



Dr. Krishna Ray

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<https://www.researchgate.net/profile/Krishna-Ray-2>

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Earlier held positions:

- 1. Research Scientist in DBT Centre of Excellence Project at Department of Genetics, Delhi University South Campus (2009)**
- 2. Research Associate in various projects at Department of Genetics, Delhi University South Campus (2001-2009)**
- 3. DBT Post Doctoral Fellow, Bose Institute, Kolkata (1999-2001)**
- 4. JRF and SRF at Bose Institute, Kolkata and IIT-BREF BIOTEK, Kharagpur during Ph. D thesis (1993-1999)**

Academic Qualifications:

- Bachelor of Science (Honors) in Botany from University of Calcutta with First class
- Master of Science (Botany) from University of Calcutta with First class with specialization in Plant Physiology and Biochemistry
- Doctor of Philosophy in Science (Botany) from University of Calcutta (work done at Bose Institute, Kolkata).

Ph.D. thesis title: Development of transgenic cotton plant expressing *Bacillus thuringiensis* endotoxin gene

Doctoral and Post Doctoral Research Areas

- *CryIAc* transgenic development in Cotton for resistance against bollworm
- Transformation of mustard plants with lectin *ASAL* gene from *Allium sativum*
- Study of the expression of *Bt* endotoxin *CryIAc* and its detrimental effect on the *in vitro* regeneration as well as *in vivo* growth and development of tobacco and cotton transgenics
- *Barnase* and *Barstar* transgenic development for hybrid seed production in Indian oilseed mustard (*Brassica juncea*)
- Establishment of double mutant form of *Acetolactate Synthase* gene as a selection marker for both transgenic mustard and cotton
- Isolation of tapetum specific promoter from various plant sources for their use in transgenic cotton

Major achievements in Research:

- ❖ Ecological Restoration of Degraded Mangrove Ecosystem in Indian Sundarbans in West Bengal in collaboration with Department of Forests, Govt. of West Bengal. 3.16 hectares of degraded mangroves located at Ramganga village of Patharpratima Block, Indian Sundarbans, at the confluence of the large tidal river Mridangabhangra (lower arm named as Calchara) and Barchara river have already been ecologically restored (work being carried out since 2013 and still continued) and showed evidence of eco-resilience during super cyclones “Amphan” and “Yaas”. Presently since 2020, another ~60 hectares of degraded mangroves have been targeted and ecological restoration of these degraded mangroves is being executed in collaboration with Department of Forests, Govt. of West Bengal. All necessary helps and permissions for carrying out this work are granted by different departments of Govt. of West Bengal and West Bengal State University. Under the umbrella of this ~2.41 crore present project, 11 research staff have been recruited for 5 years, out of which 8 people belong to the core areas of Sundarbans. The necessary funding for this work is obtained from Department of Biotechnology (DBT), Govt. of India. This project is being carried out with Dr. Krishna Ray as Principal Investigator and Dr. Sandip Kumar Basak, Principal, Sarat Centenary College, Dhaniakhali, Hooghly as well as Joint Director, Sundarban Biosphere Reserve, Department of Forests, Govt. of West Bengal as co-investigators.
- ❖ West Bengal State University, India and Newcastle University, UK, organized a field-based workshop on the theme “Building Ecological Resilience in Vulnerable Mangroves of the Indian Sundarbans: Sustainable and Equitable Management of Biodiversity and Ecosystem Services in the era of Climate Change” from 2nd to 6th January, 2022. This workshop was supported by the Newton Bhabha Fund and co-funded by the Department of Biotechnology (DBT), Govt. of India, and delivered by the British Council with Dr. Krishna Ray and West Bengal State University, as lead successful applicant from India and Dr. Marion Pfeifer and Newcastle University, Newcastle Upon Tyne, NE1 7RU, as lead successful applicant from UK.
- ❖ Confederation of Indian Industry (CII), New Delhi and Vivify Media, New Delhi have released a publication compendium, “Women in STEM: Vanguarders of India@75” showcasing the success stories of women luminaries and achievers who have made a mark in the arena of Science, Technology, Engineering and Mathematics (STEM) to celebrate 'Azadi ka Amrit Mahotsav' inaugurated on 12th March, 2021 by our Honorable Prime Minister, India. The compendium was released by Principal Scientific Adviser to the Government of India on 22nd July, 2022 and Dr. Krishna Ray's profile has been showcased in this compendium giving credit to her work on ecological restoration of degraded mangrove ecosystem in Indian Sundarbans, in collaboration with the Department of Forests, West Bengal.
- ❖ **Till date this ecological restoration of degraded mangroves research work and its success have been reported under the following links:**

1. September 17, 2019
<https://www.thehindubusinessline.com/news/science/how-bio-restoration-is-helping-restore-degraded-mangroves-in-sunderbans/article29440448.ece#>
2. September 17, 2019
<https://vigyanprasar.gov.in/isw/bio-restoration-is-helping-restore-degraded-mangroves-in-Sunderbans.html>
3. September 17, 2019
<https://www.downtoearth.org.in/news/wildlife-biodiversity/how-bio-restoration-is-helping-restore-degraded-mangroves-in-sunderbans-66782>
4. September 28, 2019
<https://mangroveactionproject.blogspot.com/2019/09/map-news-issue-478-sept27-2019.html?m=1>
5. September 28, 2019
<https://www.thehindu.com/sci-tech/science/bio-restoring-degraded-patches-of-sunderbans/article29542941.ece>
6. June 5, 2020
<https://twitter.com/DBTIndia/status/1268868913627934721?s=20>
7. June 23, 2020
<https://www.thehindu.com/news/national/other-states/restored-mangroves-provide-evidence-of-resilience-against-cyclones-in-sundarbans/article31899790.ece>
8. March 26-28, 2021
Live Webinar series on- "Understanding Flora from Aquatic Ecosystems: Towards Better Conservation & Sustainable Use" Deshbandhu College, University of Delhi with Universiti Malaya, Institute of Ocean and Earth Sciences, Kuala Lumpur, MALAYSIA.
<https://www.youtube.com/watch?v=G7Cv3YRwyzc>
9. September 22, 2021
<https://indianexpress.com/article/technology/science/expert-explains-rare-species-sundarbans-threatened-by-human-activities-7527840/>
10. February 22, 2022
World Wetlands Day Celebration by Climate Reality Project India Chapter
"What we actually mean by ecological restoration of degraded mangroves: a scientific approach".
<https://youtu.be/PVcP3B5WfjQ>
11. March 03, 2022
<https://india.mongabay.com/2022/03/grasses-spur-mangroves-to-grow-in-an-erosion-riddled-sundarbans-patch/>
12. March 13, 2022

<https://billspindle.substack.com/p/in-the-sprawl-of-the-sunderbans-climate?s=r>

13. April 26, 2022

Virtual Tour To The Indian Sundarbans

Organized by Department of Botany, Deshbandhu College, University of Delhi

<https://youtu.be/xvXnuYu3V2U>

14. September 6, 2022

<https://india.mongabay.com/2022/09/the-reality-of-saving-young-mangroves-in-the-sundarbans/>

15. October 18, 2022

[Mongabay India](#) video reporting linked to

<https://india.mongabay.com/2022/09/the-reality-of-saving-young-mangroves-in-the-sundarbans/>

Mangrove plantations are big in Sundarbans. But how successful are they?

<https://www.youtube.com/c/MongabayIndia>

<https://youtu.be/SUFkzChFOwQ>

16. February 21, 2023

<https://era-india.org/resources/experience-with-ecological-restoration-of-degraded-mangroves-in-indian-sundarbans-dr-krishna-ray/>

17. June 5, 2023

World Environment Day, 2023, Webinar on “Potential Biotechnological Approaches in Management and Mitigation of Environmental Pollution”

Organized by Department of Biotechnology, Govt. of India

Restoring Mangroves for Environment Conservation

You Tube Link :

<https://www.youtube.com/watch?v=IPYfZBBsSsY>

Other lecture links

- Webinar series entitled “Magical Microbes: Episode 1” on 01.10.2021 organized by Eminent College of Pharmaceutical Technology, Barasat, Kolkata 700126. “Biological Phosphorus Remediation From Waste Water: Scientific Mechanisms, Novelties and Prospective Downstream Uses”

<https://youtu.be/mMyOzYm6Wm8>

Research Areas:

Research areas being pursued in my laboratory:

My laboratory is engaged in multiple research areas of **Environmental Biotechnology**. We cover the following research areas at present:

1. My team's major research interest lies with establishing an ecological restoration methodology for degraded mangrove ecosystem of Indian Sundarbans' settlement areas and expanding our developed biore restoration technology for multi-site trials on a demonstration scale and further scaling up of the same as far as possible.
2. Extensive studies in the Indian Sundarban mangrove habitats to evaluate the degradation of mangrove ecosystem and associated biodiversity loss; the prediction of degradation criteria of mangrove ecosystems on the basis of eco-physiological acclimation and related gene expression levels of mangrove and associate species; ecological restoration challenges in degraded mangroves of Indian Sundarbans with an efficient biore restoration technology already developed by our team.
3. Reproductive ecology of mangroves of Indian Sundarban with an attempt to highlight in-depth the prevalent breeding strategies of mangrove species; role of the autogamy and geitonogamy (self compatibility) versus xenogamy (self-incompatibility) in pollination and embryo development; elimination of reproductive hindrances in mangrove propagation towards successful mangrove rehabilitation; effect of climate change on mangrove reproduction.
4. Cultivation dependent/independent rhizophytic and endophytic bacterial population isolation and identification from both pristine and degraded Sundarban mangrove ecosystem and native halophytic grass rhizospheres of Sundarbans; evaluation of nutrient cycling and plant growth promotion attributes of these bacteria; utilization of promising PGPR and their consortia in restoration of degraded mangroves and rhizosphere microbiome engineering of Sundarban halotolerant rice cultivars.
5. Nitrate based modulation of PHO regulon gene expression in polyphosphate accumulating bacteria; application of the findings in phosphate remediation of phosphate rich waste water; application of accumulated polyphosphates in bacterial cells as phosphate biofertilizer.
6. Screening for Sigatoka leaf spot disease resistance among Indian cultivars of banana; Sigatoka leaf spot diseases caused by *Mycosphaerella* spp., a serious threat to banana production worldwide; identification of the Sigatoka leaf spot disease resistant banana cultivars or tolerant sources among the Indian banana cultivars by screening on the basis of Phenylpropanoid pathway activation upon artificial inoculation to utilize the resistant strains in banana improvement programmes.
7. Studying the tri-trophic interactions of Non-mulberry Muga and Eri silkworms and their primary and accessory host plants with respect to EFN and VOCs.

8. Presently we are in search of Development of a Biological Control Technology for an invasive plant species, *Polyalthia suberosa*, Hamjam, in Wild Life Sanctuary of Bethuadahari, West Bengal in collaboration with West Bengal Forest Department. The selected bio-control agent is mainly microbial, in the form of fungal pathogen or deleterious rhizo-bacteria being exclusively native to the sanctuary and its host specificity being only restricted within “Hamjam” population.
9. Latest research interest of our team is to explore the ecological potential of a lesser known carragenophyte *Catenella* spp. as an environmental/climate change bio-indicator based on its life cycle and biology of carrageenan biosynthesis for Indian Sundarbans mangrove ecosystem. *Catenella* spp., a red algal species is an integral component of Indian Sundarbans mangrove ecosystem.

Completed Research Projects:

1. “Genetic Manipulation Based Enhancement of microbial phosphate and nitrate remediation for waste water treatment” Funded by Indian Council of Agricultural Research (ICAR), New Delhi under the NFBSFARA scheme (duration **2011-2014**). Amount: **Rs. 44.82570 lakh. NFBSFARA/GB-2019/2011-12**
2. "Biore Restoration of degraded mangrove forest along the embankment of the river Ramganga and related molecular study for the loss of mangrove ecosystem homeostasis" Funded by Department of Biotechnology, New Delhi (duration **2013-2018**). Amount: **Rs 68.25600 lakh. BT/PR7501/BCE/8/982/2013 dated 30.10.2013**
3. Project entitled “An in-depth study of host-non-mulberry silkworm interaction with special reference to extra floral nectaries (EFN) and volatile organic chemicals (VOC) of host plants and the silkworm’s adaptations to the host plant’s defense response” Funded by Department of Biotechnology, GOI (duration **2016-2019**). Amount: **Rs. 25.16 lakh. BT/PR 16610/NER/95/221/2015 dated 13.10.2016**
4. Project entitled “Molecular dissection of defense against Sigatoka infection in Banana: Exploitation of *Musa* germplasm of North East for development of Sigatoka-resistant hybrid” under DBT’s Banana program for the NE. Funded by Department of Biotechnology, GOI, (duration **2018-2021**). Amount: **Rs. 22.67 lakh. DBT-NER/AGRI/33/2016(Group-2) dated 22.3.2018**
5. Project entitled "Study of reproductive biology of mangrove species in Sundarbans in correlation to its potential for mangrove restoration" as Co-investigator under SCIENCE & ENGINEERING RESEARCH BOARD (SERB), Department of Science and Technology (DST), Govt. of India (duration **2017-2020**). Amount: **Rs. 39.36790 lakh. EMR/2016/005262 dated 31.7.2017**

Ongoing Research Projects:

1. Project entitled “Demonstration of established bio-restoration technology for ecological restoration of degraded mangrove ecosystem in Indian

Sunderbans through site-specific approach across differential degradation gradients” under Department of Biotechnology (DBT), New Delhi, Govt. of India. Ongoing **2020-2025 (5 yrs)**. Amount: **Rs. 2.4189420 crores. BT/PR30531/BCE/8/1496/2018 dated 29.02.2020**

2. Project entitled “Development of Biological Control Technology for invasive species, *Polyalthia suberosa*, Hamjam, in Wild Life Sanctuary of Bethuadahari, West Bengal” under Department of Biotechnology (DBT), New Delhi, Govt. of India. Ongoing **2022-2025 (3 yrs)**. Amount: **Rs.39.83360 lakh. BT/PR39375/FCB/125/51/2020 dated 17.03.2022.**
3. Project entitled “*In situ* bioremediation approach at two major drains leading to Nohai Khal (falling on the River Bidyadhari) and Khardah Khal (falling on the River Hooghly) respectively for effective removal of pollutants in domestic sewage” under West Bengal Pollution Control Board (WBPCB), Govt. of West Bengal. Ongoing from 2022, initially for 6 months. Amount: **Rs. 21.10 lakh. 3398-2022-RHRB/1/C. Lab dt 5.12.2022.**
4. Project entitled “Exploring the ecological potential of a lesser known carragenophyte *Catenella* spp. as an environmental/climate change bio-indicator based on its life cycle and biology of carrageenan biosynthesis for Indian Sundarbans mangrove ecosystem” under Science & Engineering Research Board (SERB), Govt. of India. Ongoing **2023-2026 (3 yrs)**. Amount: **Rs. 40.29885 lakh. CRG/2022/009348 dated 04.07.2023.**

Travel Grant Awards obtained:

- Travel grant obtained from Department of Biotechnology, Govt. of India for attending and presenting research work at **the Joint Annual Meeting of the American Society of Plant Biologists and Canadian Society of Plant Physiologists during 31st July-4th August, 2010, held in Montreal, Canada.**
- Travel grant obtained from Department of Biotechnology, Govt. of India for attending and presenting research work at **Mangrove and Macrobenthos Meeting, July 18-22, 2016 in Florida, U.S.A. University of Florida, USA.**

International Workshop Grant obtained:

- ❖ **Newton-Bhabha Researcher Links Workshop grant supported by the Newton Bhabha Fund and co-funded by the Department of Biotechnology (DBT), Govt. of India, and delivered by the British Council for a West Bengal State University, India and Newcastle University, UK, collaborated field-based workshop project on the theme “Building Ecological Resilience in Vulnerable Mangroves of the Indian Sundarbans: Sustainable and Equitable Management of Biodiversity and Ecosystem Services in the era of Climate Change” at Indian Sundarbans from 2nd to 6th January, 2022. Amount: Rs. 11.61202 lakh. File No. IC-12047(12)/17/2021-ICD-DBT (Computer No. 14730) dated 15.12.2021**

Major Research Collaborators:

1. **Dr. Sandip Kumar Basak**, Principal, Sarat Centenary College, Dhaniakhali, Hooghly 712302, West Bengal, India.
2. **Dr. Kiranmoy Chatterjee**, Assistant Professor, Department of Statistics, Bidhannagar College, Salt Lake City, Sector 1, Block EB, Kolkata 700064, India.
3. **Prof. Punyasloke Bhadury**, Swarna Jayanti Fellow, Department of Biological Sciences, IISER Kolkata.
4. **Dr. Arup Kumar Mitra**, Associate Professor, Department of Microbiology St. Xavier's College, Kolkata.
5. **Dr. Mahashweta Mitra Ghosh**, Assistant Professor, Department of Microbiology St. Xavier's College, Kolkata.
6. **Dr. Anindita Banerjee**, Assistant Professor, Department of Microbiology St. Xavier's College, Kolkata.
7. **Dr. Priyadarshini Bhorali**, Assistant Professor, Department of Agricultural Biotechnology, Assam Agricultural University, Jorhat-785013, Assam, India.
8. **Prof. Dipshikha Bora**, Department of Life Sciences, Dibrugarh University, Dibrugarh - 786004 Assam, India.
9. Collaboration on research project of student of M.Sc. Wildlife Biology & Conservation at NCBS-TIFR, Bangalore with **Dr Jayashree Ratnam, Program Director, Wildlife Biology and Conservation Program, National Centre for Biological Sciences, Tata Institute of Fundamental Research, Bangalore.**
10. Collaboration with **Dr. Suresh Babu, Dean, School of Human Ecology, Ambedkar University Delhi**, on collaborative internships to **Masters students of School of Human ecology (SHE) at Sundarbans.**

Invited lectures delivered:

- Delivered the talk “Experience with Ecological Restoration of Degraded Mangroves in Indian Sundarbans” on 21st February, 2023 in a webinar platform organized by Ecological Restoration Alliance- India
- Delivered Plenary Lecture in the Bilateral International Conference, jointly

organized by the Institute of Ecotoxicology and Environmental Sciences (IE&ES), India and the Bangladesh Environment and Development Society (BEDS), Bangladesh in association with the Khulna University, Khulna, Bangladesh during 19th–20th October, 2022 at the Khulna University, Bangladesh on “A SUCCESSFUL ENDEAVOR OF ECOLOGICAL RESTORATION/CONSERVATION OF DEGRADED MANGROVES OUTSIDE THE PROTECTED AREAS OF INDIAN SUNDARBANS”.

- Delivered a lecture on “Biodiversity Conservation Outside Protected Areas in India: A conservation effort at degraded mangrove ecosystem in Indian Sundarbans” organized by Department of Botany, Chemistry, Geography and Zoology, East Calcutta Girls' College, Lake Town, on a two-days' National Seminar on "Biodiversity: Assessment, Issues, Ethics and Management- Global Scenario" during 11-12" July, 2022.
- Delivered a lecture on “Ecological mangrove restoration as a reliever of the obvious climate change effect” on 04.06.2022 on the occasion of World Environment Day, in a seminar on the theme “*Self-Employment & Clean and Green Environment through Natural Fibres*” organized by ICAR-CRIJAF, Barrackpore, Kolkata.
- Shared and delivered talk on ecological restoration and revival of degraded mangroves through the “ VIRTUAL TOUR TO THE INDIAN SUNDARBANS ” as an invited speaker in the event organized by Department of Botany, Deshbandhu College, University of Delhi under the aegis of IQAC and DBT Star College Scheme on April 26, 2022
- Delivered an invited lecture in the ‘Peek into biodiversity and beyond: a hands-on workshop on NGS’ Workshop organized by IISER Kolkata, held in Hotel Ibis, Kolkata from 4th-6th March, 2022 on “Can NGS assist in ecological restoration of degraded mangrove ecosystems?”
- Delivered an invited lecture on World Wetlands Day Celebration by Climate Reality Project India Chapter on 22.02.2022 on “What we actually mean by ecological restoration of degraded mangroves: a scientific approach”.
- Acted as a panel member, Indian team lead and expert on the mangrove resilience workshop in the Lake District, Brathay Hall, Ambleside, Cumbria LA22 0HP, UK, November 29th- November 30th, 2021. This workshop forms part of Newton Bhabha Researchers Link Workshop 2020, British Council and Department of Biotechnology, Govt. of India funded project “Building Ecological Resilience in Vulnerable Mangroves of the Indian Sundarbans: Sustainable and Equitable Management of Biodiversity and Ecosystem Services in the era of Climate Change”, organized by the Newcastle University, UK.
- Invited lecture on “Biological Phosphorus Remediation From Waste Water:

Scientific Mechanisms, Novelties and Prospective Downstream Uses” in Webinar series entitled “Magical Microbes: Episode 1” on 01.10.2021 organized by Eminent College of Pharmaceutical Technology, Barasat, Kolkata 700126.

- Invited lecture on “Mangroves in Indian Sundarbans: current degradation threats towards its loss of habitat and challenges for bio-restoration of this unique ecosystem” in 3-Day International Live Webinar series on- "Understanding Flora from Aquatic Ecosystems: Towards Better Conservation & Sustainable Use" organized by Department of Botany, Deshbandhu College, University of Delhi, Delhi, INDIA jointly with Universiti Malaya, Institute of Ocean and Earth Sciences, Kuala Lumpur, MALAYSIA. 26-28th March 2021 under DBT Star College Program.
- Key note address on “An unheeded point source of phosphorus pollution in Indian environment and its nitrate induced enhanced P-remediation yielding substitute P and N fertilizers” DBT sponsored National Seminar entitled “Modern Trends in Microbiology” Chapter-12 at St. Xavier’s College, Kolkata-700016, on 10th October, 2015.

Research Publications:

A. Research papers published in Refereed/ Peer Reviewed Journals

1. Mst Momtaj Begam, Rajojit Chowdhury, Tapan Sutradhar, Chandan Mukherjee, Kiranmoy Chatterjee, Sandip Kumar Basak & **Krishna Ray**. Forecasting mangrove ecosystem degradation utilizing quantifiable eco-physiological resilience -A study from Indian Sundarbans. *Scientific Reports* **10**, 6683 (2020). <https://doi.org/10.1038/s41598-020-63586-4> [**Impact factor 4.6**]
2. Mukherjee C, Chowdhury R, Begam MM, Ganguli S, Basak R, Chaudhuri B and **Ray K** (2019) Effect of Varying Nitrate Concentrations on Denitrifying Phosphorus Uptake by DPAOs With a Molecular Insight Into Pho Regulon Gene Expression. *Frontiers in Microbiology* 10:2586. doi: 10.3389/fmicb.2019.02586 [**Impact factor: 5.2**]
3. Rajojit Chowdhury, Tapan Sutradhar, Mst. Momtaj Begam, Chandan Mukherjee, Kiranmoy Chatterjee, Sandip Kumar Basak, **Krishna Ray**. Effects of nutrient limitation, salinity increase, and associated stressors on mangrove forest cover, structure, and zonation across Indian Sundarbans. *Hydrobiologia*, 2019. 842(1), 191-217 <https://doi.org/10.1007/s10750-019-04036-9>. [**Impact factor: 2.6**]
4. Mst. M Begam, T. Sutradhar, R. Chowdhury, C. Mukherjee, S. K. Basak, **K. Ray**. Native salt-tolerant grass species for habitat restoration, their acclimation and

- contribution to improving edaphic conditions: a study from a degraded mangrove in the Indian Sundarbans. **Hydrobiologia** (2017) 803(1):373-387. DOI 10.1007/s10750-017-3320-2 [Impact factor: 2.6]
5. C. Mukherjee, R. Chowdhury, T. Sutradhar, M. Begam, S. M. Ghosh , Sandip Kumar Basak, **K. Ray**. Parboiled rice effluent: A wastewater niche for microalgae and cyanobacteria with growth coupled to comprehensive remediation and phosphorus biofertilization. **Algal Research** 19 (2016) 225–236 DOI: <http://dx.doi.org/10.1016/j.algal.2016.09.009> [Impact factor: 5.1]
 6. Mukherjee, C., Chowdhury, R., **Ray, K.** (2015). Phosphorus recycling from an unexplored source by polyphosphate accumulating microalgae and cyanobacteria – a step to phosphorus security in agriculture. **Frontiers in Microbiology** 6:1421. DOI: doi:10.3389/fmicb.2015.01421 [Impact Factor: 5.2].
 7. Chandan Mukherjee and **Krishna Ray** (2015). An improved DAPI staining procedure for visualization of polyphosphate granules in cyanobacterial and microalgal cells. Community Contributed **Protocol Exchange**. ISSN 20430116. **Research Square**. doi:10.1038/protex.2015.066. <https://assets.researchsquare.com/files/nprot-4075/v1/a9db75c0-a48e-45cf-ab79-070fe2c0505d.pdf>
 8. Chandan Mukherjee and **Krishna Ray** (2015). An improved method for extraction and quantification of polyphosphate granules from microbial cells. Community Contributed. **Protocol Exchange**. ISSN 20430116. **Research Square**. doi:10.1038/protex.2015.067 <https://assets.researchsquare.com/files/nprot-4073/v1/507e4804-b2b9-430b-8800-67ea1c4fa9a3.pdf>
 9. **Ray, K.**, Mukherjee, C., Ghosh, A.N. (2013). A way to curb phosphorus toxicity in the environment: use of polyphosphate reservoir of cyanobacteria and microalga as a safe alternative phosphorus biofertilizer for Indian agriculture. **Environ. Sci. Technol.** 47 (20), pp 11378–11379 DOI: 10.1021/es403057c [Impact factor: 11.357]
 10. Preeti Rawat*, Amarjeet Kumar Singh*, **Krishna Ray***, Bhupendra Chaudhary, Sanjeev Kumar, Taru Gautam, Shaveta Kanoria, Gurpreet Kaur, Paritosh Kumar, Deepak Pental and Pradeep Kumar Burma (2011)***These authors contributed equally to the work.** The expression of *Bacillus thuringiensis* endotoxin Cry1Ac has detrimental effect on the in vitro regeneration as well as in vivo growth and development of tobacco and cotton transgenics **Journal of Biosciences** vol. 36 (2), 363-376 DOI: 10.1007/s12038-011-9074-5 [Impact factor: 2.9]
 11. P. Rawat, **Krishna Ray**, D. Pental and P.K.Burma (2008) Mutant *acetolactate*

synthase gene conferring resistance to the herbicide ‘Imazethapyr’ is an efficient *in vitro* selection marker for genetic transformation of cotton. **Current Science** Vol.95, No.10: 1454-1458 [**Impact factor: 1.169**]

12. **Krishna Ray**, N.C. Bisht, D. Pental, P. K. Burma (2007) Development of barnase/barstar transgenics for hybrid seed production in Indian oilseed mustard (*Brassica juncea* L. Czern & Coss) using a mutant *acetolactate synthase* gene (*ALS^{dm}*) conferring resistance to Imidazolinone-based herbicide ‘Pursuit’. **Current Science** Vol.93, No.10: 1390-1396 [**Impact factor: 1.169**]
13. I. Dutta, P. Majumder, P. Saha, **Krishna Ray**, S. Das (2005). Constitutive and phloem specific expression of *Allium sativum* leaf agglutinin (ASAL) to engineer aphid (*Lipaphis erysimi*) resistance in transgenic Indian mustard (*Brassica juncea*). **Plant Science**: 169: 996-1007 **DOI**: 10.1016/j.plantsci.2005.05.016 [**Impact factor: 5.2**]
14. **Krishna Ray**, A. Jagannath, S.A. Gangwani, P.K.Burma, D. Pental (2004). Mutant *acetolactate synthase* gene is an efficient *in vitro* selectable marker for the genetic transformation of *Brassica juncea* (oilseed mustard). **Journal of Plant Physiology** 161: 1079-1083 **DOI**: 10.1016/j.jplph.2004.02.001 [**Impact factor: 4.3**]

B. Oral/Poster Presentations in International Conferences organized outside India

1. “In Indian Sundarbans xenogamous pollination is preferred in *Bruguiera gymnorrhiza* and *Avicennia* spp., the most successful ones used commonly for mangrove afforestation ventures”. Sandip Kumar Basak, **Krishna Ray**, Subhajit Saha. Oral presentation in Sixth Mangrove Macro-benthos and Management conference (MMM6) held during July 24-28, 2023, at Universidad de los Andes (Caribbean Campus) and Universidad de Cartagena (San Agustín Cloister) at Cartagena-Colombia, in the South American continent and the Caribbean region.
2. “Testing a site-specific approach for ecological restoration of degraded mangrove ecosystems, species communities and ecosystem services: Case study from Indian Sundarbans”. **Krishna Ray**, Sandip Kumar Basak. Poster presentation in Sixth Mangrove Macro-benthos and Management conference (MMM6) held during July 24-28, 2023, at Universidad de los Andes (Caribbean Campus) and Universidad de Cartagena (San Agustín Cloister) at Cartagena-Colombia, in the South American continent and the Caribbean region.
3. “Effect of degradation stressors on loss of original habitat and biodiversity of “rare and

threatened” mangrove species and its associates in fringe mangroves of Indian Sundarbans”. Sandip Kumar Basak, **Krishna Ray**, Chayan Kumar Giri, Subhajit Saha, Hemendra Nath Kotal, Anup Mandal, Rajojit Chowdhury, Mst Momtaj Begam. Oral presentation in Bilateral International Conference, jointly organized by the Institute of Ecotoxicology and Environmental Sciences (IE&ES), India and the Bangladesh Environment and Development Society (BEDS), Bangladesh in association with the Khulna University, Khulna, Bangladesh during 19th–20th October, 2022 at the Khulna University, Bangladesh.

4. “Major bacterial communities present in mangrove forest ecosystem in Indian Sundarbans and their ecological significance”. Anup Mandal, Sandip Kumar Basak, **Krishna Ray**. Oral presentation in Bilateral International Conference, jointly organized by the Institute of Ecotoxicology and Environmental Sciences (IE&ES), India and the Bangladesh Environment and Development Society (BEDS), Bangladesh in association with the Khulna University, Khulna, Bangladesh during 19th–20th October, 2022 at the Khulna University, Bangladesh.

5. “Restoration attempts of rare and near threatened species in Indian Sundarbans with reference to conventional and non-conventional techniques”. Chayan Kumar Giri, **Krishna Ray**, Sandip Kumar Basak. Oral presentation in Bilateral International Conference, jointly organized by the Institute of Ecotoxicology and Environmental Sciences (IE&ES), India and the Bangladesh Environment and Development Society (BEDS), Bangladesh in association with the Khulna University, Khulna, Bangladesh during 19th–20th October, 2022 at the Khulna University, Bangladesh.

6. “Phthalic acid esters (PAEs), an endogenous secondary metabolite frequently observed to be present in mangrove species of Indian Sundarbans and its ecological/toxicological relevance of presence”. Hemendra Nath Kotal, Sandip Kumar Basak, **Krishna Ray**. Oral presentation in Bilateral International Conference, jointly organized by the Institute of Ecotoxicology and Environmental Sciences (IE&ES), India and the Bangladesh Environment and Development Society (BEDS), Bangladesh in association with the Khulna University, Khulna, Bangladesh during 19th–20th October, 2022 at the Khulna University, Bangladesh.

7. Poster and lightning talk presentation in 5th International Mangrove Macrobenthos and Management meeting (MMM5) in Singapore, 01-05 July, 2019 entitled “Elimination of reproductive hindrances in mangrove propagation, an emergent criterion for successful mangrove rehabilitation- A study from Indian Sundarbans”
Subhajit Saha, Satarupa Nath, Ipsita Das, Tapan Sutradhar, Sandip Kumar Basak and **Krishna Ray**

8. Poster presentation in IUCN-SSC Mangrove Specialist Group: Mangrove Symposium 2017. 12-17 September 2017, Leibniz-Centre for Tropical Marine Research (ZMT), Bremen, Germany entitled “Importance of rhizosphere conservation in mangroves of Indian Sundarbans”.

Sandip Kumar Basak, Rajojit Chowdhury, Chandan Mukherjee, Tapan Sutradhar, **Krishna Ray**

9. Oral presentation in Mangrove & Macrobenthos Meeting (MMM4), held in July 18-22, 2016, at Flagler College in St. Augustine, Florida, USA entitled “Osmotic adaptation in mangroves and associates-A challenge for degraded mangrove ecosystem”.

Krishna Ray, Tapan Sutradhar, Momtaj Begam, Sandip Kumar Basak
Travel Supported by Department of Biotechnology, Govt. of India.

10. Poster and Lightning Talk presentation in Mangrove & Macrobenthos Meeting (MMM4), held in July 18-22, 2016, at Flagler College in St. Augustine, Florida, USA
“Mangrove community structure analysis in Western Sundarbans in India-A guide for designing mangrove restoration”

Sandip Kumar Basak, Tapan Sutradhar, Momtaj Begam, **Krishna Ray**

11. Poster presentation in Mangrove & Macrobenthos Meeting (MMM4), held in July 18-22, 2016, at Flagler College in St. Augustine, Florida, USA

“In search of soil indicators to evaluate the impact of sea level rise -A study from Sundarban, India”

Chandan Mukherjee, Rajojit Chowdhury, Momtaj Begam, Tapan Sutradhar, Sandip Kumar Basak, and **Krishna Ray**

12. Oral presentation in TURNING THE TIDE ON MANGROVE LOSS “a focus on the state of mangroves in Asia” organized by IUCN Mangrove specialist group held during 12th & 13th of November 2015 in Xiamen University, Xiamen, Fujian, P. R. China

“Establishing a degraded mangrove bioremediation technology in Indian Sundarban and associated study for the loss of mangrove ecosystem homeostasis”

Krishna Ray, Tapan Sutradhar, Momtaj Begam, Rajojit Chowdhury, Chandan Mukherjee and Sandip Kumar Basak

13. A double mutant *Acetolactate Synthase (ALS^{dm})* gene of *Arabidopsis thaliana* for efficient *in vitro* and field selection of *barnase/barstar* transgenics for hybrid seed production in Indian oilseed mustard (*Brassica juncea*). **Krishna Ray**, Deepak Pental and Pradeep Kumar Burma. Poster presented in Joint Annual Meeting of the American Society of Plant Biologists and Canadian Society of Plant Physiologists held in Montreal, Canada, 31st July-4th August, 2010. Travel Supported by Department of Biotechnology, Govt. of India.

14. Expression of *cryIAc* gene is detrimental to regeneration and development of transgenics: A study in tobacco and cotton. Preeti Rawat, **Krishna Ray**, Amarjeet Kumar Singh, D. Pental and P.K.Burma. Poster presented in In Vitro Biology Meeting, June, 2009 in South Carolina, USA organized by Society for *In Vitro* Biology, USA.

C. Oral/Poster Presentations in International Conferences organized in

India

1. “Exploitation of scientific rationales while designing successful ecological restoration of degraded mangrove ecosystems: a case study from Indian Sundarbans”. **Krishna Ray**, Sandip Kumar Basak, Chayan Giri, Anup Mandal, Hemendra Nath Kotal, Subhajit Saha. Oral presentation as part of the symposium session “Restoring terrestrial ecosystems in India: Frameworks, synthesis and the way forward”. 59th ANNUAL MEETING OF THE ASSOCIATION FOR TROPICAL BIOLOGY AND CONSERVATION organized at Kumaraguru College of Technology, Coimbatore, India, July 02-06, 2023.
2. “Bacterial community structure variability across mangrove rhizo-gradient and its ecological roles- an observation from western part of Indian Sundarbans”. Anup Mandal, Sumana Mondal, Biswajit Biswas, Rajojit Chowdhury, Hemendra Nath Kotal, Chayan Giri, Rudranil Sengupta, Sandip Kumar Basak, **Krishna Ray**. Oral presentation as part of the oral session “Ecosystem function and ecosystem services”. 59th ANNUAL MEETING OF THE ASSOCIATION FOR TROPICAL BIOLOGY AND CONSERVATION organized at Kumaraguru College of Technology, Coimbatore, India, July 02-06, 2023.
3. “Exploring disappearance of rare and near-threatened taxa of mangrove species from river-shore fringes of Indian Sundarbans with attempts to restore”. Chayan Giri, Anup Mandal, Hemendra Nath Kotal, Subhajit Saha, **Krishna Ray**, Sandip Kumar Basak. Presented as a Speed Talk during the conference. 59th ANNUAL MEETING OF THE ASSOCIATION FOR TROPICAL BIOLOGY AND CONSERVATION organized at Kumaraguru College of Technology, Coimbatore, India, July 02-06, 2023.
4. “A study of phthalic acid esters (PAEs) of mangrove origin and its ecological significance in mangrove ecosystem of Indian Sundarbans”. Hemendra Kotal, Chayan Giri, Anup Mandal, Subhajit Saha, Sandip Kumar Basak, **Krishna Ray**. Oral presentation as as part of the oral session “Marine and coastal ecology”. 59th ANNUAL MEETING OF THE ASSOCIATION FOR TROPICAL BIOLOGY AND CONSERVATION organized at Kumaraguru College of Technology, Coimbatore, India, July 02-06, 2023.
5. “Nature-based strategies utilizing two Ascomycetes pathogens, in crop improvement program vis-à-vis for biological control of invasive plant species in sanctuary”. Ipsita Das, Anjali Ghosh, Subhajit Saha, Chayan Giri, Hemendra Kotal, Anup Mandal, Sandip Kumar Basak, **Krishna Ray**. Presented as a Poster part of the poster session “Ecosystem function and ecosystem services”. 59th ANNUAL MEETING OF THE ASSOCIATION FOR TROPICAL BIOLOGY AND CONSERVATION organized at Kumaraguru College of Technology, Coimbatore, India, July 02-06, 2023.
6. “A differential gene expression profile distinguishes mangrove physiology under disturbed ecosystem from that of pristine one in Indian Sundarbans” Tapan Sutradhar, Mst. Momtaj Begam, Chandan Mukherjee, Sandip Kumar Basak, **Krishna Ray**. 4th International Plant Physiology Congress, December 2-5, 2018, CSIR-NBRI, Lucknow, India.

7. “Osmolyte accumulation pattern in mangroves and associates in response to salinity and related stressful environment in Indian Sundarbans”. **Krishna Ray**, Tapan Sutradhar, Momtaj Begam, Rajojit Chowdhury, Chandan Mukherjee and Sandip Kumar Basak. Insight to Plant Biology in the Modern Era. Organized by Division of Plant Biology, Bose Institute, Kolkata. 8-10 February, 2017.

8. “Loss of adaptive plasticity of mangroves in degraded ecosystem-a study based on osmolyte accumulation” **Krishna Ray**, Sandip Kumar Basak, Tapan Sutradhar, Chandan Mukherjee, Rajojit Chowdhury, Momtaj Begam
3rd International Plant Physiology Congress, Challenges and Strategies in Plant Biology Research held during December 11-14, 2015, Convention Centre, JNU, New Delhi.

9. “Mangroves-A concept of convergent evolution” by Tapan Sutradhar, Mst Momtaj Begam, Sandip Kumar Basak, **Krishna Ray**. National Symposium on “EVOLVING PLANT BIOLOGY: FROM CHROMOSOMES TO GENOMICS”, November 27-29, 2014, organized by West Bengal Academy of Science and Technology (WAST), in collaboration with Bose Institute, University of Calcutta and The Ramakrishna Mission Institute of Culture.

13. “Waste water phosphorus and its biological remediation by cyanobacteria and microalgae”. Chandan Mukherjee, Rajojit Chowdhury, **Krishna Ray**. International conference on Molecular Biology and Its Applications organized by Department of Life Science and Biotechnology, Jadavpur University, February 14-15, 2014.

14. “Application of Cyanobacteria for saline soil remediation”. Sejuti Magdalene Ghosh, Chandan Mukherjee, Tapan Sutradhar, **Krishna Ray**. International Conference on Molecular Biology and its applications organized by Department of Life Science & Biotechnology, Jadavpur University, February 14-15, 2014.

15. “Salt tolerant rice cultivars versus Halophytic grass species - A Biochemical comparison”. Tapan Sutradhar, Angana Das, Mst Momtaj Begam, Sandip Kumar Basak, **Krishna Ray**. International Conference on Molecular Biology and its applications organized by Department of Life Science & Biotechnology, Jadavpur University, February 14-15, 2014.

D. Oral/Poster Presentations (National)

1. “In spite of different environmental barriers reproductive ecology of mangroves of Indian Sundarbans indicates Xenogamy as preferred mode of successful reproduction.” Subhajit Saha, Ipsita Das, Anindita Banerjee, **Krishna Ray** and Sandip Kumar Basak. National Seminar On “Popular and Basic Sciences: A Quest Towards Foundation of Science” organized by Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302 Department of Science & Technology and Biotechnology (DSTBT), Govt. of West Bengal, 23-24 September, 2022.

2. “Importance of metagenomic surveys of soil bacterial communities in monitoring mangrove forest health.” Anup Mandal, Sandip Kumar Basak, **Krishna Ray**. National

Seminar On “Popular and Basic Sciences: A Quest Towards Foundation of Science” organized by Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302 Department of Science & Technology and Biotechnology (DSTBT), Govt. of West Bengal, 23-24 September, 2022.

3. “Climate change affects the diversity of Indian Sundarbans: Restoration attempts of this lost diversity with reference to conventional and non-conventional techniques.” Chayan Kumar Giri, **Krishna Ray**, Sandip Kumar Basak. National Seminar On “Popular and Basic Sciences: A Quest Towards Foundation of Science” organized by Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302 Department of Science & Technology and Biotechnology (DSTBT), Govt. of West Bengal, 23-24 September, 2022.

4. “Diethyl phthalate, no more a xenobiotic compound for plant species, is widespread in mangrove species of Indian Sundarbans and its relevance of presence”. Hemendra Nath Kotal, Sandip Kumar Basak, **Krishna Ray**. National Seminar On “Popular and Basic Sciences: A Quest Towards Foundation of Science” organized by Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302 Department of Science & Technology and Biotechnology (DSTBT), Govt. of West Bengal, 23-24 September, 2022.

5. “Diversity of plants used for clinical purposes in Indian Sundarbans settlement villages--an analysis through the eyes of native “Kaviraj” community”. Bhanumati Sarkar and **Krishna Ray**. National Seminar on "Biodiversity: Assessment, Issues, Ethics and Management-Global Scenario". July 11-12, 2022. East Calcutta Girls' College, Lake Town, Kolkata-700 089

6. “A complex convergence of abiotic stresses in the mangrove habitat in Indian Sundarban leads to secondary metabolites accumulation as active components of medicinal values”. Bhanumati Sarkar and **Krishna Ray**. National Symposium on Frontiers in Plant Science Research. June 10, 2022. Archana Sharma Foundation of Calcutta, Department of Botany, University of Calcutta.

7. “Study of rare and near threatened species in Indian Sundarbans and their restoration” Chayan Kumar Giri, **Krishna Ray**, Sandip Kumar Basak. National Seminar on “Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change”. April 22-23, 2022. Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302.

8. “A comparative account of Reproductive biology of mangroves in different habitat conditions indicating cross-pollination as preferred mode of reproductive success in Indian Sundarbans”. Subhajit Saha, Ipsita Das, Anindita Banerjee, **Krishna Ray** and Sandip Kumar Basak. National Seminar on “Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change”. April 22-23, 2022. Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302.

9. “Study of photosynthesis and photosynthates as osmotic stress warriors in mangroves of Indian Sundarbans”. Hemendra Nath Kotal, Sandip Kumar Basak, **Krishna Ray**. National Seminar on “Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change”. April 22-23, 2022. Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302.

10. “Diversity of root endophytic bacteria of mangroves, plant growth promotion at lab and at rice fields of Indian Sundarbans”. Biswajit Biswas, Sumana Mondal, Chayan Kumar Giri, Mahasweta Mitra Ghosh, Sandip Kumar Basak and **Krishna Ray**. National Seminar on “Biodiversity Conservation & Sustainable Development-with a sense of

urgency to combat desertification and climate change”. April 22-23, 2022. Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302.

11. “Bacterial diversity in native halophytic grass rhizospheres in Indian Sundarbans-Culture independent and Culture dependent scenario. Sumana Mondal, Chayan Kumar Giri, Sandip Kumar Basak, and **Krishna Ray**. National Seminar on “Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change”. April 22-23, 2022. Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302.

12. “Ecological aspects of Planctomycetes and Actinobacteria in mangrove forest ecosystem in Indian Sundarbans.” Anup Mandal, Sandip Kumar Basak, **Krishna Ray**. National Seminar on “Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change”. April 22-23, 2022. Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302.

13. “‘Phenylpropanoid’ pathway as a biomarker for screening Sigatoka Leaf Spot disease-resistant *Musa* germplasms. Ipsita Das, Subhajit Saha, **Krishna Ray**. National Seminar on “Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change”. April 22-23, 2022. Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302.

14. “Revisiting the molecular cross-talk between denitrification and phosphate uptake by PAO bacteria for efficient phosphate bioremediation.” Rudranil Sengupta, Sandip Kumar Basak, **Krishna Ray**. National Seminar on “Biodiversity Conservation & Sustainable Development-with a sense of urgency to combat desertification and climate change”. April 22-23, 2022. Sarat Centenary College, Dhaniakhali, Hooghly, WB, PIN-712302.

15. “Across a wide degradation gradient in Indian Sundarbans, cross-pollination seems to be the preferred mode for reproductive success in mangroves: some data from the native habitat”. Subhajit Saha, Satarupa Nath, Ipsita Das, Rahul Joshi, Anindita Banerjee, Krishna Ray and Sandip Kumar Basak. National Virtual Conference on “Genomics to Phenomics: A New Horizon in Plant Science Research” (NVC-2021), Department of Botany, University of Calcutta, 28th February -1st March, 2021.

16. “Culturable community of root endophytic bacteria in Indian Sundarban mangrove species demonstrate high potential for plant growth promoting activities under laboratory conditions”. Biswajit Biswas, Sumana Mondal, Mahasweta Mitra Ghosh, Sandip Kumar Basak and Krishna Ray. National Virtual Conference on “Genomics to Phenomics: A New Horizon in Plant Science Research” (NVC-2021), Department of Botany, University of Calcutta, 28th February -1st March, 2021.

17. “Halophytic grasses and rice rhizosphere in Indian Sundarbans are habitat of nutrient cycling bacteria having high potential of plant growth promotion”. Sumana Mondal, Biswajit Biswas, Sandip Kumar Basak and Krishna Ray. National Virtual Conference on “Genomics to Phenomics: A New Horizon in Plant Science Research” (NVC-2021), Department of Botany, University of Calcutta, 28th February -1st March, 2021.

18. “Screening for Sigatoka leaf spot disease resistance among fourteen Indian cultivars of banana using activation level of ‘core’ Phenylpropanoid pathway as biomarker of pathogen resistance.” Ipsita Das, Subhajit Saha, Krishna Ray. National Virtual Conference on “Genomics to Phenomics: A New Horizon in Plant Science Research” (NVC-2021), Department of Botany, University of Calcutta, 28th February -1st March, 2021.

19. Dual role of microalgae and cyanobacteria: A step towards overcoming the challenges of groundwater scarcity and phosphorus deficiency. Chandan Mukherjee, Rajojit Chowdhury, Tapan Sutradhar, **Krishna Ray**. National Conference on “New Avenues in microbiology & biotechnology: Challenges and prospects” jointly organized by Department of Microbiology, West Bengal State University & Sarada Ma Girls’ College, Barasat on 18th & 19th March, 2016.
20. Moderate halotolerant phosphate solubilizing bacteria from Sundarban mangrove ecosystem and role in reclamation of saline agricultural soil. Sejuti Magdalene Ghosh, Chandan Mukherjee, Rajojit Chowdhury, **Krishna Ray**. National Conference on “New Avenues in microbiology & biotechnology: Challenges and prospects” jointly organized by Department of Microbiology, West Bengal State University & Sarada Ma Girls’ College, Barasat on 18th & 19th March, 2016.
21. Sundarban grass rhizosphere microbes and their contribution to mangrove environment” Tapan Sutradhar, Momtaj Begam, Chandan Mukherjee, Rajojit Chowdhury, Sandip Kumar Basak and **Krishna Ray**. National Conference on “New Avenues in microbiology & biotechnology: Challenges and prospects” jointly organized by Department of Microbiology, West Bengal State University & Sarada Ma Girls’ College, Barasat on 18th & 19th March, 2016.
22. Soil microbial enzyme activity profile under degraded and non-degraded mangrove forest” Rajojit Chowdhury, Chandan Mukherjee, Tapan Sutradhar, Sandip Kumar Basak and **Krishna Ray**. National Conference on “New Avenues in microbiology & biotechnology: Challenges and prospects” jointly organized by Department of Microbiology, West Bengal State University & Sarada Ma Girls’ College, Barasat on 18th & 19th March, 2016.
23. “Halotolerant phosphate solubilizing bacteria from high saline environments”. Sejuti Magdalene Ghosh, Chandan Mukherjee, Rajojit Chowdhury, Biswajit Biswas and **Krishna Ray**. UGC & DST Sponsored National Symposium on Advances in Plant and Microbial Research organized by DRS-Department of Botany, University of North Bengal, Siliguri 734013, India, 12th-13th December 2014.
24. “Mangrove associates: a lesser studied assemblage in mangrove ecosystem”. Momtaj Begam, Tapan Sutradhar, **Krishna Ray** and Sandip Kumar Basak. UGC & DST Sponsored National Symposium on Advances in Plant and Microbial Research organized by DRS-Department of Botany, University of North Bengal, Siliguri 734013, India, 12th-13th December 2014.
25. “Organic solutes and soluble sugars: Back bone of mangrove salinity adaptation”. Tapan Sutradhar, Momtaj Begam, **Krishna Ray**, Sandip Kumar Basak. UGC & DST Sponsored National Symposium on Advances in Plant and Microbial Research organized by DRS-Department of Botany, University of North Bengal, Siliguri 734013, India, 12th-13th December 2014.
26. “Bacterial isolates from Rice mill effluent in Bioremediation of Ammonia”. Chandan Mukherjee, Rajojit Chowdhury, **Krishna Ray**. UGC & DST Sponsored National Symposium on Advances in Plant and Microbial Research organized by DRS-Department of Botany, University of North Bengal, Siliguri 734013, India, 12th-13th December 2014.
27. “Bacterial isolates from rice mill effluent and their bioremediation capability in reducing toxic level of phosphorus”. Chandan Mukherjee, Rajojit Chowdhury, **Krishna**

Ray. 1st National conference on Advancing Biology Through Technology and Computation organized by Department of Microbiology, West Bengal State University and Kingston College of Science. August 22, 2014.

28. “Efficient phosphate accumulating cyanobacteria for waste water remediation.” Chandan Mukherjee, Sejuti Magdalene Ghosh, Rajojit Chowdhury, **Krishna Ray.** National Seminar on Micro- and Macro- resources in Biomolecular Technology, February 25-26, 2013. Department of Biotechnology & Department of Microbiology North Bengal University.

29. “Studies on adaptive plasticity of two halophytic grasses-Primary colonizers in mangrove ecosystem”. Tapan Sutradhar, Angana Das, Sandip Basak, **Krishna Ray.** National Seminar on Micro- and Macro- resources in Biomolecular Technology, February 25-26, 2013. Department of Biotechnology & Department of Microbiology, North Bengal University.

30. “Efficient sodium chelating cyanobacteria for saline soil remediation for agriculture”. Sejuti Magdalene Ghosh, Chandan Mukherjee, Tapan Sutradhar, Angana Das, **Krishna Ray.** National Seminar on Micro- and Macro-resources in Biomolecular Technology, February 25-26, 2013. Department of Biotechnology & Department of Microbiology, North Bengal University.

31. “Halophytic grasses as potential sources of germplasm for salinity stress related genes to develop salt tolerant rice”. Sadhukhan, M., Basak S.K. and **Ray, K.** Advances in Abiotic and Biotic Stress Management of Plants, September 23-24, 2011. Department of Botany, University of North Bengal.

32. “Development of hybrid seeds in *Brassica juncea* (Indian oilseed mustard) using transgenic approach – our experiences.” A. Jagannath, P. Bandopadhyay, N.C. Bisht, **K. Ray,** N. Arumugam, V. Gupta, A.K. Pradhan, D. Pental & P.K.Burma, 2010. National Symposium on Genomics and Crop Improvement: Relevance and Reservations. February 25-27, 2010, Acharya N.G. Ranga Agricultural University, Hyderabad.

33. “The expression of *Bt* endotoxin *CryIAc* has detrimental effect on the *in vitro* regeneration as well as *in vivo* growth and development of tobacco and cotton transgenics.” P. Rawat, A. Singh, **K. Ray,** S. Kumar, B. Chowdhuy, S. Kanoria, T. Gautam, D. Pental & P. K. Burma, 2009. International Conference on Emerging Trends in Biotechnology, December 4-6, 2009, Banaras Hindu University, Varanasi.

34. “Why achieving high levels of *CryIAc* protein is difficult in cotton?” P. Rawat, A. Singh, **K. Ray,** S. Kumar, B. Chowdhuy, S. Kanoria, T. Gautam, D. Pental & P.K.Burma, 2008. International Conference on Plant Biotechnology and Molecular Biology, August 15-17, 2008, Warangal.

35. “Development of transgenic Indian cotton cultivars tolerant against bollworm (*Helicoverpa armigera*) damage.” **K. Roy,** S. Mishra, A. Mondal, N.A. Ramakrishnan, D. Basu, A. Basu, P. Nayak, S.K.Sen. National symposium on role of plant tissue culture in Biodiversity conservation and Economic development, June 7-9, 1999, G. B. Pant Institute of Himalayan Environment& Development, Almora.

Research Guidance towards Ph.D. degree:

- Ph.D. thesis awarded under my supervision till date: **4**

- Ph.D. students registered but not awarded Ph.D. degree yet under my supervision and currently continuing research in my laboratory: **8**
- Ph.D. students yet to be registered under my supervision and currently continuing research in my laboratory: **2**