NAAC
Reaccredited- 'A' grade in 3rd cycle

PSGVP Mandal's
A RUSA Beneficiary and DBT Star Status Institution
SHRI S.I.PATIL ARTS, G.B.PATEL SCIENCE & STKVS COMMERCE COLLEGE,
SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
GOLDEN JUBILEE YEAR- (2020-21)
Website: www. psgvpasc.ac.in
Phone/ Fax Office (02565) 229576
Email:principal.shahada@gmail.com
IQAC- psgvpnaac@gmail.com
Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.2. ***Number of functional MoUs with institutions, other universities, industries, corporate houses etc. during the year 2016-17***

S N	Organisation with which MoU is signed	Name of the institution/ industry/ corporate house	Year of signing MoU	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs	Page No.
01	Shri. Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., purushottamnagar, Tal: Dist Shahada Nandurbar, MS, 425424	Shri. Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., purushottamnagar, Tal: Dist Shahada Nandurbar, MS, 425424	2011	15 June 2011 to 14 June 2021	Industry Sponsorship to M.Sc Chemistry students	02	2-4

(Prof. Dr. R. S. Patil)
Principal

Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Scien
& S.T.K.V.S Comm. College, Shahad
Dist.Nandurbar(M.S.)

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH AND CONSULTANCY

Between

Department of Microbiology, PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College, Shahada, Dist: Nandurbar, (425409) hereafter called as "**PSGVPM's ASC College**"

And

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., Purushottamnagar, Tal: Shahada Dist Nandurbar, MS, 425424 hereafter called as "**Sugar Factory, Purushottamnagar**"

This Memorandum of Understanding (MOU) is signed between **PSGVPM's ASC College** and **Sugar Factory, Purushottamnagar**.

That this MOU is purely meant for sharing the research facilities and research outcome and getting consultancy services between **PSGVPM's ASC College** and **Sugar Factory, Purushottamnagar.**

That **PSGVPM's ASC College** shall provide estimation of BOD, COD and other microbial analysis of samples submitted by **Sugar Factory, Purushottamnagar** and **Sugar Factory, Purushottamnagar** shall allow the use of research facilities available at their distillery unit.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the staff and students of **PSGVPM's ASC College** and concerned staff, Scientist and technicians of **Sugar Factory, Purushottamnagar**.

This MOU exists from 15th June 2011 and is valid till 14th June 2021.

Prof. Dr. R. S. Patil, Principal, PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College, Shahada Dist: Nandurbar, (425409) **E-mail : principal.shahada@gmail.com,** **Tel : 02565-229576**	PRINCIPAL P.S.G.V.P.M's Arts, Sci. College & Commerce S. College, Shahada Dist.Nandurbar (M.S.) 425409
Mr. P. R. Patil **Managing Director,** Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., Purushottamnagar, Tal: Shahada, Dist: Nandurbar, MS, 425424 **Tel : 02565-229545,229764**	Managing Director Shree Satpuda Tapi Parisar S.S.K.Ltd. Purushottamnagar - 425 424, Tal.Shahada, Dist. Nandurbar (M.S.)

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd.

A/p.Purushottamnagar,
Tal. Shahada,
Dist. Nandurbar,
Pin - 425 424 (M.S.)

Reg.No. : DHL / PRG / (A) / 2,
Date 5 Sept. 1969

UNIT	Telephone	E-mail
Sugar	: (02565) 229245/229764	satpuda2012@rediffmail.com
Distillery	: (02565) 229438	satpudadist@gmail.com
Bagasse Board	: (02565) 229439	satpuda2004@sancharnet.in
Fax	: (02565) 229453	EBPX Mob. : 09921751313

Ref.No.48/ 1564-J

Date – 01/08/2016

To,
The Principal,
PSGVPM's, Arts, Scienor & Commerce,
College, Shahada (Dist. Nandurbar)

Subject: Industrial Sponsorship for admission to M. Sc. Organic Chemistry...

Dear Sir,

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd. Purushottamnagr, Tal. Shahada, Dist. Nandurbar is please to sponsor **Miss Kulkarni Dipali Mahesh** for the admission to M. Sc. (Organic Chemistry) during the year 2016-17 and 2017-18 at P. S. G. V. P. Mandal's Arts, Science and Commerce College, Shahada, Dist. Nandurbar.

Yours Faithfully,

MANAGING DIRECTOR

Arts Science & Commerce
College SHAHADA
Reward No 7850
Date 02.08.2016

Mumbai Office : Mittal Court, 'C' Wing, Room 105, 10th Floor, Nariman Point, Mumbai - 400 021.
Ph. (022) 2285 1772 Fax. (022) 2202 8528 EMAIL : manasigupte@ymail.com

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd.

A/p.Purushottamnagar,
Tal. Shahada,
Dist. Nandurbar,
Pin - 425 424 (M.S.)

Reg.No. : DHL / PRG / (A) / 2,
Date 5 Sept. 1969

UNIT	Telephone	E-mail
Sugar	: (02565) 229245/229764	satpuda2012@rediffmail.com
Distillery	: (02565) 229438	satpudadist@gmail.com
Bagasse Board	: (02565) 229439	satpuda2004@sancharnet.in
Fax	: (02565) 229453	EBPX Mob. : 099217 51313

Ref.No.48/ 1563-1 Date – 01/08/2016

To,
The Principal,
PSGVPM's, Arts, Scienc r & Commerce,
College, Shahada (Dist. Nandurbar)

Subject: Industrial Sponsorship for admission to M. Sc. Organic Chemistry...

Dear Sir,

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd. Purushottamnagr, Tal. Shahada, Dist. Nandurbar is please to sponsor **Shri Patil Kunal Dilip** for the admission to M. Sc. (Organic Chemistry) during the year 2016-17 and 2017-18 at P. S. G. V. P. Mandal`s Arts, Science and Commerce College, Shahada, Dist. Nandurbar.

Yours Faithfully,

MANAGING DIRECTOR

Arts Science & Commerce
College SHAHADA
Serial No 7849
Date 01-08-2016

Mumbai Office : Mittal Court, 'C' Wing, Room 105, 10th Floor, Nariman Point, Mumbai - 400 021.
Ph. (022) 2285 1772 **Fax.** (022) 2202 8528 **EMAIL** : manasigupte@ymail.com

NAAC
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PSGVP Mandal's
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SHRI S.I.PATIL ARTS, G.B.PATEL SCIENCE & STKVS COMMERCE COLLEGE,
SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
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Website: www. psgvpasc.ac.in Email:principal.shahada@gmail.com IQAC- psgvpnaac@gmail.com
Phone/ Fax Office (02565) 229576 Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.2. *Number of functional MoUs with institutions, other universities, industries, corporate houses etc. during the year 2017-18*

S N	Organisation with which MoU is signed	Name of the institution/ industry/ corporate house	Year of signing MoU	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs	Page No.
01	Shri. Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., purushottamnagar, Tal: Dist Shahada Nandurbar, MS, 425424	Shri. Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., purushottamnagar, Tal: Dist Shahada Nandurbar, MS, 425424	2011	15 June 2011 to 14 June 2021	Industry Sponsorship to M.Sc Chemistry students	02	2-4

(Prof. Dr. R. S. Patil)
Principal
Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science & S.T.K.V.S Comm. College, Shahada, Dist.Nandurbar(M.S.)

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH AND CONSULTANCY

Between

Department of Microbiology, PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College, Shahada, Dist: Nandurbar, (425409) hereafter called as "**PSGVPM's ASC College**"

And

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., Purushottamnagar, Tal: Shahada Dist Nandurbar, MS, 425424 hereafter called as "**Sugar Factory, Purushottamnagar**"

This Memorandum of Understanding (MOU) is signed between **PSGVPM's ASC College** and **Sugar Factory, Purushottamnagar**.

That this MOU is purely meant for sharing the research facilities and research outcome and getting consultancy services between **PSGVPM's ASC College** and **Sugar Factory, Purushottamnagar.**

That **PSGVPM's ASC College** shall provide estimation of BOD, COD and other microbial analysis of samples submitted by **Sugar Factory, Purushottamnagar** and **Sugar Factory, Purushottamnagar** shall allow the use of research facilities available at their distillery unit.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the staff and students of **PSGVPM's ASC College** and concerned staff, Scientist and technicians of **Sugar Factory, Purushottamnagar**.

This MOU exists from 15th June 2011 and is valid till 14th June 2021.

Prof. Dr. R. S. Patil, Principal, PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College, Shahada Dist: Nandurbar, (425409) **E-mail : principal.shahada@gmail.com,** **Tel : 02565-229576**	PRINCIPAL P.S.G.V.P.M's Arts, Sci. College & Commerce S. College, Shahada Dist.Nandurbar (M.S.) 425409
Mr. P. R. Patil **Managing Director,** Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., Purushottamnagar, Tal: Shahada, Dist: Nandurbar, MS, 425424 **Tel : 02565-229545,229764**	Managing Director Shree Satpuda Tapi Parisar S.S.K.Ltd. Purushottamnagar - 425 424, Tal.Shahada, Dist. Nandurbar (M.S.)

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd.

A/p. Purushottamnagar,
Tal. Shahada, Dist. Nandurbar,
Pin - 425 424 (M.S.)

Reg.No. : DHL / PRG / (A) / 2, Date 5 Sept. 1969

UNIT	Telephone	E-mail
Sugar	: (02565) 229764	satpuda2012@rediffmail.com
Distillery	: (02565) 229438	satpudadist@gmail.com
Bagasse Board	: (02565) 229439	satpuda2004@sancharnet.in

Ref.No.49/Gen.

Date: – 04/08/2017

To,
The Principal,
PSGVPM`s Arts, Science & Commerce,
College, Shahada (Dist. Nandurbar)

Subject:- Industrial Sponsorship for admission to M. Sc. Organic Chemistry

Dear Sir,

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd. Purushottamnagar, Tal. Shahada, Dist. Nandurbar is pleased to sponsor **Mr. Patil Makrand Ramesh** for the admission to M.Sc. (Organic Chemistry) during the year 2017-18 and 2018-19 at P.S.G.V.P. Mandal`s Arts, Science and Commerce College, Shahada, Dist. Nandurbar.

Yours Faithfully,

MANAGING DIRECTOR

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd.

A/p. Purushottamnagar,
Tal. Shahada, Dist. Nandurbar,
Pin - 425 424 (M.S.)

Reg.No. : DHL / PRG / (A) / 2, Date 5 Sept. 1969

UNIT	Telephone	E-mail
Sugar	: (02565) 229764	satpuda2012@rediffmail.com
Distillery	: (02565) 229438	satpudadist@gmail.com
Bagasse Board	: (02565) 229439	satpuda2004@sancharnet.in

Ref.No.49/Gen.

Date :– 04/08/2017

To,
The Principal,
PSGVPM`s Arts, Science & Commerce,
College, Shahada (Dist. Nandurbar)

Subject:- Industrial Sponsorship for admission to M. Sc. Organic Chemistry

Dear Sir,

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd. Purushottamnagar, Tal. Shahada, Dist. Nandurbar is pleased to sponsor **Mr. Patil Kalpesh Shankar** for the admission to M.Sc. (Organic Chemistry) during the year 2017-18 and 2018-19 at P.S.G.V.P. Mandal`s Arts, Science and Commerce College, Shahada, Dist. Nandurbar.

Yours Faithfully,

MANAGING DIRECTOR

NAAC
Reaccredited- 'A' grade in 3rd cycle

PSGVP Mandal's
A RUSA Beneficiary and DBT Star Status Institution
SHRI S.I.PATIL ARTS, G.B.PATEL SCIENCE & STKVS COMMERCE COLLEGE,
SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
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IQAC- psgvpnaac@gmail.com
Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.2. ***Number of functional MoUs with institutions, other universities, industries, corporate houses etc. during the year 2018-19***

S N	Organisation with which MoU is signed	Name of the institution/ industry/ corporate house	Year of signing MoU	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs	Page No.
01	Shri. Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., purushottamnagar, Tal: Dist Shahada Nandurbar, MS, 425424	Shri. Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., purushottamnagar, Tal: Dist Shahada Nandurbar, MS, 425424	2011	15 June 2011 to 14 June 2021	Industry Sponsorship to M.Sc Chemistry students	2	2-4

(Prof. Dr. R. S. Patil)
Principal

Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science & S.T.K.V.S Comm. College, Shahada, Dist.Nandurbar(M.S.)

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH AND CONSULTANCY

Between

Department of Microbiology, PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College, Shahada, Dist: Nandurbar, (425409) hereafter called as "**PSGVPM's ASC College**"

And

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., Purushottamnagar, Tal: Shahada Dist Nandurbar, MS, 425424 hereafter called as "**Sugar Factory, Purushottamnagar**"

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That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the staff and students of **PSGVPM's ASC College** and concerned staff, Scientist and technicians of **Sugar Factory, Purushottamnagar**.

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Prof. Dr. R. S. Patil, Principal, PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College, Shahada Dist: Nandurbar, (425409) **E-mail : principal.shahada@gmail.com,** **Tel : 02565-229576**	PRINCIPAL P.S.G.V.P.M's Arts, Sci. College & Commerce S. College, Shahada Dist.Nandurbar (M.S.) 425409
Mr. P. R. Patil **Managing Director,** Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., Purushottamnagar, Tal: Shahada, Dist: Nandurbar, MS, 425424 **Tel : 02565-229545,229764**	Managing Director Shree Satpuda Tapi Parisar S.S.K.Ltd. Purushottamnagar - 425 424, Tal.Shahada, Dist. Nandurbar (M.S.)

SHREE SATPUDA TAPI PARISAR SAHAKARI SAKHAR KARKHANA LTD.,
REG. NO. : DHL/PRG(A)2, DATE 5TH SEPT. 1969
AT.POST. PURUSHOTTAMNAGAR TAL. SHAHADA DIST. NANDURBAR (MH) PIN- 425424

DEPARTMENT		PHONE NO.	EMAIL
SUGAR	:	(02565) 229764	SATPUDA2012@REDIFFMAIL.COM
DISTILLERY	:	(02565) 229438	SATPUDADIST@GMAIL.COM
BAGASSE BOARD	:	(02565) 229439	SATPUDA2004@SANCHARNET.IN

1346-A

E 8 AUG 2018

To,
The Principal,
P.S.G.V.P.Mandal`s,
SIP Arts, GBP Science &
STKVS Commerce College,
Shahada (Dist. Nandurbar).

Subject: - Industrial Sponsorship for admission to M.Sc. (I) Organic Chemistry..

Dear Sir,

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd. Purushottamnagar is a leading industry in our State. We are in need of young and dynamic chemists for our industry.

As a part of Industry Institute interaction we are pleased to sponsor Mr. PATIL DIPAK DEVIDAS for the admission to M. Sc. (I) Organic Chemistry under Industry Sponsored seats for the year 2018-19 and 2019-20 at P. S. G. V. P. Mandal`s SIP Arts, GBP Science & STKVS Commerce College, Shahada (Dist. Nandurbar).

Yours faithfully,

(MANAGING DIRECTOR)

SHREE SATPUDA TAPI PARISAR SAHAKARI SAKHAR KARKHANA LTD.,
REG. NO. : DHL/PRG(A)2, DATE 5TH SEPT 1969
AT.POST. PURUSHOTTAMNAGAR TAL. SHAHADA DIST. NANDURBAR (MH) PIN- 425424

DEPARTMENT		PHONE NO.	EMAIL
SUGAR	:	(02565) 229764	SATPUDA2012@REDIFFMAIL.COM
DISTILLERY	:	(02565) 229438	SATPUDADIST@GMAIL.COM
BAGASSE BOARD	:	(02565) 229439	SATPUDA2004@SANCHARNET.IN

1347

8 AUG 2018

To,
The Principal,
P.S.G.V.P.Mandal`s,
SIP Arts, GBP Science &
STKVS Commerce College,
Shahada (Dist. Nandurbar).

Subject: - Industrial Sponsorship for admission to M.Sc. (I) Organic Chemistry..

Dear Sir,

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd. Purushottamnagar is a leading industry in our State. We are in need of young and dynamic chemists for our industry.

As a part of Industry Institute interaction we are pleased to sponsor Mr. KULATHE RADHESHYAM GAJANAN for the admission to M. Sc. (I) Organic Chemistry under Industry Sponsored seats for the year 2018-19 and 2019-20 at P. S. G. V. P. Mandal`s SIP Arts, GBP Science & STKVS Commerce College, Shahada (Dist. Nandurbar).

Yours faithfully,

(MANAGING DIRECTOR)

NAAC
Reaccredited- 'A' grade in 3rd cycle

PSGVP Mandal's
A RUSA Beneficiary and DBT Star Status Institution
SHRI S.I.PATIL ARTS, G.B.PATEL SCIENCE & STKVS COMMERCE COLLEGE,
SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
GOLDEN JUBILEE YEAR- (2020-21)
Website: www. psgvpasc.ac.in Email:principal.shahada@gmail.com IQAC- psgvpnaac@gmail.com
Phone/ Fax Office (02565) 229576 Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.2. *Number of functional MoUs with institutions, other universities, industries, corporate houses etc. during the year 2019-20*

S N	Organisation with which MoU is signed	Name of the institution/ industry/ corporate house	Year of signing MoU	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs	Page No.
1	Rubicon Skill Development Pvt. Ltd'	Rubicon Skill Development Pvt. Ltd'	2020	25 Jan 2020 to 24 Jan 2025	M1A. New Hire Training On Personality Development and Placement By Rubicon by India Pvt. Ltd And Barkley Bank Dated: 5,6 and 7 Feb. 2020	124	2-17
2	Rubicon Skill Development Pvt. Ltd'	Rubicon Skill Development Pvt. Ltd'	2020	25 Jan 2020 to 24 Jan 2025	M1B. New Hire Training On Personality Development and Placement By Rubicon by India Pvt. Ltd And Barkley Bank Dated: 17, 18 & 19th February 2020	94	18-24
3	S. I. Biozyme, SHAHADA 425409 Dist Nandurbar, MS.	S. I. Chemicals, SHAHADA 425409 Dist Nandurbar, MS.	2011	15 June 2011 to 14 June 2021	Industry Sponsorship to M.Sc Microbiology students	2	25-27

(Prof. Dr. R. S. Patil)
Principal

Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science & S.T.K.V.S Comm. College, Shahada, Dist.Nandurbar(M.S.)

Memorandum of Understanding (MOU)

Between
P.S.G.V.P. Mandal's SIP Arts GBP Science & STKVS Commerce College
&
Rubicon Skill Development Pvt. Ltd.

For Training students on Rubicon's Campus to Corporate Program

This Memorandum of Understanding is made at Pune on 25th day of January P.S.G.V.P. Mandal's SIP Arts GBP Science & STKVS Commerce College. A Here in after referred to as "**THE COLLEGE**" (Which term shall so far as the context admits be deemed to mean and include its successors and assigns) of the First Part,

AND

Rubicon Skill Development Private Limited a Company incorporated and registered under the Companies Act, 2013, having its Corporate office at 801, 8th Floor, Tower 1, World Trade Centre, Pune - 411014, Maharashtra, hereinafter referred to as "**Rubicon**" (which term shall so far as the context admits be deemed to mean and include its successors, administrators, executors and assignees) of the Second Part.

1. **Introduction**

THE COLLEGE has decided to partner with **RUBICON** for the conduct of Tomorrow's Foundation **Connect with Work** Program (hereinafter referred to as "Training Program") at THE COLLEGE.

2. **THE COLLEGE Responsibilities:**

2.1. Shall nominate one person with adequate accountability and responsibility to coordinate the Training Program. He / She would act as the single point of contact for the proposed Programme.

2.2. Shall make available the infrastructure (including IT infrastructure, applications and connectivity) required to conduct the Training Program.

2.3. Shall provide all the support services and facilities to **RUBICON** during the conduct of the said Training Program. Adequate power backup through UPS and DG [illegible] the training sessions

2.4 Shall coordinate with RUBICON and facilitate conduct of all the assessments including the assessment to be conducted by the external agency (if any) identified by RUBICON, as per schedule communicated by RUBICON.

2.5. Provide lodging, wherever available, as per the standards of RUBICON for faculty conducting the Training Programme for the total duration of the Training Programme plus two days (one day prior and one day after closure).The lodging so planned to be provided should be with independent room (with attached toilet), regular water supply, clean, with access to boarding facilities, should have well lit approach and surroundings, have adequate safety & protection and peaceful environment.

2.6. Shall share the details of students in a prescribed format to ensure that there is no duplication of beneficiaries

2.7. This is a multi-year program to create social impact. The college shall share few details to assess the impact of the program. For e.g. Placement details of trained students will be required to assess the impact of the program from one year to another year.

3. **Rubicon Responsibilities:**

3.1. Will provide necessary training as per Training Programme requirements and curriculum for delivery as per Annexure I to this MOU

3.2. Will provide suitable faculties for the training exclusive for classroom training

3.3. Will conduct assessment of its own and also arrange external assessment as required.

4. **Other Terms & Conditions:**

The following are other terms and conditions of engagement:

4.1. Batch Size: The batch size would need to be a min/ max of 35-40.

4.2 Each student would be made available for the Training Program for specified number of hours per day for the duration of the Training Program.

4.3 Pre-assessment & Selection: RUBICON may carry out pre-assessment of the students who have applied for the course and shortlist the select candidates to undergo the Training Program. The final decision on selection of candidates eligible to take the Training Program shall be with RUBICON.

4.4 Programme schedule:

4.4.1 Training Program scheduled commencement date

4.4.2. Scheduled Completion Date: and will be completed by not later than

4.5. Commercials:

4.5.1. Training Fees: The training Fees is as follows,

Since this is a CSR funded Program there is no fee payable by THE COLLEGE for this Training Program

4.5.2. Payment Terms
Not Applicable

4.6. Certification:

Students who are successful in the assessment conducted by RUBICON shall be awarded a certificate post completion of the training program.

4.7. Term of engagement:

This MoU is valid from the date of sign off by both parties for a period of Two years, however both parties agree that based on mutual agreement, the terms may be extended. Both parties also agree that terms may be renegotiated.

4.8. Limitations and Warranties

Rubicon Skill Development Pvt. Ltd. PUNE

Both parties agree that it would be their endeavour to prevent any liability arising out of default or non-compliance of the MoU terms by the other party.

4.9. Termination

4.9.1. Both parties can terminate the MoU with a prior written thirty (30) day notice on default of terms of non adherence to any condition or responsibilities by the other party as outlined in this MoU in case such default is not rectified within such 30 days.

4.9.2. Both parties also agree that it would be their professional endeavour that despite any termination of the MOU, progress would continue, without any prejudice to the ongoing Training Programmes, which would be without any hindrance and would be progressed for completion.

General Terms:

5.1. Both the parties may receive information proprietary to other party (the Confidential Information) in the course of performance of their obligations under this MOU. Confidential Information is not meant to include any information which (a) is publicly available (b) is rightfully received by the parties from third parties without accompanying secrecy obligations; (c) is already in either party's possession and was lawfully received from sources other than the parties or (d) is independently developed by the parties. The two bodies understand and acknowledge that the Confidential Information is valuable and confidential and agrees that it will at all times be kept in trust to be disclosed only to such persons as have a "need to know" the same for the effective implementation of this MOU and that it will only be used by the parties for the benefit of others.

5.2. Both the parties understand and agree that all written or other tangible data and documentation developed or procured by the other party in performing its obligations under this MOU, whether in printed or electronic form, belongs to other party and that other party will have all rights, titles and interests therein.

5.3. Both parties shall not use the name and brand of other party in any advertisement or make any public announcement without the prior written approval of the other.

5.4 Each party shall be at liberty to terminate this MOU with a written notice period of three (3) month to the other party without any compensation and seeking legal redress.

6. **Jurisdiction**

In the event of any litigation, the court of jurisdiction shall be Pune

7. **Indemnification**

Both parties agree to indemnify each other and hold the other party harmless from and against any claim, loss, liability, or expense, including, but not limited to, damages, patent, and trademark infringement, costs and attorneys' fees, arising out of or in connection with any acts or omissions of their agents or employees, as related to the terms of this MoU.

Any claim, compensation, case initiated by any student against Aricent in relation to the Training Program due to any acts or omissions of COLLEGE and/or RUBICON shall be defended and contested by the COLLEGE and RUBICON at their sole expenses and cost keeping Aricent indemnified from the same.

8. **Limitation of Liability:**

Except for the indemnification obligations, both parties agree that the liability would be limited to the amount of actual transactions between the two parties

9. **Notices:**

Any notices under this MOU will be sent by certified or registered mail, return receipt requested, to the respective address of Parties as contained in this MOU. Such notice will be effective upon its mailing as specified.

10. **Intellectual Property Rights**

10.1. RUBICON explicitly warrants that it owns all the intellectual properties related to content in all formats, the technology framework and all other related objects and the THE COLLEGE has no rights to use the content and mode of delivery for any other purpose.

10.2 Each party hereby undertakes to inform the other party of any violation of Intellectual Property Rights or its unlawful use, under prevalent laws of India Further, each of the party herein, agrees to co-operate with the other to the extent possible in the process of investigating such cases of any violation of Intellectual Property Rights or its unlawful use and taking legal action against the said infringement.

10.3. Upon expiration of this MoU, or two years period of time from the date of completion of the courses, whichever is later, each party hereby agrees that it shall not make any claim on the Trade Name or the copyrights of the other, which belongs exclusively to the other party, nor shall either party use any trade name which is deceptively or confusingly similar to the trade name of the other.

11. Force Majeure:

11.1. Neither party to this MOU shall be liable for any failure or delay on its part in performing any of its obligations under this MOU, if such failure or delay shall be result of or arising out of Force Majeure conditions and, provided that the party claiming Force Majeure shall use its best efforts to avoid or remove such cause of non-performance and shall fulfil and continue performance hereunder with the utmost dispatch whenever and to the extent such cause or causes are removed.

11.2 Any extraordinary event, which cannot be controlled by the parties, shall for the purpose of this MOU be considered as a Force Majeure event. Such events include acts of God, acts or omissions of any Government or agency thereof, compliance with rules, regulations or order of any Government Authority. Provided however, if either party claims that existence of any of the aforesaid conditions is delaying or disabling the performance by said party of its obligations under this MOU, such party shall give immediate notice to the other party of the existence of such conditions whose existence are claimed to delay or disable the performance of obligations as aforesaid.

IN WITNESS WHEREOF, to show their assent, the duly authorized representative of the parties hereto have signed the MoU and set their seals as below:-

Party of the First Part

For **P.S.G.V.P. Mandal's SIP Arts GBP Science & STKVS Commerce College**

Stamp of the Party

Signature of Authorised Signatory :
Name of Authorised Signatory

Mr/Mrs

PRINCIPAL
P.S.G.V.P.M's Arts,Science & Commerce College,SHAHADA
Dist.Nandurbar Pin-425409

Designation

Director

Witness
Signature of Witness

(Professor (Dr) S. D. Sindkhedkar

Name of Witness

Party of the Second Part
Stamp of the Party:

For Rubicon Skill Development Pvt. Ltd.

Signature of Authorised Signatory :
Name of Authorised Signatory

Pravir Kumar

Designation

Chief Executive Officer

MoU valid upto Jan 25, 2025

Witness

Signature of Witness

Name of the Witness Sruthi Menon.

Rubicon Skill Development Pvt Ltd
PUNE

Annexure 1

1	Expectation setting	Role play	To learn Industry expectations from freshers	
2	Ice breaking	Introduction	To know more about the trainer & candidates	1
3	Organizational Structure	Case study	To learn Organizational structure	2
4	SWOT Analysis	Free speech	To identify their Strength/Weakness/Opportunities/ Threat	2
5	Corporate Jargons	Presentation	To learn most commonly used words in corporates	1
6	Public Speaking	Extempore	To eliminate stage fear	2
7	Presentation Skills	Power Point presentation	To articulate your thoughts through Power point presentation	2
8	E-mail Etiquette	Presentation/Mock E-mails	To learn E-mail writing skills	2
9	Grooming	Presentation/Do's & Don'ts/Role play	Dress to impress/ Proximity/ Personal hygiene/	2
10	Body language	Role play	To learn positive body language	1
11	Telephone Etiquette	Role play/Mock Calls	To handle telephonic round of interview/ To learn call mechanics	2
12	Group Discussion	Group activity	To access candidates' public speaking skills	2
13	Personal Interview	Mock Interviews	To perform well during interviews	4
				24 hrs.

NAAC Reaccredited-'A' grade in 3rd cycle

PSGVP Mandal's

SHRI S. I. PATIL ARTS, G. B. PATEL SCIENCE & STKVS COMMERCE COLLEGE,

SHAHADA - 425409, Dist- Nandurbar (M.S.)

Website: www. psgvpasc.ac.in Email:principal.shahada@gmail.com

IQAC- psgvpnaac@gmail.com

Phone/ Fax Office (02565) 229576

Mob.9421530100

TITLE OF ACTIVITY/EVENT: New Hire Training On Personality Development and Placement By Rubicon by India Pvt. Ltd And Barkley Bank
DATE(S): FROM: _on 5,6 and 7 Feb.2020__ TIME: _9.00 am to 5.00 pm____
VENUE: ___P.S.G.V.P. Mandal;s Arts Commerce and Science College Shahada_

Brief Description of Event:

Training and Placement Cell of P.S.G.V. P Mandal's Arts Commerce and Science College Shahada Organized Placement activity **New Hire Training On Personality Development and Placement By Rubicon India Pvt. Ltd And Barkley Bank**

Trainers were 1) Mukesh sing 2) Rahul Chheda

Aims/ Objectives are, to motivate students to upgrade their personality for the knowledge in placement fairs.
This workshop helped students in following areas.
Soft Skills, Retail Training, Mind Mapping, Goal Setting, Time Management, Creative Thinking, Team Building , Digital Marketing, Selling Skills, Leadership Skills etc.

Outcome of the Event: Students learn thorough process of Campus to Corporate training & Soft Skills training from the trainer and it was observed by their interactions with the trainers during question answer hours.

Personality ... 5th to 7th Feb. 2020.

Trainer: - 1) Mukesh Sing
2) Rahul Chedda

Sr. No.	Name of Student	Class	Sign.
1	Bhagyashri Bharat Patil	M.Sc.	[signature]
2	Jain Swapnil Rajmal	S.Y.B.A.	[signature]
3	Thakare Nevrath Vishnu	F.Y.B.Sc.	[signature]
4	Rathod Shruti Rajendra	S.Y.B.A.	[signature]
5	Nikumbh Gorakh Mohan	F.Y.B.Sc.	[signature]
6	Nikumbh Megha Pravin	S.Y.B.Sc.	[signature]
7	Nagesh Ashwinikumar Eknath	S.Y.B.A.	[signature]
8	Ajay Atmaram Naik	F.Y.B.Sc.	[signature]
9	Tawade Nilisha Gotulal	M.Sc. chem	[signature]
10	Koli Rajendra Laxman	F.Y.B.Sc.	[signature]
11	Patil Neha Sanjay	S.Y.B.Sc.	[signature]
12	Patil Rupesh Rajendra	T.Y.B.Sc.	[signature]
13	Tople Jyotsna Suhas	T.Y.B.Sc.	[signature]
14	Mahale Vaishali Chandrakant	S.Y.B.Sc.	[signature]
15	Patil Rushikesh Sanjay	T.Y.B.Sc.	[signature]
16	Sonawane Vidya Kishor	S.Y.B.Sc.	[signature]
17	Ajale Mahesh Naresh	S.Y.B.Sc.	[signature]
18	Chitrarath Gorakh Raju	T.Y.B.Sc.	[signature]
19	Mote Rohini Rajendra	M.Sc. - II	[signature]
20	More Ganesh Madhukar	M.Sc. - I	[signature]
21	Patil Suvarna Purushottam	F.Y.B.Sc.	[signature]
22	Koli Vinod Rajdhar	M.Sc. - I	[signature]
23	Koli Harshita Manohar	F.Y.B.Sc.	[signature]
24	Jadhav Vijay Sanjay	M.Sc. - I	[signature]
25	Suryawanshi Harshala Dagadu		[signature]

Workshop - 2020. Batch - I

5-2-2020 to 7-2-20 5/02/2020.

Sr. No.	Name of student	Class	Sign.
26	Pawar Manisha Daut	FY.SC.I	M.Pawar
27	Borse Kunal Gokul	SY B.Sc.	Borse
28	Jayashri Kamalsing Girase	TY B.Sc.	Girase
29	Agale Priyanka Rajendra	F.Y.B.Sc	Aagale
30	Lohar Mayur Laxman	F.Y.BSc	[illegible]
31	Lakade Mayur Sanjay	SYBSc.	[illegible]
32	Sonawane Gayatri Bhausaheb	F.Y.BSC	G.Sonawane
33	Palawthe Dinesh Vishnu	F.Y.BSC	[illegible]
34	Girase Ashwini Devendra sing	F.Y B.Sc	Girase
35	Warade Jayesh Bhatu	TY BSc	Warade
36	patil pushkar manoj	TYBSc	[illegible]
37	patil Kanchan Nagin	M.Sc-I	KPatil
38	patil Vaibhav Prakash	TYBSC	patil
39	patil Harshada Uddhav	S.Y.B.Sc	Patil
40	Vasave Ravi Bhika	SY BSc	Ravi
41	patil Nikita shriram	S.Y.Bsc.	Patil
42	Pramod suhasan Shiv	T.Y.Bcom	[illegible]
43	Badgujar Chetan Ramchandra	T.Y.Bcom	CRB
44	Soni Komal sunil	S.Y. BSc	Ksoni
45	Wagh Divya Tairam	MSc-II	[illegible]
46	Shinde Harshada Rajendra	TY B.Sc	HShinde
47	Sonar Bhavika Rajendra	MSc-I	BSonar
48	Suryawanshi Swati Murlidhar	SY BSc	Swati
49	patil Harshada Uddhav	S.Y.B.Sc	Patil
50	patil Priyanka Sampatrao	MSc I	[illegible]

Sr No.	Name of student	class	Sign
51	patil Ghanshyam Suresh	S.Y.B.Sc	[illegible]
52	Girase Nikita Nirmalsing	M.Sc.II	Girase
53	Chavan Bhagyashri Ashok	T.Y Bsc	Bhagya
54	Shende sagar Santosh	S.Y.B.A	[illegible]
55	Chaudhari Achal Ravindra	T.Y.B.Sc	Achal
56	Ansari Iflah Masood	F.Y.B.Sc	Iflah
57	Pathan Inam Raees	F.Y B.Sc	[illegible]
58	Sindhi Gayatri Shankarlal	Msc-II	[illegible]
59	Jangid Vinita Jaiprakash	M.Sc-II	[illegible]
60	Patil Tejaswini Madhav	M.Sc.II	[illegible]
61	Padhale Bhagyashri Dilip	S.Y B.Sc	[illegible]
62	Girase Vishakha Vittalsing	T.Y.B.Sc	[illegible]
63	Patil Shreya Narottam	S.Y.B.Sc	Patil
64	Sayyed Uzma Mukhtar	MSc II (micro)	[illegible]
65	Pawar Kavita Diwan	Msc - I	Kavita
66	Khan Ayesha Afzal	M.Sc.II (Micro)	[illegible]
67	Khan Uzma Vikar Ahamad	M.Sc.II (Math)	[illegible]
68	Patil Jagruti Nimba	Msc-I	[illegible]
69	Girase Mamta Prakash	M.Sc - I	[illegible]
70	Chaudhari Pratiksha Ravindra	S.Y.Bsc.	Chaudhary
71	Patel Nikoli Sunil	S.Y.B.Sc.	[illegible]
72	Shaikh Junila Rafique	S.Y.B.A	Junily
73	Shaikh Suneha Rafique	S.Y.B.A	[illegible]
74	Sawale Tejasa Prasanna	SY Bsc	[illegible]
75	Patil Harshada Sunil	SY. BSC	[illegible]

"Personality Development Training Student By-Rubicon: Campus to Corporate Programm" Workshop - 5-7 feb-2020

Sr. No.	Name of student	Class	Sign.
76	Kokulde Priti Narayan	S.Y. BSC	Kokulde.
77	Kapadi Raksha Narendra	S.Y. BSC	[illegible]
78	patil Rajashri Suresh	S.Y.BSC	[illegible]
79	Tayade Ruchika Ashok	T.Y. BSC	[illegible]
80	More Pravin Dilip	T.Y. BSC	[illegible]
81	patil Vaishnavi Prashant	T.Y. BSC	Vpatil
82	patil Gunjan Umakant	T.Y. BSC	Gpatil
83	Jain Shubham Suresh ~~Pinjari Vitkasha Vijay~~	~~T.Y. BSC~~ BA, SC	[illegible]
84	Tamboli Ankita ~~Ramesh~~ Dinesh	T.Y. BSC	Tamboli
85	Chavan Harshada Sudam	T.Y. BSC	[illegible]
86	Chaudhari Dhanashri Yogesh	T.Y. B.SC	Chaudhari.
87	Khedkar Kuldeep Rajendra	S.Y. BSC.	Khedkar
88	Pisal Kuldeep Prabhakar	S.Y. B.Com	[illegible]
89	Pawara Anil Jahangir	T.Y. B.A.	[illegible]
90	Valvi Papsing Brijalu	T.Y. B.A.	[illegible]
91	Pawara Panchshila Nana	S.Y. B.A	[illegible]
92	Gosavi Pravin Vinod	T.Y. B.SC	Gosavi
93	Patil Ashwini Kantilal	MSc II (Phy)	APatil
94	Patil Kalyani Rajaram	MSC Phy (II)	KPatil
95	Sapkale Dipmala Ashok	T.Y. BSC	Sapkale
96	Pardeshi Shubhangi Kishor	T.Y. BSC.	[illegible]
97	Memon Salma Rashid	T.Y. B.A	[illegible]
98	Dhangar Harshada Ramlal	T.Y. BA	[illegible]
99	Thakare Rushali Gulab	T.Y. B.A	[illegible]
100	Patil Yugandhara Mohan.	T.Y. B.SC	[illegible]

Sr. No.	Name of student	class	sign
101	Ghate Priya Dhansing / Patve Shaikh Sadigue	T.Y.BSC	Ghate
102	Tangid Supriya Suresh / Pinjari Shueb Shakil	T.Y.BSC	Tangid
103	Tiemale Akshay Dilip	S.Y.BSC	Tiemale.
104	Patel Meghaben Nilashbhai	T.Y.BSC	[illegible]
105	Dhangar Mayuri Omprakash	T.Y.BSC.	[illegible]
106	Patel Harshada Dilip	T.Y.BSC.	Patel
107	Patel Harshita Subhash	T.Y.BSC.	H.patel
108	Shinde Nisha Santosh	S.Y.BSC.	Shinde
109	Saheb Khadija Qutubuddin	T.Y.B.SC.	Khadija
110	Gosavi Kalyani Chunilal	M.SC.-II	Gosavi
111	Shirsath Nikhil Yashwant	F.Y.B.A.	[illegible]
112	Pangatil Dharmesh Nilesh	F.Y.B.A.	[illegible]
113	Patil Ganesh Sanjay	F.Y.B.A.	[illegible]
114	Pardeshi Pawan Sanjay	MSC-I (Chi)	[illegible]
115	Gavit Monika Rajesh	M.A.-II (Eng.)	M.Gavit
116	Shaikh Shahid Ayyub	M.A.-I (Eng)	Shaikh
117	Pawar Pohela Pandey	M.A.-II (Eng)	[illegible]
118	Shaikh Irfan Akhmaledin	M.A. Eng	[illegible]
119	Thakare Kalpesh Ajay	T.Y.BSC (Chem)	Thakare
120	Sonar Megha Jagdish / Patil Gaurav Raghunath	M.SC.-II	M.Sonar
121	Ahire Kajal Vilas	S.Y.BSC	Ahire
122	Patil Karishma Chunilal	M.SC.-II	[illegible]
123	Patve Shaikh Sadigue	M.SC.	[illegible]
124	Pinjari Shoeb Shakil	M.SC.	[illegible]

Dr. ... J. Patil
Co-ordinator
5.2.2020

NAAC Reaccredited-'A' grade in 3rd cycle

PSGVP Mandal's

SHRI S. I. PATIL ARTS, G. B. PATEL SCIENCE & STKVS COMMERCE COLLEGE,

SHAHADA - 425409, Dist- Nandurbar (M.S.)

Website: www. psgvpasc.ac.in Email:principal.shahada@gmail.com

IQAC- psgvpnaac@gmail.com

Phone/ Fax Office (02565) 229576

Mob.9421530100

TITLE OF ACTIVITY/EVENT: New Hire Training on Soft Skill and Personality Development by Rubicon India Pvt. Ltd and Barclay Bank
DATE(S): 17, 18 and 19th Feb. 2020 **TIME:** 9.00 am to 5.00 pm
VENUE: Mahatma Gandhi Hall,_P.S.G.V.P. Mandal;s Arts Commerce and Science College Shahada
No of Students Involved: **94**

Brief Description of Event:

Training and Placement Cell of P.S.G.V._P Mandal Arts Commerce and Science College Shahada Organized Placement activity New Hire Training On Soft Skill and Personality Development on17,18and 19th Feb.2020 By Rubicon India Pvt. Ltd and Barclay BANK

Rubicon Conducted Campus to Corporate training & Soft Skills training for final years college students. The Trainer was **Kallyan Kumar** from Rubicon India Pvt. Ltd.
The areas of training were Soft Skills, RetailTraining, Mind Mapping, Goal Setting, Time Management, Creative Thinking, Team Building , Digital Marketing, Selling Skills, Leadership Skills etc.

Outcome of the Event: Students learn thorough process of Campus to Corporate training & Soft Skills training from the trainer and it was observed by their interactions with the trainers during question answer hours.


सुस्वागतम
महात्मा गांधी सभागार


सुस्वागतम
महात्मा गांधी सभागार


सुस्वागतम
महात्मा गांधी सभागार

Personality Development

Training student by

Rubicon's campus to

Corporate program.

Work shop-II

On 17, 18 & 19th Feb-2020

Trainer :- Mr. Kalyankumar

Personality Development

Teacher - Mr. Kalyan Kumar

Se No	Name of Student	class	Sign
1)	Patil Roshan Rajendra	T.Y.B.Sc.	
2)	Vaishnavi prashant Patil	T.Y.BSc.	
3)	Mistari Jitendra Madhukar	M.Sc. II	
4)	Malvika Jagdish Chandhan	T.Y.BSc.	
5)	Sandesh Vilas Khedkar	M.Sc. II	
6)	Koli Dakshata Manohar	S.Y.B.com	
7)	Sidharth Kishor Varma	S.Y.B.com	
8)	Sakshi Ajit Jain	T.Y.B.Sc	
9)	Thorat Dipak Krushna	Sy. B com	
10)	Pawar Dipali Mohan	S.Y.B com	
11)	Marathe Tushar Ravindra	S.Y. B.com	
12)	Sonawane Archana Rajesh	S.Y. B.com	
13)	Khedkar Dhananjay shantilal	M.A. II	
14)	Patil Priyanka kashinath	M.Sc.-I	
15)	Vasave Dilip Vasrev	MA - II	
16	Shraddha Rajesh Bagale	M.Sc-II [Zoo]	
17)	Borse Yogesh Pravin	T.Y. Bsc	
18)	Patil Ramini Baijlal	M Sc II [Zoo]	
19)	Bhil Samya Bhatuya	MA. I (Eng)	
20)	Patil Priyanka Dinesh	M.Sc. I	
21)	Sonar Vishali Vidya	F.Y. B.com	
22	Ishi Harshada Premsing	T.Y.B.A[ECO]	
23	Rashta Yamini Subhash	T.Y.B.A[Eco	
24	Patil Nikita Chimanrao	F.Y.B.Sc.	
25	Zaveri Arwa Zulfekar	S.Y.B.com	

Workshop - 17th to 19th Feb. 2020. (Batch II)

Sr No.	Name of Student	Class	Sign.
26)	Hasnavi Afina Munaf	TY. Bcom	
27)	Patil Urvashi Narendra	S.Y. BSC	
28)	Kuwar Dakshata Panditrao	T.Y. BSc	
29)	Khedkar Hiteshwari Rajendra	T.Y. BSc	
30)	Patil Divya Vasant	S.Y. Bsc.	
31)	Girase Tejaswini Rajendra	F.Y BSc	
32)	Patil Harshada Suresh	F.Y. BSc	
33)	Gosavi Bhagyashri Manilal	F.Y.BSc	
34)	Jagdale Priyanka madhukar	F.Y BSc	
35)	Raul Rupali Rajsing	S.Y. B.Sc	
36)	Bhavsar Khushabu Bhaskar	S.Y. B.COM	
37)	Chaudhari Rekha Ummedram	S.Y.B.Com	
38)	Pawara Ashwini Bamaj	T.Y. BSc	
39)	Patil Nivrutti Jagdish	S.Y. BSc	
40)	Barsale shital Rajendra	T.Y.BSC	
41)	chaudhari Rakshe sanjay	T.Y. b Sc	
42)	Nistani Nitanjali Ganesh	T.Y.BSC	
43)	Pawara Yogita Yuvaraj	T.Y.B.Sc	
45)	Dawale Hemangi Dilip	T.Y.BSc	
46)	Jagdev Janavi Raja	F.Y.BSc	
47)	Pagal chunilal patil	M.Sc. (SY)	
48)	Nita basant patel	M Sc (SY)	
49)	Jagruti govinda patil	M.Sc (SY)	
50)	Thakare Gitanjali S	F.Y.BSC	
51)	Chavan Patil Chhagan	FY. BSc.	

Sr No	Name of student	Class	Sign
52)	Patil Gehilas Aatya	M.A. II	[illegible]
53	Pralhad Limbaji patel	S.Y.BSC	Bpatel
54	Beldar Roshani vittal	MSC-I	Bev
55	More Nikita martand	MSC-I	Nmore
56)	Pawar Renuka Ratansing	MSC-I	RPawar
57)	kamil marjeena Teli	M.SC.I	[illegible]
58)	Bhadane Shweta Kailas	M.SC-II	[illegible]
59)	Borase Harshada Rajendra	M.SC-II	Borase
60)	Deore Vaibhavi Jagdish	M.SC II	VDeore
61)	Pooja Ganesh patil	MSC II	[illegible]
62)	Jangid Anjali Kailash	M.SC. I	Jangid
63)	Chaudhari Vrushali Dilip	MSC I	Chaudhari
64)	Patil Nikita Ambalal	MSC-I	Patil
65)	Patil Pooja Suresh	MSC-I	[illegible]
66)	Patil Pallavi Dinesh	MSC-I	Pall
67)	Patil Gaurav K.	MSC-II	Patil
68)	Mahale Umesh vilas	MSC-II	[illegible]
69)	Patil Bhushan Arun	MSC-II.	Bpatil
70)	Patil Nilam Jitendra	M.SC-II	Npatil
71)	Patil Dimpal Ramesh	M.SC-II	DPatil
72)	Raul Harshda B.	M.SC-II	HRaul
73)	Girase Neeta P.	M.SC-II	NGirase
74)	Patil Dhananjay D.	BSC-TY	Patil
75	More Rupali Bhaurao	MSC-I	[illegible]
76	Chaudhari Darshana. N	FY.BSC	DChau.

Sr No	Name of student.	class	Sign
77	Patil Kiran sharad	M.Sc-II	
78	Bezade mangalal Abhiman.	M.A. I	
79	Grease sagar Nanhar	M.Sc -II	
80	Rajput Rapil Rajendra	T.Y BSc	
81	Jadhav Priyashri Ravindra	MSc -II	
82	Vasave shakuntala Nimaji	M.Sc-I	
83	Ishi Ashwini Sanjay	M.Sc - II	
84	Patil Harshal Bharat	M.Sc-II	
85	Patil Vishaksha Ishwar	M.Sc-II	
86	Chaudhari Yogita Rajaram	M.Sc-II	
87	Marathe Gaurav Sanjay	BSC-II	
88	Kulkarni Gaurav Dinesh	BSc-I	
89	Koli Dinesh Dnyaneshwar	T.Y.BSC	
90	Jain Muskan Lalit	F.Y. Bcom	
91	Chavan Sakshi Suresh	F.Y. Bcom	
92	Khairnar Nikita Sanjay	F.Y. Bcom	
93	Sonavane Ganesh Rajendra	Sy. Bsc	
94	Tamachi Rohit prakash	F.Y. Bsc	

17.2.

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH /CONSULTANCY

between

Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, MS

and

S. I. Chemicals, SHAHADA 425409 Dist Nandurbar, MS

This Memorandum of Understanding (MOU) is signed between Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425 409, Maharashtra, INDIA and S. I. Chemicals, SHAHADA 425409 Dist Nandurbar, MS.

That this MOU is purely meant for sharing the research facilities and research outcome and getting consultancy services between S. I. Chemicals, SHAHADA 425 409, MS and Department of Microbiology of P.S.G.V.P. Mandal's Arts, Science and Commerce College, SHAHADA 425409, MS.

That the Department of Microbiology, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425 409, Maharashtra, India, shall provide microbial analysis and other relevant microbiological studies of samples submitted by S. I. Chemicals, SHAHADA 425 409 Maharashtra, India, and S. I. Chemicals, SHAHADA 425409 Maharashtra, India, shall sponsor the admission of two students in M.Sc. Microbiology class to Department of Microbiology, P.S.G.V.P. Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the concerned staff, scholars and Department of Microbiology of P.S.G.V.P. Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India and concerned staff, Scientist and technician of S. I. Chemicals, SHAHADA 425409 Maharashtra, India.

This MOU exists since 15th June 2011 and is valid till 14th June 2021.

Prof. Dr. R. S. Patil, Principal, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India. **E-mail : principal.shahada@gmail.com,** **Tel 02565 229576**	PRINCIPAL R.S.G.V.P. M'S, Arts, Science & Commerce Sr. College, SHAHADA Dist.Nandurbar (Pin-425409)
Mr. Kishore N Patil, Chairman, S. I. Chemicals, SHAHADA 425 409, Dist Nandurbar, Maharashtra, India **Tel : 02565 223735**	S.I.CHEMICAL INDUSTRIES PROPRIETOR KISHOR N. PATIL

S.I.BIOZYME™
Nature the Key, Technology the Way

To,
The Principal.
P.S.G.V.P.Mandal`s
Arts, Science & Commerce,
College Shahada (Dist. Nandurbar).

Subject: - Industrial Sponsorship for admission to M. Sc. Microbiology.....

Dear Sir,

S. I. Biozyme, Shahada, Tal. Shahada, Dist. Nandurbar is pleased to sponsor Miss. Patil Bhavini Manohar for the admission to M. Sc. (Microbiology) during the academic year 2019-20 and 2020-21 at P.S.G.V.P.Mandal`s Arts, Science and Commerce College, Shahda Dist. Nandurbar.

Yours Faithfully,
S. I. BIOZYME
PROPRIETOR
KISHOR N. PATIL
MANAGING DIRECTOR

S.I.BIOZYME™
Nature the Key, Technology the Way

To,
The Principal.
P.S.G.V.P.Mandal`s
Arts, Science & Commerce,
College Shahada (Dist. Nandurbar).

Subject: - Industrial Sponsorship for admission to M. Sc. Microbiology.....

Dear Sir,

S. I. Biozyme, Shahada, Tal. Shahada, Dist. Nandurbar is pleased to sponsor Mr. Chitte Gopal Nimba for the admission to M. Sc. (Microbiology) during the academic year 2019-20 and 2020-21 at P.S.G.V.P.Mandal`s Arts, Science and Commerce College, Shahda Dist. Nandurbar.

Yours Faithfully,
S. I. BIOZYME
PROPRIETOR
KISHOR N. PATIL
MANAGING DIRECTOR

NAAC
Reaccredited- 'A' grade in 3rd cycle

PSGVP Mandal's
A RUSA Beneficiary and DBT Star Status Institution
SHRI S.I.PATIL ARTS, G.B.PATEL SCIENCE & STKVS COMMERCE COLLEGE,
SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
GOLDEN JUBILEE YEAR- (2020-21)
Website: www. psgvpasc.ac.in
Email:principal.shahada@gmail.com
IQAC- psgvpnaac@gmail.com
Phone/ Fax Office (02565) 229576
Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.2. *Number of functional MoUs with institutions, other universities, industries, corporate houses etc. during the year 2020-21*

S N	Organisation with which MoU is signed	Name of the institution/ industry/ corporate house	Year of signing MoU	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs	Page No.
1	Shri. Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., purushottamnagar, Tal: Dist Shahada Nandurbar, MS, 425424	Shri. Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., purushottamnagar, Tal: Dist Shahada Nandurbar, MS, 425424	2011	15 June 2011 to 14 June 2021	Industry Sponsorship to M.Sc Chemistry students	2	2-4
2	BALAJI BIOZYMES, 1, Sharayu Complex, Dongargron Road, SHAHADA, 425409, Dist. Nandurbar	BALAJI BIOZYMES, 1, Sharayu Complex, Dongargron Road, SHAHADA, 425409, Dist. Nandurbar	2021	2/2/2021 to 1/2/2026			5-8

(Prof. Dr. R. S. Patil)
Principal

Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science & S.T.K.V.S Comm. College, Shahada, Dist.Nandurbar(M.S.)

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH AND CONSULTANCY

Between

Department of Microbiology, PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College, Shahada, Dist: Nandurbar, (425409) hereafter called as "**PSGVPM's ASC College**"

And

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., Purushottamnagar, Tal: Shahada Dist Nandurbar, MS, 425424 hereafter called as "**Sugar Factory, Purushottamnagar**"

This Memorandum of Understanding (MOU) is signed between **PSGVPM's ASC College** and **Sugar Factory, Purushottamnagar**.

That this MOU is purely meant for sharing the research facilities and research outcome and getting consultancy services between **PSGVPM's ASC College** and **Sugar Factory, Purushottamnagar.**

That **PSGVPM's ASC College** shall provide estimation of BOD, COD and other microbial analysis of samples submitted by **Sugar Factory, Purushottamnagar** and **Sugar Factory, Purushottamnagar** shall allow the use of research facilities available at their distillery unit.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the staff and students of **PSGVPM's ASC College** and concerned staff, Scientist and technicians of **Sugar Factory, Purushottamnagar**.

This MOU exists from 15th June 2011 and is valid till 14th June 2021.

Prof. Dr. R. S. Patil, Principal, PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College, Shahada Dist: Nandurbar, (425409) **E-mail : principal.shahada@gmail.com,** **Tel : 02565-229576**	PRINCIPAL P.S.G.V.P.M's Arts, Sci. College & Commerce S. College, Shahada Dist.Nandurbar (M.S.) 425409
Mr. P. R. Patil **Managing Director,** Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd., Purushottamnagar, Tal: Shahada, Dist: Nandurbar, MS, 425424 **Tel : 02565-229545,229764**	Managing Director Shree Satpuda Tapi Parisar S.S.K.Ltd. Purushottamnagar - 425 424, Tal.Shahada, Dist. Nandurbar (M.S.)

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd.

A/p. Purushottamnagar,
Tal.Shahada Dist.Nandurbar,
Pin – 425 424 (M.S.)

Reg. No. : DHL/PRG/ (A) / 2,
Date. 5 Sept. 1969

UNIT	Telephone	E-mail
Sugar :	(02565) 229245/229764	satpuda2012@rediffmail.com
Distillery :	(02565) 229438	satpudadist@gmail.com
Bagasse Board:	(02565) 229439	satpuda2004@gmail.com
Fax :	(02565) 229453	EBPX Mob. : 099217 51313

To,
The Principal,
P. S. G. V. P. Mandal's,
SIP Arts, GBP Science &
STKVS Commerce College,
Shahada (Dist. Nandubar).

Subject : Industrial Sponsorship for admission to M.Sc. Chemistry

Dear Sir,

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd. Purushottamnagar is a leading industry in our state. We are in need of young and dynamic chemist for our industry.

As a part of Industry Institute interaction we are pleased to sponsor Mr. PATIL BHAGYASHRI VIJAY for the admission to M. Sc. Chemistry under Industry Sponsored seats for the year 2020-2021 and 2021-2022 at P. S. G. V. P. Mandal's, SIP Arts, GBP Science & STKVS Commerce College, Shahada (Dist. Nandubar)

Your faithfully,

(MANAGING DIRECTOR)

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd.

A/p. Purushottamnagar,
Tal.Shahada Dist.Nandurbar,
Pin – 425 424 (M.S.)

Reg. No. : DHL/PRG/ (A) / 2,
Date. 5 Sept. 1969

UNIT	Telephone	E-mail
Sugar :	(02565) 229245/229764	satpuda2012@rediffmail.com
Distillery :	(02565) 229438	satpudadist@gmail.com
Bagasse Board:	(02565) 229439	satpuda2004@gmail.com
Fax :	(02565) 229453	EBPX Mob. : 099217 51313

To,
The Principal,
P. S. G. V. P. Mandal's,
SIP Arts, GBP Science &
STKVS Commerce College,
Shahada (Dist. Nandubar).

Subject : Industrial Sponsorship for admission to M.Sc. Chemistry

Dear Sir,

Shree Satpuda Tapi Parisar Sahakari Sakhar Karkhana Ltd. Purushottamnagar is a leading industry in our state. We are in need of young and dynamic chemist for our industry.

As a part of Industry Institute interaction we are pleased to sponsor Mr. PATIL RITESH SRIDHAR for the admission to M. Sc. Chemistry under Industry Sponsored seats for the year 2020-2021 and 2021-2022 at P. S. G. V. P. Mandal's, SIP Arts, GBP Science & STKVS Commerce College, Shahada (Dist. Nandubar)

Your faithfully,

(MANAGING DIRECTOR)

भारतीय गैर न्यायिक

एक सौ रुपये Rs. 100

रु. 100 ONE HUNDRED RUPEES

सत्यमेव जयते

भारत INDIA

INDIA NON JUDICIAL

महाराष्ट्र MAHARASHTRA ◑ 2020 ◑ XH 206750

20 JAN 2021

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH /CONSULTANCY

Between

Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS)

and

BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS)

This Memorandum of Understanding (MOU) is signed between Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

That this MOU is purely meant for sharing the research facilities and research outcome between and getting consultancy services between Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

जोडपत्र-१/Annexure-I
फक्त प्रतिज्ञापत्रासाठी/ Only For Affidavit
मुद्रांक विक्री नोंदवही अ.क्र./दि./Sr.No.& Dt.
मुद्रांक विकत घेणा[illegible] खरी सत्ता व सही -
परवानाधारक मु[illegible] ची सही,
परवाना क्र. मुद्रां[illegible] लेकाण-
श्री. [illegible] टी. चौधरी २/९९,
मुद्रांक [illegible] तहसिल कार्या.शहादा

ज्या कारणासाठी [illegible] मुद्रांक खरेदी केला त्यांनी त्याच कारणासाठी [illegible] खरेदी केल्यापासून ६ महिन्यात वापरणे बंधनकारक आहे.

करार
४९७.दि.०२/०५/२००५. रु.१००/-
प्राचार्य पुज्य साने गुरुजी विद्या प्रसारक मंडळाचे कला, वाणिज्य व विज्ञान महाविद्यालय शहादा व बालाजी बायोझाईम्स
ज गणेश पाटील

सुनिल टी.चौधरी
स्टॅम्प वेन्डर,शहादा
परवाना क्र. २/९९

That the Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS), shall provide estimation of enzyme activity, determination of microbial contamination of final product samples submitted by BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS) shall allow the use of research and training facility at their organization.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the concerned staff and students of Department of Biotechnology, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and concerned staff, scientist and technician of by BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

This MOU is valid for 05 years.

Prof. Dr. R. S. Patil, Principal, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS). **E-mail : principal.shahada@gmail.com** **Tel. No. : 02565 229576**	PRINCIPAL P.S.G.V.P. M's, Arts,Science & Commerce :College,SHAHADA Dist.Nandurbar(Pin-425409)
Dr. T. R. Patel, Chairman, BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS). **E-mail : balajibiozymes@gmail.com** **Mo. No. : 09890287788**	BALAJI BIOZYMES Partner

NAAC Reaccredited- 'A' grade in 3rd cycle

PSGVP Mandal's

SHRI S. I. PATIL ARTS, G. B. PATEL SCIENCE & STKVS COMMERCE COLLEGE,

SHAHADA - 425409, Dist- Nandurbar (M.S.)

Website: www. psgvpasc.ac.in Email:principal.shahada@gmail.com IQAC- psgvpnaac@gmail.com

Phone/ Fax Office (02565) 229576 Mob.9421530100

ACTIVITY REPORT- (2020 - 2021)

DEPARTMENT/COMMITTEE: Biotechnology **NAAC Criterion No: _____**

TITLE OF ACTIVITY/EVENT: MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH / CONSULTANCY

DATE(S): FROM: 2/2/2021 TO: 1/2/2026 TIME:_____

VENUE: PSGVP Mandal's SHRI S. I. PATIL ARTS, G. B. PATEL SCIENCE & STKVS COMMERCE COLLEGE, SHAHADA - 425409, Dist- Nandurbar (M.S.)

NAME OF CHIEF GUEST/SPEAKER/RESOURCE PERSON WITH DESIGNATION AND AFFILIATIONS: Dr. Tushar Patel, Balaji Biozymes, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

NO.OF PARTICIPANTS: FACULTY: _____ STUDENTS: - M:_____ F:-_____ OTHERS: _____

BRIEF DESCRIPTION OF EVENT (in 500 words):

This Memorandum of Understanding (MOU) is signed between Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

That this MOU is purely meant for sharing the research facilities and research outcome between and getting consultancy services between Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

OUTCOME OF THE ACTIVITY/EVENT:

That the Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS), shall provide estimation of enzyme activity, determination of microbial contamination of final product samples submitted by BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS) shall allow the use of research and training facility at their organization.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the concerned staff and students of Department of Biotechnology, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and concerned staff, scientist and technician of by BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

HOD/EVENT COORDINATOR **CORDINATOR, IQAC** **PRINCIPAL**

Photo 1:

Photo 2:

भारतीय गैर न्यायिक
एक सौ रुपये
Rs. 100
रु. 100
ONE HUNDRED RUPEES
भारत INDIA
INDIA NON JUDICIAL
महाराष्ट्र MAHARASHTRA 2020 XH 206750

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH /CONSULTANCY

Between

Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS)

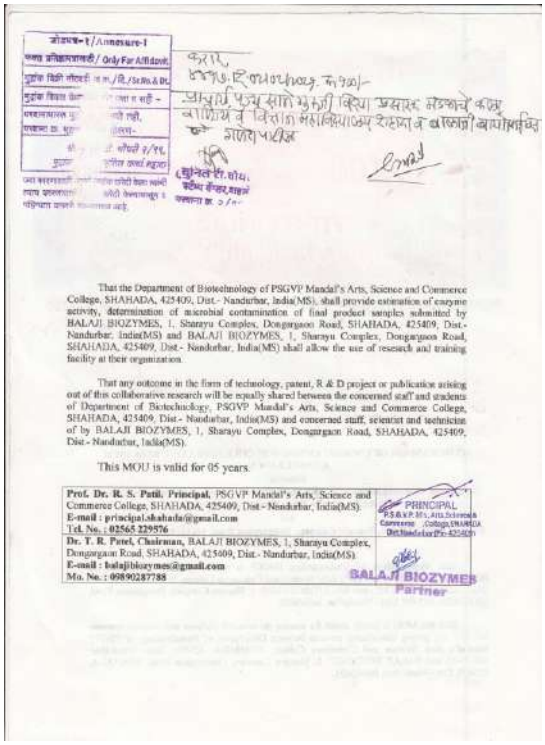
and

BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS)

This Memorandum of Understanding (MOU) is signed between Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

That this MOU is purely meant for sharing the research facilities and research outcome between and getting consultancy services between Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

Photo 3:



Annexure-I

That the Department of Biotechnology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS), shall provide estimation of enzyme activity, determination of microbial contamination of final product samples submitted by BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS) shall allow the use of research and training facility at their organization.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the concerned staff and students of Department of Biotechnology, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS) and concerned staff, scientist and technician of by BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).

This MOU is valid for 05 years.

Prof. Dr. R. S. Patil, Principal, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA, 425409, Dist.- Nandurbar, India(MS).
E-mail : principal.shahada@gmail.com
Tel. No. : 02565 229576

Dr. T. R. Patel, Chairman, BALAJI BIOZYMES, 1, Sharayu Complex, Dongargaon Road, SHAHADA, 425409, Dist.- Nandurbar, India(MS).
E-mail : balajibiozymes@gmail.com
Mo. No. : 09890287788

PRINCIPAL
BALAJI BIOZYMES
Partner

Photo 4:

HOD/EVENT COORDINATOR **CO-ORDINATOR, IQAC** **PRINCIPAL**

NAAC
Reaccredited- 'A' grade in 3rd cycle

PSGVP Mandal's
A RUSA Beneficiary and DBT Star Status Institution
SHRI S.I.PATIL ARTS, G.B.PATEL SCIENCE & STKVS COMMERCE COLLEGE,
SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
GOLDEN JUBILEE YEAR- (2020-21)
Website: www. psgvpasc.ac.in
Phone/ Fax Office (02565) 229576
Email:principal.shahada@gmail.com
IQAC- psgvpnaac@gmail.com
Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.1.1 *Number of Collaborative activities for research, Faculty exchange, Student exchange/ internship during the year 2016-17*

Sl. No.	Title of the collaborative activity	Name of the collaborating agency with contact details	Name of the participant	Year of collaboration	Duration	Nature of the activity	Page No.
C1.	State level seminar	Shankarrao Bhelke College, Arts, Commerce and Scince, Pune	Dr. A. R. Nikam	2017	22.02.2017	**Faculty exchange** - Resource Person	02-03
C2.	Workshop on Pesonality development	Arts and Sceince College, Shahada	Dr. M. M. Jogi	2016	20.09.2016	**Faculty exchange** - Guest lecture	04
C3.	Hindi Divas	Senior Arts College, Mhasavad, Shahada	Dr. G. B. Kuwar	2016	17.09.2016	**Faculty exchange** - Invited Talk	05

(Prof. Dr. R. S. Patil)
Principal
Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science & S.T.K.V.S Comm. College, Shahada, Dist.Nandurbar(M.S.)

Pune District Education Association's

SHANKARRAO BHELKE COLLEGE

ARTS, COMMERCE & SCIENCE

Nasarapur, Tal.Bhor, Dist. Pune - 412 213.

Re-Accredited by NAAC (2014) 'B' Grade

Estd. : June 1990

Tel. : 02113 - 272213, 284709

Fax. : 02113 - 272213

E-mail : principalsbcnasarapur@gmail.com
principal@sbacs.co.in

Web : www.sbacs.co.in

Affiliated to Savitribai Phule Pune University ID No. PU/PN/ASC/083/1990

Outward No. : SBC / /2016-17 Date : 22.02.2017

To,
~~Principal~~/Dr.Avinash Nikam,
Arts,Commerce &Science College,
Tal-Shahada, Dist-Nandurbar

Sir,

We are extremely thankful for your cooperation and guidance on Challenges, Scope Remedies in Indian Agriculture in the two days State Level Seminar organized by on 22nd and 23rd February 2017 your expertise and guidance would have enriched the delegates, participants and students. We expect your co-operation in further also.

Thanking you,

Dr. Narayan Tak
PRINCIPAL
Shankarrao Bhelke College
Nasarapur, Tal. Bhor, Dist. Pune

Pune District Education Association's

Shankarrao Bhelke College

Nasrapur ,Tal. Bhor, Dist.Pune
Re-Accredited by NAAC with 'B'Grade(2014)

A State Level Seminar on

'Challenges, Scope and Remedies in Indian Agriculture'

22nd and 23rd February, 2017.

Organized by

Department of Economics

Certificate

This is to certify that Dr./Prof./Mr./~~Smt.~~ Avinash Nikam

of PSGVPM's Arts Sci. & Com. College, Shahada has

Resource Person in

State Level Seminar on 'Challenges, Scope and Remedies in Indian Agriculture' organized by Shankarrao Bhelke College, Nasarapur on 22nd & 23rd February 2017.

Prof. J. E. Gaikwad
Asst. Co-ordinator

Prof. Dr. S. G. Ghadage
Co-ordinator

Dr. Narayan Tak
Principal

॥ विद्यावती शिलवतीच नारी ॥ (०) - Off. (02565) 224939

सोनामाई शिक्षण प्रसारक मंडळ विद्यानगरी, धुळे संचलित

कला व विज्ञान महिला महाविद्यालय, शहादा

NAAC Accredited Web site - www.apjmes.org जि.नंदुरबार e-mail - mahilacollege.shahada@gmail.com

• स्थापना •	• संस्थापक - प्रेरक •	• संस्थापक / अध्यक्षा •	• प्राचार्य •
सन १९९१	मा. नानासाहेब प्रेमचंद जाधव	मा. सौ. आशाताई प्र. जाधव	डॉ.सुभाष महाले - 9422612221

जा.क्र. मम/९३४/२०१६ दिनांक - २०/०९/२०१६

प्रति,
प्रा.डॉ.मृणाल जोगी,
पू.सा.गु.विद्या प्रसारक मंडळाचे, कला,विज्ञान व वाणिज्य,
महाविद्यालय, शहादा जि. नंदुरबार.

आभार पत्र

महाशय,

आमच्या महाविद्यालयात युवंती सभा कार्यशाळेंतर्गत व्यक्तिमत्व विकास योजना 'मुलगी वाचवा - मुलगी शिकवा' या विषयावर दिनांक २०.०९.२०१६ रोजी महाविद्यालयाच्या विद्यार्थिनींना उद्‌बोधन केले. त्याबद्दल आपले आभारी आहोत.

धन्यवाद !

आपला विश्वास,

(डॉ. सुभाष महाले)
प्राचार्य
कला व विज्ञान महिला महाविद्यालय
शहादा, जि नंदुरबार

श्री साईबाबा भक्त मंडळ म्हसावद संचलित

कला वरिष्ठ महाविद्यालय, म्हसावद

ता.शहादा जि.नंदुरबार

शासन आदेश- एन.जी.सी. 2007 (169/07) प्रति-3 दि. 2/7/2007 अन्वये मंजूर

प्र.प्राचार्य: प्रा.एम.आर.पाटील (एम.ए.,बी.एड.,नेट.,सेट.) मोबाईल नं. 9503237309	College Code: 230090 Website - www.saibabeducation.org E-mail - saibabaarts@rediffmail.com (कार्यालय) 02565-255486 / 9921034378	• अध्यक्ष • श्री.विपुल हिरणी चौधरी मोबाईल नं. 9421463548

जा.क्र. दिनांक: / /20

सेवा में

प्रा. डॉ० गौतम कुवर
हिंदी विभाग प्रमुख
पूज्य साने गुरुजी विद्या प्रचारक मंडळ का
कला, विज्ञान, वाणिज्य महाविद्यालय, शहादा
जि. नंदुरबार

विषय: प्रमुख मार्गदर्शक के रूप में उपस्थिति हेतु सहर्ष,

उपर्युक्त विषयानुसार हम आपसे अनुरोध करते हैं कि महाविद्यालयीन परंपरा के अनुसार इस वर्ष भी 'हिंदी दिवस' हम मनाने की योजना है, अत: आप दिनांक 17 सितंबर 2018 को प्रमुख वक्ता के रूप में हमें मार्गदर्शन करें।

प्रमाणित किया जाता है कि प्रा.डॉ. गौतम कुवर हिंदी विभाग, शहादा आपने दिनांक 17 सितंबर 2018 को 'माध्यमिक संप्रेषण तथा हिंदी भाषा' विषय पर प्रमुख वक्ता के रूप में हमारे विद्यार्थियों को मार्गदर्शन किया। अत: हम आपके प्रति आभार व्यक्त करते हैं।

सहयोग की अपेक्षा!

PRINCIPAL
Shri. Saibaba Bhakt Mandal Sanchit,
Art's Senior College, Mhasawad
Tal.Shahada, Dist. Nandurbar

NAAC
Reaccredited- 'A' grade in 3rd cycle

PSGVP Mandal's
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SHRI S.I.PATIL ARTS, G.B.PATEL SCIENCE & STKVS COMMERCE COLLEGE,
SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
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IQAC- psgvpnaac@gmail.com
Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.1.1 ***Number of Collaborative activities for research, Faculty exchange, Student exchange/ internship during the year 2017-18***

Sl. No.	Title of the collaborative activity	Name of the collaborating agency with contact details	Name of the participant	Year of collaboration	Duration	Nature of the activity	Page No.
C1.	Sharing of facilities and Research Outcomes	National Centre For Celt Science, NCCS Complex, P.B. No. 40, Ganeshkhind, Pune - 411 007. India e- mail: infonccs@giaspn0l.vsnl.net.in	Dr. R. Z. Sayyed, M. S. Sonawane, M. H. Khairnar	2017	2017-2022	**Research** - This MoU is purely meant for sharing the research facilities and research outcome between two Institutes, it does not involve any financial commitments from both ends.	02
C2.	Advances in Nanoscience and Nanotechnology	Arts, Commerce and Science College, Taloda, Dist. Nandurbar	Dr. Anil Beldar	2017	25/12/2017	**Faculty exchange** - Resoruce person	03
C3.	Hindi Divas	Arts Senior College, Mhasavad, Dist. Nandurbar	Dr. G. B. Kuwar	2017	15/09/2017	**Faculty exchange** - Invited talk	04

(Prof. Dr. R. S. Patil)
Principal
Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science & S.T.K.V.S Comm. College, Shahada, Dist.Nandurbar(M.S.)

NCCS

राष्ट्रीय कोशिका विज्ञान केन्द्र

National Centre For Cell Science

जैवप्रौद्योगिकी विभाग, भारत सरकार का स्वायत्त संस्थान

(An Autonomous Institution of the Department of Biotechnology, Government of India)

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH

Between

Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India,

And

National Centre for Microbial Resource formarly Microbial Culture Collection, National Centre for Cell Science, PUNE 411021, Maharashtra, India.

This Memorandum of Understanding (MOU) is signed between Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA and Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India.

That this MOU is purely meant for sharing the research facilities and research outcome between two institutes, it does not involve any financial commitments from both the ends.

That the Staff, Research Scholars and Post Graduate students of Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA will screen, isolate and will perform the preliminary characterization of potential bacterial cultures and Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India will perform 16s rRNA gene sequence, phenotypic finger printing, BIOLOG and GC-FAME analysis of the partially characterized bacterial cultures.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the concerned staff, scholars and Post Graduate students of Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA and concerned staff, Scientist and technician of Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India.

1). Head, Dept of Microbiology, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA. **E-mail: sayyedrz@gmail.com, Tel** 02565 229576	
Witness : **Dr. M. K. Patel, IQAC Coordinator,** PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, MS, INDIA. **Tel** 02565 229576	
Head of Institution : **Prof. Dr. R. S. Patil, Principal,** PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra,INDIA. **E-mail :principal.shahada@gmail.com, Tel** 02565 229576	
2). **Prof. Yogesh S Shouche, Scientist F**, and In-Charge NCMR, NCCS, Pune. (An Autonomous Institute of DBT, Govt. of India) **E-mail : yogesh@nccs.res.in Tel:** +91-20-25329026	

एनसीसीएस कॉम्प्लेक्स, पो. बॅ. नं. ४०, गणेशखिंड पी. ओ., पुणे ४११ ००७. महाराष्ट्र, भारत

NCCS Complex, P.B. No. 40, Ganeshkhind P. O., Pune - 411 007. Maharashtra, India

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ई मेल / E- mail : infonccs@giaspn01.vsnl.net.in

वेबसाईट / Website : http://www.nccs.res.in

Reg.No.E.247

Adhyapak Shikshan Mandal's
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☎ (02567)233054,232254

C. H. Chaudhari Arts, S. G. Patel Commerce & Babaji B. J. Patel Science College, Taloda-425 413, Dist. Nandurbar

NAAC REACCREDITED 'B' WITH 2.68 CGPA

Principal
Dr.P. V. RAMAIAH
Mob.No.09423448388

Outward No.-

Date - / /201

C ERTIFICATE

This is to certify that **Dr. Anil Beldar**, P.S.G.V.P. Mandal's A.S.C. College, Shahada has participated in the short-term programme in "Advances in Nanoscience and Nanotechnology" conducted during 22nd to 28th December 2017. His participation as resource person in the said programme on 25th December 2017 is greatly appreciated.

Dr. S. R. Gosavi
COURSE CO-ORDINATOR

Dr. P. V. Ramaiah
PRINCIPAL

A.S.Mandal's
Art's Commerce College Trust's
C.H.C.Art's, S.G.P. Commerce &
B.B.J.P. Science College
TALODA Dist Nandurbar (M.S.)

167

श्री साईबाबा भक्त मंडळ म्हसावद संचलित

कला वरिष्ठ महाविद्यालय, म्हसावद

ता.शहादा जि.नंदुरबार

शासन आदेश- एन.जी.सी. 2007 (189/07) माशि-3 दि. 2/7/2007 अन्वये मंजूर

प्र.प्राचार्य: प्रा.एम.आर.पाटील
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• अध्यक्ष •
श्री.विठ्ठल हिरजी चौधरी
मोबाईल नं. 9421483548

जा.क्र.

दिनांक: 15/09/2017

आभार पत्र

प्रमाणित किया जाता है कि प्रा.डॉ. गोरख कुवर हिंदी विभाग प्रमुख, पूज्य साने गुरुजी विद्या प्रसारक मंडळ का कला, विज्ञान वाणिज्य महाविद्यालय, शहादा जि. नंदुरबार आपने दिनांक 15 सितंबर 2017 को 'हिंदी दिवस' के उपलक्ष्य में 'हिंदी में रोजगार के अवसर' इस विषय पर हमारे विद्यार्थियों को मार्गदर्शन किया इस हेतु यह प्रमाणपत्र आपको प्रदान किया जाता है और हम आपके प्रति आभार प्रकट करते हैं।

सहयोग की अपेक्षा के साथ,

APRINCIPAL
Shri. Saibaba Bhakt Mandal Sanchalit
Art's Senior College, Mhasawad
Tal.Shahada, Dist. Nandurba

NAAC
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PSGVP Mandal's
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Phone/ Fax Office (02565) 229576
Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.1.1 ***Number of Collaborative activities for research, Faculty exchange, Student exchange/ internship during the year 2018-19***

Sl. No.	Title of the collaborative activity	Name of the collaborating agency with contact details	Name of the participant	Year of collaboration	Duration	Nature of the activity	Page No.
C1.	Sharing of facilities and Research Outcomes	National Centre For Celt Science, NCCS Complex, P.B. No. 40, Ganeshkhind, Pune - 411 007. India e- mail: infonccs@giaspn01.vsnl.net.in	Dr. R. Z. Sayyed, M. S. Sonawane, M. H. Khairnar	2017	2017-2022	**Research** - This MoU is purely meant for sharing the research facilities and research outcome between two Institutes, it does not involve any financial commitments from both the ends. Exchange of faculty and researchers. Joint Publications with NCCS and RZS.	03
C2.	Sharing of facilities and Research Outcomes	Uzbekistan academy of Sciences, Tashkent, Uzbekistan	R. Z. Sayyed, Kakhramon Davranov, Dilfuza Jabborova, Zafarjon Jabbarov	2019	2019-2024	**Research** - Joint publication, sharing of facilities	04-05

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SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
GOLDEN JUBILEE YEAR- (2020-21)
Website: www. psgvpasc.ac.in Email:principal.shahada@gmail.com IQAC- psgvpnaac@gmail.com
Phone/ Fax Office (02565) 229576 Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

C3.	Nationl level seminar on "India's goods and service tax: Emerging issues and chanllenges	R.B. Naraynrao Borwake College, Shrirampur, Dit. Ahmednagar	Dr. A. R. Nikam	2019	11-12/ 01/2019	**Faculty exchange** - Resource person	06-07
C4.	Marathi bhasha din	Additional District Court	Dr. G.B. Kuwar	2019	14/01/2019	**Faculty exchange** - Invited talk	08
C5.	Hindi Divas	Arts Senior College, Mhasavad, Dist. Nandurbar	Dr. G.B. Kuwar	2018	14/09/2018	**Faculty exchange** - Invited talk	09
C6.	NSS Camp	Vasantrao Naik Arts, Science and Commerce College, Shahada	Dr. G.B. Kuwar	2019	4/1/2019	**Faculty exchange** - Invited talk	10
C7.	Hindi Day Week	Science and Commerce College, Dhadgaon, Dist. Nandurbar	Dr. G.B. Kuwar	2018	26/09/2018	**Faculty exchange** - Invited talk	11
C8.	National Seminar	SPT Arts & RYK Science College, Nasik	Dr. G.B. Kuwar	2019	18-19/01/2019	**Faculty exchange** - Chair person	12
C9.	NSS Camp	GTP Arts, Science and Commerce College, Nandurbar	Dr. G.B. Kuwar	2019	3/1/2019	**Faculty exchange** - Resource person	13
C10.	NSS Camp	Senior Science College, Akkalkuwa, Dist. Nandurbar	Prof. K. G. Valvi	2018	25/12/2018	**Faculty exchange** - Resource person	14

(Prof. Dr. R. S. Patil)
Principal
Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science & S.T.K.V.S Commerce College, Shahada, Dist.Nandurbar (M.S.)

NCCS

राष्ट्रीय कोशिका विज्ञान केन्द्र

National Centre For Cell Science

जैवप्रौद्योगिकी विभाग, भारत सरकार का स्वायत्त संस्थान

(An Autonomous Institution of the Department of Biotechnology, Government of India)

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH

Between

Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India,

And

National Centre for Microbial Resource formarly Microbial Culture Collection, National Centre for Cell Science, PUNE 411021, Maharashtra, India.

This Memorandum of Understanding (MOU) is signed between Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA and Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India.

That this MOU is purely meant for sharing the research facilities and research outcome between two institutes, it does not involve any financial commitments from both the ends.

That the Staff, Research Scholars and Post Graduate students of Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA will screen, isolate and will perform the preliminary characterization of potential bacterial cultures and Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India will perform 16s rRNA gene sequence, phenotypic finger printing, BIOLOG and GC-FAME analysis of the partially characterized bacterial cultures.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the concerned staff, scholars and Post Graduate students of Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA and concerned staff, Scientist and technician of Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India.

1). Head, Dept of Microbiology, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA. **E-mail: sayyedrz@gmail.com, Tel** 02565 229576	
Witness : **Dr. M. K. Patel, IQAC Coordinator,** PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, MS, INDIA. **Tel** 02565 229576	
Head of Institution : **Prof. Dr. R. S. Patil, Principal,** PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra,INDIA. **E-mail :principal.shahada@gmail.com, Tel** 02565 229576	
2). **Prof. Yogesh S Shouche, Scientist F**, and In-Charge NCMR, NCCS, Pune. (An Autonomous Institute of DBT, Govt. of India) **E-mail : yogesh@nccs.res.in Tel:** +91-20-25329026	

एनसीसीएस कॉम्प्लेक्स, पो. बॅ. नं. ४०, गणेशखिंड पी. ओ., पुणे ४११ ००७. महाराष्ट्र, भारत

NCCS Complex, P.B. No. 40, Ganeshkhind P. O., Pune - 411 007. Maharashtra, India

दूरभाष / Tel.: (020) 25708000 फैक्स / Fax : 91 (020) 25692259

ई मेल / E- mail : infonccs@giaspn01.vsnl.net.in

वेबसाईट / Website : http://www.nccs.res.in

COLLABORATION RESEARCH AGREEMENT(CRA)

BETWEEN

PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India

AND

Institute of Genetics and Plant Experimental Biology of the Academy of Sciences of the Republic of Uzbekistan

This document constitutes an agreement between PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India and Institute of Genetics and Plant Experimental Biology of the Academy of Sciences of the Republic of Uzbekistan to collaborate on training, PhD studies, research and exchange programs.

I. PURPOSE

The purpose of this **Collaboration Research Agreement (CRA)** is intended as the starting point for collaboration to exploit the complementary nature of the strengths of research, teaching and enterprise and to focus primarily on collaborative research, faculty exchange and curriculum development.

II. AREAS OF COLLABORATION

- Genetics and Plant Breeding of medicinal plants, leguminous and oil crops
- Agrotechnology and Biotechnology of medicinal plants, leguminous and oil crops
- Physiology and Biochemistry of medicinal plants, leguminous and oil crops
- Plant microbe interactions
- Biological control of plant disease

III. RESPONSIBILITIES OF THE PARTIES

With these stated goals, both parties agree to:

- Consult faculty, departments and center to explore potential mutual beneficial research, applied research and community based research projects.
- Encourage units to cooperate in areas such as curriculum development, student and laboratory exchange for research, lectures, training and discussion that are mutually beneficial to the institutions.
- Setup collaborative training and/or research projects for mutual benefits
- Investigate outside funding sources for projects determined to be mutually beneficial to both institutions

IV. LIMITATIONS

- This CRA is neither a fiscal nor funds obligation document. Nothing in this MOU authorizes or is intended to obligate the parties to expend, exchange, or reimburse funds, services, or supplies, or transfer or receive anything of value, or to enter into any contract, assistance agreement, interagency agreement, or other financial obligation.
- This CRA in no way restricts either of the parties from participating in any activity with other public or private agencies, organizations, or individuals.

V. PERIOD OF AGREEMENT

This CRA shall enter into force as of the date of signature and will remain in force for a period of five years, after which, by mutual agreement, it may be extended for further periods of 5 years. Each organization should notify the other of its intention to terminate the Agreement six months prior to the expiration of each period.

The contact persons for the CRA shall be as follows for the each side:-

Signed on behalf of

Signature & Seal of the Head of the Institutions

Prof. Dr. R. S. Patil
Principal,
PSGVP Mandal's,
Arts, Science and Commerce College
SHAHADA (MS) 425409

Dr. R. Z. Sayyed
Head, Dept. of Microbiology
PSGVP Mandal's,
Arts, Science & Commerce College
SHAHADA (MS) 425409

Date: 19 Feb 2019

Prof. Abdujalil Narimanov
Director,
Institute of Genetics & Plant
Experimental Biology, Uzbekistan

PhD. Difluza Jabborova
Head of Laboratory of Medicinal Plants
Genetics and Biotechnology, Institute of
Genetics and Plant Experimental
Biology, Uzbekistan

Date: 19.02.2019.

Rayat Shikshan Sanstha`s

R.B.Narayanrao Borawake College

Shrirampur - 413 709, Dist. Ahmednagar.

Affiliated to Savitribai Phule Pune University

[(Id.No. PU/AN/AS/02/(1960)](Jr./HSC/Id.No.J - 12.14.001)

NAAC Re-accredited 'A' Grade

ISO - 9001 - 2015

Dr. K.H. Shinde

Principal

M.A., M.Phil., Ph.D.

Founder

Padmabhushan Dr. Karmaveer Bhaurao Patil D.Litt.

☎ Offi. : 02422 222347, Resi. : 02422 222072, Fax : 02422-222472 E-mail ID : rbnbcollege@gmail.com Web : www.rbnbcollege

Ref. No. by hand /2018-19

Date : 12/1/2019

To,

Dr. Avinash Nikam

Head, Department of Economics

PSGVP Vidhaprasarak College, Shahada

Dist Nandurbar

Letter of Gratitude.

We thank you for accepting our invitation and attending the National Level Seminar on "India's Goods and Services Tax: Emerging Issues and Challenges' as a **'Resource Person/ Chairperson/ Session in-charge** held on 11th and 12th January, 2019. The Department of Economics of our college takes this opportunity to express our sense of gratitude for sharing your expertise and making this academic event more lively.

Sir, you spent your valuable time for guiding and boosting our moral. We, the members of organizing committee heartily thank you for your kind co-operation and positive response.

We look forward to your co-operation in futures as well.

Thanking You,

Seminar Convener

R.B.N.B. COLLEGE Shrirampur

Principal

Estd.1966

"Education through self help is our Motto." KARMAVEER

Rayat Shikshan Sanstha's

ANNASAHEB AWATE ARTS, COMMERCE, HUTATMA BABU GENU SCIENCE COLLEGE & SOU. KUSUMBEN KANTILAL SHAH ARTS, COMMERCE, SCIENCE JUNIOR COLLEGE

Manchar, Tal. Ambegaon, Distt. Pune (Maharashtra) - 410 503.

ACCREDITED 'A' BY NAAC

ID. No. - PU/PN/ASC/017/1966 Junior College No. - J11.01.001

A.I.S.H.E. - C - 41221

* PRINCIPAL *
Dr. Kanade K. G.
M.Sc., M.Phil., Ph.D.

* FOUNDER *
Padmabhushan
Dr. Karmaveer
Bhaurao Patil, D. Litt.

Ref. No. 703/2020-21

Date : 13/02/2021

To,
Dr. Avinash Nikam
Head, Department of Economics,
PSGVPM's A.S.C. College
Shahada, Dist. Nandurbar.

Sub:-Letter of Thanks

Respected Sir,

I am very much thankful to you for accepting our invitation and delivering a marvelous talk in **'National Online Conference on Self Reliant India: Reality, Opportunities & Challenges on 11th& 12th February, 2021** organized by Rayat Shikshan Sanstha's Annasaheb Awate College, Manchar, Pune 410503.

We expect same co-operation from you in future too.

Thanking You

Co-ordinator

ANNASAHEB AWATE COLLEGE MANCHAR

Principal
Annasaheb Awate College,
Manchar, Pune 410503

Phone No. - S.T.D. (02133) Office : 223160 Principal : 225721 Computer : 223860 Resi.: 223312 Fax : 223160
Website : aacmanchar.com E-mail : annasahebawate2007@yahoo.com / aac.manchar@gmail.com skype : aac.manchar1

प्रमाणपत्र

प्रमाणित करण्यात येते की, डॉ. श्री. गौतम भाईदास कुवर, पुज्य साने गुरुजी विद्या प्रसारक मंडळाचे कला, विज्ञान व वाणिज्य महाविद्यालय, शहादा हे दिनांक १४/०१/२०१९ रोजी मराठी भाषेचे व्याख्यान व मराठी भाषेचे महत्व / मार्गदर्शन करणे कामी या न्यायालयात हजर होते त्या बद्दल त्यांना हे प्रमाणपत्र देण्यात येत आहे.

ADDITIONAL DISTRICT COURT SHAHADA

अधिक्षक,

29.1.19

(आर. बी. पावरा)
जिल्हा न्यायालय-१, शहादा

दिनांक :-२९/०१/२०१९
जिल्हा न्यायालय-१, शहादा

208

श्री साईबाबा भक्त मंडळ म्हसावद संचलित

कला वरिष्ठ महाविद्यालय, म्हसावद

ता.शहादा जि.नंदुरबार

शासन आदेश- एन.जी.सी. 2007 (189/07) माशि-3 दि. 2/7/2007 अन्वये मंजूर

प्र.प्राचार्य: प्रा.एम.आर.पाटील
(एम.ए., बी.एड., नेट., सेट.)
मोबाईल नं. 9503237309

College Code: 230099
Website - www.saibabeducation.org.
E-mail - saibabaarts@rediffmail.com
(कार्यालय) 02565-255486 / 9921034378

• अध्यक्ष •
श्री.विठ्ठल हिरजी चौधरी
मोबाईल नं. 9421483548

जा.क्र. दिनांक: / /२०

आभार पत्र

सेवा में
प्रा.डॉ. गौतम कुवर
विभाग प्रमुख-हिंदी
पूज्य साने गुरुजी विद्या प्रसारक मंडळ का
कला, विज्ञान, वाणिज्य महाविद्यालय, शहादा
जि. नंदुरबार

महोदय,

महाविद्यालयीन परंपरा के अनुसार हमारे महाविद्यालय में दिनांक 14 सितंबर 2018 को 'हिंदी दिवस' संपन्न हुआ। इस अवसर आपने हमारे विद्यार्थियों को 'आधुनिक दृष्टिकोण से हिंदी भाषा का महत्व' विषय पर अनेक उदाहरणों द्वारा मार्गदर्शन किया हमें उपकृत किया। अतः महाविद्यालय आपके प्रति आभार प्रकट करता है। सहयोग की अपेक्षा रहेगी!

PRINCIPAL
Shri. Saibaba Bhakt Mandal Sanchalit
Art's Senior College, Mhasawad
Tal.Shahada, Dist. Nandurbar

२०९

॥ तमसो मा ज्योतिर्गमय ॥ ✆ - कार्यालय (02565) 22369

सातपुडा शिक्षण प्रसारक मंडळ, धुळे संचलित

वसंतराव नाईक कला, विज्ञान व वाणिज्य महाविद्यालय,

शहादा जि.नंदुरबार

NAAC Accredited Web site - www.sspmvnc.org e-mail - principalvnc_shahada@yahoo.co.in

• स्थापना • 1993 • संस्थापक अध्यक्ष • कर्मयोगी मा.अण्णासाहेब प्रेमचंद जाधव • प्राचार्य • डॉ. ए.एम.पाटील - 9422795527

जा.क्र. वनाम/रासेयो/ /२०१ दिनांक- ०८/०१/२०१९

प्रति,

मा. प्रा. डॉ. गौतम कुवर

हिंदी विभाग, पूज्य साने गुरुजी

वि. प्र. म. सं. कला, विज्ञान व वाणिज्य

महा. शहादा, जि. नंदुरबार.

विषय :- राष्ट्रीय सेवा योजनेच्या हिवाळी शिबीरास मार्गदर्शना बाबत..

महोदय,

आमच्या महाविद्यालयातील राष्ट्रीय सेवा योजना एककाचे हिवाळी शिबीरास आपण दिनांक ३०/१२/२०१८ ते ०५/०१/२०१९ कालावधीत आपण जातिमुक्त भारत समृद्ध भारत या विषयावर आमच्या विद्यार्थ्यांना मार्गदर्शन केले. त्याबद्दल महाविद्यालयाच्या वतीने आपले आभार.

धन्यवाद.

आपला विश्वासू,

कार्यक्रम अधिकारी
राष्ट्रीय सेवा योजना
वसंतराव नाईक महाविद्यालय
शहादा, जि. नंदुरबार

प्राचार्य
वसंतराव नाईक वरीष्ठ महाविद्यालय
शहादा, जि. नंदुरबार

The College is located at Tribal, Hilly & Arduous Area

NAAC ACCREDITED C++

...Adivasi Satpuda Shikshan Prasarak Mandal's...

MAHARAJ J. P. VALVI ARTS, COMMERCE & SHRI. V. K. KULKARNI SCIENCE COLLEGE

DHADGAON, Tal. Akrani, (Dist. Nandurbar) ☎ : (02595) 220396, 220496

• College Code : 280061 • Centre Code : 2817 • E-mail ID : mjpvascdhadgaon@rediffmail.com

Outward No. 148 /2018-2019 Date : 26/9/2018

सेवा में
प्रा. डॉ. गौतम भारदास बुवर
(सिनेट सदस्य क.ब.चौ.उ.म.वि. जलगांव)
पी. एस. जी. व्ही. पी. मंडल संचलित
कला, वाणिज्य एवं विज्ञान महाविद्यालय
शहादा.

विषय :- प्रमुख अतिथि के रूप में उपस्थिति हेतू आभार पत्र ---

महोदय,

उपरोक्त विषयानुसार आप 26 सितम्बर 2018 को हमारे महाविद्यालय में हिंदी समारोह के अवसर पर उपस्थित रहे और आपके असीम ज्ञान से हमारे छात्रों को प्रेरित किया इसके फलस्वरूप आपको यह आभार पत्र दिया जाता है।

धन्यवाद।

प्राचार्य
महाराज जे.पी. वळवी कला, वाणिज्य व
पं. वि. कृ. कुलकर्णी विज्ञान महाविद्यालय
धडगांव ता. अक्राणी जि. नंदुरबार (म.रा.)

Gokhale Education Society's
HPT ARTS & RYK SCIENCE COLLEGE
Prin. T. A. Kulkarni Vidyanagar, NASHIK - 422 005.
ID No. : PU/NS/AS/001(1924)
NAAC RE-ACCREDITED 'A' GRADE
ISO 9001 : 2015 CERTIFIED COLLEGE
JR. COLLEGE CODE NO. : J13.17.003
Phone : Sr. College : (0253) 2572153
Jr. College : (0253) 2579480
Fax : (0253) 2573097
Email : prinhptryknsk@rediffmail.com
Website : www.hptrykcollege.com

Ref. No.

Date :

दि. /01/2019.

प्रतिष्ठा मे,

डॉ. गौतम कुँवर
हिंदी विभाग प्रमुख,
पूज्य साने गुरुजी विद्या प्रसारक मंडल का
कला, विज्ञान एवं वाणिज्य महाविद्यालय, शहादा, नंदुरबार.

विषय : आभार पत्र

महोदय,

महाविद्यालय के हिंदी विभाग द्वारा दि.18-19 जनवरी 2019 को 'आदिवासी विमर्श' इस विषय पर आयोजित राष्ट्रीय संगोष्ठी में **विषय प्रवर्तक / सत्राध्यक्ष** के रूप में उपस्थित रहकर संगोष्ठी की सफलता में सक्रीय योगदान दिया।

आपके मार्गदर्शन हेतु महाविद्यालय आपका ऋणी रहेगा।

हिंदी विभाग प्रमुख
डॉ. चव्हाण एम.एल.
विभागाध्यक्ष
एच.पी.टी. आर्ट्स व आर.वाय.के. साइन्स
महाविद्यालय, नाशिक-०५

H.P.T. Arts & R.Y.K. Science College NASHIK 05.

प्राचार्य
Principal
Principal
H.P.T. ARTS & R.Y.K. SCIENCE COLLEGE,
Nashik-422-005.

॥ SHRI ॥

NANDURBAR TALUKA VIDHAYAK SAMITI's

G. T. PATIL ARTS, COMMERCE AND SCIENCE COLLEGE,

NANDURBAR, DIST- NANDURBAR-425412 (M.S.)

NAAC RE-ACCREDIATED 'A' GRADE

DST FIST Identified College

Awarded "Excellent College" By North Maharashtra University, Jalgaon 2014

GOLDEN JUBILEE YEAR 2014-15

Prof. Dr. V. S. Shrivastava
Ph.D. Post. Doct. (S.America)
Principal

Office : (02564) 222293, 226534
E-mail: gtpcollege@ rediffmail.com
drvinod_shrivastava@yahoo.com
Web: www.ntvsgtpcollege.org

दि.03/01/2019

॥ आभार पत्र ॥

प्रति,

डॉ. गौतम कुवर

शहादा

महोदय,

आपण आमच्या महाविद्यालयाच्या शैक्षणिक वर्ष २०१८-१९ मधील दि. २८/१२/२०१८ ते दि. ०३/०१/२०१९ या दरम्यान **मौजे केवाडीपाडा**, ता. जि. नंदुरबार या ठिकाणी संपन्न होत असलेल्या राष्ट्रीय सेवा योजना विशेष हिवाळी शिबिरात आज दि. 03/01/2019 रोजी --- समारोप समारंभ प्रसंगी मार्गदर्शन ---

या विषयावर व्याख्यान देऊन आमच्या रासेयो स्वयंसेवकांना मार्गदर्शन केले.

आपण आपला अमूल्य वेळ देऊन जे सहकार्य केले त्याबद्दल आम्ही आपले आभारी आहोत !

PRINCIPAL
Gajmal Tulshiram Patil College
NANDURBAR Dist.Nandurbar

डॉ. व्ही. एस. श्रीवास्तव

डॉ. सतीश सूर्ये

कार्यक्रम अधिकारी
राष्ट्रीय सेवा योजना
गजमल तुळशिराम पाटील महाविद्यालय
नंदुरबार

Rural Foundation Nandurbar Sanchalit
SENIOR SCIENCE COLLEGE
Akkalkuwa district Nandurbar
NATIONAL SERVICE SCHEME

आभार पत्र

प्रति,

प्रा. सुमानसिंग वळवी (इंग्रजी विभाग)
पुज्य साने गुरुजी विद्या प्रसारक मंडळाचे
कला, वाणिज्य व विज्ञान महाविद्यालय, खोंडा
महोदय,

रुरल फौन्डेशन नंदुरबार संचालित वरिष्ठ विज्ञान महाविद्यालय अक्कलकुवा जि. नंदुरबार आमच्या महाविद्यालयाचे राष्ट्रीय सेवा योजना विभागाने आयोजित केलेल्या विशेष हिवाळी श्रम-संस्कार शिबिर दि.२४/१२/२०१८ ते ३०/१२/२०१८ सदर कार्यक्रमात आपण दिनांक २५/१२/२०१८ रोजी विद्यार्थ्यांना "जाती मुक्त भारत" या विषयावर मोलाचे मार्गदर्शन केल्या बद्दल व आपला अमुल्य वेळ आम्हास दिल्याबद्दल आम्ही आपले आभारी आहोत.

धन्यवाद!

प्राचार्य
रुरल फौन्डेशन नंदुरबार संचलित
वरिष्ठ विज्ञान महाविद्यालय,
अक्कलकुवा जि. नंदुरबार

NAAC
Reaccredited- 'A' grade in 3rd cycle

PSGVP Mandal's
A RUSA Beneficiary and DBT Star Status Institution
SHRI S.I.PATIL ARTS, G.B.PATEL SCIENCE & STKVS COMMERCE COLLEGE,
SHAHADA - 425409, (Dist- Nandurbar), (M.S.), INDIA.
GOLDEN JUBILEE YEAR- (2020-21)
Website: www. psgvpasc.ac.in
Email:principal.shahada@gmail.com
IQAC- psgvpnaac@gmail.com
Phone/ Fax Office (02565) 229576
Mob.9421530100
Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.1.1 ***Number of Collaborative activities for research, Faculty exchange, Student exchange/ internship during the year 2019-20***

Sl. No.	Title of the collaborative activity	Name of the collaborating agency with contact details	Name of the participant	Year of collaboration	Duration	Nature of the activity	Page No.
C1.	Sharing of facilities and Research Outcomes	National Centre For Celt Science, NCCS Complex, P.B. No. 40, Ganeshkhind, Pune - 411 007. India e-mail: infonccs@giaspn0l.vsnl.net .in	Dr. R. Z. Sayyed, M. S. Sonawane, M. H. Khairnar	2017	2017-2022	**Research** - This MoU is purely meant for sharing the research facilities and research outcome between two Institutes, it does not involve any financial commitments from both the ends. Exchange of faculty and researchers. Joint Publications with NCCS and RZS.	02-12
C2.	Sharing of facilities and Research Outcomes	Uzbekistan academy of Sciences, Tashkent, Uzbekistan	R. Z. Sayyed, Kakhramon Davranov, Dilfuza Jabborova, Zafarjon Jabbarov	2019	2019-2024	Joint publication, sharing of facilities	13-14
C3.	Sant Kabir Vyakhyanmala	Vasantrao Naik Arts, Science and Commerce College, Shahada	Dr. G. B. Kuwar	2019	05/09/2019	Invited Talk	15-16

(Prof. Dr. R. S. Patil)
Principal
Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science & S.T.K.V.S Comm. College, Shahada
Dist Nandurbar (M.S.)

NCCS

राष्ट्रीय कोशिका विज्ञान केन्द्र

National Centre For Cell Science

जैवप्रौद्योगिकी विभाग, भारत सरकार का स्वायत्त संस्थान

(An Autonomous Institution of the Department of Biotechnology, Government of India)

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH

Between

Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India,

And

National Centre for Microbial Resource formarly Microbial Culture Collection, National Centre for Cell Science, PUNE 411021, Maharashtra, India.

This Memorandum of Understanding (MOU) is signed between Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA and Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India.

That this MOU is purely meant for sharing the research facilities and research outcome between two institutes, it does not involve any financial commitments from both the ends.

That the Staff, Research Scholars and Post Graduate students of Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA will screen, isolate and will perform the preliminary characterization of potential bacterial cultures and Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India will perform 16s rRNA gene sequence, phenotypic finger printing, BIOLOG and GC-FAME analysis of the partially characterized bacterial cultures.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the concerned staff, scholars and Post Graduate students of Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA and concerned staff, Scientist and technician of Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India.

1). Head, Dept of Microbiology, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA. **E-mail: sayyedrz@gmail.com, Tel** 02565 229576	
Witness : **Dr. M. K. Patel, IQAC Coordinator,** PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, MS, INDIA. **Tel** 02565 229576	
Head of Institution : **Prof. Dr. R. S. Patil, Principal,** PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra,INDIA. **E-mail :principal.shahada@gmail.com, Tel** 02565 229576	
2). **Prof. Yogesh S Shouche, Scientist F**, and In-Charge NCMR, NCCS, Pune. (An Autonomous Institute of DBT, Govt. of India) **E-mail : yogesh@nccs.res.in Tel:** +91-20-25329026	

एनसीसीएस कॉम्प्लेक्स, पो. बॅ. नं. ४०, गणेशखिंड पी. ओ., पुणे ४११ ००७. महाराष्ट्र, भारत

NCCS Complex, P.B. No. 40, Ganeshkhind P. O., Pune - 411 007. Maharashtra, India

दूरभाष / Tel.: (020) 25708000 फैक्स / Fax : 91 (020) 25692259

ई मेल / E- mail : infonccs@giaspn01.vsnl.net.in

वेबसाईट / Website : http://www.nccs.res.in

Production of alkaline protease by rhizospheric Bacillus cereus *HP_RZ17 and* Paenibacillus xylanilyticus *HP_RZ19*

H. P. Jadhav, M. S. Sonawane, M. H. Khairnar & R. Z. Sayyed

Environmental Sustainability

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DOI 10.1007/s42398-020-00096-z

Springer

Environmental Sustainability (2020) 3:5–13
https://doi.org/10.1007/s42398-020-00096-z

ORIGINAL ARTICLE

Production of alkaline protease by rhizospheric *Bacillus cereus* HP_RZ17 and *Paenibacillus xylanilyticus* HP_RZ19

H. P. Jadhav[1] · M. S. Sonawane[2] · M. H. Khairnar[2] · R. Z. Sayyed[1]

Received: 12 June 2019 / Revised: 4 January 2020 / Accepted: 8 January 2020 / Published online: 4 February 2020

Abstract

Alkaline protease of microbial sources is remarkably stable, highly active, and produced conveniently at a large-scale in a more cost-effective way. Owing to higher activity and more stability at alkaline pH, the enzyme has attracted significant commercial interest in many fields. Although alkaline protease is produced by a large number of microbes; however, the search for high yielding novel strains and optimization for getting more yields are always desired. Therefore, the aim of the present research work was to search and select high yielding strains and to optimize the physicochemical parameters for better yield of alkaline protease. A total of 09 protease positive isolates were obtained from the rhizosphere of various crop plants such as peanut (*Arachis hypogaea*), cotton (*Gossypium hirsutum*), banana (*Musa acuminata*) and papaya (*Carica papaya*). Two of these isolates, namely HP_RZ17 and HP_RZ19 produced a copious amount of protease. These isolates were later identified as *Bacillus cereus* HP_RZ17 and *Paenibacillus xylanilyticus* HP_RZ19. The influence of various physicochemical factors were studied by one variable at a time (OVAT) approach where only one factor was varied keeping other factors constant and the results were statistically analyzed using the Student's *t* test. The optimized protocol resulted in a 2.45 and 3.04-fold increase in the production of protease by *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19, respectively.

Keywords Alkaline protease · *Bacillus* · *Paenibacillus* · Optimization · 16S rRNA sequencing

Introduction

The alkaline proteases (EC.3.4.21–24.99) have become commercially significant group of microbial enzymes, acquiring about 60% share of the global enzyme market. They are widely used in agro-industries as biocontrol agents (BCAs) and for plant growth promotion, in pharmaceuticals for drug development, in food processing, in detergent industries for removing stains and in leather processing, etc. Their demand is expected to increase in the upcoming period (Chew et al. 2019) and this compels the need to produce the enzyme in more amounts. Owing to their higher activity, ease in genetic modification, availability at large scale, convenience in processing and application and safe and cost-effective production besides high stability and ability to function over the broader pH and temperature range, microbial protease have gained more significance than the plant or animal sources (Jadhav et al. 2017).

A wide variety of soil microorganisms produce alkaline proteases (Jadhav and Sayyed 2016; Jadhav et al. 2017), however, the plant growth promoting rhizobacteria (PGPR) that produce this enzyme are of major agricultural significance due to their role as BCAs (Sayyed et al. 2019; Akinrinlola et al. 2018; Shaikh et al. 2018) against phytopathogens like *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus wentii*, *Alternaria alternata*, *Byssochlamys fulva*, *Botrytis cinerea* (Földes et al. 2000; Tewari et al. 2019). Although various strains of *Bacillus* sp. viz; *B. subtilis* GB03, *B. pumilus* GB34, *B. thuringiensis* BMP123, *B. amyloliquefaciens* FZB24, etc. are in use as PGPR cum BCAs, however, only those strains that produce the best amount of protease extracellularly will have significant commercial value. In order to get the best yield of enzyme, it is necessary to know and

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optimize the physicochemical and nutritional factors that regulate the production (of enzyme) (Souza et al. 2017; Asha and Palaniswamy 2018). This study was aimed to isolate high yielding PGPR from the rhizosphere and to optimize the protocol for enhanced production of protease by them.

Materials and methods

Sample collection

Rhizospheric soil from various plants such as peanut (*Arachis hypogaea*), cotton (*Gossypium hirsutum*), banana (*Musa acuminata*) and papaya (*Carica papaya*) around Shahada, North Maharashtra, India (21°34′04.5″ N 74°32′05.6″ E) were used for the isolation of protease producing bacteria. Samples were collected from four different corners and centers of field (of each crop) and were mixed to make a composite sample.

Isolation of bacteria from rhizosphere soil

A 10 g of soil sample from each rhizosphere was transferred into each 100 mL of sterile distilled water and shaken at 120 rpm for 30 min for proper mixing. A 0.1 mL of an aliquot (10^{-4}) was spread on sterile nutrient agar plate and incubated at 30 ± 2 °C for 24–48 h (Mukhtar et al. 2019). Morphologically different bacterial isolates were purified and preserved in 20% (v/v) glycerol with phosphate buffer (pH 7.0) until further use.

Screening of protease producing bacteria

For screening of proteolytic activity, each isolate was grown on skim milk agar (SMA) containing (g L^{-1}), skim milk powder 28, casein enzyme hydrolysate 5.0, yeast extract 2.5, dextrose 1.0 and agar 20 at 30 ± 2 °C for 24–48 h. Colonies showing zone of protein hydrolysis were selected as protease producer isolate (Jani et al. 2016). Extent of protease production was determined based on the diameter of the zone of protein hydrolysis around the colonies.

Production and quantitative estimation of protease

For the quantitative estimation of protease, isolates showing the maximum zone of proteolysis were selected. For this purpose all 09 protease positive isolates were separately grown in minimum salt medium (MSM) containing (g L^{-1}) KH_2PO_4 0.2, $MgSO_4$ 0.5, NaCl 0.5, $CaCl_2$ 0.5, peptone 10 at 30 °C for 48 h at 120 rpm (Saraswathy et al. 2013). After incubation, broth cultures were centrifuged at 10,000 rpm for 10 min at 4 °C and the cell-free supernatant was assayed for alkaline protease activity with casein as a substrate (Sevinc and Demirkan 2011). A 1 mL of 0.65% casein prepared in 20 mM phosphate buffer (pH 7) and 1 mL enzyme solution was incubated at 37 °C for 10 min. The reaction was stopped by adding 5 mL of 110 mM Tri-chloroacetic acid (TCA) and the precipitated proteins were separated by centrifugation (10,000 rpm for 10 min). The number of tyrosine units liberated was estimated by incubating 1 mL of the supernatant in 5 mL of 500 mM Na_2CO_3 at 30 °C for 20 min followed by the addition of 1 mL Folin–Ciocalteu reagent. Absorbance was measured at 660 nm against the reference (without enzyme) (Cupp-Enyard 2008). One unit of protease activity was defined as the amount of enzyme that liberates 1 µg tyrosine mL^{-1} min^{-1} from casein (Kim et al. 2016). The protein content of the sample was estimated as per Lowry et al. (1951) with bovine serum albumin as standard. The concentration of protein in the test sample was calculated using the following equation:

$$y = mx + b,$$

where, y—absorbance, m—slope (0.0008), x—concentration of unknown, b–y-intercept (0.0472).

Optimization of protease production

Influence of incubation period

Incubation period is one of the crucial physical factors in bacterial growth and enzyme synthesis as it determines the peak period for production and catabolism of any metabolite. In order to know the exact incubation period required for optimum growth and protease production, isolates HP_RZ17 and HP_RZ19 were separately grown in MSM at 30 °C for 96 h at 120 rpm. Samples withdrawn after every 6 h intervals were subjected for measurment of growth and enzyme activity.

Influence of media pH

The pH of the medium regulates growth of organisms and their ability to produce metabolites. In order to find the optimum pH for good growth and best protease production, isolates HP_RZ17 and HP_RZ19 were separately grown in MSM prepared with various pH in the range 4.0 to 14.0. The pH of MSM was adjusted with 0.1 N HCL and NaOH. Inoculated media were incubated at 30 °C for 48 h at 120 rpm. Following the incubation, growth and protease activity was measured.

Influence of incubation temperature

Incubation temperature is yet another parameter that determines metabolite production. It varies from organism to

organism and hence needs optimization (for each organism) (Abusham et al. 2009). In order to know the optimum temperature required for maximum bacterial growth and production of protease, isolates HP_RZ17 and HP_RZ19 were separately grown in MSM for 48 at 120 rpm at various temperatures in the range from 20 to 50 ± 2 °C. Following the incubation, growth and protease activity was measured.

Influence of concentration of inoculum

Production of an enzyme or any metabolite depends on initial inoculum density. Therefore, it is necessary to decide the optimum level of inoculum for maximum production of enzyme. In order to determine the optimum level of inoculum lag phase (OD ~ 0.3 at 600 nm), log phase cultures of isolates HP_RZ17 and HP_RZ19 were separately inoculated in MSM in the range 0.5, 1.0, 1.5 and 2% v/v at 30 °C for 48 h at 120 rpm. Following the incubation, measurement of growth and protease activity was performed.

Influence of carbon source

The source of carbon regulates cell growth of an organism and thereby metabolite production. The type of carbon substrate required by organisms varies from organism to organism and therefore, it is necessary to select the best utilizable carbon source for good growth and higher production of metabolite. In order to decide the best carbon source for good growth and higher production of protease sugars, like glucose, fructose, sucrose, lactose, maltose, and dextrose were added (1% w/v) in MSM, isolates HP_RZ17 and HP_RZ19 were separately grown in each sugar at 30 °C for 48 h at 120 rpm. Following the incubation, growth and protease activity were estimated.

Influence of nitrogen source

Since all the enzymes contain amino groups, type of nitrogen substrate plays a vital role in the synthesis of enzymes. In order to decide the best nitrogen substrate for cell growth and enzyme production, peptone of MSM was replaced by casein, tryptone, yeast extract, urea, ammonium nitrate (NH_4NO_3) and ammonium chloride (NH_4Cl_2) (1.0% w/v). Isolates HP_RZ17 and HP_RZ19 were separately grown in each modified MSM at 30 °C for 48 h at 120 rpm. Following the incubation, growth and protease activity were measured.

Protease production in optimized medium

Protease production was carried out in MSM having all the optimized parameters. For this purpose, both the isolates were separately grown in MSS at 30 °C for 48 h at 120 rpm. Following the incubation, growth and protease activity were measured.

Identification of isolate by 16S rRNA gene sequencing

The genomic DNA of the isolate was separated as per the method of Sambrook and Russell (2001). The 16S rRNA genes of the isolates were amplified with universal primers 27F (5′-GAGTTTGATCMTGGCTCAG-3′) and 1525R (5′-AAGGAGGTGATCCAGCC-3′) using Gene Amplifier PCR System 9700 (Perkin Elmer, USA). The polymerase chain reaction (PCR) was set up with 20–50 ng of DNA. The 16S rRNA gene was amplified by following protocol—initial denaturation at 94 °C for 5 min, 35 cycles of denaturation at 94 °C for 1 min, annealing at 55 °C for 1 min and extension at 72 °C for 1 min, final extension at 72 °C for 7 min with a final hold at 20 °C. The resulting PCR products were purified on 1.0% agarose gel and sequenced on ABI 3730Xl automated sequencer using a ready reaction kit (Perkin Elmer Applied Biosystems Division, CA). Amplified sequences were identified from NCBI (http://www.ncbi.nlm.nih.gov) and EzTaxon (http://www.eztaxon.org) database and phylogenetic trees were constructed by using the neighbor-joining method with the help of MEGA5 software (Sonawane et al. 2016).

Statistical analysis

The experimental data mentioned is the mean of three replicates. Analysis of resulting data was performed by using the Student's *t* test and the values of $p \leq 0.05$ were considered as statistically significant (Parker 1979).

Results

Isolation and screening of protease producing microbes

Zone of protein hydrolysis was observed around the colonies of 9 isolates; 5 isolates from peanut (*A. hypogaea*), 1 from cotton (*G. hirsutum*), 2 from banana (*M. acuminate*) and 1 from papaya (*C. papaya*) rhizospheric soil. The maximum zones of protein hydrolysis were observed in the case of isolate HP_RZ17 (Supplementary Fig. 1A) and HP_RZ19 (Supplementary Fig. 1B). All the isolates exhibiting proteolytic activity were evaluated for their ability to produce maximum amount of protease (Jani et al. 2016).

Production and quantitative estimation of protease

Among these 9 isolates, HP_RZ17 (49.8 U mL^{-1}) and HP_RZ19 (34.8 U mL^{-1}) produced higher amounts of protease (Table 1), hence these were considered as potent protease producers and were selected for further studies.

Optimization of protease production

Influence of incubation period

The incubation period of 48 h appeared as the best suitable for the production of protease by isolates HP_RZ17 and HP_RZ19 in MSM (Table 2; Fig. 1a, b). In both the isolates, protease production started during the beginning of log-phase (6 h of incubation) and continued up to 48 h. Optimum protease activity (46.36 U mL^{-1} and 52.18 U mL^{-1}) was recorded at 48 h of incubation in HP_RZ17 and HP_RZ19.

Influence of media pH

Both the isolates produced higher amounts of protease at alkaline pH. In the case of HP_RZ17, alkaline pH (11.00) resulted in higher enzyme yield (87.99 U mL^{-1}) while in the case of isolate HP_RZ19, pH 10.00 gave the best protease yield (73.23 U mL^{-1}) (Table 2). Acidic pH (4.0) affected the enzyme yield at this pH isolate HP_RZ17 and HP_RZ19 produced minimum protease i.e. 27.57 U mL^{-1} and 26.43 U mL^{-1}, respectively.

Influence of incubation temperature

Isolates HP_RZ17 and HP_RZ19 produced an optimum amount of protease (36.45 and 50.06 U mL^{-1}) at 30 °C. Incubation temperature below or above 30 °C affected the yield of protease (Table 2). A 30 °C incubation temperature was found to be the best suitable for the higher production of protease.

Table 1 Protease activity of isolates (un-optimized)

Colony code	Genebank submission	Mean enzyme activity (U mL^{-1})
HP_RZ11	*Brevibacillus brevis* HP_RZ11	22.0
HP_RZ12	*Brevibacillus brevis* HP_RZ12	25.4
HP_RZ13	*Brevibacillus brevis* HP_RZ13	23.2
HP_RZ14	*Brevibacillus brevis* HP_RZ14	26.8
HP_RZ15	*Bacillus cereus* HP_RZ15	29.4
HP_RZ16	*Bacillus cereus* HP_RZ16	32.5
HP_RZ17	*Bacillus cereus* HP_RZ17	49.8
HP_RZ18	*Bacillus cereus* HP_RZ18	31.2
HP_RZ19	*Paenibacillus xylanilyticus* HP_RZ19	34.8

Influence of concentration of inoculum

The best inoculum levels for the higher production of protease by HP_RZ17 (57.54 U mL^{-1}) and HP_RZ19 (63.44 U mL^{-1}) were 1.5% and 0.5% (Table 2). Inoculum levels of 1.0% and 2% resulted in the lowest enzyme activity in HP_RZ17 (52.04 U mL^{-1}) and HP_RZ19 and (34.48 U mL^{-1}).

Influence of carbon source

Among various carbon sources, fructose appeared as the best for higher production of protease by both the isolates. Protease production was negatively affected by maltose and dextrose (Table 2).

Influence of nitrogen source

In this case, the best suitable nitrogen substrate for isolate HP_RZ17 was yeast extract; it yielded a protease activity of 103.45 U mL^{-1}. While in the case of isolate HP_RZ19, the best suitable nitrogen source was casein; as it gave a maximum protease activity of 92.51 U mL^{-1} (Table 2).

Protease production in optimized medium

Medium prepared using the above-optimized parameters (best selected conditions) resulted in 2.45-fold (144.99%) and 3.04-fold (204.6%) increase in protease production by HP_RZ17 and HP_RZ19, respectively.

Identification of isolate by 16S rRNA gene sequencing

The phylogenetic tree and NCBI blast comparison of isolates HP_RZ17 and HP_RZ19 showed 100% and 98.70% identity with *B. cereus* (Fig. 2a) and *P. xylanilyticus* (Fig. 2b). The gene sequences of the isolates were submitted to NCBI gene bank under the name *Bacillus cereus* HP_RZ17 and *Paenibacillus xylanilyticus* HP_RZ19 with Genebank accession number MH235735 and MH235731, respectively. *B. cereus* HP_RZ17 has been deposited in National Center for Microbial Resources (NCMR)-NCCS Pune, Maharashtra, India under the accession No. MCC4158. Deposition of *P. xylanilyticus* is under process at NCMR.

Discussion

The rhizosphere is a nutrient-rich site and favors the growth of various groups of organisms. However, the ability of organisms to use various substrates is determined by its capacity to produce multiple enzymes (Thakkar and Saraf

Table 2 Influence of various parameters on alkaline protease production by *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19

INCU (h)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	pH	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	INTE (°C)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	NIS (1% w/v)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	CS (1% w/v)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	INOC (% v/v)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})
0	0^{ND}	0^{ND}	4.00	27.57^{NS}	26.43^{NS}	20	25.02*	23.50^{NS}	PEP	81.94*	72.66*	Glu	88.62*	64.07*	0.5	50.49^{NS}	63.44*
6	0*	0.21*	5.00	29.98^{NS}	35.56*	25	26.25*	28.63*	CAS	84.66*	92.51*	Fru	119.75*	102.22*	1.0	52.04*	55.87*
12	18.78^{NS}	21.38^{NS}	6.00	41.15*	45.56*	30	36.45*	50.06*	TRY	63.64*	47.57*	Suc	49.26*	17.12*	1.5	57.54*	42.35^{NS}
18	27.17*	33.16*	7.00	59.80*	61.86*	35	26.00*	45.50*	YEX	103.45*	15.83*	Lac	35.25^{NS}	49.51*	2.0	55.39*	34.48^{NS}
24	37.91*	48.00*	8.00	63.98*	64.30*	40	24.88*	40.49*	URE	23.39*	13.94*	Mal	63.26*	50.60*			
30	41.41*	48.25*	9.00	72.63*	66.13*	45	20.50*	33.64*	AMN	11.82^{NS}	07.81^{NS}	Dex	55.99*	18.03^{NS}			
36	43.24*	49.77*	10.00	80.34*	73.23*	50	13.88^{NS}	26.31*	AMC	19.69*	06.49*						
42	45.25*	52.01*	11.00	87.99*	68.31*												
48	46.36*	52.18*	12.00	81.77*	66.79*												
54	46.13*	52.15*	13.00	79.28*	65.61*												
60	45.59*	50.60*	14.00	77.99*	64.38*												
66	44.01*	48.77*															
72	42.52*	48.37*															
78	43.36*	47.08*															
84	42.55*	46.68*															
90	42.52*	46.05*															
96	40.75*	45.76*															

INCU incubation period, *INOC* inoculum concentration, *INTE* incubation temperature, *HJ17 B. cereus* HP_RZ17, *HJ19 P. xylanilyticus* HP_RZ19, *EA* enzyme activity, *pH* media pH, *NIS* nitrogen source, *CS* carbon source, *PEP* peptone, *CAS* casein, *TRY* tryptone, *YEX* yeast extract, *URE* urea, *AMN* ammonium nitrate, *AMC* ammonium chloride, *Glu* glucose, *Fru* fructose, *Suc* sucrose, *Lac* lactose, *Mal* maltose, *Dex* dextrose, *ND* not determined, "*" statistically significant at $p \leq 0.05$, *NS* statistically non-significant at $p \leq 0.05$

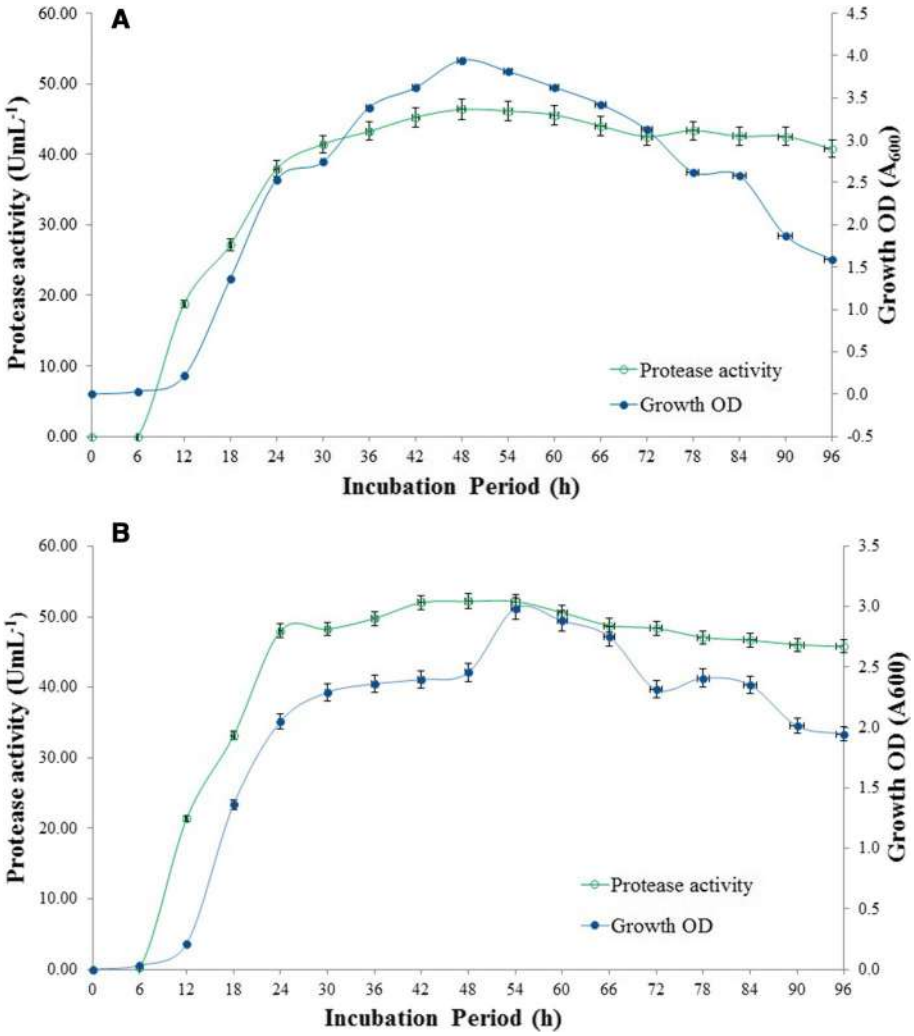

Fig. 1 **a** Growth kinetics and alkaline protease activity of *B. cereus* HP_RZ17 in MSM. Cell density and protease activity were monitored after every 6 h interval. **b** Growth kinetics and alkaline protease activity of *P. xylanilyticus* HP_RZ19 in MSM. Cell density and protease activity were monitored after every 6 h interval

2014). A microbe having diverse metabolic potential will dominate over the other groups. The ability of isolates *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19 to secrete protease reflected their metabolic potential of utilizing diverse protein substrates. Production of copious amounts of protease may be due to the reason that root exudates are rich in protein content (Thakkar and Saraf 2014).

The best level of enzyme production at 48 h corresponded to the late exponential phase of the growth of both the isolates. Marathe et al. (2018) have also reported the best alkaline protease production in *B. subtilis* during 48 h of incubation. While a decrease in protease production in both isolates after 48 h may be due to the change in pH of media as a result of enzyme production, depletion of nutrients, and due to denaturation of the enzyme (Oumer and Abate 2018).

Production of protease at alkaline pH and mesophilic temperature conditions support the alkali nature and stability of the enzyme. This property makes it useful for the application of these isolates in alkaline soil (Contesini et al. 2018).

Large numbers of *Bacillus* sp. viz *Paenibacillus* sp. B2, *B. amyloliquefaciens* CPA-8, *B. stratosphericus* FW3, *B. velezensis* G341, *B. pumilus* JUBCH08, *B. alvei,* and *B. polymyxa* HS-26 isolated from rhizosphere are known to secrete protease and are in use as BCAs (Arfaoui et al. 2019; El-Sayed et al. 2019; Farzand et al. 2019; Gotor-Vila et al. 2019; Tewari et al. 2019; Wang et al. 2019).

Chantawannakula et al. (2002) have reported higher production of protease in *B. subtilis* strain at 30 °C. Gouda (2006) has reported an optimum yield of alkaline protease at 30 °C. Anandharaj et al. (2016) have observed a similar pattern of alkaline protease production in *B. alkalitelluris* TWI3 and *B. clausii*. Cui et al. (2015) have reported higher yield of alkaline protease at a broad pH range (8.0–11.0) in a marine bacterium.

High inoculum concentration with respect to the dissolved oxygen in the medium decreases the production of the enzyme while low inoculum levels lengthen the duration of lag phase leading to delay in the production time (Limkar et al. 2019). Hui et al. (2019) have claimed that a

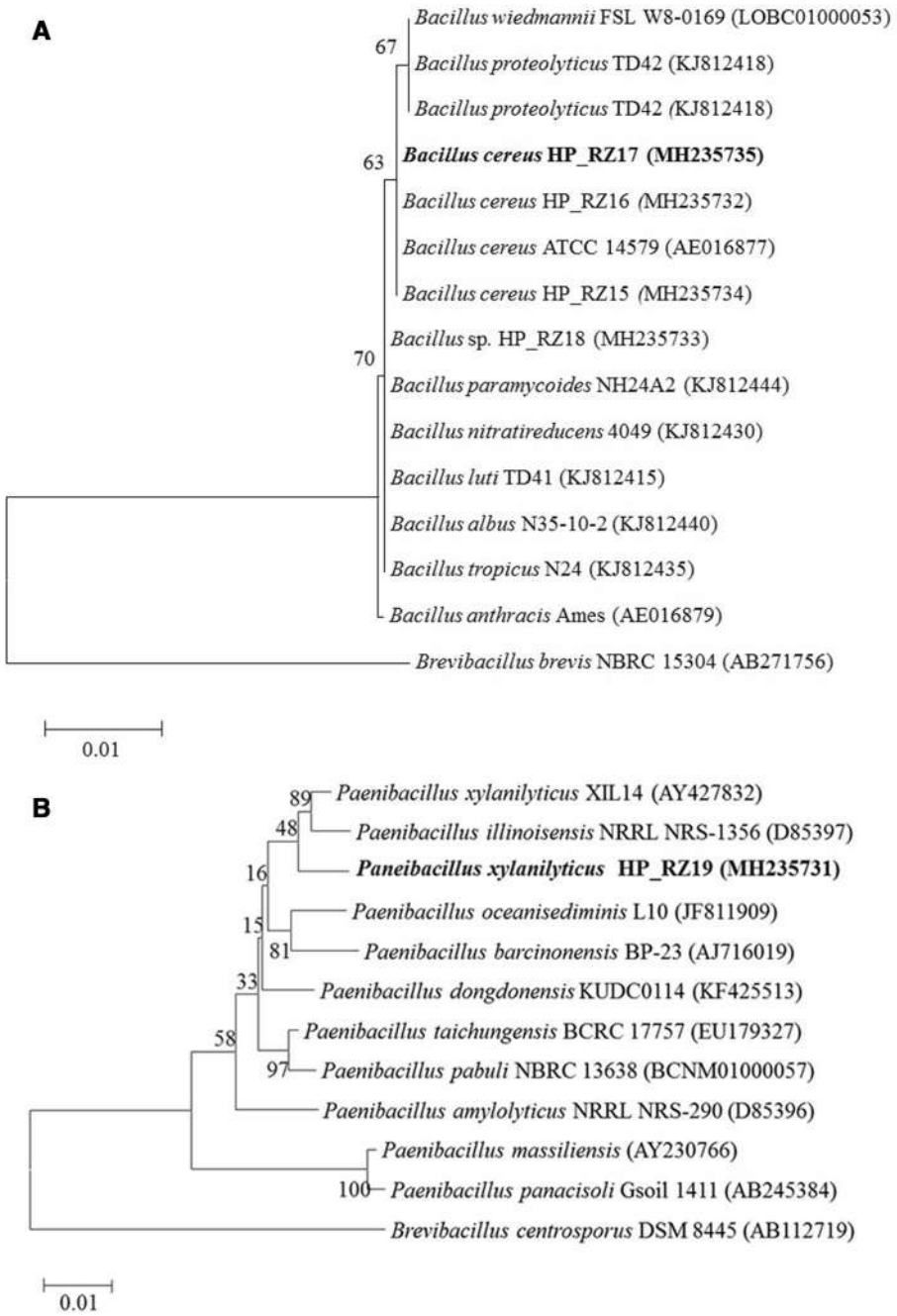

Fig. 2 **a** Phylogenetic tree of *B. cereus* HP_RZ17 based on the 16S rRNA gene sequence drawn using the neighbor-joining method. **b** Phylogenetic tree of *P. xylanilyticus* HP_RZ19 based on the 16S rRNA gene sequence drawn using the neighbor-joining method

higher concentration of inoculum supports more cell growth and decreases the concentration of ammonia that affects the production of the enzyme. Hence, optimization of inoculum concentration is important for better production of the enzyme/metabolite.

The types of carbon and nitrogen sources affect the production of extracellular enzymes. The physiological mechanisms regulate the enzyme production and catabolite repression that are channelized by carbon substrates. Patel et al. (2018) have reported 1.25-fold increase in alkaline protease production in *B. cereus* AG1 with fructose as a sole source of carbon. Reports on the production of alkaline protease by *Bacillus* sp. mention that fructose is one of the significant carbon sources required for optimum production of protease (Sevinc and Demirkan 2011) as also proven in the present study.

Maximum enzyme production in the presence of yeast extract is due to the fact that it is a complex nitrogen source and provides a complete pool of amino acids required for the synthesis of the enzyme (Habicher et al. 2019). Briki et al. (2016) and Kim et al. (2016) have reported higher production of alkaline protease with yeast extract, casein,

and peptone as sole source of nitrogen in *Bacillus* sp. SB12 and *B. subtilis* FBL-1.

The selected isolates *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19 having the ability to produce good amounts of protease under diverse physicochemical and nutritional conditions and over the wide range of pH and temperature may have great demands in various fields and industries and were thus deposited in culture collection center.

Conclusion

Alkaline protease is used as an eco-friendly replacement for hazardous chemicals that are conventionally used for proteolysis. Their increasing demand compels the search for high yielding strains that can produce the enzyme under diverse conditions. Growth of isolates *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19 under mesophilic temperature and their capacity to use a wide range of carbon and nitrogen substrates indicates their ability to survive under varying agro-climatic and nutrient conditions. This suggests their possible use as high yielding strains for commercial production of alkaline protease and for their applications as safe solutions in maintaining environmental sustainability in various ways for different industries.

Compliance with ethical standards

Conflict of interest The authors have no conflict of interest.

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COLLABORATION RESEARCH AGREEMENT(CRA)

BETWEEN

PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India

AND

Institute of Genetics and Plant Experimental Biology of the Academy of Sciences of the Republic of Uzbekistan

This document constitutes an agreement between PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India and Institute of Genetics and Plant Experimental Biology of the Academy of Sciences of the Republic of Uzbekistan to collaborate on training, PhD studies, research and exchange programs.

I. PURPOSE

The purpose of this **Collaboration Research Agreement (CRA)** is intended as the starting point for collaboration to exploit the complementary nature of the strengths of research, teaching and enterprise and to focus primarily on collaborative research, faculty exchange and curriculum development.

II. AREAS OF COLLABORATION

- Genetics and Plant Breeding of medicinal plants, leguminous and oil crops
- Agrotechnology and Biotechnology of medicinal plants, leguminous and oil crops
- Physiology and Biochemistry of medicinal plants, leguminous and oil crops
- Plant microbe interactions
- Biological control of plant disease

III. RESPONSIBILITIES OF THE PARTIES

With these stated goals, both parties agree to:

- Consult faculty, departments and center to explore potential mutual beneficial research, applied research and community based research projects.
- Encourage units to cooperate in areas such as curriculum development, student and laboratory exchange for research, lectures, training and discussion that are mutually beneficial to the institutions.
- Setup collaborative training and/or research projects for mutual benefits
- Investigate outside funding sources for projects determined to be mutually beneficial to both institutions

IV. LIMITATIONS

- This CRA is neither a fiscal nor funds obligation document. Nothing in this MOU authorizes or is intended to obligate the parties to expend, exchange, or reimburse funds, services, or supplies, or transfer or receive anything of value, or to enter into any contract, assistance agreement, interagency agreement, or other financial obligation.
- This CRA in no way restricts either of the parties from participating in any activity with other public or private agencies, organizations, or individuals.

V. PERIOD OF AGREEMENT

This CRA shall enter into force as of the date of signature and will remain in force for a period of five years, after which, by mutual agreement, it may be extended for further periods of 5 years. Each organization should notify the other of its intention to terminate the Agreement six months prior to the expiration of each period.

The contact persons for the CRA shall be as follows for the each side:-

Signed on behalf of

Signature & Seal of the Head of the Institutions

Prof. Dr. R. S. Patil
Principal,
PSGVP Mandal's,
Arts, Science and Commerce College
SHAHADA (MS) 425409

Dr. R. Z. Sayyed
Head, Dept. of Microbiology
PSGVP Mandal's,
Arts, Science & Commerce College
SHAHADA (MS) 425409

Date: 19 Feb 2019

Prof. Abdujalil Narimanov
Director,
Institute of Genetics & Plant
Experimental Biology, Uzbekistan

PhD. Difluza Jabborova
Head of Laboratory of Medicinal Plants
Genetics and Biotechnology, Institute of
Genetics and Plant Experimental
Biology, Uzbekistan

Date: 19.02.2019.

।। तमसो मा ज्योतिर्गमय ।। ✆ - कार्या.(02565) 223597

सातपुडा शिक्षण प्रसारक मंडळ, धुळे संचलित

वसंतराव नाईक कला, विज्ञान व वाणिज्य महाविद्यालय,

शहादा जि.नंदुरबार

NAAC Accredited Web site - www.sspmvnc.org e-mail - principalvnc_shahada@yahoo.co.in

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जा.क्र. वनाम/व्याख्यानमाला/२०१९ दिनांक- ०४/०९/२०१९.

प्रति,
मा.प्रा.डॉ.गौतम कुंवर
अधिसभा सदस्य,
कबचौ उत्तर महाराष्ट्र विद्यापीठ, जळगांव.

विषय :- व्याख्यानासाठी उपस्थित राहणे बाबत..
संदर्भ :- कबचौउमवि/१६/व्या.माला/९९/२०१९ दिनांक-१३/०८/२०१९.

महोदय,

उपरोक्त विषय व संदर्भीय पत्रास अनुसरुन विनंती की, आमच्या महाविद्यालयास प्राप्त झालेल्या पत्रान्वये **संत कबीर व्याख्यानमाला** घेण्याची जबाबदारी आम्हास दिली आहे. त्यानुसार दिनांक-०५/०९/२०१९ रोजी होणाऱ्या कार्यक्रमास म्हणून आपण उपस्थित राहुन आम्हास उपकृत करावे.

कळावे,

आपला विश्वासू,

प्राचार्य
वसंतराव नाईक वरीष्ठ महाविद्यालय
शहादा, जि.नंदुरबार

॥ तमसो मा ज्योतिर्गमय ॥

सातपुडा शिक्षण प्रसारक मंडळ, धुळे संचलित

वसंतराव नाईक कला, विज्ञान व वाणिज्य महाविद्यालय,

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जा.क्र. वनाम/आभार पत्र/२०१९ दिनांक-०५/०९/२०१९.

प्रति,

मा.प्रा.डॉ.गौतम कुंवर

अधिसभा सदस्य,

कबचौउमवि, जळगांव.

महोदय,

वसंतराव नाईक कला, विज्ञान व वाणिज्य महाविद्यालयात दिनांक-05 सप्टेंबर-2019 रोजी संत कबीर व्याख्यानमाला निमित्त आपण आमच्या विनंतीस मान देवून या कार्यक्रमास हजर राहीलात तसेच विद्यार्थ्यांना प्रोत्साहनपर मार्गदर्शन केले त्याबददल महाविद्यालयाच्या वतीने आपले हार्दिक आभार.

धन्यवाद!

प्राचार्य,

वसंतराव नाईक महाविद्यालय,

शहादा जि.नंदुरबार.

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A RUSA Beneficiary and DBT Star Status Institution
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Principal : Prof. Dr. Rajendra Shankarrao Patil, M.Sc., M.Phil., Ph.D.

3.5.1.1 *Number of Collaborative activities for research, Faculty exchange, Student exchange/ internship during the year 2020-21*

Sl. No.	Title of the collaborative activity	Name of the collaborating agency with contact details	Name of the participant	Year of collaboration	Duration	Nature of the activity	Page No.
C1.	Sharing of facilities and Research Outcomes	National Centre For Celt Science, NCCS Complex, P.B. No. 40, Ganeshkhind, Pune - 411 007. India e- mail: infonccs@giaspn0l.vsnl.net.in	Dr. R. Z. Sayyed, M. S. Sonawane, M. H. Khairnar	2017	2017-2022	This MoU is purely meant for sharing the research facilities and research outcome between two Institutes, it does not involve any financial commitments from both the ends. Exchange of faculty and researchers. Joint Publications with NCCS and RZS.	05-17
C2.	Sharing of facilities and Research Outcomes	Uzbekistan academy of Sciences, Tashkent, Uzbekistan	R. Z. Sayyed, Kakhramon Davranov, Dilfuza Jabborova, Zafarjon Jabbarov	2019	2019-2024	**Research** - Joint publication, sharing of facilities	18-38
C3.	Basic Knowledge of Computer and Use of Computer in Research	Shri Govind Guru University, Godhra, Gujarat	Mahesh Bholehar Jagtap	2021	02/11/2021 One Day	**Faculty exchange** - Resource person	40

C4.	Mathematics in Biology	R.C.Patel Arts Commerce and Science college Shirpur	Dr. Chandrashekhar Shalik Sutar	2020	06/08/2020 One Day	**Faculty exchange -** Guest lecture	41
C5.	Natural products, synthetic organic chemistry, heterocyclic chemistry and guidance for short research project and NET-SET exam preparation	R.C.Patel Arts Commerce and Science college Shirpur	Dr. A. G. Beldar	2020	26/05202 to 30/05/2020 One day	**Faculty exchange -** Invited talk	42
C6.	Spectroscopy as a Tool for Recent Trends in Research	Govt P G. College, Sendhwa, Dist. Barwani (MP)	Dr. A. G. Beldar	2021	09/02/2021 One Day	**Faculty exchange -** Resource person	43
C7.	Spectroscopy : Basic to Advance NMR Spectroscopy	Govt P G. College, Sendhwa, Dist. Barwani (MP)	Dr. A. G. Beldar	2021	10/03/2021 One Day	**Faculty exchange -** Invited talk	44
C8.	PGPR: Multipurpose solution for sustainable agriculture	Enviornment and social development association, Delhi	Prof. Dr. Riyaz Sayyed	2020	25/07/20 To 27/07/20 One Day	**Faculty exchange -** Keynote speaker	45

C9.	1st Asian PGPR Indonesia Chapter International Conference Sustainable Agriculture and Ecotourism	Udayana University, Bali-Indonesia	Prof. Dr. R. Z. Sayyed	2021	28/08/21 To 30/08/21 One Day	**Faculty exchange** - Guest Lecture	46
C10.	Effects of Covid on local National and international tourism	Bpcs's Dadasaheb Devidas Namdeo Bhole College Bhusawal, Dist.Jalgaon (Ms)	Dr. Uttam Vedu Nile	2020	20/8/2020 One Day	**Faculty exchange** - Resource person	47
C11.	Rural Development and Tramsformation of Rural Enviornment	Govt. College, Patharia, Damoh (MP)	Dr. Uttam Vedu Nile	2021	12/01/2021 One Day	**Faculty exchange** - Resource person	48
C12.	Widowhood in the Indian Society	Shri. Kumarswami Mahavidyalaya, Ausa, Dist. Latur	Dr. M. M. Jogi	2021	01/12/20 To 08/01/2021 One Day	**Faculty exchange** - Resource person	49
C13.	Recent Trends in Research Methodology in Life Sciences	Vasantdada Patil ASC College, Patoda, Dist. Beed (MS)	Dr. M. M. Jogi	2021	14/09/2021 One Day	**Faculty exchange** - Resource person	50
C14.	Industry specific challenges, job skills, and career trends in post COVID 19 scenario	ST Co-op Edu. Society's Ltd. Science Sr. College, Shahada, Dist. Nandurbar	Dr. M. K. Patil	2021	04/06/2021 One Day	**Faculty exchange** - Resource person	51

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C15.	Advances in spectral analysis andnanotechnology for chemical and physical sciences	PBCS'S Dadasaheb Devidas Namdeo Bhole College, Bhusawal	Dr. M. K. Patil	2020	02/07/2020 One Day	**Faculty exchange -** Session Chairman	52
C16.	हिंदी साहित्य की सामाजिक उपादेयता	P E Society's Modern College of Art's,Sci.And Comm.Shivajinagar,Pune	Dr. Vijayprakash Omprakash Sharma	2021	28/09/2021 One Day	**Faculty exchange -** Guest Lecture	53
C17.	Vishva Kavita Divas, Kavi Sammelan	Maharashtra Shashan,Maharashtra Rajya Hindi Sahitya Akadami,Mumbai	Dr. Vijayprakash Omprakash Sharma	2021	20/03/2021 One Day	**Faculty exchange -** Invited talk	54
C18.	Workshop on Elearning for Students	SPDM Arts, Commerce and Sceince College, Shirpur, Dist. Dhule	Dr. M. K. Patil	2020	16/08/2020 One Day	**Faculty exchange -** Chief Guest	55
C19.	World biodiversity day	ST Co-op Edu. Society's Ltd. Science Sr. College, Shahada, Dist. Nandurbar	Dr. Hitendra P Jadhav	2021	23/05/2021 One Day	**Faculty exchange -** Resource person	56

(Prof. Dr. R. S. Patil)
Principal
Principal
PSGVPM's S.I.Patil Arts, G.B.Patel Science
& S.T.K.V.S Comm. College, Shahada,
Dist.Nandurbar(M.S.)

NCCS

राष्ट्रीय कोशिका विज्ञान केन्द्र

National Centre For Cell Science

जैवप्रौद्योगिकी विभाग, भारत सरकार का स्वायत्त संस्थान

(An Autonomous Institution of the Department of Biotechnology, Government of India)

MEMORANDUM OF UNDERSTANDING FOR COLLABORATIVE RESEARCH

Between

Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India,

And

National Centre for Microbial Resource formarly Microbial Culture Collection, National Centre for Cell Science, PUNE 411021, Maharashtra, India.

This Memorandum of Understanding (MOU) is signed between Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA and Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India.

That this MOU is purely meant for sharing the research facilities and research outcome between two institutes, it does not involve any financial commitments from both the ends.

That the Staff, Research Scholars and Post Graduate students of Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA will screen, isolate and will perform the preliminary characterization of potential bacterial cultures and Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India will perform 16s rRNA gene sequence, phenotypic finger printing, BIOLOG and GC-FAME analysis of the partially characterized bacterial cultures.

That any outcome in the form of technology, patent, R & D project or publication arising out of this collaborative research will be equally shared between the concerned staff, scholars and Post Graduate students of Department of Microbiology of PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA and concerned staff, Scientist and technician of Microbial Culture Collection Center, PUNE 411 021, Maharashtra, India.

1). Head, Dept of Microbiology, PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, INDIA. **E-mail: sayyedrz@gmail.com, Tel** 02565 229576	
Witness : **Dr. M. K. Patel, IQAC Coordinator,** PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, MS, INDIA. **Tel** 02565 229576	
Head of Institution : **Prof. Dr. R. S. Patil, Principal,** PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra,INDIA. **E-mail :principal.shahada@gmail.com, Tel** 02565 229576	
2). **Prof. Yogesh S Shouche, Scientist F**, and In-Charge NCMR, NCCS, Pune. (An Autonomous Institute of DBT, Govt. of India) **E-mail : yogesh@nccs.res.in Tel:** +91-20-25329026	

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Production of alkaline protease by rhizospheric Bacillus cereus *HP_RZ17 and* Paenibacillus xylanilyticus *HP_RZ19*

H. P. Jadhav, M. S. Sonawane, M. H. Khairnar & R. Z. Sayyed

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ORIGINAL ARTICLE

Production of alkaline protease by rhizospheric *Bacillus cereus* HP_RZ17 and *Paenibacillus xylanilyticus* HP_RZ19

H. P. Jadhav[1] · M. S. Sonawane[2] · M. H. Khairnar[2] · R. Z. Sayyed[1]

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Abstract

Alkaline protease of microbial sources is remarkably stable, highly active, and produced conveniently at a large-scale in a more cost-effective way. Owing to higher activity and more stability at alkaline pH, the enzyme has attracted significant commercial interest in many fields. Although alkaline protease is produced by a large number of microbes; however, the search for high yielding novel strains and optimization for getting more yields are always desired. Therefore, the aim of the present research work was to search and select high yielding strains and to optimize the physicochemical parameters for better yield of alkaline protease. A total of 09 protease positive isolates were obtained from the rhizosphere of various crop plants such as peanut (*Arachis hypogaea*), cotton (*Gossypium hirsutum*), banana (*Musa acuminata*) and papaya (*Carica papaya*). Two of these isolates, namely HP_RZ17 and HP_RZ19 produced a copious amount of protease. These isolates were later identified as *Bacillus cereus* HP_RZ17 and *Paenibacillus xylanilyticus* HP_RZ19. The influence of various physicochemical factors were studied by one variable at a time (OVAT) approach where only one factor was varied keeping other factors constant and the results were statistically analyzed using the Student's *t* test. The optimized protocol resulted in a 2.45 and 3.04-fold increase in the production of protease by *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19, respectively.

Keywords Alkaline protease · *Bacillus* · *Paenibacillus* · Optimization · 16S rRNA sequencing

Introduction

The alkaline proteases (EC.3.4.21–24.99) have become commercially significant group of microbial enzymes, acquiring about 60% share of the global enzyme market. They are widely used in agro-industries as biocontrol agents (BCAs) and for plant growth promotion, in pharmaceuticals for drug development, in food processing, in detergent industries for removing stains and in leather processing, etc. Their demand is expected to increase in the upcoming period (Chew et al. 2019) and this compels the need to produce the enzyme in more amounts. Owing to their higher activity, ease in genetic modification, availability at large scale, convenience in processing and application and safe and cost-effective production besides high stability and ability to function over the broader pH and temperature range, microbial protease have gained more significance than the plant or animal sources (Jadhav et al. 2017).

A wide variety of soil microorganisms produce alkaline proteases (Jadhav and Sayyed 2016; Jadhav et al. 2017), however, the plant growth promoting rhizobacteria (PGPR) that produce this enzyme are of major agricultural significance due to their role as BCAs (Sayyed et al. 2019; Akinrinlola et al. 2018; Shaikh et al. 2018) against phytopathogens like *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus wentii*, *Alternaria alternata*, *Byssochlamys fulva*, *Botrytis cinerea* (Földes et al. 2000; Tewari et al. 2019). Although various strains of *Bacillus* sp. viz; *B. subtilis* GB03, *B. pumilus* GB34, *B. thuringiensis* BMP123, *B. amyloliquefaciens* FZB24, etc. are in use as PGPR cum BCAs, however, only those strains that produce the best amount of protease extracellularly will have significant commercial value. In order to get the best yield of enzyme, it is necessary to know and

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s42398-020-00096-z) contains supplementary material, which is available to authorized users.

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optimize the physicochemical and nutritional factors that regulate the production (of enzyme) (Souza et al. 2017; Asha and Palaniswamy 2018). This study was aimed to isolate high yielding PGPR from the rhizosphere and to optimize the protocol for enhanced production of protease by them.

Materials and methods

Sample collection

Rhizospheric soil from various plants such as peanut (*Arachis hypogaea*), cotton (*Gossypium hirsutum*), banana (*Musa acuminata*) and papaya (*Carica papaya*) around Shahada, North Maharashtra, India (21°34′04.5″ N 74°32′05.6″ E) were used for the isolation of protease producing bacteria. Samples were collected from four different corners and centers of field (of each crop) and were mixed to make a composite sample.

Isolation of bacteria from rhizosphere soil

A 10 g of soil sample from each rhizosphere was transferred into each 100 mL of sterile distilled water and shaken at 120 rpm for 30 min for proper mixing. A 0.1 mL of an aliquot (10^{-4}) was spread on sterile nutrient agar plate and incubated at 30 ± 2 °C for 24–48 h (Mukhtar et al. 2019). Morphologically different bacterial isolates were purified and preserved in 20% (v/v) glycerol with phosphate buffer (pH 7.0) until further use.

Screening of protease producing bacteria

For screening of proteolytic activity, each isolate was grown on skim milk agar (SMA) containing (g L^{-1}), skim milk powder 28, casein enzyme hydrolysate 5.0, yeast extract 2.5, dextrose 1.0 and agar 20 at 30 ± 2 °C for 24–48 h. Colonies showing zone of protein hydrolysis were selected as protease producer isolate (Jani et al. 2016). Extent of protease production was determined based on the diameter of the zone of protein hydrolysis around the colonies.

Production and quantitative estimation of protease

For the quantitative estimation of protease, isolates showing the maximum zone of proteolysis were selected. For this purpose all 09 protease positive isolates were separately grown in minimum salt medium (MSM) containing (g L^{-1}) KH_2PO_4 0.2, $MgSO_4$ 0.5, NaCl 0.5, $CaCl_2$ 0.5, peptone 10 at 30 °C for 48 h at 120 rpm (Saraswathy et al. 2013). After incubation, broth cultures were centrifuged at 10,000 rpm for 10 min at 4 °C and the cell-free supernatant was assayed for alkaline protease activity with casein as a substrate (Sevinc and Demirkan 2011). A 1 mL of 0.65% casein prepared in 20 mM phosphate buffer (pH 7) and 1 mL enzyme solution was incubated at 37 °C for 10 min. The reaction was stopped by adding 5 mL of 110 mM Tri-chloroacetic acid (TCA) and the precipitated proteins were separated by centrifugation (10,000 rpm for 10 min). The number of tyrosine units liberated was estimated by incubating 1 mL of the supernatant in 5 mL of 500 mM Na_2CO_3 at 30 °C for 20 min followed by the addition of 1 mL Folin–Ciocalteu reagent. Absorbance was measured at 660 nm against the reference (without enzyme) (Cupp-Enyard 2008). One unit of protease activity was defined as the amount of enzyme that liberates 1 µg tyrosine mL^{-1} min^{-1} from casein (Kim et al. 2016). The protein content of the sample was estimated as per Lowry et al. (1951) with bovine serum albumin as standard. The concentration of protein in the test sample was calculated using the following equation:

$$y = mx + b,$$

where, y—absorbance, m—slope (0.0008), x—concentration of unknown, b–y-intercept (0.0472).

Optimization of protease production

Influence of incubation period

Incubation period is one of the crucial physical factors in bacterial growth and enzyme synthesis as it determines the peak period for production and catabolism of any metabolite. In order to know the exact incubation period required for optimum growth and protease production, isolates HP_RZ17 and HP_RZ19 were separately grown in MSM at 30 °C for 96 h at 120 rpm. Samples withdrawn after every 6 h intervals were subjected for measurment of growth and enzyme activity.

Influence of media pH

The pH of the medium regulates growth of organisms and their ability to produce metabolites. In order to find the optimum pH for good growth and best protease production, isolates HP_RZ17 and HP_RZ19 were separately grown in MSM prepared with various pH in the range 4.0 to 14.0. The pH of MSM was adjusted with 0.1 N HCL and NaOH. Inoculated media were incubated at 30 °C for 48 h at 120 rpm. Following the incubation, growth and protease activity was measured.

Influence of incubation temperature

Incubation temperature is yet another parameter that determines metabolite production. It varies from organism to

organism and hence needs optimization (for each organism) (Abusham et al. 2009). In order to know the optimum temperature required for maximum bacterial growth and production of protease, isolates HP_RZ17 and HP_RZ19 were separately grown in MSM for 48 at 120 rpm at various temperatures in the range from 20 to 50 ± 2 °C. Following the incubation, growth and protease activity was measured.

Influence of concentration of inoculum

Production of an enzyme or any metabolite depends on initial inoculum density. Therefore, it is necessary to decide the optimum level of inoculum for maximum production of enzyme. In order to determine the optimum level of inoculum lag phase (OD ~ 0.3 at 600 nm), log phase cultures of isolates HP_RZ17 and HP_RZ19 were separately inoculated in MSM in the range 0.5, 1.0, 1.5 and 2% v/v at 30 °C for 48 h at 120 rpm. Following the incubation, measurement of growth and protease activity was performed.

Influence of carbon source

The source of carbon regulates cell growth of an organism and thereby metabolite production. The type of carbon substrate required by organisms varies from organism to organism and therefore, it is necessary to select the best utilizable carbon source for good growth and higher production of metabolite. In order to decide the best carbon source for good growth and higher production of protease sugars, like glucose, fructose, sucrose, lactose, maltose, and dextrose were added (1% w/v) in MSM, isolates HP_RZ17 and HP_RZ19 were separately grown in each sugar at 30 °C for 48 h at 120 rpm. Following the incubation, growth and protease activity were estimated.

Influence of nitrogen source

Since all the enzymes contain amino groups, type of nitrogen substrate plays a vital role in the synthesis of enzymes. In order to decide the best nitrogen substrate for cell growth and enzyme production, peptone of MSM was replaced by casein, tryptone, yeast extract, urea, ammonium nitrate (NH_4NO_3) and ammonium chloride (NH_4Cl_2) (1.0% w/v). Isolates HP_RZ17 and HP_RZ19 were separately grown in each modified MSM at 30 °C for 48 h at 120 rpm. Following the incubation, growth and protease activity were measured.

Protease production in optimized medium

Protease production was carried out in MSM having all the optimized parameters. For this purpose, both the isolates were separately grown in MSS at 30 °C for 48 h at 120 rpm. Following the incubation, growth and protease activity were measured.

Identification of isolate by 16S rRNA gene sequencing

The genomic DNA of the isolate was separated as per the method of Sambrook and Russell (2001). The 16S rRNA genes of the isolates were amplified with universal primers 27F (5′-GAGTTTGATCMTGGCTCAG-3′) and 1525R (5′-AAGGAGGTGATCCAGCC-3′) using Gene Amplifier PCR System 9700 (Perkin Elmer, USA). The polymerase chain reaction (PCR) was set up with 20–50 ng of DNA. The 16S rRNA gene was amplified by following protocol—initial denaturation at 94 °C for 5 min, 35 cycles of denaturation at 94 °C for 1 min, annealing at 55 °C for 1 min and extension at 72 °C for 1 min, final extension at 72 °C for 7 min with a final hold at 20 °C. The resulting PCR products were purified on 1.0% agarose gel and sequenced on ABI 3730Xl automated sequencer using a ready reaction kit (Perkin Elmer Applied Biosystems Division, CA). Amplified sequences were identified from NCBI (http://www.ncbi.nlm.nih.gov) and EzTaxon (http://www.eztaxon.org) database and phylogenetic trees were constructed by using the neighbor-joining method with the help of MEGA5 software (Sonawane et al. 2016).

Statistical analysis

The experimental data mentioned is the mean of three replicates. Analysis of resulting data was performed by using the Student's *t* test and the values of $p \leq 0.05$ were considered as statistically significant (Parker 1979).

Results

Isolation and screening of protease producing microbes

Zone of protein hydrolysis was observed around the colonies of 9 isolates; 5 isolates from peanut (*A. hypogaea*), 1 from cotton (*G. hirsutum*), 2 from banana (*M. acuminate*) and 1 from papaya (*C. papaya*) rhizospheric soil. The maximum zones of protein hydrolysis were observed in the case of isolate HP_RZ17 (Supplementary Fig. 1A) and HP_RZ19 (Supplementary Fig. 1B). All the isolates exhibiting proteolytic activity were evaluated for their ability to produce maximum amount of protease (Jani et al. 2016).

Production and quantitative estimation of protease

Among these 9 isolates, HP_RZ17 (49.8 U mL^{-1}) and HP_RZ19 (34.8 U mL^{-1}) produced higher amounts of protease (Table 1), hence these were considered as potent protease producers and were selected for further studies.

Optimization of protease production

Influence of incubation period

The incubation period of 48 h appeared as the best suitable for the production of protease by isolates HP_RZ17 and HP_RZ19 in MSM (Table 2; Fig. 1a, b). In both the isolates, protease production started during the beginning of log-phase (6 h of incubation) and continued up to 48 h. Optimum protease activity (46.36 U mL^{-1} and 52.18 U mL^{-1}) was recorded at 48 h of incubation in HP_RZ17 and HP_RZ19.

Influence of media pH

Both the isolates produced higher amounts of protease at alkaline pH. In the case of HP_RZ17, alkaline pH (11.00) resulted in higher enzyme yield (87.99 U mL^{-1}) while in the case of isolate HP_RZ19, pH 10.00 gave the best protease yield (73.23 U mL^{-1}) (Table 2). Acidic pH (4.0) affected the enzyme yield at this pH isolate HP_RZ17 and HP_RZ19 produced minimum protease i.e. 27.57 U mL^{-1} and 26.43 U mL^{-1}, respectively.

Influence of incubation temperature

Isolates HP_RZ17 and HP_RZ19 produced an optimum amount of protease (36.45 and 50.06 U mL^{-1}) at 30 °C. Incubation temperature below or above 30 °C affected the yield of protease (Table 2). A 30 °C incubation temperature was found to be the best suitable for the higher production of protease.

Table 1 Protease activity of isolates (un-optimized)

Colony code	Genebank submission	Mean enzyme activity (U mL^{-1})
HP_RZ11	*Brevibacillus brevis* HP_RZ11	22.0
HP_RZ12	*Brevibacillus brevis* HP_RZ12	25.4
HP_RZ13	*Brevibacillus brevis* HP_RZ13	23.2
HP_RZ14	*Brevibacillus brevis* HP_RZ14	26.8
HP_RZ15	*Bacillus cereus* HP_RZ15	29.4
HP_RZ16	*Bacillus cereus* HP_RZ16	32.5
HP_RZ17	*Bacillus cereus* HP_RZ17	49.8
HP_RZ18	*Bacillus cereus* HP_RZ18	31.2
HP_RZ19	*Paenibacillus xylanilyticus* HP_RZ19	34.8

Influence of concentration of inoculum

The best inoculum levels for the higher production of protease by HP_RZ17 (57.54 U mL^{-1}) and HP_RZ19 (63.44 U mL^{-1}) were 1.5% and 0.5% (Table 2). Inoculum levels of 1.0% and 2% resulted in the lowest enzyme activity in HP_RZ17 (52.04 U mL^{-1}) and HP_RZ19 and (34.48 U mL^{-1}).

Influence of carbon source

Among various carbon sources, fructose appeared as the best for higher production of protease by both the isolates. Protease production was negatively affected by maltose and dextrose (Table 2).

Influence of nitrogen source

In this case, the best suitable nitrogen substrate for isolate HP_RZ17 was yeast extract; it yielded a protease activity of 103.45 U mL^{-1}. While in the case of isolate HP_RZ19, the best suitable nitrogen source was casein; as it gave a maximum protease activity of 92.51 U mL^{-1} (Table 2).

Protease production in optimized medium

Medium prepared using the above-optimized parameters (best selected conditions) resulted in 2.45-fold (144.99%) and 3.04-fold (204.6%) increase in protease production by HP_RZ17 and HP_RZ19, respectively.

Identification of isolate by 16S rRNA gene sequencing

The phylogenetic tree and NCBI blast comparison of isolates HP_RZ17 and HP_RZ19 showed 100% and 98.70% identity with *B. cereus* (Fig. 2a) and *P. xylanilyticus* (Fig. 2b). The gene sequences of the isolates were submitted to NCBI gene bank under the name *Bacillus cereus* HP_RZ17 and *Paenibacillus xylanilyticus* HP_RZ19 with Genebank accession number MH235735 and MH235731, respectively. *B. cereus* HP_RZ17 has been deposited in National Center for Microbial Resources (NCMR)-NCCS Pune, Maharashtra, India under the accession No. MCC4158. Deposition of *P. xylanilyticus* is under process at NCMR.

Discussion

The rhizosphere is a nutrient-rich site and favors the growth of various groups of organisms. However, the ability of organisms to use various substrates is determined by its capacity to produce multiple enzymes (Thakkar and Saraf

Table 2 Influence of various parameters on alkaline protease production by *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19

INCU (h)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	pH	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	INTE (°C)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	NIS (1% w/v)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	CS (1% w/v)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})	INOC (% v/v)	HJ17 EA (U mL^{-1})	HJ19 EA (U mL^{-1})
0	0^{ND}	0^{ND}	4.00	27.57^{NS}	26.43^{NS}	20	25.02*	23.50^{NS}	PEP	81.94*	72.66*	Glu	88.62*	64.07*	0.5	50.49^{NS}	63.44*
6	0*	0.21*	5.00	29.98^{NS}	35.56*	25	26.25*	28.63*	CAS	84.66*	92.51*	Fru	119.75*	102.22*	1.0	52.04*	55.87*
12	18.78^{NS}	21.38^{NS}	6.00	41.15*	45.56*	30	36.45*	50.06*	TRY	63.64*	47.57*	Suc	49.26*	17.12*	1.5	57.54*	42.35^{NS}
18	27.17*	33.16*	7.00	59.80*	61.86*	35	26.00*	45.50*	YEX	103.45*	15.83*	Lac	35.25^{NS}	49.51*	2.0	55.39*	34.48^{NS}
24	37.91*	48.00*	8.00	63.98*	64.30*	40	24.88*	40.49*	URE	23.39*	13.94*	Mal	63.26*	50.60*			
30	41.41*	48.25*	9.00	72.63*	66.13*	45	20.50*	33.64*	AMN	11.82^{NS}	07.81^{NS}	Dex	55.99*	18.03^{NS}			
36	43.24*	49.77*	10.00	80.34*	73.23*	50	13.88^{NS}	26.31*	AMC	19.69*	06.49*						
42	45.25*	52.01*	11.00	87.99*	68.31*												
48	46.36*	52.18*	12.00	81.77*	66.79*												
54	46.13*	52.15*	13.00	79.28*	65.61*												
60	45.59*	50.60*	14.00	77.99*	64.38*												
66	44.01*	48.77*															
72	42.52*	48.37*															
78	43.36*	47.08*															
84	42.55*	46.68*															
90	42.52*	46.05*															
96	40.75*	45.76*															

INCU incubation period, *INOC* inoculum concentration, *INTE* incubation temperature, *HJ17 B. cereus* HP_RZ17, *HJ19 P. xylanilyticus* HP_RZ19, *EA* enzyme activity, *pH* media pH, *NIS* nitrogen source, *CS* carbon source, *PEP* peptone, *CAS* casein, *TRY* tryptone, *YEX* yeast extract, *URE* urea, *AMN* ammonium nitrate, *AMC* ammonium chloride, *Glu* glucose, *Fru* fructose, *Suc* sucrose, *Lac* lactose, *Mal* maltose, *Dex* dextrose, *ND* not determined, "*" statistically significant at $p \leq 0.05$, *NS* statistically non-significant at $p \leq 0.05$

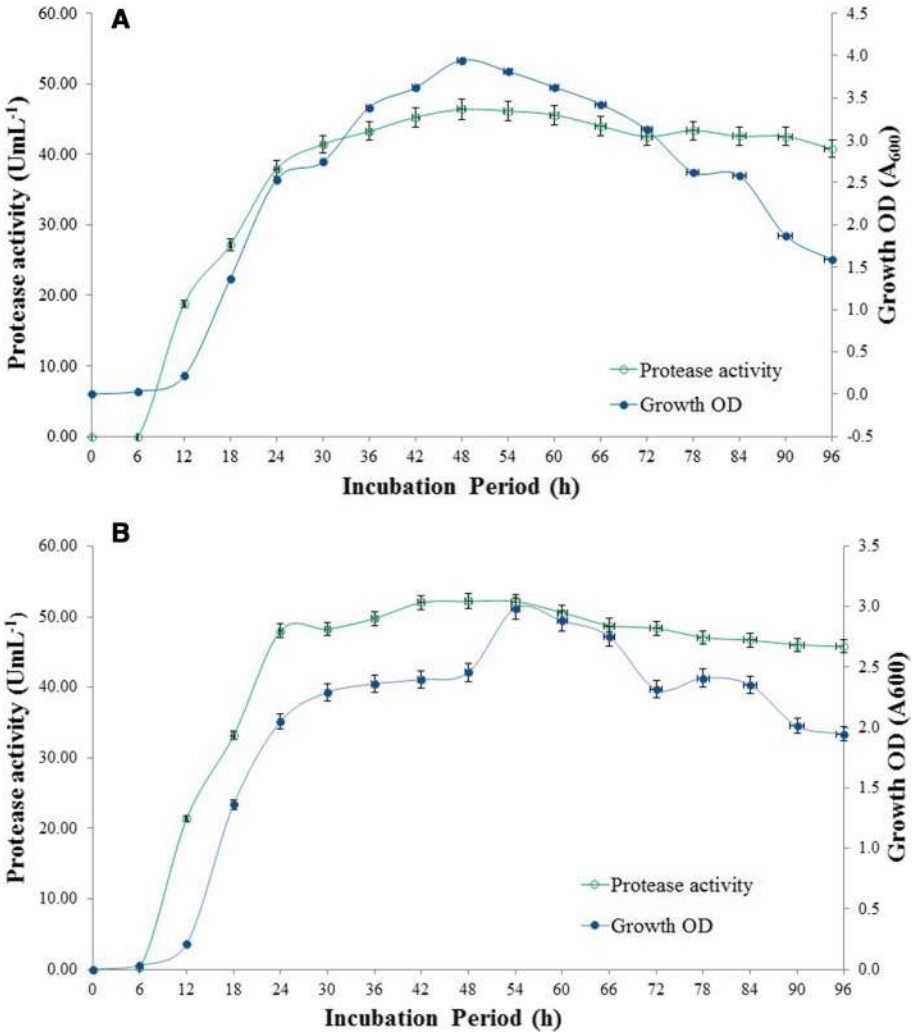

Fig. 1 **a** Growth kinetics and alkaline protease activity of *B. cereus* HP_RZ17 in MSM. Cell density and protease activity were monitored after every 6 h interval. **b** Growth kinetics and alkaline protease activity of *P. xylanilyticus* HP_RZ19 in MSM. Cell density and protease activity were monitored after every 6 h interval

2014). A microbe having diverse metabolic potential will dominate over the other groups. The ability of isolates *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19 to secrete protease reflected their metabolic potential of utilizing diverse protein substrates. Production of copious amounts of protease may be due to the reason that root exudates are rich in protein content (Thakkar and Saraf 2014).

The best level of enzyme production at 48 h corresponded to the late exponential phase of the growth of both the isolates. Marathe et al. (2018) have also reported the best alkaline protease production in *B. subtilis* during 48 h of incubation. While a decrease in protease production in both isolates after 48 h may be due to the change in pH of media as a result of enzyme production, depletion of nutrients, and due to denaturation of the enzyme (Oumer and Abate 2018).

Production of protease at alkaline pH and mesophilic temperature conditions support the alkali nature and stability of the enzyme. This property makes it useful for the application of these isolates in alkaline soil (Contesini et al. 2018).

Large numbers of *Bacillus* sp. viz *Paenibacillus* sp. B2, *B. amyloliquefaciens* CPA-8, *B. stratosphericus* FW3, *B. velezensis* G341, *B. pumilus* JUBCH08, *B. alvei,* and *B. polymyxa* HS-26 isolated from rhizosphere are known to secrete protease and are in use as BCAs (Arfaoui et al. 2019; El-Sayed et al. 2019; Farzand et al. 2019; Gotor-Vila et al. 2019; Tewari et al. 2019; Wang et al. 2019).

Chantawannakula et al. (2002) have reported higher production of protease in *B. subtilis* strain at 30 °C. Gouda (2006) has reported an optimum yield of alkaline protease at 30 °C. Anandharaj et al. (2016) have observed a similar pattern of alkaline protease production in *B. alkalitelluris* TWI3 and *B. clausii*. Cui et al. (2015) have reported higher yield of alkaline protease at a broad pH range (8.0–11.0) in a marine bacterium.

High inoculum concentration with respect to the dissolved oxygen in the medium decreases the production of the enzyme while low inoculum levels lengthen the duration of lag phase leading to delay in the production time (Limkar et al. 2019). Hui et al. (2019) have claimed that a

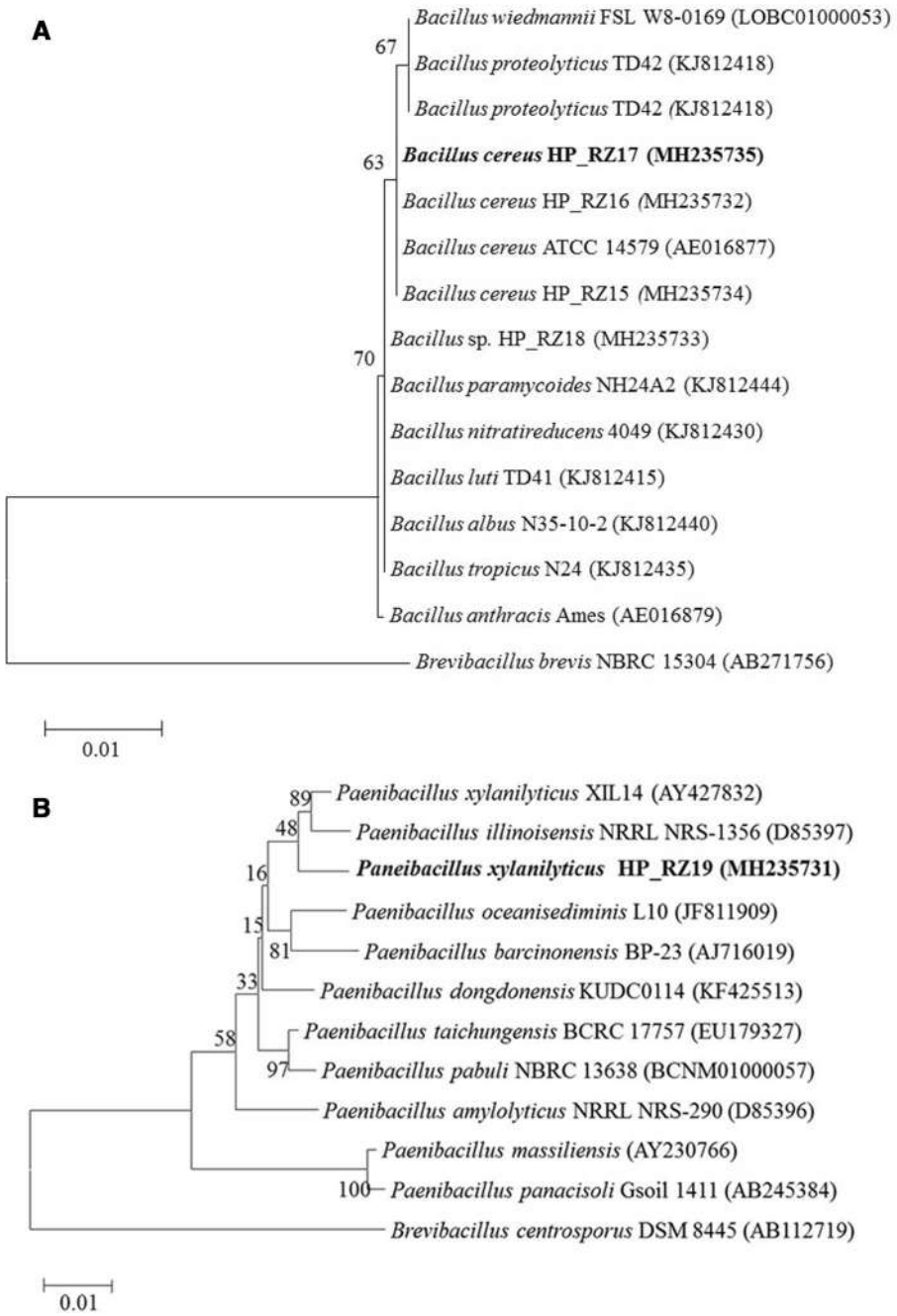

Fig. 2 **a** Phylogenetic tree of *B. cereus* HP_RZ17 based on the 16S rRNA gene sequence drawn using the neighbor-joining method. **b** Phylogenetic tree of *P. xylanilyticus* HP_RZ19 based on the 16S rRNA gene sequence drawn using the neighbor-joining method

higher concentration of inoculum supports more cell growth and decreases the concentration of ammonia that affects the production of the enzyme. Hence, optimization of inoculum concentration is important for better production of the enzyme/metabolite.

The types of carbon and nitrogen sources affect the production of extracellular enzymes. The physiological mechanisms regulate the enzyme production and catabolite repression that are channelized by carbon substrates. Patel et al. (2018) have reported 1.25-fold increase in alkaline protease production in *B. cereus* AG1 with fructose as a sole source of carbon. Reports on the production of alkaline protease by *Bacillus* sp. mention that fructose is one of the significant carbon sources required for optimum production of protease (Sevinc and Demirkan 2011) as also proven in the present study.

Maximum enzyme production in the presence of yeast extract is due to the fact that it is a complex nitrogen source and provides a complete pool of amino acids required for the synthesis of the enzyme (Habicher et al. 2019). Briki et al. (2016) and Kim et al. (2016) have reported higher production of alkaline protease with yeast extract, casein,

and peptone as sole source of nitrogen in *Bacillus* sp. SB12 and *B. subtilis* FBL-1.

The selected isolates *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19 having the ability to produce good amounts of protease under diverse physicochemical and nutritional conditions and over the wide range of pH and temperature may have great demands in various fields and industries and were thus deposited in culture collection center.

Conclusion

Alkaline protease is used as an eco-friendly replacement for hazardous chemicals that are conventionally used for proteolysis. Their increasing demand compels the search for high yielding strains that can produce the enzyme under diverse conditions. Growth of isolates *B. cereus* HP_RZ17 and *P. xylanilyticus* HP_RZ19 under mesophilic temperature and their capacity to use a wide range of carbon and nitrogen substrates indicates their ability to survive under varying agro-climatic and nutrient conditions. This suggests their possible use as high yielding strains for commercial production of alkaline protease and for their applications as safe solutions in maintaining environmental sustainability in various ways for different industries.

Compliance with ethical standards

Conflict of interest The authors have no conflict of interest.

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COLLABORATION RESEARCH AGREEMENT(CRA)

BETWEEN

PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India

AND

Institute of Genetics and Plant Experimental Biology of the Academy of Sciences of the Republic of Uzbekistan

This document constitutes an agreement between PSGVP Mandal's Arts, Science and Commerce College, SHAHADA 425409, Maharashtra, India and Institute of Genetics and Plant Experimental Biology of the Academy of Sciences of the Republic of Uzbekistan to collaborate on training, PhD studies, research and exchange programs.

I. PURPOSE

The purpose of this **Collaboration Research Agreement (CRA)** is intended as the starting point for collaboration to exploit the complementary nature of the strengths of research, teaching and enterprise and to focus primarily on collaborative research, faculty exchange and curriculum development.

II. AREAS OF COLLABORATION

- Genetics and Plant Breeding of medicinal plants, leguminous and oil crops
- Agrotechnology and Biotechnology of medicinal plants, leguminous and oil crops
- Physiology and Biochemistry of medicinal plants, leguminous and oil crops
- Plant microbe interactions
- Biological control of plant disease

III. RESPONSIBILITIES OF THE PARTIES

With these stated goals, both parties agree to:

- Consult faculty, departments and center to explore potential mutual beneficial research, applied research and community based research projects.
- Encourage units to cooperate in areas such as curriculum development, student and laboratory exchange for research, lectures, training and discussion that are mutually beneficial to the institutions.
- Setup collaborative training and/or research projects for mutual benefits
- Investigate outside funding sources for projects determined to be mutually beneficial to both institutions

IV. LIMITATIONS

- This CRA is neither a fiscal nor funds obligation document. Nothing in this MOU authorizes or is intended to obligate the parties to expend, exchange, or reimburse funds, services, or supplies, or transfer or receive anything of value, or to enter into any contract, assistance agreement, interagency agreement, or other financial obligation.
- This CRA in no way restricts either of the parties from participating in any activity with other public or private agencies, organizations, or individuals.

V. PERIOD OF AGREEMENT

This CRA shall enter into force as of the date of signature and will remain in force for a period of five years, after which, by mutual agreement, it may be extended for further periods of 5 years. Each organization should notify the other of its intention to terminate the Agreement six months prior to the expiration of each period.

The contact persons for the CRA shall be as follows for the each side:-

Signed on behalf of

Signature & Seal of the Head of the Institutions

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Article

Co-Inoculation of Rhizobacteria and Biochar Application Improves Growth and Nutrientsin Soybean and Enriches Soil Nutrients and Enzymes

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Abstract: Gradual depletion in soil nutrients has affected soil fertility, soil nutrients, and the activities of soil enzymes. The applications of multifarious rhizobacteria can help to overcome these issues, however, the effect of co-inoculation of plant-growth promoting rhizobacteria (PGPR) and biochar on growth andnutrient levelsin soybean and on the level of soil nutrients and enzymes needs in-depth study. The present study aimed to evaluate the effect of co-inoculation of multifarious *Bradyrhizobium japonicum* USDA 110 and *Pseudomonas putida* TSAU1 and different levels (1 and 3%) of biochar on growth parameters and nutrient levelsin soybean and on the level of soil nutrients and enzymes. Effect of co-inoculation of rhizobacteria and biochar (1 and 3%) on the plant growth parameters and soil biochemicals were studied in pot assay experiments under greenhouse conditions. Both produced good amounts of indole-acetic acid; (22 and 16 µg mL^{-1}), siderophores (79 and 87%SU), and phosphate solubilization (0.89 and 1.02 99 g mL^{-1}). Co-inoculation of *B. japonicum* with *P. putida* and 3% biochar significantly improved the growth and nutrient content ofsoybean and the level of nutrients and enzymes in the soil, thus making the soil more fertile to support crop yield. The results of this research provide the basis of sustainable and chemical-free farming for improved yields and nutrients in soybean and improvement in soil biochemical properties.

Keywords: biochar; *Bradyrhizobium japonicum*; *Pseudomonas putida*; plant growth; plant nutrients; soil enzymes; soil nutrients; soybean

1. Introduction

The global climate scenario is experiencing a drastic depletion of soil nutrients due to various anthropogenic activities, burning of fossil fuel, and excess use of agrochemicals [1]. Applications of plant-growth promoting rhizobacteria (PGPR) and biochar have been advocated as an effective, cheap, and sustainable approach for the replenishment of crop health, crop nutrients, and soil nutrients and enzymes and for improving and sustaining soil fertility [2]. Furthermore, these amendments have a positive impact on the growth [3], development, and yield of several crops [4,5]. Various reports claimed that the application of plant growth-promoting rhizobacteria (PGPR) and biochar improves plant growth, plant nutrients, and physicochemical properties of soil [6–8]. Moreover, such applications of biochar also keep a check onatmospheric CO_2 levels [9] and, thus, contribute todecrease global warming effects [10], while the use of PGPR to increase soil fertility and plant nutrients will help to reduce the doses of agrochemicals in the field [11].

A wide variety of symbiotic bacteria, such as *Rhizobium* sp. and *B. japonicum*, etc., have been reported to promote seed germination, the growth of root and shoot, andthe level of nutrients in soybean and also improve soil biochemical properties [4,5].Rhizobia-legumes symbiosis plays a vital role in increasing crop yields, reducing the use of inorganic nitrogen fertilizers and improving soil fertility [12]. Rhizobial species are commonly used as inoculants in various parts of the world for improving the yield of legumes. Co-inoculation with multifarious *Bradyrhizobium* sp. and *Pseudomonas* sp. improves plant growth, plant, and soil nutrients and enzymes through the production of siderophores [13], phytohormones [14], enzymes [15], exopolysaccharide [16], stress tolerance [17], and phosphate solubilization [18–23], etc. Thus, several studies reported increases in nodules number, nodule weight, nitrogen fixed, plant growth, and yield of legumes due to co-inoculation with plant growth promoting *Bradyrhizobium* sp. and *Pseudomonas* sp. [12–14], while the combination of biochar with PGPR further increases root length, shoot length, nodule per plant, seed number, and yield of crops [5].

The activity of PGPR bioinoculants helps in improving the level of extracellular soil enzymes that facilitates the decomposition of soil organic matter and ensures the availability of nutrients in the soil [15]. Among the soil enzymes, proteases and acid and alkaline phosphomonoesterase are the major enzymes that mediate the hydrolysis of the protein and phosphate (P) into bioavailable amino acids, organic nitrogen, and soluble P [16]. However, the activities of these enzymes are governed by many factors, such as soil properties, soil organic matter level, and the presence of organic compounds [24]. We hypothesized that co-inoculation with *B. japonicum*+*P. putida* and biochar would facilitate the beneficial effects on soybean plant growth, plant nutrients, and soil nutrients and enzymes.

The present study was aimed at evaluating the effects of co-inoculation of multiple plant growth-promoting traits positive in *Bradyrhizobium japonicum* USDA 110 and *Pseudomonas putida* TSAU1 and different levels (1 and 3%) of biochar on seed germination, growth parameters, and nutrient levels in soybean and the level of nutrients and enzymes in soil. The outcome of this study may provide a better way of increasing soil fertility and increasing the growth and yield of soybean. This approach has multiple dimensions; as utilization of biochar is not only a cheaper option but will also help in solving the management issues of biochar, it is expected to minimize the doses of agrochemicals and produce chemical-free food. The consortium effect of PGPR and application of biochar provide excellent benefits to the farmers as theyincur less investment and yield more crop productivity, and this organically grown crop has more demand with a good selling price.

2. Materials and Methods

2.1. Bacterial Culture, Soybean, and Biochar

B. japonicum USDA 110 and *P. putida* TSAU1 strains were collected from the culture collection of the Department of Microbiology and Biotechnology, National University of Uzbekistan, Tashkent, Uzbekistan. Soybean (*Glycine max* L. Merr.) seeds were obtained from Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany.

The maize biochar (MBC) was collected from the Leibniz-Institute for Agriculture Engineering and Bioeconomy (ATB), Potsdam, Germany. Pyrolysis of MBC was carried out at 600 °C for 30 min and the chemical compositions of MBC were analyzed according to the method of Reibe et al. [25].

2.2. Screening for the Production of PGP Metabolites

B. japonicum USDA 110 and *P. putida* TSAU1 strains were screened for phosphate (P) solubilization on Pikovoskaya's agar and in Pikovoskaya's broth [26] for the production of indole-3-acetic acid (IAA)according to the method of Brick et al. [27], for production and estimation of siderophore according to the method of Patel et al. [28] and Payne [29], and the production and estimation of aminocyclopropane-1-carboxylate deaminase (ACCD) activity according to the method of Penrose and Glick [30]. The ACCD activity was measured as the amount of α-keto-butyrate produced per mg protein per h.

2.3. Surface Sterilization, Germination, and Bacterization of Seeds

Soybean seeds were sorted to eliminate broken, small, infected seeds and sterilized with 10% sodium hypochlorite solution for 5 min and washed three times with sterile, distilled water. Seeds were germinated in 85 mm × 15 mm tight-fitting plastic Petri dishes with 5 mL of water. *B. japonicum* USDA 110 and *P. putida* TSAU 1 broth rich in PGP metabolites were used for the inoculation of germinated seeds. Germinated seeds were first placed with sterile forceps into bacterial suspension (5×10^6 CFU g^{-1}) for 10 min before planting, were air-dried, and then planted in plastic pots containing 400 g sandy loamy soil.

2.4. Experimental Design

The effect of rhizobacteria on the growth of soybean was studied in pot experiments in a greenhouse at ZALF, Müncheberg, Germany during July 2015. All the experiments were carried out in a randomized block design (RBD) with three replications. Experimental treatments included un-inoculated control (soil without biochar and soil with two levels of biochar (1 and 3%)), inoculation with *B. japonicum* USDA 110 (soil without biochar and soil with two levels of biochar (1 and 3%)), and co-inoculation with *B. japonicum* USDA 110 and *P. putida* TSAU 1 strains (soil without biochar and soil with two levels of biochar (1 and 3%)). The plants were grown in greenhouse conditions at 24 °C during the day and 16 °C at night for 30 days.

2.5. Measurement of Plant Growth Parameters and Plant Nutrients

Plants harvested after 30 days were subjected to the measurement of seed germination rate, root length, shoot length, root dry weight, shoot dry weight, and the number of nodules per plant of soybean. Plant nutrients, such as nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), sodium (Na), and calcium (Ca) were estimated from crushed plant tissue with an inductively coupled plasma optical emission spectrometer (ICP-OES; iCAP 6300 Duo, Thermo Fischer Scientific Inc., Waltham, MA, USA) via Mehlich-3 extraction [30]. The nitrogen and phosphorus contents of root and shoot were determined from dried powdered biomass. For nitrogen estimation, 1 g of plant biomass was digested with 10 mL concentrated H_2SO_4 and 5 g catalyst mixture in the digestion tube. The mixture was allowed to cool and then processed for distillation. The distillate was collected and titrated with H_2SO_4 blank (without leaf). Total nitrogen was calculated from the blank and sample titer reading [31]. For the estimation of P content, plant P was extracted with 0.5 N $NaHCO_3$ (pH8.5)and treated with ascorbic acid in an acidic medium [32]. The intensity of blue color produced was measured and the amount of P was calculated from the standard curve of P. For the estimation of potassium content of plant biomass, 25 mL of ammonium acetate solution was added in 5 g of the biomass sample, the content was shaken for 5 min and filtered, and the amount of K from the filtrate was measured [33]. For the estimation of Na, Mg, and Ca, 1 g of plant extract was mixed with 80 mL of 0.5 N HC1 for 5 min at 25 °C followed by measurement of concentrations of these elements in the filtrate [34].

2.6. Analysis of Soil Nutrient and Soil Enzymes

The rootsoil (10 g) of experimental pots was air-dried soil, shaken with 100 mL ammonium acetate (0.5 M) for 30 min to effectively displace the available nutrients, and adhered to soil minerals. The soil organic carbon (SOC), nitrogen (N), phosphate (P), and potassium (K) content of soil were determined by the dry combustion method according to the method of Sims [35] and Nelson and Sommers [36] using a CNS analyzer (TruSpec, Leco Corp., St. Joseph, MI, USA). For this purpose, 10 mL of 1 N $K_2Cr_2O_7$ and 20 mL of concentrated $H_2SO_4$was added in 1g soil, mixed thoroughly and diluted with 200 mL of distilled water followed by the addition of 10 mL each of H_3PO_4 and sodium fluoride. The resulting solution was used for the elemental analysis. Blank (without soil) served as control. Soil Organic Carbon (SOC) of soil sample was calculated with the help of blank and sample titer reading.

The acid and alkaline phosphomonoesterase activities were assayed according to the method of Tabatabai and Bremner [37].Moist soil (0.5 g) was placed in a 15 mL vial, and 2 mL of modified universal buffer (MUB) (pH 6.5 for the acid phosphatase assay or pH 11 for the alkaline phosphatase assay) and 0.5 mL of p-nitrophenyl phosphate substrate solution (0.05 M) were added to the vial, sequentially. The assay and control batches were replicated 3 times. The concentration of p-nitrophenol (p-NP) produced in the assays of acid and alkaline phosphomonoesterase activities were calculated from a p-NP calibration curve after subtracting the absorbance of the control at 400 nm. Protease activity was assayed according to the method of Ladd and Butler [38]. For this, 0.5 g of soil was weighed into a glass vial, and 2.5 mL of phosphate buffer (0.2 M, pH of 7.0) and 0.5 mL of N-benzoyl-L-arginine amide (BAA) substrate solution (0.03 M) were added. The ammonium released was calculated by relating the measured absorbance at 690 nm.

2.7. Statistical Analyses

All the experiments were performed in three replicates and the average of triplicate was considered. Experimental data were analyzed with the StatView Software (SAS Institute, Cary, NC, USA, 1998) using ANOVA. The significance of the effect of treatment was determined by the magnitude of the p-value ($p < 0.05 < 0.001$).

3. Results

3.1. Analysis of Maize Biochar

Analysis of pyrolyzed maize biochar contained (g%) dry weight: 92.85, ash: 18.42, total C: 75.16, N: 1.65, P: 5.26, and K: 31.12 with a pH of 9.89 and electrical conductivity of 3.08.

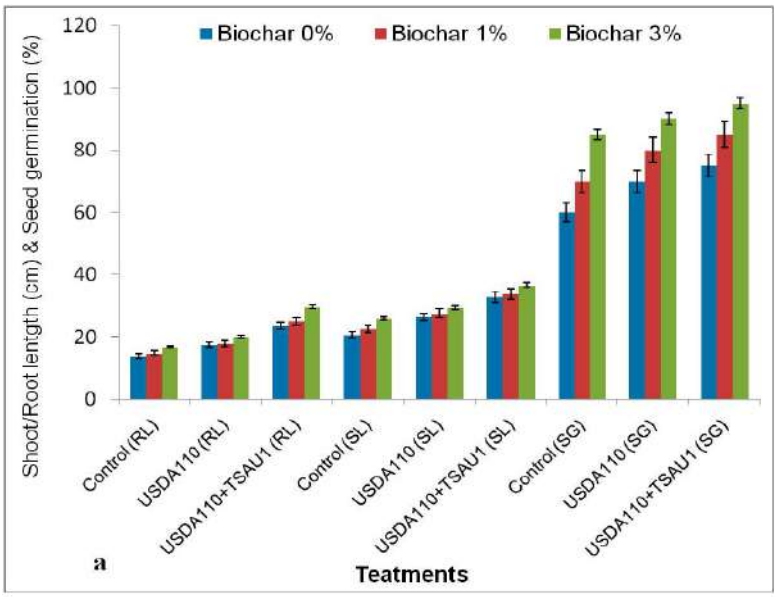
3.2. Screening for the Production of PGP Metabolites

Both the cultures under study produced a wide variety of PGP traits. *B. japonicum* USDA 110 and *P. putida* TSAU1 produced 22 and 16 μg mL^{-1} of IAA, 79 and 87% siderophore, and 0.89 and 1.02 99 g mL^{-1} phosphate solubilization, respectively.

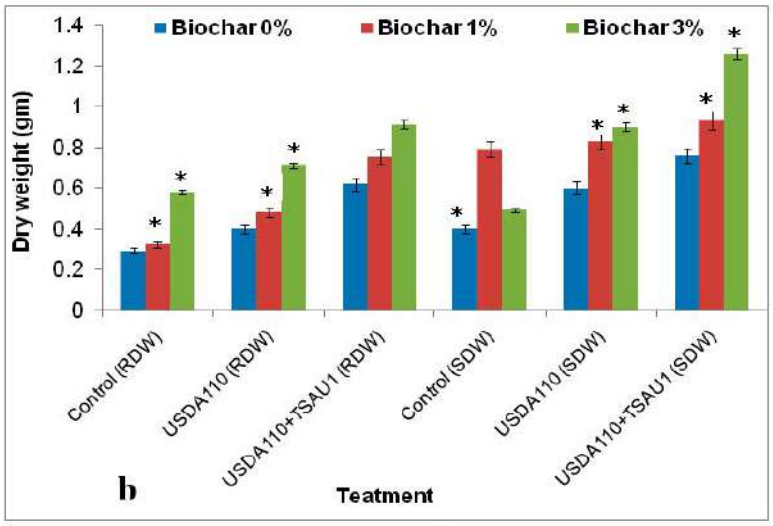
3.3. Measurement of Plant Growth Parameters and Plant Nutrients

The effect of rhizobacteria and biochar levels indicated a significant improvement in the seed germination rate and growth of the soybean plant treated with biochar and rhizobacteria over the control plant (without biochar treatment). The addition of different levels of biochar, inoculation of *B. japonicum* USDA 110, and *P. putida* strain TSAU 1 with biochar and without biocharshowed variable increases in the growth parameters. Addition of 3% biochar alone enhanced the seed germination by 15%, root length by 20% (Figure 1a), shoot length by 41% (Figure 1a), root dry weight by 22% (Figure 1b), and shoot dry weight by 13% (Figure 1b), as compared to the control plant (without biochar). Individual addition of *B. japonicum* USDA 110 and *P. putida* strains TSAU 1 with varying levels of biochar (1–3%) and without biochar also promoted the growth of the plant. However, a co-inoculation

with *B. japonicum* USDA 110 and *P. putida* strains TSAU 1 with 3% biochar resulted in significant increasesin seed germination and plant growth attributes. Increases in seed germination by 20%, root length by 76% (Figure 1a), shoot length by 41% (Figure 1a), root dry weight by 56% (Figure 1b), shoot dry weight by 59% (Figure 1b), and number of nodules per plant by 57% (Figure 1c) were recorded over the control plant treated with 3% biochar alone.



RL= Root length SL= Shoot length, SG= Seed germination *Significant at *P* (0.01)



RDW = Root dry weight, SDW = Shoot dry weight, *Significant at *P* (0.01)

Figure 1. *Cont.*

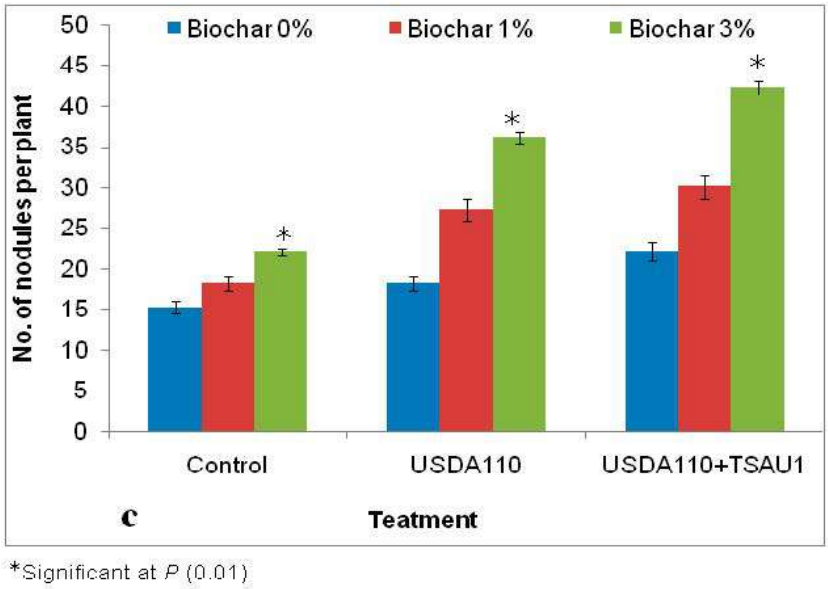


Figure 1. Effect of rhizobacteria and biochar concentrations on (**a**) root length [cm] and shoot length [cm], (**b**) dry weight of the root [g] and dry weight of the shoot [g], and (**c**) number of nodules. Plant growth parameters were measured after 30 days of growth of plant growth under greenhouse conditions.* = values significant at p 0.01.

Analysis of nutrients in a soybean plant (before sowing and after harvesting) revealedthat treatments with 1 and 3% biochar improved the content of total N, P, K, Mg, Na, and Ca in the plant. The inoculation of *B. japonicum* USDA 110 alone (0% biochar) increased N content by 36%, P content by 8.3%, K content by 5.6%, Mg content by 4.8%, Na content by 30%, and Ca content by 2.88%. However, the co-inoculation of *B. japonicum* USDA 110 and *P.putida* TSAU1 with 3% biochar showed a significant improvement in N content by 62.85%, P content by 7.42, K content by 76.85%, Mg content by 5.14%, Na content by 20%, and Ca content by 28%, as compared to the control (without biochar) (Table 1).

Table 1. Effect of rhizobacteria and biochar levels on plant nutrients.

Biochar Application	Treatments	N (%)	P (%)	K (%)	Mg (%)	Na (%)	Ca (%)
0%	Control	1.75 + 0.01	0.24 + 0.01	1.40 + 0.04	0.39 + 0.10	0.02 + 0.00	0.82 + 0.03
	TSAU1	2.00 + 0.02 *	0.25 + 0.04	1.41 + 0.02	0.43 + 0.02	0.06 + 0.01 *	0.91 + 0.03
	USDA 110	2.39 + 0.02 *	0.26 + 0.04	1.49 + 0.02	0.47 + 0.02	0.08 + 0.01 *	1.07 + 0.03
	USDA110+TSAU1	2.60 + 0.02 *	0.27 + 0.02	2.09 + 0.15 *	0.62 + 0.01 *	0.09 + 0.01 *	1.17 + 0.01 *
1%	Control	1.77 + 0.02	0.27 + 0.03	2.33 + 0.02	0.66 + 0.02	0.03 + 0.01	0.95 + 0.03
	USDA 110	2.51 + 0.02 *	0.28 + 0.02	2.52 + 0.04	0.52 + 0.02	0.07 + 0.01 *	1.25 + 0.03
	USDA+TSAU 1	2.64 + 0.02 *	0.32 + 0.02	2.33 + 0.03	0.68 + 0.02	0.13 + 0.04 *	1.21 + 0.02
3%	Control	1.91 + 0.02	0.28 + 0.01	2.41 + 0.02	0.64 + 0.02	0.03 + 0.03	1.09 + 0.02
	USDA 110	2.27 + 0.01	0.37 + 0.01	3.64 * + 0.01	0.48 + 0.01	0.02 + 0.01	0.99 + 0.01
	USDA+TSAU1	2.85 * + 0.01	0.35 + 0.01 *	3.72 * + 0.01	0.39 + 0.01	0.03 + 0.01	1.04 + 0.01

Values are the average of three replicates ± values are standard deviations. Plant nutrient contents were measured after 30 days of growth of plant under greenhouse conditions. * = values significant at p 0.01.

3.4. Estimation of Soil Nutrient Content and Soil Enzymes

Analysis of soil nutrient content revealed that the inoculation of soybean with *B. japonicum* USDA 110 alone (3% biochar) increased N content by 73%, P content by 173%, and K content by 17%, as compared to the control of 3% biochar. *B. japonicum* USDA 110 alone (3% biochar) significantly enhanced the N content by 98% and K content by 117%, as compared to the control without biochar (Table 2).

Table 2. Effect of rhizobacteria and biochar levels on soil nutrients.

Biochar Application	Treatments	SOC (%)	Total N (%)	P (mg)	K (mg)
0%	Control	21.09 ± 0.01	0.080 ± 0.01	4.29 ± 0.03	2.95 ± 0.02
	TSAU1	23.06 ± 0.01	0.082 ± 0.01	4.43 ± 0.03	3.05 ± 0.02
	USDA 110	27.08 ± 0.01	0.083 ± 0.01	4.60 ± 0.02 *	3.27 ± 0.03 *
	USDA+TSAU1	29.04 ± 0.02 *	0.094 ± 0.8 *	4.88 ± 0.02 *	5.58 ± 0.03 *
1%	Control	25.09 ± 0.01	0.091 ± 0.01	4.22 ± 0.03	4.83 ± 0.02
	USDA 110	29.06 ± 0.01	0.101 ± 0.02 *	6.14 ± 0.01 *	5.44 ± 0.01 *
	USDA+TSAU1	32.07 ± 0.8 *	0.164 ± 0.03 *	16.67 ± 0.05 *	5.68 ± 0.02 *
3%	Control	25.09 ± 0.01	0.094 ± 0.01	6.02 ± 0.01	5.35 ± 0.03
	USDA 110	33.05 ± 0.01	0.163 ± 0.01 *	16.47 ± 0.01 *	6.30 ± 0.01 *
	USDA+TSAU1	41.08 ± 0.01 *	0.170 ± 0.01 *	18.33 ± 0.01 *	8.49 ± 0.01 *

Values are the average of three replicates. ± values are standard deviations. * = values significant at p 0.01. Soil nutrient contents were measured after 30 days of growth of plant under greenhouse conditions.

The lowest level of these elements was evident in the soil without biochar treatment. The highest values of SOC, N, P, and K were observed in soil amended with 3% biochar and co-inoculation with *B. japonicum* USDA 110 and *P. putida* TSAU1 vis-à-vis the lowest value found in soil with *B. japonicum* USDA 110 and *P. putida* TSAU1 alone or in combination but without biochar and soil with no bioinoculants and no biochar treatments (Table 2).

Co-inoculation of soybean with of *B. japonicum* USDA 110 and *P. Putida* TSAU 1 strains enhanced nutrient contents of soil compared to all other treatments. The combination with *B. japonicum* USDA 110 and *P. putida* TSAU 1 (3% biochar) significantly increased N content by 80%, P content by 204%, and K content by 58% compared to the control of 3% biochar. When co-inoculated with *B. japonicum* USDA 110 and *P. putida* TSAU 1 (3% biochar)the N content rose by 11% and K content by 35% compared to variants inoculated with *B. japonicum* USDA 110 alone.

The addition of biochar to soil increased the activity of soil protease and acid and alkaline phosphomonoesterase. Substantial increases of 25.05%, 21.02%, and 23.02% in the activities of protease and acid and alkaline phosphomonoesterase, respectively, were evident due to the co-inoculation of *B. japonicum* USDA 110 and *P. Putida* TSAU1 (0% biochar). A combination of this treatment with 1% biochar further improved the activities of these enzymes. However, the activities of these enzymes were significantly improved due to the co-inoculation of *B. japonicum* USDA 110 and *P. Putida* TSAU 1 with 3% biochar. 2-fold, 1.52-fold, and 1.25-fold increases in the activities of protease and acid and alkaline phosphomonoesterase, respectively, were evident due to co-inoculation with two bioinoculants and 3% biochar (Table 3).

Table 3. Effect of rhizobacteria and biochar levels on soil enzymes.

Biochar Application	Treatments	Protease Activity ($\mu g\ NH_4^+$-N $g^{-1}h^{-1}$)	Acid Phosphomonoesterase Activity (μg pNP $g^{-1}h^{-1}$)	Alkaline Phosphomonoesterase Activity (μg pNP $g^{-1}r^{-1}$)
0%	Control	19.2 ± 0.05	650.3 ± 30.1	300.1 ± 16.3
	TSUA1	20.1 ± 0.05	697.1 ± 20.1	317.1 ± 12.3
	USDA 110	23.5 ± 0.10	703.3 ± 34.5	365.6 ± 18.1
	USDA+TSAU 1	25.8 ± 0.19 *	780.6 ± 38.8 *	380.2 ± 20.4 *
1%	Control	21.4 ± 0.07	766.3 ± 35.7	370.5 ± 19.5
	USDA 110	25.8 ± 0.20 *	820.9 ± 45.3 *	425.3 ± 21.6 *
	USDA+TSAU 1	27.7 ± 0.18 *	940.6 ± 43.2 *	482.2 ± 20.8 *
3%	Control	24.3 ± 0.09	810.3 ± 37.6	420.6 ± 19.5
	USDA 110	28.5 ± 0.11 *	911.8 ± 46.3 *	483.5 ± 21.2 *
	USDA+TSAU 1	30.8 ± 0.15 *	1020.4 ± 48.6 *	535.7 ± 25.2 *

Values are the average of three replicates. ± values are standard deviations. * = values significant at p 0.01. Soil enzyme levels were measured after 30 days of inoculation of PGPR and biochar.

4. Discussion

4.1. Screening for the Production of PGP Metabolites

PGPR is known to produce a wide variety of plant-beneficial metabolites that help in plant nutrition and the overall vigor of the plant [39–42]. Production of IAA, siderophore, and P solubilization have been reported in various species of *Bradyrhizobium*, including *B. japonicum* [42–45] and *P. putida* [46,47]. Sayyed et al. [48] reported the production of siderophores from *P. fluorescence* NCIM5096 isolated from the groundnut field rhizosphere. Shaikh et al. [49] reported the production of siderophore from *P. aeruginosa* isolated from the banana field rhizosphere. Pandya et al. [50] reported the production of siderophore and phytohormones, such as IAA and gibberellins in *Pseudomonas* sp. *Rhizobium* sp., and *Azotobacter* sp. isolated from the sugarcane field rhizosphere. Theyobserved higher yields of phytohormones in *Pseudomonas* sp., as compared to the other isolates. Wani et al. [40] reported the production of siderophore in soil bacterium *P. aeruginosa* RZS9. They claimed a further increase in siderophore yield following the optimization of the process by a statistical approach. Jabborova et al. [14] reported the production of siderophore, IAA, and enzymes, such as protease, cellulose, lipase, P solubilization, and antifungal activity in nine endophytic PGPR strains. Sayyed et al. [51] reported the production of copious amounts of siderophore in *P. fluorescence* NCIM 5096 and *P. putida* NCIM2847.

4.2. Measurement of Plant Growth Parameters and Plant Nutrients

An increase in seed germination is due to the phytohormone production, while plant growth promotion during the symbiotic association is due to the nitrogen and other nutrients supplied by the bacterial symbiont. Sayyed et al. [48] reported plant growth-promoting effects of siderophore producing *P. fluorescence* NCIM5096 in wheat and groundnut. Wani et al. [40] reported the plant growth-promoting effects and antifungal-activities production of siderophore producing *P. aeruginosa*. Pandya et al. [50] reported that the inoculation of siderophore and phytohormone producing *Pseudomonas* sp., *Rhizobium* sp., and *Azotobacter* sp. promoted growth in wheat. Jabborova et al. [14] found that inoculation of siderophore, IAA, and enzymes producing P-solubilizing endophytic PGPR strains promoted the growth of medicinal plants. Sayyed et al. [13] observed growth promotion in wheat due to the inoculation of siderophore-producing *P. fluorescence* NCIM 5096 and *P.putida* NCIM2847.

Masciarelli et al. [45] reported a significant increase in the number of root nodules in soybean due to inoculation with *B. japonicum*. Egamberdieva et al. [23] reported the synergistic effect of co-inoculation of *B. japonicum* and *P. putida* to be more effective in increasing nodulation in soybean.Several researchers reported that biochar increased plant growth, nodule number, and yield in different crops [3,5,47]. Pandit et al. [7] claimed that the application of 3% biochar promoted the growth of maize. Uzoma et al. [52] recorded a significant increase in the productivity of biocharrized maize, as compared to a control under sandy soil conditions. Increased growth, more nodulation, and improved yield of soybean after the application of biochar were also reported by Iijima et al. [53].

The addition of organically rich biochar and inoculation with PGPR plays a vital role in increasing the soil microbial activity that provides more nutrition to the plant [54]. Egamberdieva et al. [55] reported significant ($p < 0.05$) increases in N, P, K, and Mg contents in chickpea plants treated with *Mesorhizobium ciceri* and biochar. It has been reported that the biochar amendment improves the water-holding capacity of soil [56], which increases the availability of minerals and nutrients [55]. Shen et al. [57] reported the positive effect of biochar amendment on the plant uptake of plant nutrients. Prendergast et al. [58] claimed that the addition of biochar can induce changes in nutrient availability and may provide additional N, P, K, Mg, Na, Ca. Shen et al. [57] observed an increase in P uptake in plants due to the application of biochar. Egamberdieva et al. [55] observed a significant increase in K content in chickpea roots and shoots treated with *M. ciceri* and biochar. Wang et al. [59] observed similar results and claimed an increasing level of K and Mg uptake in soybean due to the addition of bamboo biochar. Ma et al. [60] reported a positive effect of co-inoculation of *B. japonicum* and biochar on N and other nutrient contents in soybean root and shoot biomass. An increase in N content may be

due to the positive impact of biochar on the nodule number that contributes more N to the shoot and root biomass.

4.3. Estimation of Soil Nutrients and Soil Enzymes

Since biochar is an organically rich amendment, its addition is expected to increase the level of soil nutrients. Egamberdievaet al. [55] reported a two-fold rise in SOC, N, P, K, and Mg concentrations in soil amended with biochar, and a three-fold increase in these nutrients in the soil treated with biochar and inoculation with *M. ciceri*. Similar results were reported by Wang et al. [61]. An increase in the soil's organic carbon and other nutrients can also be correlated with increased mineralization due to increased enzyme activity. A linear relationship between soil nutrients and the activities of soil enzymes involved in mineralization has been proposed by Ouyang et al. [62]. Fall et al. [63] reported significant ($p < 0.05$) increases in SOC, available N, soluble P, and total nitrogen upon the application of biochar at a higher rate (12 t ha^{-1}). They also recorded an increase in rice rhizospheric carboxylate secretions. Głodowska et al. [6] suggested a combination of biochar and *B. japonicum* strain 532 C, which significantly increased the number of nodules and the growth of soybean. The combination with biochar and *B. japonicum* resulted in enhanced nodulation, nodule biomass, and shoot biomass of soybean [63]. Numerous studies have shown that biocharapplication increases the nutrient contents of plants and soil and improves soil fertility [7,62–64]. Egamberdieva et al. [55] found that inoculation of *B. japonicum* USDA 110 halophilic *P. putida* TSAU1 promoted growth, protein content, nitrogen, and phosphorus uptake and improved the root-system architecture of soybean. Their results indicated that the synergistic effect of co-inoculation of these two strains significantly improved plant growth, nitrogen, phosphorus contents, and contents of soluble leaf proteins as compared with the inoculation with *B. japonicum* USDA 110 alone or the control.

Masciarelli et al. [45] found that co-inoculation of soybean plants with *B. Amyloliquefaciens* subsp. Plantarum and *B. japonicum* showed significant improvement in plant growth parameters and nodulation. They found that inoculation of *B. amyloliquefaciens* subsp. Plantarum with *B. japonicum* enhanced the ability of *B.japonicum* to colonize host plant roots and increase the number of nodules. Phosphomonoesterase (E.C. 3.1.3.2) in the soil is either of plant-root or microbial origin. It plays a major role in P solubilization in soils and in making P available to plants [40]. Acid phosphomonoesterase is dominant in acidic soil, while alkaline phosphomonoesterase occurs in the alkaline soil. The presence of these enzymes and their level in the soil is directly related to the extent of P solubilization and, hence, the amount of soluble P in the soil. Non-nitrogen fixers, such as *Pseudomonas* sp. assimilate nitrogen through the decomposition of protein–nitrogen to low molecular nitrogenous compounds and increase the soil nitrogen and, thus, soil fertility. Extracellular proteases enter the soil via microbial production.

Co-inoculation of *B. japonicum* and *P.putida* along with the application of biochar has been reported to enhance the activities of a wide variety of enzymes in soil [60]. The increase in activities of soil enzyme may be due to increased microbial activity as a result of the addition of consortium of organisms and the addition of biochar that contains good amounts of carbon, nitrogen, and minerals to support cell proliferation and, therefore, enzyme activities [60]. Egamberdieva et al. [55] demonstrated a 2-fold increase in protease and a 40% increase in acid phosphomonoesterase activity due to the addition of biochar. The positive effect on the activities of the soil enzymes can be attributed to the stimulating effect of biochar on microbial activity [63]. The enhancement in the soil enzyme activities due to rhizobial inoculation was also observed by Fall et al. [63]. Ouyang et al. [62] reported that the addition of biochar increases the activities of soil enzymes and attributed this increased enzyme activity to the availability of nutrients and increased microbial activities brought by the addition of biochar to the soil. Egamberdieva et al. [55] and Ma et al. [60] also reported the positive effect of increasing the level of biochar on protease activity. Oladele [64] reported a significant ($p < 0.05$) increase in soil enzymes, such as invertase, alkaline phosphatase, urease, and catalase as a result of the higher application of biochar. It has been reported that with the amendment of more biochar, more soil proteins adhere to the surfaces of biochar pores, make the protein (substrate) unavailable in the soil, and cause a decrease

in protease activity [22]. However, we report increased protease activity with an increase in the biochar amendment to the soil.

5. Conclusions

The application of biochar positively affects the growth and nodulation of soybean by increasing nutrient contents, such as N, P, and K in soil. Inoculation with *B. japonicum* USDA 110 alone increased the number of nodules, the length and dry weight of roots, and the length of shoots of soybean, as compared to the control. *B. japonicum* enhanced the total N content, P content, and K content of the soil, as compared to controls with biochar and without biochar, respectively. Co-inoculation with *B. japonicum* USDA 110 and *P. putida* TSAU 1 significantly increased the growth of soybean, nutrient contents in soybeanand soil, and activities of soil protease and acid and alkaline monophosphoeserase, as compared to the control. However, the combined application of *B. japonicum* USDA 110 and *P. putida* TSAU 1 and biochar (3%) showed pronounced positive effects on growth and vigor of soybean, nutrient levels in plant biomass and soil, and activities of soil enzymes. Thus, the co-inoculation with rhizobia and application of biochar offers the best eco-friendly and chemical-freestrategy for the sustainable increase in the yield and replenishment of nutrients in soybean and soil and increase in soil biochemical properties. In general, consortia of PGPR and biochar application improves plant growth, contents of plant and soil nutrients, and soil enzyme activities, which influence soil nutrient retention, nutrient availability, and improve crop growth.The present study demonstrates that application of *B.japonicum* alone has the capacity to improve soybean growth, nutrient contents, and improve soil biochemical properties, however, the co-inoculation of this symbiont along with *P.putida* has a more positive effect on plant growth and soil biochemicals, and co-inoculation of these rhizobia in combination with biochar possesses the capacity to significantly improve the growth and nutrient contents in soybean as well as nutrients and enzyme activities in soil. However, to claim the bio-efficacy potential of the co-inoculation of rhizobacteria and application of biochar needs multiple field studies over the season and in different agro-climatic zones.

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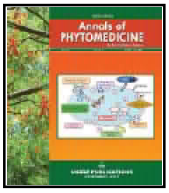

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Isolation and characterization of endophytic bacteria from ginger (*Zingiber officinale* Rosc.)

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Abstract

The present investigation was aimed to isolate and characterize endophytic bacteria from Ginger (*Zingiber officinale* Rosc.) plant with salt tolerance, antifungal activity, and plant growth-promoting traits. A total of 15 endophytic bacteria were isolated from ginger by standard microbiological culture methods. Nine endophytic bacterial isolates (GS1, GS2, GS3, GS4, GS6, GS7, GS8, GS9, and GS11) showed salt tolerance up to 10% NaCl concentration. Six isolates showed salt tolerance up to 7-8% NaCl concentrations. Studies on plant growth-promoting activity suggested that four endophytic bacterial isolates (GS2, GS5, GS8, and GS10) were positive for IAA production, siderophore production, and phosphate solubilization activity. All the endophytic bacterial isolates were screened for the production of enzymes. The result of the study revealed that maximum isolates have positive protease activity and this was followed by lipase and cellulase activities. While studying the antifungal activity of the bacterial isolates, it was determined that eight isolates showed antifungal activities against fungal strains *F. globosum* 905 and *F. graminearium* 611. Four endophytic bacterial isolates (GS4, GS6, GS8, and GS9) had antifungal activity against several fungal strains. The results indicated that endophytic bacteria were isolated from ginger with salt-tolerant and plant growth-promoting activities that were reported, that could be used as inoculants to establish a sustainable ginger production system.

1. Introduction

Ginger (*Zingiber officinale* Rosc.) is a spice and medicinal plant belonging to the *Zingiberaceae* family. Ginger has long been used in folk medicine in India and China. Especially, the wet and dry root of ginger is widely used in medicine and food industry in India. The wet root of *Z. officinale* is also used as a vegetable. It is used to make gingerbread, sweets, cakes, snacks, and soft drinks in many countries. It has been used in folk medicine for colds, sore throats, asthma, joint pain and stimulates appetite (Grzanna *et al.,* 2015). Ginger is also rich in beneficial nutrients for example phosphorus, potassium, and calcium, which play important roles in human physiological processes. These substances play an important role in boosting human immunity and maintaining health (Zadeh and Kor, 2014). The dry rhizome of ginger is medicinal contains biologically active compounds. The rhizome contains carbohydrates, fats, proteins, vitamins, minerals, amino acids, monoterpenoids (camphene, sineiol, borneol, citral curcumin, and linalool), gingerol, and sesquiterpenoids (Sharma, 2017). Microorganisms such as rhizobacteria and endophytic bacteria play an important role in increasing the growth, development, and productivity of plants (Egamberdieva *et al.,* 2013; Egamberdieva *et al.,* 2015, Egamberdieva *et al.,* 2016, Egamberieva *et al.,* 2017; Egamberdieva *et al.,* 2018; Jabborova *et al.,* 2018; Li *et al.,* 2018; Sayyed *et al.,* 2015).

Endophytic bacteria directly improve plant growth such as producing phytohormones IAA, gibberellins, cytokinins (Jabborova *et al.,* 2015), solubilizing phosphate (Sharma *et al.,* 2013), increase nutrients (Liu *et al.,* 2016; Liu *et al.,* 2017), increase stress tolerance in plants (Sagar *et al.,* 2020), biological control of plant pathogens (Sayyed and Chincholkar, 2009; Sayyed *et al.,* 2010; Shaikh *et al.,* 2014; Reshma *et al.,* 2018;) and nitrogen fixation (Li *et al.,* 2018). Phosphate solubilizing and phytohormone producing bacteria improve plant growth and yield of crops (Sharma *et al*., 2013; Jabborova *et al.,* 2015). The endophytic bacteria possess the capacity to solubilize and assimilate phosphates in plants (Kuklinsky-Sobral *et al.,* 2004). The objective of this study was to isolate and characterize the endophytic bacteria from Ginger (*Z. officinale*) medicinal plant with salt tolerance, antifungal activity, and plant growth-promoting traits.

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2. Materials and Methods

2.1 Determination of soil properties

Soil samples were collected from Termez district, Surkhandaryo province (Figure 1). To determine the soil properties before experimenting, soil samples were collected from 0-10, 0-20, and 0-30 cm depth of soil. The total nitrogen content was determined by the Kjeldahl method. The phosphorus content by Machigin, the potassium content by Machigin-Protasov, and organic matter by Tyurin methods were analyzed (Table 1).

Figure 1: Map showing the location of the sampling sites. Surkhandaryo Region, Uzbekistan.

Table 1: Soil properties of field experiments

Soil properties	Total nitrogen (N), %	Phosphorus (P_2O_5), %	Potassium (K_2O), %	Organic matter, %
0-10 cm	0.094	0.180	0.73	1.69
10-20 cm	0.097	0.175	0.63	1.71
20-30 cm	0.088	0.175	0.54	1.59

2.2 Isolation of endophytic bacteria

For the isolation of endophytic bacteria, the ginger (*Z. officinale*) was collected from the Surkhandaryo Region, Uzbekistan (Figure 2). The bacterial endophytes were isolated from root, stem, and leaves of the healthy ginger plants. The plant samples were washed under running tap water for 10-15 min. to remove adhering soil particles, air-dried and roots, stem and leaves were separated. The separated plant root, stem, and leaves were weighed up to one gram on a weighing balance. The weighed samples were soaked in distilled water and drained. The samples were then surface-sterilized by dipping in 70% ethanol for 1 min, stem and leave with 4% sodium hypochlorite for 5 minutes and roots with 2% sodium hypochlorite for 10 min and then treated with 70% ethanol for 30 sec, followed by rinsing five times in sterilized distilled water. The surface-sterilized samples were blot dried using sterile filter paper. The samples were crushed. The root, stem, and leaves samples serial dilutions were prepared, up to 10^{-5} dilutions. One hundred microliters from each dilution of the respective sample were then poured in their respective Petri-plates so labeled from 10^{-1} to 10^{-5} containing tryptone soy agar medium, KB agar medium, and nutrient agar medium separately. The plating was done in triplicate for each dilution. The plates were incubated at 28 °C for 2-4 days for isolation of bacterial endophytes. The colonies of bacterial endophytes were picked and streaked on the 3 selective media for the selection of clone.

Figure 2: Ginger (*Zingiber officinale*) used in the present study for the isolation of endophytes.

2.3 Salt tolerance

NaCl was added into nutrient agar medium at various concentrations in the range of 1 to 10% and the test bacterial isolates were streaked.

2.4 Phosphate solubilization

Phosphate solubilization ability of bacterial endophytes was detected by spot inoculating pure bacterial endophytes on the Pikovskaya medium (Pikovskaya, 1948) and incubated at 28 °C for three to seven days along with the control plates. The uninoculated plates served as control. All the inoculations were done in triplicate. After seven days of incubation at 28 °C, the formation of clearing zones were evaluated.

2.5 Indole acetic acid (IAA) production

Bacterial isolates were grown for 48 h on their respective media at 28 °C. Fully grown isolates were centrifuged at 3000 rpm for 30 min. The supernatant (2 ml) was mixed with two drops of orthophosphoric acid and 4 ml of the Salkowski reagent (50 ml, 35% of perchloric acid, 1 ml 0.5 M $FeCl_3$ solution). The development of pink color indicates IAA production (Brick *et al.,* 1991).

2.6 Siderophore production

The bacterial isolates were spotted on the Chrome azurol S agar media as described (Patel *et al.,* 2018). Isolates were incubated at 28 °C for 5-7 days. The development of yellow-orange hallow zone around the bacterial spot has been considered as a positive indication for siderophore production.

2.7 Lipase production

Production of lipase was carried out in a medium containing (gL^{-1}), (Ghodsalavi *et al.,* 2013), peptone; 10, calcium chloride; 0.1, NaCl; 5, agar; 15, distilled water 100 ml; 10 ml sterile Tween 20. All of the isolates were streaked on this medium and incubated at 27 °C for 48 h. Depositions around the bacterial colonies indicated the activity of the lipase enzyme.

2.8 Production of protease

The qualitative assay for protease production was performed on sterile skim milk agar containing (gL^{-1}) pancreatic digest of casein; 5.0, yeast extract; 2.5, glucose; 1.0, agar; 15.0, distilled water 1000 ml, skim milk (inducer), 7%. Isolates were spot inoculated grown at 30 °C for 48 h. After incubation plates were observed for the appearance of the zone of clearance around the colony indicating the enzymatic degradation of protease (Malleswari and Bagyanarayana, 2013).

2.9 Production of cellulase

Screening and production of the cellulose-degrading ability of bacterial isolates were performed by separately streaking each isolate on the cellulose congo red agar media containing (gL^{-1}) KH_2PO_4; 0.5, $MgSO_4$; 0.25, cellulose; 2, agar; 15, congo red; 0.2, gelatin; 2; distilled water 100 ml. pH was set to 6.8 with the help of 0.1 N HCl. Plates were incubated at 30 °C for 48 h. After incubation clearance of halos around and beneath the colony was taken as an indication of the enzymatic degradation of cellulose (Gupta *et al.,* 2012).

2.10 Antifungal activity

The bacterial isolates were tested for *in vitro* inhibitory effects against common phytopathogenic fungi namely: *Fusarium sporotrichiodes* 404, *F. globosum* 905, *F. oxysporum* 328, *F. culmorum* 903, *F. graminearium* 611, *F. solani* 528, and *F. proliferatum* 516. Fungal cultures were grown on the ISP_2 agar plate at 28 °C for 5 days until the fungi had grown over control plates without bacteria. Antifungal activity was recorded as the width of the zone of growth inhibition between the fungus and the test bacterial isolates. All bacterial isolates were used in triplicate for the determination of antifungal activity.

2.11 Statistical analysis

Stat View software packages were used to perform Fisher's PLSD test following an ANOVA (SAS Institute Inc., Cary, NC, USA).

3. Results

3.1 Salt tolerance test of bacterial isolates

Fifteen bacterial isolates obtained from ginger showed varied tolerance to salt levels (Table 2). Nine endophytic bacterial isolates (GS1, GS2, GS3, GS4, GS6, GS7, GS8, GS9, and GS11) tolerated 10% of NaCl. Four isolates (GS5, GS10, GS12, GS13, GS14, and GS15) tolerated up to 7% of NaCl and were inhibited at 9% and 10% NaCl concentration.

Table 2: Salt tolerance of bacterial endophytes from Ginger (*Z. officinale*)

Bacterial isolates	1% NaCl	2% NaCl	3% NaCl	4% NaCl	5% NaCl	6% NaCl	7% NaCl	8% NaCl	9% NaCl	10% NaCl
GS1	+	+	+	+	+	+	+	+	+	+
GS2	+	+	+	+	+	+	+	+	+	+
GS3	+	+	+	+	+	+	+	+	+	+
GS4	+	+	+	+	+	+	+	+	+	+
GS5	+	+	+	+	+	+	+	-	-	-
GS6	+	+	+	+	+	+	+	+	+	+
GS7	+	+	+	+	+	+	+	+	+	+
GS8	+	+	+	+	+	+	+	+	+	+
GS9	+	+	+	+	+	+	+	+	+	+
GS10	+	+	+	+	+	+	+	-	-	-
GS11	+	+	+	+	+	+	+	+	+	+
GS12	+	+	+	+	+	+	+	-	-	-
GS13	+	+	+	+	+	+	+	+	-	-
GS14	+	+	+	+	+	+	+	-	-	-
GS15	+	+	+	+	+	+	+	+	-	-

3.2 Plant growth-promoting traits

A total of 15 bacterial isolates were isolated from the medicinal plant *Z. officinale* were screened for multiple plant growth-promoting traits such as phosphate solubilization, IAA production, siderophore production, and enzymes activities (Table 3). Most bacterial isolates exhibited one or more plant growth-promoting activities. Four bacterial isolates (GS2, GS5, GS8, and GS10) were able to solubilize phosphate and produce IAA, siderophore, lipase, protease, and cellulase.

Table 3: Overview of plant beneficial properties of the fifteen isolated bacterial isolates

Bacterial isolates	Plant growth-promoting traits					
	P solubilization	IAA production	Siderophore production	Lipase	Protease	Cellulase
GS1	+	-	-	+	+	-
GS2	+	+	+	+	+	+
GS3	+	+	+	+	+	-
GS4	+	+	-	-	-	+
GS5	+	+	+	+	+	+
GS6	+	+	-	-	-	-
GS7	+	-	-	+	-	-
GS8	+	+	+	+	+	+
GS9	-	+	-	+	+	+
GS10	+	+	+	+	+	+
GS11	-	+	-	+	+	+
GS12	-	-	+	-	-	+
GS13	+	+	+	-	+	+
GS14	+	-	+	+	+	-
GS15	-	+	-	+	+	+

The results of the plant promoting growth test revealed that three isolates (GS9, GS11, and GS15) produce IAA, lipase, protease, and cellulase enzymes. Among all isolates, about 26% of them did not produce IAA (GS1, GS7, GS12, and GS14), lipase (GS4, GS6, GS12,

and GS13), and protease (GS4, GS6, GS7, and GS12) and did not solubilize phosphate (GS9, GS11, GS12, and GS15). About 47% of the isolates (GS1, GS4, GS6, GS7, GS9, GS11, and GS15) did not produce siderophore. About 33% of bacterial isolates (GS1, GS3, GS6, GS7, and GS14) did not produce cellulase.

3.3 Antifungal activity of endophytic bacterial isolates

The endophytic bacterial isolates showed antifungal activity against selected fungal strains (Table 4). Thirteen isolates did not show antagonistic activity against fungal strain *F. sporotrichiodes* 404. Eight bacterial isolates had antifungal activity against fungal *F. globosum* 905 (GS1, GS3, GS4, GS6, GS7, GS8, GS9, and GS15) and *F. graminearium* 611 (GS1, GS2, GS3, GS4, GS8, GS11, GS12, and GS13) strains. Three endophytic bacterial isolates exhibited antifungal property against fungal strains *F. oxysporum* 328 (GS4, GS11, and GS15) and *F. culmorum* 903 (GS2, GS6, and GS15). A total of 5 bacterial isolates exhibited antifungal property against fungal strains *F. solani* 528 (GS5, GS6, GS9, GS12, and GS13) and *F. proliferatum* 516 (GS5, GS6, GS7, GS8, and GS9).

Table 4: Antagonistic activity of bacterial endophytes from Ginger (*Z. officinale*) against some pathogenic fungi

Bacterial isolates	Antifungal activity (fungal growth inhibition)						
	F. sporotrichiodes 404	*F. globosum 905*	*F. oxysporum 328*	*F. culmorum 903*	*F. graminearium 611*	*F. solani 528*	*F. proliferatum 516*
GS1	-	+	-	-	+	-	-
GS2	-	-	-	+	+	-	-
GS3	-	+	-	-	+	-	-
GS4	-	+	+	-	+	-	-
GS5	-	-	-		-	+	+
GS6	+	+	-	+	-	+	+
GS7	-	+	-	-	-	-	+
GS8	-	+	-	-	+	-	+
GS9	-	+	-	-	-	+	+
GS10	+	-	-	-	-	-	-
GS11	-	-	+	-	+	-	-
GS12	-	-	-	-	+	+	-
GS13	-	-	-	-	+	+	-
GS14	-	-	-	-	-	-	-
GS15	-	+	+	+	-	-	-

growth inhibition zone "+",
"–" - no inhibition

4. Discussion

The endophytic bacterial isolates were isolated from root, stem, and leaves of ginger. Endophytic bacteria previously reported in various medicinal plants such as *Momordica charentia* (Singh *et al.,* 2013), *Cassia tora* (Kumar *et al.,* 2015), *Glycyrrhiza uralensis* (Li *et al.,* 2018), *Talinum triangular*e (Ali and Rante, 2018) and *Thymes vulgaris* (Mohamad *et al.,* 2020).

Endophytic bacteria are particularly tolerant of environmental stresses such as high salinity, heat, and cold. Our results showed that the nine endophytic bacterial isolates (GS1, GS2, GS3, GS4, GS6, GS7, GS8, GS9, and GS11) tolerated 10% of NaCl. Several other investigations have also reported that endophytic bacteria efficiently tolerated the high salt concentration (Kumar *et al.,* 2015; Mohamad *et al.,* 2020). Rashid *et al.* (2012) reported that *Pseudomonas* sp. tolerated up to 4% NaCl and *Bacillus* sp. 2% NaCl. The endophytic bacterial strains of *Curcuma longa* L showed tolerance to the increasing salt concentration. *B. thuringiensis* (ECL2) and *B. pumilus* (ECL4) tolerated higher salt level (8% NaCl) whereas *B. cereus* ECL1 and *Bacillus* sp. ECL3 tolerated 7% of NaCl. *Pseudomonas putida* (ECL5) and *Clavibacter michiganensis* (ECL6) tolerated 6% of NaCl concentration (Kumar *et al.,* 2016).

Several endophytic bacteria interact positively, *via.,* various mechanisms with their host plant. They produce plant growth, phosphate solubilization, IAA production, siderophore production, and activities of enzymes. In the present study, it was observed that several bacterial isolates isolated from medicinal plant *Z. officinale* were able to produce IAA, siderophore, enzymes, and solubilize phosphate (Table 2). Similar investigations indicated that endophytic bacteria exhibited plant beneficial traits (Singh *et al.,* 2013; Ali and Rante, 2018; Mohamad *et al.,* 2020). In this study production of IAA, siderophore, and solubilization phosphate was observed in four bacterial isolates namely GS2, GS5, GS8, and GS10, similar to the previous report by Mohamad *et al.* (2020). Mohamad *et al*. (2020) reported *Bacillus* sp. and *Pseudomonas* sp. with plant growth promotion and their activity was associated with the production of IAA and siderophore. Earlier research reported endophytic bacteria *B. pumilus*a and *P. protegens* produce siderophore (Etminani and Harighi, 2018).

Phosphorus is an important macronutrient necessary for plant growth and development. Phosphate solubilizing bacteria are capable of solubilizing the insoluble phosphate; enhance soil quality and plant growth and development of different plants (Sharma *et al*., 2013 and 2016; Jabborova *et al.,* 2015). Kumar *et al.* (2016) reported solubilization in *Bacillus cereus* ECL1, *Bacillus* sp. ECL3, *Bacillus pumilis* ECL4, and *Pseudomonas putida* ECL5. In this research, all seven endophytic bacterial isolates (GS2, GS5, Gs8, GS9, GS10 GS11, and GS15) were able to produce different enzymes such as lipase, protease and cellulase enzymes (Table 2). These results are in general agreement with (Mohamad *et al.,* 2020) who reported that endophytic bacteria associated with the medicinal plant, *Thymes vulgaris* capital were able to produce enzymes. Li *et al.,* (2018) reported endophytic bacteria with the same capacity of producing plant growth-promoting traits.

Many endophytic bacteria exhibited antifungal properties that inhibit the growth of fungal pathogens. This study has demonstrated the antifungal activity of bacterial isolates (GS1, GS3, GS4, GS6, GS7, GS8, GS9, and GS15) against *F. globosum* 905 and *F. graminearium* 611 (GS1, GS2, GS3, GS4, GS8, GS11, GS12, and GS13) strains in Table 3. Our results showed that three endophytic bacterial isolates (GS4, GS11, and GS15) inhibited the growth of fungal strain *F. oxysporum* 328. Endophytic bacteria isolated from different medicinal plants have been reported to inhibit the growth of fungi (Kumar *et al.,* 2016; Mohamad *et al.,* 2020). Endophytic bacteria isolated from medicinal plant *Glycyrrhiza uralensis* have been reported to exhibit antifungal activity. Many of the previous studies have shown that endophytic bacteria control fungal pathogens, including *Bacillus* sp. ECL3 (Kumar *et al.,* 2016), *Bacillus*

atrophaeus (Mohamad *et al.,* 2018) and *Bacillus* sp. and *Pseudomonas* sp. (Mohamad *et al.,* 2020).

5. Conclusion

Nine endophytic bacterial isolates (GS1, GS2, GS3, GS4, GS6, GS7, GS8, GS9, and GS11) tolerated high salt (10% of NaCl) concentration. Endophytic bacterial isolates have different abilities related to plant growth promotion such as solubilization of phosphate, IAA, siderophores, protease, lipase, and cellulase. Only four bacterial isolates (GS2, GS5, GS8, and GS10) were able to solubilize phosphate and produce IAA, siderophore, lipase, protease, and cellulase. All the bacterial isolates variously showed antifungal activity against selected fungal strains *F. sporotrichiodes* 404*, F. globosum* 905, *F. graminearium* 611, *F. oxysporum* 328, *F. culmorum, F. solani, F. proliferatum* 516. Four endophytic bacterial isolates (GS4, GS6, GS8, and GS9) had antifungal activity against several fungal strains. This study provides future encouragement for the plant growth-promoting endophytic bacterial isolates (GS2, GS5, GS8, and GS10) for the improvement of eco-friendly biofertilizers to increase the ginger yield and enhance plant tolerance to salt stress.

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Conflict of interest

The authors declare that there are no conflicts of interest in the course of conducting the research. All the authors had final decision regarding the manuscript and decision to submit the findings for publication.

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Shri Govind Guru University, Godhra
(Established Vide Gujarat Act No. 24/2015)

શ્રી ગોવિંદ ગુરુ યુનિવર્સિટી, ગોધરા
(ગુજરાત એકટ નં. ૨૪/૨૦૧૫ દ્વારા સ્થાપિત)
સરકારી પોલીટેકનીક કેમ્પસ, ગદુકપુર, ગોધરા. જિ.પંચમહાલ-૩૮૯૦૦૧

Date: 11 /02/2021

LETTER OF APPRECIATION

To,

Mr. Mahesh B. Jagtap

Assistant Professor. Botany

PSGVPM's Arts, Science & Commerce College, Shahada

Dist.Nandurbar.(MS)

We are thankful to you for sparing your valuable time and visiting our university to deliver session on **"Basic Knowledge of Computer and Use of Computer in Research"** to the participants of Ph. D. Course Work on 11/02/2021.

All our participants have good experience attending your session. Content and presentation was very effective and well organized.

We look forward to invite you for more such sessions in the future.

Regards,

I/c. Registrar
Shri Govind Guru University
Godhra

R. C. Patel Arts, Commerce& Science College,

Shirpur

STAY SAFE

RCPET

R.C.PATEL EDUCATIONAL TRUST

Certification of Appreciation

This Certificate is awarded to

DR. C. S. SUTAR

Guest Speaker from ***PSGVP Mandals Arts, Science & Commerce College, Shahada*** for imparting his valuable insights and inspirations to the pupils, teachers, and community members during COVID-19 Pandemic. Given this on 8 June 2020 at National Webinar on "Vital Mathematics" Organized by Dept. of Mathematics R. C. Patel Arts, Commerce & Science College, Shirpur.

Dr. D. R. Patil
(Principal)

Prof. R.P. Mahajan
(Co-ordinator)

R.C.PATEL EDUCATIONAL TRUST

NATIONAL WEBINAR ON

Natural Products, Synthetic Organic chemistry, Heterocyclic chemistry & Guidance for Short Research Project & NET-SET Exam Preparation

Organized by

R.C.Patel Educational Trust's

R. C. Patel Arts, Commerce & Science College, Shirpur

Affiliated with Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

-CERTIFICATE-

This is to certify that ***Prof. Anil G. Beldar*** *of* ***PSGVP's Arts, Commerce & Science College, Shahada*** *has actively delivered expert talk during the session in five days National Webinar series on* ***Natural Products, Synthetic Organic Chemistry, Heterocyclic Chemistry and guidance for Short Research Project and NET-SET exam preparation*** *organized by the Department of Chemistry of R.C.Patel Arts, Commerce & Science College, Shirpur on 26th May to 30th May 2020.*

Mr. J. P. Sonawane
Co-coordinator

Dr. J. P. Mahashabde
Head & Coordinator

Dr. D. R. Patil
Principal & Convener

GOVT. P. G. COLLEGE, SENDHWA

Distt. Barwani (M.P.)

ONLINE NATIONAL CONFERENCE ON

"Spectroscopy as a Tool for Recent Trends in Research"

February 09, 2021

Certificate

This is to certify that Prof./Dr./Mr./~~Mrs.~~ DR. ANIL BELDAR

of PSGVPMs ASC COLLEGE, SHAHADA (MH) *participated as resource person /presenter/participant in Online National Conference on* ***"Spectroscopy as a Tool for Recent Trends in Research"*** *under MPHEQIP, Higher Education Department M.P. and Organized by IQAC and Chemistry Department Govt. P.G. College, Sendhwa (M.P.).*

He/She delivered (Oral/Poster/paper) presentation on title RESOURCE PERSON

Dr. Dinesh Kanade	Prof. Mahesh Baviskar	Dr. Vikas Pandit	Prof. Irshad Mansuri	Dr. MEENA BHAWSAR
RUSA Co-Ordinator	IQAC Co-Ordinator	Convener	Co-Convener	Principal Govt. P.G. College, Sendhwa (M.P.)

SHAHEED BHEEMA NAYAK GOVERNMENT POST-GRADUATE COLLEGE

BARWANI (M.P.) INDIA

(Accredited by NAAC with grade 'B' & Affiliated to Devi Ahilya University, Indore)

CERTIFICATE

This is to Certify that Dr./Prof./Mr./Ms. ..ANIL GOKULBELDAR (ASSISTANT PROFESSOR)
PSGVPM's Arts, Sci & Comm. College, Shahada (Maharashtra)
had actively participated as Speaker/Presenter/Co-Presenter/Participant in the

Lecture/Seminar/Webinar entitled

Spectroscopy: Basics to Advanced NMR Spectroscopy

Sponsored by MPHEQIP, W.B. Project DHE GoMP, Bhopal

Organized by Department of .....CHEMISTRY.....

On dated ...10/03/2021.

Coordinator

Convener

Nodal Officer RUSA/WB

Principal & Patron

INTERNATIONAL E-CONFERENCE

On

"Emerging Innovation and Advancement in Biological Science, Human Welfare and Agriculture Research in Current Era"

EIABSHWAR-2020

Organized By: Department of Biotechnology & Microbiology,

Kalp laboratories, Mathura, The Bouquet Society, Mathura

Co-Organized by: Environment and Social Development Association, Delhi

International Biotech Technocrats & Consultants Association, Dehradun

Jointly Organized by: Plant Research & Educational Promotion Society

Date: 25th to 27th of July, 2020

This is to certify that

Dr. R.Z. Sayyed

Professor and Head

of

Department of Microbiology, P.S.G.V.P. M's, ASC College, SHAHADA, KBC North Maharashtra University (NMU), Jalgaon, Maharashtra, India

has actively delivered a lecture as an ***KEYNOTE SPEAKER*** *during*

International e-Conference

at Technical Session: -II

entitled:- PGPR: Multipurpose Solution for Sustainable Agriculture

Mr. Yagyavalkya Sharma
Organizing Secretary
EIABSHWAR-2020

Dr. Jitendra K. Nagar
Co-Patron
EIABSHWAR-2020

CERTIFICATE OF APPRECIATION

This is to certify that,

Prof. Riyaz Sayyed

has participated as

ORGANIZING COORDINATOR

in 1st Asian PGPR Indonesia Chapter International Conference
Sustainable Agriculture and Ecotourism

28th - 30th August 2021, Udayana University, Bali-Indonesia

Prof. M.S. Reddy
Founder & ChairmanAsian PGPR Society

Dr. Sarjia Antonius
President, Indonesia Chapter of Asian PGPR Society

Dr. Ni Luh Suriani
Local Organizing Chairman

5 Days ONLINE INTERNATIONAL MULTIDISCIPLINARY CONFERENCE

ON

Covid19 Changes in Socio-Cultural,Economical, Commercial, Educational, Literary, Science & Technological Scenario

Organized by

BPCS's DADASAHEB DEVIDAS NAMDEO BHOLE COLLEGE BHUSAWAL, DIST.JALGAON (MS)

AFFILIATED TO KBC North Maharashtra University, Jalgaon (M.S)

This is to certify that Dr./Ms./Mrs./Mr, **Dr.Nile Uttam Vedu** of Assistant Professor in Geography PSGVM ASC College Lonkheda Shahada as a resource person in the 5 Days ONLINE INTERNATIONAL MULTIDISCIPLINARY CONFERENCE (17/8/2020 to 21/8/2020) ON Covid19 Changes in Socio-Cultural, Economical, Commercial, Educational, Literary, Science & Technological Scenario He/She talked on Effects of Covid on local National and international tourism **Dated on 20/8/2020 In the Morning Session**

Dr. S. V. Baviskar (Convener) BPCS's
DADASAHEB DEVIDAS NAMDEO
BHOLE COLLEGE BHUSAWAL

Dr J B Bagul
(Secretary of the Online International
Multidisciplinary Conference)

Prin. Dr. R P Phalak Chairman of Conference
BPCS's D.D.N.Bhole College, Bhusawal

123 Certificates

GOVT. COLLEGE PATHARIA DAMOH M.P.

International Webinar

on

Rural Development and Transformation of Rural Environment

Certificate

This is to certify that Dr./ Shri / Smt. Dr.Uttam Vedu Nile

Designation Asst. Professor from P.S.G.V.P. Mandals Arts Science and Commerce College Shahada ,Nandurbar M.S. has participated as resource person and deliver his/her lecture in one day International Webinar on "Rural Development and Transformation of Rural Environment" organised by the Department of Geography and History Govt. College Patharia Distt. Damoh on. 12 January 2021

Convener & Co-ordinator IQAC

Dr. Vinay Verma

Patron /Principal

Dr. Sandhya Pimplapure

श्री महंतस्वामी शिक्षण प्रसारक मंडळाचे
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(कला, वाणिज्य, विज्ञान)
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श्री गिरीष शेषेराव पाटील
सचिव

डॉ. बेटकर एम. एम.
प्राचार्य

Reference : SKSMAUSA/2020-21/e-mail /Resource person/32-61 Date 06-01-2021

LETTER OF THANKS

To,

Dr. Mrunal Madhukar Jogi,
PSGVPM'S ASC College,
Shahada, Dist. Nandurbar,

Dear Mam,

We express sincere thanks for delivering an informative talk on topic entitled, Widowhood in the Indian Society, as Resource Person for the National Level webinar Series organized on 06th January, 2021, by NSS Department of our college as a academic event for celebrating the Golden Jubilee year of our college, by organizing 50-National Level webinars from 01st December, 2020 to 08th January, 2021.

Thanks from organizing team, as being a part of the Golden Jubilee Year celebration.

Yours faithfully,

(Dr. BETKAR M M)
PRINCIPAL

Navgan Shikshan Sanstha Rajuri's

VASANTDADA PATIL ARTS, COMMERCE & SCIENCE COLLEGE, PATODA. TQ. PATODA. DIST. BEED. MAHARASHTRA

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DR. BALIRAM RAKH
Cell No. 7709445740, 9421957770

SECRETARY
DR. BHARATBHUSHAN KSHIRSAGAR

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VPCP/2020-2021 / 18901

Date: 14 / 09 / 2021

To,

Prof. Dr. Mrunal Jogi,

Professor & Head, Department of Biotechnology,

PSGVPM's ASC College,

Shahada Dist, Nandurbar.

Maharashtra.

Subject: Letter of Thanks

Respected Madam,

With reference to the above mentioned subject, we express our heartfelt thanks to you for accepting our invitation for being a Resource Person for Guest Lecture organized by IQAC and Research, Innovation & Extension Committee of our college on the topic ***"Recent Trends in Research Methodology in Life Sciences"*** held on **14th September 2021, at 11:00 am** on Zoom meeting and delivering the same for enlightenment of our staff and students.

We are sure that the knowledge imparted by you through your lecture would be fruitful for all. We wish a best luck for your future work.

Thanking you,

With regards,

Principal
Vasantdada Patil Arts,Comm.
& Sci.College Patoda,Dist.Beed

S. T. Co-op. Edu. Society's Ltd.
(Affi. KBC North Maharashtra University Jalgaon)
Science Sr. College, Shahada Dist Nandurbar
NAAC Reaccredited, Grade-B (CGPA 2.42)

Dr. Shantaram P. Badgujar
(M.A.,PhD)
Principal

Shri. Motilal F. Patil
(M.Sc. Agri.)
Chairman

College Phone
02565-223122, 223532

Website: -http://stesciencecollege.com

E-Mail:- stcoopsciencecollegeshd@gmail.com

SSC/72/2021

2/6/2021

Invitation Letter

To,
Dr. Milind Kashinath Patel,
Vice Principal, IQAC Co-ordinator
PSGVP Mandal's SIP Arts, GBP Science and STKVS Commerce College,
Shahada, Dist-Nandurbar (M.S.),
India

Dear Sir,

We are pleased to invite you as a '**Resource Person**' to the Online Webinar on **"Industry - Specific Challenges, Job Skills and Career Trends in Post COVID 19 Scenario"** organized by Department of Chemistry, S. T. Co-op. Edu. Society's Ltd. Science Sr. College, Shahada Dist-Nandurbar (M.S.), India on **June 4th, 2021. 04:00 PM.**

This web-based webinar will be targeted to PG students our institute. It is an honor and privilege to invite you as '**Resource Person**'

We look forward to a positive confirmation, an honor for us indeed.

Yours Faithfully,

(Dr. Shantaram P. Badgujar)
Principal

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***E-mail** : ddnbcbsl@gmail.com
drphalakrp@yahoo.com
***Website** : www.ddnbc.com

Ref No.

Date

05/07/2020

To,

Dr. M. K. Patel,

P.S.G.V.P.M's SIP Arts, GBP Science and STKVS Commerce College,

Shahada.

Sub: Regarding your acceptance of the invitation as a "**Session Chairman**" for One-day National Webinar at our college.

Respected Sir,

I the undersigned extend my gratitude to you for accepting my invitation as a ***"Session Chairman"*** at the National Webinar on ***"Advances in Spectral Analysis and Nanotechnology for Chemical and Physical Sciences"*** held at the ***BPCS's Dadasaheb Devidas Namdeo Bhole College Bhusawal*** dated 2nd July 2020. Hope to have your support in future activities too.

Thanking you.

Yours sincerely,

Prin. Dr. R. P. Phalak

Education Society's
MODERN COLLEGE OF ARTS, SCIENCE & COMMERCE (Autonomous)
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- 'Star College Scheme', DBT
- 'Community College Scheme', UGC
- National Award : Best Accessible Website

Dr. R. S. Zunjarrao
M.Sc. Ph.D.
PRINCIPAL

- P.U. AFFILIATION No. (Id No. PU/PN/ASC/022(1970))
- U.G.C. RECG.NO. included U/S 2 (F) of the U.G.C. Act 1956, Letter No. F.13-371(CD) dated 1st Sept.71
- Govt. RECG. No. D.E.M.S. Pune Oct. 77, Code No. PA/ASC-13.
- Jr. College Permission No. HSC/1077/31029/XII-HS dt/ 4-5-77, HSC College Code No. J-11.11.005.

Ref. No. : MCASC/

Date : 28 सितंबर 2021

प्रति,
प्रा. डॉ. विजयप्रकाश ओमप्रकाश शर्मा,
सहायक प्राध्यापक, हिंदी विभाग,
पूज्य साने गुरुजी विद्या प्रसारक मंडल का
कला, विज्ञान व वाणिज्य महाविद्यालय, शहादा
जिला – नंदुरबार, महाराष्ट्र।

विषय- 'ऑनलाईन हिंदी पखवाड़ा समापन समारोह' का निमंत्रण स्वीकारने हेतु आभार...

महोदय,

मंगलवार, दिनांक 28 सिंतबर 2021को आपने हमारे महाविद्यालय में आयोजित **'ऑनलाईन हिंदी पखवाड़ा समापन समारोह'** के अवसर पर **'हिंदी साहित्य की सामाजिक उपादेयता'** विषय पर चिंतनपरक व्याख्यान देकर हमें लाभान्वित किया। आपका उद्बोधन हमारे प्राध्यापक और छात्रों लिए अत्यंत प्रेरणादायी रहा। आपके सहयोग से हमारा कार्यक्रम सुचारू ढंग से संपन्न हुआ इसलिए हम आपके अत्यंत आभारी हैं।

हम आशा करते हैं कि भविष्य में भी आपसे सहयोग और मार्गदर्शन मिलता रहेगा।

धन्यवाद।

P. Ubale

डॉ. प्रेरणा उबाळे
संयोजिका, हिंदी विभागाध्याक्षा
संपर्क नं. 7028525378

डॉ. राजेंद्र झुंजारराव
प्राचार्य

☎ : 020-2553 5927, 020-2553 5102 Fax : 020-2553 6075, 020-2553 0137
e-mail : principal@moderncollegepune.edu.in

महाराष्ट्र शासन
महाराष्ट्र राज्य हिंदी साहित्य अकादमी
दूरध्वनी : ०२२ - २२६७२५३९
ई-मेल : mhsahityaacademy@gmail.com
ओल्ड कस्टम हाऊस, विकास विभाग इमारत, दुसरा मजला,
शहिद भगतसिंह मार्ग, मुंबई - ४०० ००१.

जा.क्र./मराहिंसाअ/३४२/२०२१ दिनांक :१९ /०७/२०२१

प्रमाण-पत्र

प्रमाणित किया जाता है कि, डॉ. विजयप्रकाश शर्मा ने दिनांक 20 मार्च, 2021 को महाराष्ट्र राज्य हिंदी साहित्य अकादमी, मुंबई द्वारा "विश्व कविता दिवस के अवसर" पर आयोजित "कविसम्मेलन" में निमंत्रित कवि के रूप में अपनी भूमिका का निर्वहन किया।

सचिन निंबालकर
सहनिदेशक एवं सदस्य सचिव,
महाराष्ट्र राज्य हिंदी साहित्य अकादमी

KISAN VIDYA PASARAK SANSTHA'S
ShrimatiParvatibaiDalpat Mali Arts,
ShriBanduBhagwan&ShrimatiHirabaiDalal Commerce &
Shirpur Merchant's Association Science College, SHIRPUR
Dist. - Dhule (MS)
Post Box No.: 14 **Tel. No**. (02563) 255054 , **Fax** : (02563)255203**e-mail** spdmcollege@yahoo.co.in

Shri.TusharViswasraoRandhe
President

Dr. S.N.PATEL
Principal

Ref. No. - SPDM

Date: - 18/08/2020

To,

Dr. M. K Patel,

P.S.G.V.P.M. ACS College,

Shahada

Respected Sir,

We express heartfelt gratitude towards your kind acceptance of our invitation as Chief Guest for National Level "Workshop on Elearning for Students" on 16th Aug 2020.

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Your exhaustive knowledge and wonderful expression during the session has benefited all of us. All the participants were highly motivated by your presence and guidance.

Looking forward similar association in future.

Dr. S. N. Patel

Principal

S. T.E.S.& Co-op. Edu. Society Ltd's.
(Affi. North Maharashtra University Jalgaon)

Science Sr. College, Shahada Dist Nandurbar

NAAC Accredited, Grade-B (CGPA 2.47)

Dr. S.P. Badgujar
(M.A.,Ph.D)
Principal

College Phone
02565-223122, 223532

Website: - http://stesciencecollege.com

Shri. Motilal F. Patil
(M.Sc. Agri.)
Chairman

stcoopsciencecollegeshd@gmail.com

Date: 22/05/2021

Invitation Letter

To,
Dr. Hitendra P. Jadhav
Department Of Biotechnology,
PSGVP Mandal's Art, Science and Commerce College,
Shahada. Tal. Shahada Dist. Nandurbar
Maharashtra.

Subject: Invitation as resource Person for workshop.

Respected Sir,

I am glad to cordially invite you as resource person for workshop. As per above subject we kindly inform, S.T.Co-Op.Education Society's Ltd's **Science Senior College** jointly organizing the workshop on One day on the occasion of celebrating **"World Biodiversity Day"** on 23 May 2021.

We genuinely hope you would consider this invitation.

Thank you.

Principal.

PRINCIPAL
S.T.Co.op.Edu.Society's Ltd.
Science Sr.College
Shahada,Dist.Nandurbar

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(M.Sc. Agri.)
Chairman
stcoopsciencecollegeshd@gmail.co

Date: 23/05/2021

To,
Dr. Hitendra P. Jadhav
Department Of Biotechnology,
PSGVP Mandal's Art, Science and Commerce College,
Shahada. Tal. Shahada Dist. Nandurbar
Maharashtra.

Subject: Thanks to Dr. Hitendra P. Jadhav as a Guest Speaker for attending Resource Person in the one day workshop on World Biodiversity Day.

Respected Sir,

With due respect, we would like to thank you for your kind arrival at the Resource Person to One day workshop on the occasion of celebrating of "**World Biodiversity Day**" in our college on 23 May 2021 at 11.00 am. We felt great pleasure to have you among us on this festive occasion. You took the festivity of the event to a greater level by your zealous speech to the students. Everyone on and off the stage appreciated your kind thoughts and motivation which you inculcated into the young students. Your presence was inspirational for us.

Thanking you on the behalf of S. T. Co-Op. Education Society's Ltd's **Science Senior College, Shahada**.

Yours Truly,

Principal

PRINCIPAL
S.T.Co.op.Edu.Society's Ltd.
Science Sr.College
Shahada,Dist.Nandurbar