stone formation because of many reasons like they may have diuretic activity, crystallization inhibiting activity, lithotriptic activity, analgesic and anti-inflammatory activity. For the present study, an ethobotanical survey (data not shown) was conducted in Mahad (Raigad) to identify plants used locally for the treatment of kidney stones. From the plants identified in the survey, *Tectona grandis* and *Bryophyllum pinnata* were selected for the study due to previously published studies that noted their lithotriptic activity.[9] The targets for the extract activity were *Ficus elastica* cystolith and *Colocasia esculenta* raphides.

MATERIALS AND METHOD

Phytochemical screening: *Tectona grandis* fruit and *Bryophyllum pinnata* leaves were air dried till a constant weight was achieved. Preliminary phytochemical screening was performed of *Tectona grandis* fruit and *Bryophyllum pinnata* leaves. The extracts were prepared in chloroform, acetone, 90% methanol and water by sonicating 1 g in 100 mL solvent in an ultrasonic bath for 15 minutes at room temperature. Respective filtrates were used while all phytochemical tests were performed.

Effect of plant extract on calcium oxalate crystals: Extracts of *Tectona grandis* fruit and *Bryophyllum pinnata* leaves were prepared by crushing 1 g of plant material in 10 mL distilled water using a mortar and pestle. The extract was filtered with Whatmann filter paper no. 1. The filtrate was used for further studies. Free hand sections of *Ficus elastica* and *Colocasia esculenta* showing cystoliths and raphides, respectively, were treated with the plant extracts. The sections were incubated in the extract at 25±2 ºC for 20-22 hours. Effects of the extracts on the cystoliths and raphides were observed by comparing photomicrographs taken before and after treatment. Control was maintained by treating cystolith and raphides with normal water. Photomicrographs of *Ficus* cystolith and *Colocasia* raphides were taken at 10x magnification using a Motic Digital Microscope B1 and their size was determined using the Motic Image Plus 2.0 software. The results were derived by observing 30 sections of *Ficus* cystolith and *Colocasia* raphides treated with the extracts.

RESULTS

The phytochemical screening of *Tectona grandis* fruit (Table 1) and *Bryophyllum pinnata* leaf (Table 2) extract was also done. The screening showed while majority of the secondary and primary metabolites were not detected, the presence of alkaloids was detected in all extracts for both plants.

Table 1: Phytochemical screening of *Tectona grandis*

Chemical constituent	Test	Extracts			
		CH	AC	ME	WA
Alkaloids	Dragendroff reagent	+	+	+	+
	Wagner's reagent	+	+	+	+
Anthocyanin	Concentrated HCl and NH_3	+	-	-	-
Antraquinone	Dilute H_2SO_4, benzene and NH_3	+	-	+	-
Carbohydrate	Fehling's test	+	-	-	-
	Benedict's test	-	-	-	-
Cardiac glycosides	Baljet's reagent	-	-	-	+
Emodins	NH_4OH and benzene	-	-	+	+
Flavonoids	Pew's test	-	-	-	-
	Sodium hydroxide test	-	-	-	-
	Ammonium hydroxide test	-	-	-	-
	Alkaline reagent test	-	-	-	-
Glycosides	Kedde's test	+	+	-	-
	Keller-Killani test	+	-	-	-
Polyphenol	Folin-Ciocalteau's test	-	+	+	+
Saponin	Foam test	-	-	-	-
Steroids	Salkowski's test	-	-	-	-
Tannin	Ferric chloride test	-	-	-	-
Terpenoids	Anisaldehyde reagent	-	+	-	-
	Vanillin-sulphuric acid regent	+	-	+	-

(CH: Chloroform; AC: Acetone; ME: 90% Methanol; WA: Water)

Table 2: Phytochemical screening of *Byrophyllum pinnata*

Chemical constituent	Test	Extracts			
		CH	AC	ME	WA
Alkaloids	Dragendroff reagent	+	+	+	+
	Wagner's reagent	+	+	+	+
Anthocyanin	Concentrated HCl and NH_3	-	-	-	-
Antraquinone	Dilute H_2SO_4, benzene and NH_3	-	-	-	-
Carbohydrate	Fehling's test	+	-	-	-
	Benedict's test	-	-	-	-
Cardiac glycosides	Baljet's reagent	-	-	-	-
Emodins	NH_4OH and benzene	-	-	-	-
Flavonoids	Pew's test	-	-	-	-
	Sodium hydroxide test	-	-	-	-
	Ammonium hydroxide test	-	-	-	-

	Alkaline reagent test	-	-	-	-
Glycosides	Kedde's test	+	+	-	-
	Keller-Killani test	+	-	-	-
Polyphenol	Folin-Ciocalteau's test	-	-	+	+
Saponin	Foam test	-	-	-	-
Steroids	Salkowski's test	-	-	-	-
Tannin	Ferric chloride test	-	-	-	-
Terpenoids	Anisaldehyde reagent	-	+	-	-
	Vanillin-sulphuric acid regent	-	-	-	-

(CH: Chloroform; AC: Acetone; ME: 90% Methanol; WA: Water)

Colocasia esculenta petiole sections showing raphides were used for the study. *Tectona grandis* fruit (Figure 2) and *Bryophyllum pinnata* leaves (Figure 3) extracts were used as treatment on raphides. It was seen that the raphides were completely dissolve after 20-22 hours of incubation. The control sections (Figure 1) treated with water did not show any difference on the raphides.

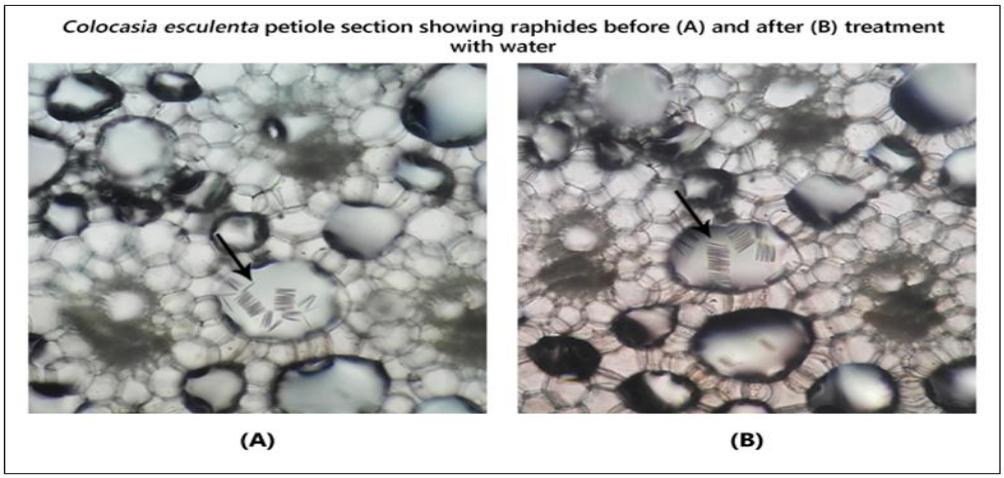

Figure 1: Control for *Colocasia esculenta* raphides

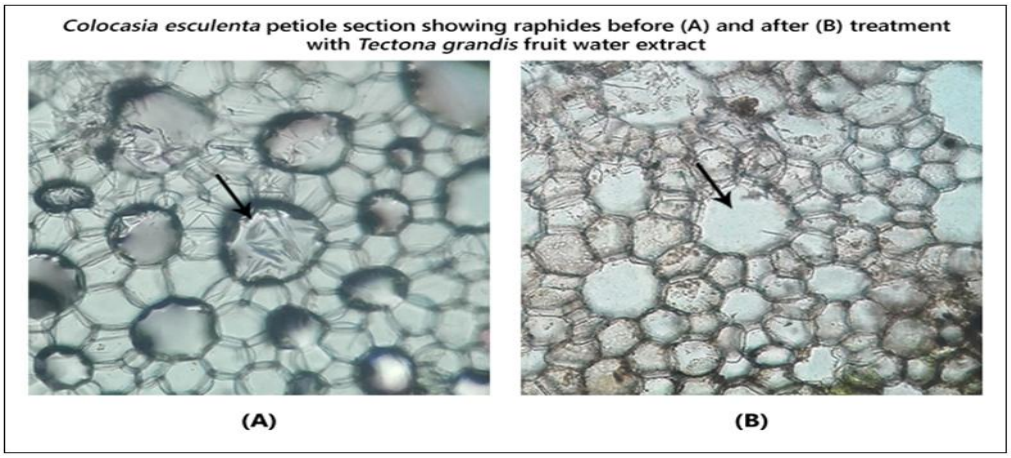

Figure 2: *Colocasia esculenta* raphides treated with *Tectona grandis* fruit extract

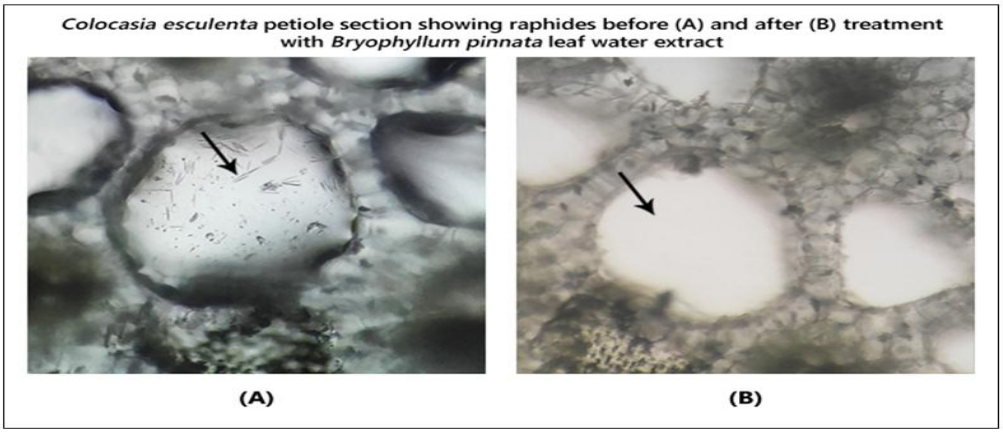

Figure 3: *Colocasia esculenta* raphides treated with *Bryophyllum pinnata* leaf extract

Ficus elastica leaf sections showing cystolith were used for the study. *Tectona grandis* fruit (Figure 5) and *Bryophyllum pinnata* leaf (Figure 6) extracts were used as treatment on cystolith. It was seen that after 20-22 hours the cystolith showed a significant decrease in size. However, the sectioned treated with water (Figure 4) were not affected.

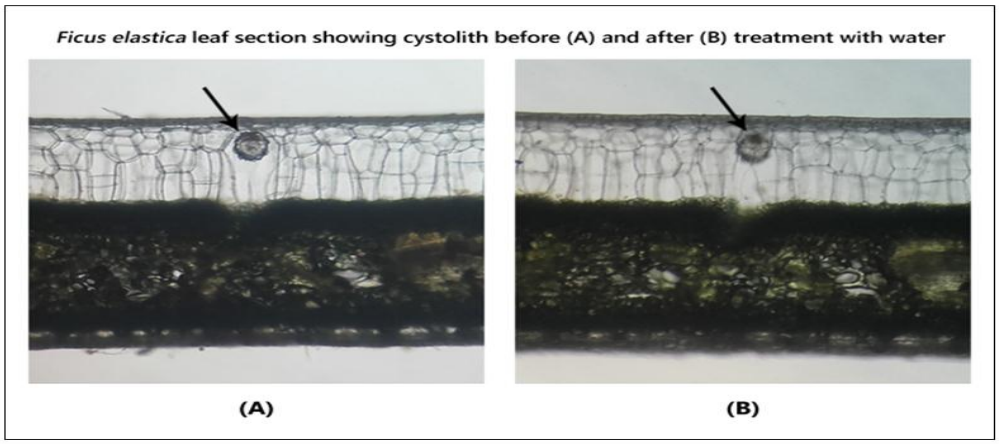

Figure 4: Control for *Ficus elastica* cystolith

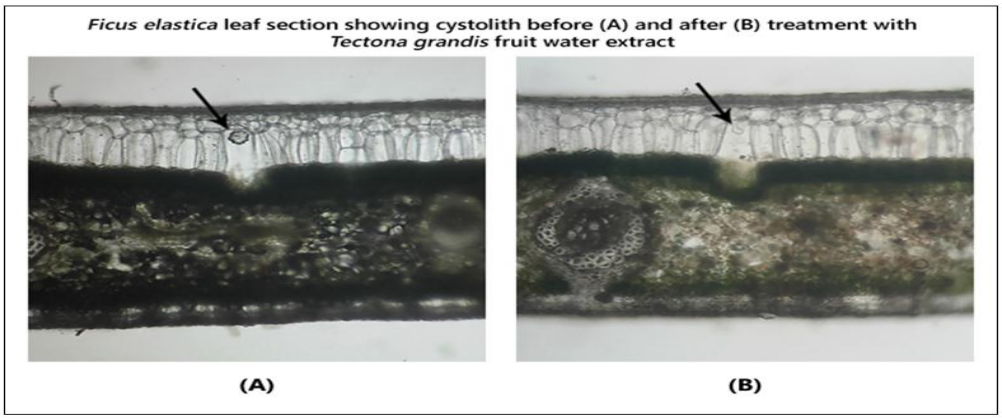

Figure 5: *Ficus elastica* cystolith treated with *Tectona grandis* fruit extract

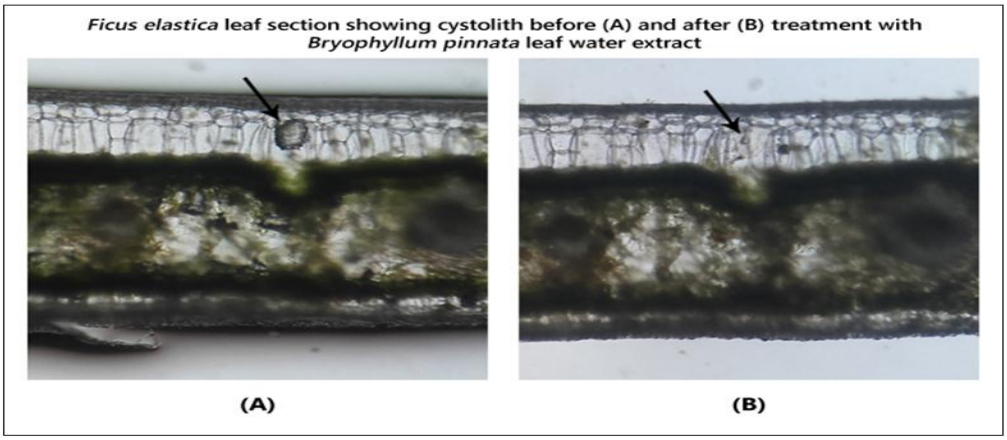

Figure 6: *Ficus elastica* cystolith treated with *Bryophyllum pinnata* leaf extract

Table 3: Effect of plant extracts on the size of calcium oxalate crystals

Calcium oxalate type	Herbal drugs	Before treatment (zero hour)	After treatment (20-22 hours)
Cystolith	*Tectona grandis*	Length: 30.3 µm Breadth: 20.2 µm	Length: 18.5 µm Breadth: 10.0 µm
Cystolith	*Bryophyllum pinnata*	Length: 39.6 µm Breadth: 33.5 µm	Length: 20.0 µm Breadth: 6.5 µm
Cystolith	Control (water)	Length: 40.4 µm Breadth: 29.8 µm	Length: 40.4 µm Breadth: 29.8 µm
Raphides	*Tectona grandis*	Range of lengths for groups for raphides 20-28 µm	Completely dissolved
Raphides	*Bryophyllum pinnata*	Range of lengths for groups for raphides 15-30 µm	Completely dissolved
Raphides	Control (water)	Range of lengths for groups for raphides 21-25 µm	Range of lengths for groups for raphides 21-25 µm

DISCUSSION

In India, 12% and nearly 4-15% of the global population suffer from urinary stone problems; of which 50% may end up with loss of kidney(s) or renal damage. Calcium oxalate stones represent up to 80% of analyzed stones and calcium phosphate accounts for 15-25%, while 10- 15% are mixed stones. The others are struvite 15-30%, cystine 6-10%, and uric acid stones 2-10%. Calcium oxalate stones are of two types, calcium oxalate monohydrate (whewellite) and calcium oxalate dehydrate (weddellite).[3]

Many medicines like Thiazide diuretics (e.g. Hydrochlorothaizide), alkali, (e.g. Potassium citrate), Allopurinol, Sodium cellulose phosphate (SCP), Penicillamine (Cuprimine), Bisphosphonates, Potassium phosphate, *Oxalobacter formigenes* and other probiotics are used to treat the stones formed which act by decreasing the excretion of stone forming agent such as oxalates, calcium, phosphates etc.[2]

Now-a-days, however, herbal medicine has gained much popularity because, herbal medicines are effective, have less side effects and reduce recurrence rate of stone formation, hence search for antilithiatic drugs from natural sources has assumed greater importance and is promising. Herbal medicines have many phytoconstituents which may exert their beneficial effect in kidney stone treatment. Plant extracts contain phytochemicals that inhibit stone formation by inhibiting synthesis and agglomeration of crystals.[1]

Herbal extracts may prevent stone formation because of many reasons like they may have diuretic activity, crystallization inhibiting activity, lithotriptic activity, analgesic and anti-inflammatory activity.[4] However, further research is needed to identify the active principles from medicinal plants to assess their dosage and quality control, and investigate their interactions and adverse effects. Although use of herbal medicine is popular and promising, it is essential to carry out further research to understand the disease, and the mechanism of action of herbal medicines in order to develop efficient and safe lithotriptic agents. But for this, clinical trials on animals are a must. Replacement of animals is what most people think of when you say alternatives to animal testing. The animals are replaced, either by methods that does not involve animals at all (absolute replacement) or by use only the cells or tissues of animals (relative replacement). Our method is absolute replacement as it involves plant cells as a test subject.

As discussed earlier, both animals and plants follow the same process in formation of calcium oxalate crystals. Thus via treating plant cystolith and raphides with well known ethno medicine we have studied the mechanism of dissolution of crystals in plant cells by imaging technique. This will provide an overview of whole treatment mechanism as shown in above images. *Bryophyllum* and *Tectona* extracts seemed to be very effective on calcium oxalate crystals. There is almost complete dissolution of *Ficus* cystolith and *Colocasia* raphides. The sections were also incubated in normal water as treatment control. Medicinal plants comprise of approximately 8000 species and account for about 50% of all the flowering plant species in India. Thus every plant can be used for the study as this method is simple, easy, economical, and precise, with the biggest benefit being that no animal testing is required.

ACKNOWLEDGEMENT

The authors would like to thank DBT, Government of India for the financial support provided to the Department of Botany, Ramniranjan Jhunjhunwala College under the DBT-Star College Scheme.

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