

Curriculum Vitae



1. Name: **Dr. Subhas Chandra Roy**
2. Date of Birth: **01.01.1964**
3. Designation: **Professor of Botany**
4. Date of Joining in NBU: 23.02.2006
5. Area of Specialization: **Plant Genetics & Molecular Breeding**
6. **Academic qualifications:**

	Degree	Year	Subject	University/Institution	% of marks
1.	B.Sc (Hons)	1987	Botany	University of North Bengal	58.00
2.	M.Sc (Botany)	1989	Cytogenetics	University of North Bengal	68.30
3.	M.Tech(Biotech)	1995	Biotechnology	Jadavpur University	69.80

7. Ph.D thesis title, Institute/Organization/University, Year of Award.

Title	Institution	Year of Award
Genomic Fingerprinting of Tea Germplasm And Analysis of Transcript Accumulation of A Defense Protein Involved During Induced Systemic Resistance.	University of North Bengal	2009

8. Professional Recognition/ Award/ Prize/ Certificate, Fellowship received by the applicant.

S.No	Name of Award	Awarding Agency	Year
1	1 st Class 1 st in M.Sc (Botany)	University of North Bengal	1990
2	UGC Fellowship CSIR NET	UGC-CSIR	1993

Government Award:

Siksha Ratna Award 2019.	Department of Higher Education, Govt. of West Bengal.	2019
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9. Post held and Work experience (in chronological order).

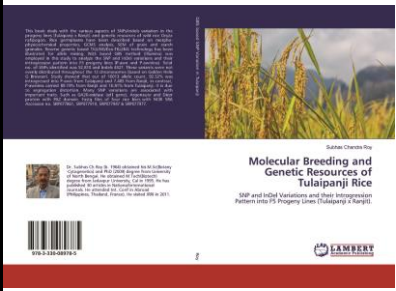
Sl.No.	Positions held	Name of the Institute	From	To	Pay Scale
1.	Sr. Research Assistant (SRA)	CSR&TI, Central Silk Board, Govt of India	31.01.1992	10.11.1997	Rs. 6500-10500/-
2.	Lecturer in Botany as WBES.	Jhargram Raj College and Darjeeling Govt. College	11.11.1997	22.02.2006	Rs. 8000-13500/-
3.	Lecturer in Botany	University of North Bengal	23.02.2006	14.07.2009	Rs. 15600-42500/-
4.	Reader in Botany	University of North Bengal	15.07.2009	14.07.2012	Rs. 15600-42500/-
5.	Associate Professor of Botany	University of North Bengal	15.07.2012	14.07.2015	Rs. 37400-64000/- AGP 9000/-
6.	Professor of Botany	University of North Bengal	15.07.2015	Continuing	Rs. 1,44,200-2,18,200/- Matrix Level -14. AGP 10000/-

10. Professional Experience: 23 Years, served as SRA, in the Central Silk Board, Govt. of India, served as WBES (West Bengal Education Service) as Lecturer in Botany in different Govt. Colleges, Govt. of West Bengal, and University of North Bengal (wef. 23.02.2006 –contd.)

11. Administrative Experiences: Post held as Dean, Faculty council of PG studies in Science, University of North Bengal (wef. March 2021 to March 2024), Post held as Head, Department of Botany, NBU 2012-2014 and 2019-2021 continue till July 2021. Worked as Member of the Executive Council (EC) and member of the Court (Court member) of the University.

12. Postdoctoral research and Training: Training taken on ‘Molecular Breeding on Rice’ from world’s premier institute of rice research, **IRRI** (International Rice Research Institute), Manila, **Philippines** in 2011.

13. Book published:

S.No	Title	Author's Name	Publisher	Year of Publication
1.	<p>Molecular Breeding and Genetic Resources of Tulaipanji Rice.</p> <p>ISBN-9783330089785 Marketed by: www.morebooks.de</p> <p>Total pages-224, Cost. €55.90.</p> 	Subhas Chandra Roy	LamBert Academic Publishing, Germany.	05.06.2017

Book Chapter:

T Choudhury, **Subhas Ch Roy**, Dilip De Sarker. 2019. Ethnobotanical studies of Dakshin Dinajpur District of West Bengal: Local knowledge and Traditions. In: Ethnobotany: Local knowledge and traditions. (Edi) JL Martinez, Amner Munoj-Acevedo and Mahendra Rai, ISBN: 9781138388987. CRC-Press, Taylor & Francis Group, pp. 132-157.

14. Patent (if any): As such no patent.

Under Intellectual Property Rights (IPR) of PPV & FR Act, 2001.

A. Submitted to ICAR-NBPGR Gene Bank, Govt. of India.

**Four New Genetic Stock of rice breeding line
(Received National Identity number, IC No)-**

- i. NBUTRNF7-18, (Tulaipanji x Ranjit) with IC no. 626287;
- ii. Dinajmati 1 (variety name) (Tulaipanji x IR64) with IC No-638920;
- iii. Dinajmati 2 IC No-638921 (Tulaipanji x IR64); and
- iv. Dinajmati 3 IC No-638922 (Tulaipanji x IR64)

Submitted four breeding lines on 06.04.2022 (Yet to receive IC no)

- i. Tulaimati-1(Tulaipanji x IR64 x PB1460)
- ii. Tulaimati-1 (Tulaipanji x IR64 x PB1460)
- iii. Tulaimati-1(Tulaipanji x IR64 x PB1460)
- iv. ChhandaSakha (IR64 x Patichaula)

The screenshot displays the NBPGR database interface. At the top, it says "NATIONAL BUREAU of PLANT GENETIC RESOURCES". Below this, there is a header with "Wednesday, 25 Jul 2018" and "Accession wise Data Entry". A search bar shows "Accession: IC" with a dropdown menu and "626287" entered. A green bar indicates "Selected Accession: IC:626287 for Kalyani Srinivasan".

BatchNo	Received On	Received From	Total Samples
264/2018	13/07/2018	University of North Bengal, Darjeeling, West Bengal	1

Batch No	Crop Name	Species	Samples	Curator
264/2018	Rice	Oryza sativa var. indica	1	Kalyani Srinivasan

GeneBank Data

Generation # : 1
Moisture : 7
Germination : 96
Monitoring Date : 15/05/2018
Moni. Cycle # : 1
Next Moni. After year : 10
No. of Seeds : 3000
Dormant/Treatment : No Physical
Remark :

Storage Details

M.	R.	S.	B.	Seeds	Rem
1	M	7	3801	3000	

Passport Information

Crop Name	Species	Collector No	Other Identity	Cultivar Name	variety	Status	Village	District	State
Rice	Oryza sativa var. indica		Breeding line/NBUTRNF7-18			GENETIC STOCK/REGISTERED GERMPASM			Unknown

B. Two Rice Breeding Lines Submitted to IIRR (Indian Institute of Rice Research), ICAR, Hyderabad, Govt. of India, Under AICRIP Trial on 19.04.2022.

- i. NBU-Bot-01-22 (Tulaipanji x IR64)
- ii. NBU-Bot-02-22 (IR64 x Patichaula)

15. Abroad visit:

Country visited	Year	Purpose
Philippines	2011	Molecular Breeding course on Rice in IRRI (International Rice Research Institute, Laguna, Los Ban̄os, Manila, Philippines). Duration: 19-30 September 2011.
Thailand	2014	Attending the 4 th International Rice Congress, 27 October to 1 st November 2014, at BITECH, Bangkok, Thailand .
France	2016	Attended 14 th International Symposium of Rice Functional Genomics (ISRFG16, 26-30 September, 2016, Montpellier, France .
Switzerland	2016	Visited: ETH, at Zurich , 01-02 October, 2016.
Singapore	2018	5 th International Rice Research Congress, 15-17 Oct, 2018. Accepted the Abstract for Flash-Talk 5 minutes, Singapore

16. Courses taught in PG levels:

M.Sc (Botany): Cytogenetics and molecular breeding, Biotechnology- Tissue culture, Molecular biology, Genetic Engineering, Transgenic technology for GM crop development and Bioinformatics.

PhD: Techniques of Molecular breeding especially for rice crop, GWAS, Allele mining, proteomics, transcriptomics, Whole-genome sequencing in rice.

17. Members of Academic societies:

- i. Indian society of genetics & plant breeding, IARI, New Delhi, India (Annual).
- ii. Indian society of plant genetic resources, NBPGR, ICAR, New Delhi, India. **Life member.**

18. Number of Seminar/conference/symposium attended (National/International/State):

<i>National</i>	<i>International</i>	<i>State level</i>
Fourteen	Six	One
	<p>4th International Rice Congress, BITEC, Bangkok, Thailand, 27 Oct-1st Nov, 2014, Assessment of morphological diversity within wild rice (<i>Oryza rufipogon</i> Griff.) germplasm of NBU campus (West Bengal) for in situ conservation- A case study.</p> <p>14th International Symposium on Rice Functional Genomics, LeCurm, Montpellier, France. 26-29 September 2016. Evaluation of SNPs and InDels Variation in two progeny lines (F5) of rice [cross between Aromatic Tulaipanji and HYV Ranjit] using NGS based</p>	<p>22nd West Bengal Science & Technology Congress 2015, 28 Feb-1st March 2015, NBU, Role of rice grain in world</p>

	<p>Genotyping-by-Sequencing (GBS) Techniques and Genomic introgression into Progeny Lines.</p> <p>1st International Agrobiodiversity Congress, 6-9 November 2016, New Delhi, India. Climate change as opportunity to exploit the potential of rice landrace in a cross between local cultivar Tulaipanji and Ranjit (HYV) through analysis of genome introgression based on SNPs variations revealed by GBS system.</p> <p>International Conference on Agriculture and Allied Sciences: The Productivity, Food Security and Ecology. 13-14 August 2018. BCKV, Mohanpur, WB, India. Title: Improvement of Tulaipanji Rice through Molecular Breeding. Oral presentation, Organized by BCKV, Mohanpur, WB.</p> <p>5th International Rice Congress, Singapore, 15-17 October 2018. Title: Hybridization to Broaden the Genetic Base of Local Rice Landrace Tulaipanji and Genome-wide Diversity Analysis by WGS by Roy Subhas Chandra.</p> <p>2nd International Agrobiodiversity Congress, Use agrobiodiversity to transform food systems. 15-18 November 2021 - Rome, Italy (Virtual mode). Title: Origin of Black Rice from Wild rice (<i>O. rufipogon</i>) of India, (Black Rice Developed Through Interspecific Hybridization (<i>O. sativa</i> x <i>O. rufipogon</i>)).</p>	<p>food security: A perspective</p>
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19. **Resources person for ASC-NBU (HRDC-UGC):** Refresher courses/Orientation program: **RC-** 20 classes, **OP/FIP-** 25 classes.

20. **PhD Supervising:**

Awarded:

- i. Sabina Pradhan,** Title: Studies on Physiology and Biochemistry of *Swertia chirayita* (Roxb.) Karsten in Darjeeling Hills: Influence of Plant growth substances on growth, metabolism and yield. 31.07.2012 – 07.04.2016.
- ii. Tanmoy Choudhury:** Ethnobotany of Dakshin Dinajpur district with special reference to biodiversity and conservation of *Ocimum* species. 22.08.2012- 17.01.2018
- iii. Sachina Yongone:** Isolation and biochemical characterization of L-Myo-inositol 1-phosphate synthase from *Asterella khasiana* (Griff.) Grolle and *Sphagnum junghuhnianum* Doz 7 Mol. Of Darjeeling Hills. 21.08.2012 – 06.02.2019

Under process of PhD Thesis submission:

- i. **Koushik Moitra:** Conservation of some selected orchid of North Bengal through *in vitro* mass-propagation. 12.02.2014

Under PhD Registration process: Four (05)

- i. Indrajit Singha (Registered)
- ii. Pankaj Shil (Registered)
- iii. Shukdeb Sarker (Registered)
- iv. Jayita Sarker (Registered)
- v. Sona Limboo (Registered)

21. Number of Research Project undertaken/on-going:

Name	Funding agency	Title	Amount	Period
Dr. S. C. Roy	UGC	Genomic Fingerprinting of Tea Germplasm using RAPD and ISSR markers for Evaluation of Genetic Diversity. 2007-2009. Final Report was submitted to UGC and the results published in a two National Journals.	Rs.75,000/-	2007-09
Dr. S. C. Roy	UGC	Molecular cloning and expression of chitinase cDNA of tea plant [<i>Camellia sinensis</i>] for its functionality in plant defense system.	Rs. 5,46,500/-	2010-2013
Dr. S. C. Roy	University project	Assessment of Genetic Diversity in Rice [<i>Oryza sativa</i> L.] for Germplasm Characterization based on Morpho-Quality Traits and Crop Improvement through Molecular Breeding	Rs.75,000/-	2012-13
Dr. S. C. Roy	University project	QTLs Mapping and Genotyping-by-Sequencing (GBS) of the RIL Lines for the Improvement of Aromatic Tulaipanji Rice of West Bengal using Molecular Breeding.	Rs.75,000/-	2015-16
Dr. S. C. Roy	SAP-UGC	Evaluation of Rice Diversity (<i>Oryza sativa</i> L.) for conservation and crop improvement.	Rs. 30,000/Yr	2013-2018
Prof. S.C. Roy	University project	Improvement of Tulaipanji Rice through Molecular Breeding	Rs. 1,50,000/-	2019-2020
Prof. S.C. Roy	University project	Rice Breeding for the Development of High Yield Varieties for Food and Nutritional Security.	Rs. 1,50,000/-	2022-2023

22. List of Publications: Total 30 publications

- 2021** Roy SC, Chowdhury A (2021) Comparative ultrastructure of caryopsis and leaf surface anatomy in wild rice *Oryza coarctata* and *O. rufipogon* through Scanning Electron Microscope (SEM). *Open J Plant Sci* 6(1): 030-041. DOI: [10.17352/ojps.000030](https://doi.org/10.17352/ojps.000030)
- 2021** Roy Subhas Chandra and P Shil. 2021. Black Rice Developed Through Interspecific Hybridization (*O. sativa* x *O. rufipogon*): Origin of Black Rice Gene from Indian Wild Rice. *bioRxiv* 2020.12.25.423663; doi: <https://doi.org/10.1101/2020.12.25.423663>
- 2020** Roy Subhas Chandra and P Shil . Assessment of Genetic Heritability in Rice Breeding Lines Based on Morphological Traits and Caryopsis Ultrastructure. (2020), **Scientific Reports, Nature Group**, 10:7830 <https://doi.org/10.1038/s41598-020-63976-8>.
- 2019** Roy Subhas Chandra Yield Improvement of Tulaipanji Rice through Recombination Breeding and Selection. *Indian Journal of Plant Genetic Resources*. 2019. 32(2):192-199. ISSN-0971-8184.
- 2018** Roy Subhas Chandra. 2018. Improvement of Tulaipanji rice through Molecular Breeding. *Int J Biotechnol Biomedical Sciences*. ISSN 2454-4582. Vol 4(2): 22-27.
- 2017** Tanmay Chowdhury, Amitava Mandal, Subhas Chandra Roy, Dilip De Sarker. Diversity of the genus *Ocimum* (Lamiaceae) through morpho-molecular (RAPD) and chemical (GC-MS) analysis. *Journal of Genetic Engineering and Biotechnology* (2017), 9th January 2017. <https://doi.org/10.1016/j.jgeb.2016.12.004>. ISSN. 20905920.
- Subhas Chandra Roy, Kaushik Moitra, Dilip De Sarker. Assessment of genetic diversity**

among four orchids based on ddRAD sequencing data for conservation purposes. *Physiol Mol Biol Plants* (January–March 2017) 23(1):169–183. DOI 10.1007/s12298-016-0401-z. ISSN: 0971-5894.

Roy Subhas Chandra and Reddy VB. 2017. Assessment of SNP and InDel Variations Among the Rice Lines [Tulaipanji x Ranjit]. *Rice Science*, ISSN: 1672-6308. 2017, 24(6): 336-348.

2016 Tanmay Chowdhury, Amitava Mandal, Amit Kumar Jana, **Subhas Chandra Roy**, Dilip De Sarker. 2016. Study of phyto-sociology and ecology of naturally growing *Ocimum* species with their conservational strategies in Dakshin Dinajpur district of West Bengal. *Acta Ecologica Sinica*, vol. **36(6)**: 483–491. ISSN: 1872-2032.

2015 **Subhas Chandra Roy**. (2015). Gene transfer in higher plants for the development of genetically modified crops (GM crops). *International Journal of Current Advanced Research*, vol 4, issue 6: 132-148. ISSN No. 2319-6475.

Subhas Chandra Roy. (2015). Phylogenetic relationship among the wild rice [*Oryza rufipogon* Griff.] of NBU campus and cultivated rice as revealed by chloroplast matK gene. *International Journal of Agriculture Innovations and Research*, Vol 3 issue 6:1869-1875. ISSN no. 2319-1473.

Subhas Ch. Roy (2015) . DNA Barcoding for Wild Rice [*Oryza rufipogon* Griff.] of NBU Campus Based on matK gene and Assessment of Genetic Variation Using DREB and BAD2 Gene Sequences. *Journal of Plant Gene and Trait*, Canada. Vol.6 pages 1-10. ISSN: 1925-2013.

2014 T Chowdhury, **Subhas Ch. Roy** and Dilip De Sarker (2014). Wild edible plants of Uttar Dinajpur District, West Bengal. *Life Science Leaflets*, 47: 20-36. (ISSN no. 2277-4297 print).

Roy Subhas Chandra & B. D. Sharma. 2014. Assessment of genetic diversity in rice [*Oryza sativa* L.] germplasm based on agro-morphology traits and zinc-iron content for crop improvement., *Physiol Mol Biol Plants*, 20(2): 209-224. Springer-Germany. ISSN: 0971-5894.

Roy Subhas Chandra (2014). Morphological characterization of wild rice (*Oryza rufipogon* Griff.) of NBU campus (West Bengal) for *in situ* conservation and germplasm enhancement. *NBU J Plant Sci*. 8 (1): 53-64. ISSN No. 09746927.

Chowdhury Tanmoy, De Sarker Dilip and **Roy Subhas Chandra** (2014). Local folk use of plants in Dakshin Dinajpur district of West Bnegal, India. *International Research Journal of Biological sciences*, 3(5): 67-79. ISSN (P), 2278 - 3202.

Roy Subhas Chandra (2014). Molecular cloning and expression of tea chitinase gene in *Pichia pastoris*, International Journal of Advanced Biotechnology and Research(IJBR) ISSN 0976-2612, Online ISSN 2278–599X, Vol5, Issue4, 2014, p612-618

Roy Subhas Chandra (2014). Assessment of Morphological Diversity within Wild Rice (*Oryza rufipogon* Griff.) Germplasm of NBU Campus (West Bengal) For *In Situ* Conservation- A Case Study. Indian J plant Genetic Resources, vol.27(3):_251-258. ISSN : 0971-8184.

Roy Subhas Chandra (2014). Mass propagation of an epiphytic orchid *Acampe papillosa* (Lindl.) through *in vitro* seed germination. NBU J Plant Sci. vol. 8 (1): 65-70. ISSN No. 09746927.

2013 Roy, S. C. and Tirthankar Roy. (2013). Peptide mass fingerprinting of rice (*Oryza sativa* L.) leaves during UV-B induced stress at seedling stage: A proteome analysis. Indian Journal of Biotechnology, 12: 504-508. ISSN: 0972-5849.

Roy, S. C. (2013). Assessment of Genetic diversity in F2 Rice seed population of a cross between Tulaipanji and Ranjit using morphological, physiological and SSR Markers. NBUJPS, Vol.7(1): 9-20. ISSN no- 0974 6927.

Roy, S.C., BD Sharma, S Singha and B Sinha (2013). Characterization of rice [*Oryza sativa* L.] germplasm based on Iron and Zinc content. NBUJPS, ISSN no- 0974 6927. Vol. 7(1): 89-94.

2012 Roy, S. C. and T. O. Bhutia. Evaluation of genetic variation among three species of *Allium* on the basis of karyomorphology and SDS-PAGE profiling. NBU Journal of Plant Science, ISSN no- 0974 6927. vol. 6 (1) March: 57-61.

Roy, S. C and B N Chakraborty. Analysis of chitinase gene specific transcript accumulation in tea [*Camellia sinensis* (L.) O. Kuntze] during induced systemic resistance by methyl jasmonate, Indian Journal of Biotechnology, **11**: 142-147. ISSN: 0972-5849.

2011 Roy, S. C and Abhishek Chattopadhyay (2011). Evaluation of genetic diversity in mango germplasm resources using RAPD markers and characterization of cultivar Guti based on 18SrRNA gene sequence. Indian J Genet Plant Breed, 71(3), 254-261. ISSN: 0975-6906

2009 Roy, S. C. and Chakraborty, B. N. (2009). Cloning and sequencing of chitinase gene specific PCR amplified DNA fragment from tea plant [*Camellia sinensis*] and analysis of the nucleotide sequence using bioinformatics algorithms. *Canadian J Pure Appl Sci*, 3(ii), 798-801.

K. Maitra, **Roy, S. C.** and De Sarker D. (2009). Mass propagation of *Cymbidium aloifolium* (L.) Sw. from asymbiotically germinated seeds using filter-paper bridge technique. *J Pl Biol*, 36 (1&2), 17-22.

Roy, S. C and Chakraborty B. N. (2009). Genetic diversity and relationships among 21 tea

cultivars (*Camellia sinensis*)- as revealed by RAPD and ISSR based fingerprinting., Indian J Biotech, 8, 370-376.

2008 Roy, S. C and Chattopadhyaya, A. (2008). Alkaline protease producing bacteria isolated from the soil of mango orchard and identified on the basis of 16S rDNA sequencing. *Canadian J Pure Appl Sci.* 2 (1), 143-148.

2007 Roy, S. C. (2007). Intraspecific diversification in *Caladium bicolor* (Ait.) Vent. (Araceae) as revealed by chromosome analysis. *Environ Ecol*, 25(4), 903-911.

23. Research interest and Vision-Mission

Major area of research interest is on genetics and molecular breeding of crop plants mainly on rice crop for the development of **new rice varieties** with high yield potentiality and climate resilient. This includes marker assisted selection (MAS) for biotic and abiotic stress tolerance genes / QTLs mapping, and for introgression of the desired traits from rice genetic resources. Pre-breeding is for widening the gene pool of the released varieties using CWR as donor (Wild rice *Oryza rufipogon*) for the development of climate ready rice varieties to fulfill the target of Sustainable Development Goal (SDG1-3) with Food and Nutritional Security. Whole Genome Sequencing of three rice cultivars – Tulaipanji, Kalonunia and Chenga has been finished and submitted to the DataBank of NCBI, USA. Maintenance and on farm *in situ* conservation of more than 130 local rice varieties including eight different types of Black rice and Red rice for their genetic evaluation and future use in Breeding program.

➤ **Breeding achievement:(Crossing/Hybridization):**

A. Intraspecific Hybridization

- i. Tulaipanji x Ranjit** = **F11**
- ii. Tulaipanji x IR64** = **F8**
- iii. Tulaipanji x PB1460** = **F5**
- iv. (Tulaipanji x IR64) x PB1460** = **F6**
- v. Badshabhog x Swarna Sub1** = **F6**
- vi. IR64 x Patichaula** = **F4**

B. Interspecific Hybridization (Pre-breeding)

- vii. Ranjit x *O. rufipogon* (RRF)** = **F5**
- viii. Badshabhog x *O. rufipogon* (BWF)** = **F5**
- ix. Chenga x *O. rufipogon* (CWF)** = **F5**

C. Mutation Breeding (EMS Mutagenesis)

- x. Badshabhog** = **M4**
- xi. Tulaipanji** = **M4**
- xii. BWF3** = **M4**
- xiii. CWF3** = **M4**

Project: Black Rice Developed Through Interspecific Hybridization (*O. sativa* x *O. rufipogon*): Origin of Black Rice from Wild rice (*O. rufipogon*) of India.

Summary

New Hypothesis proposed about the Origin of Black Rice

This is a first report in the history of rice pre-breeding, that black rice has been developed through wide crossing and introgression of genes (black pigmented genes) from wild rice accession (*O. rufipogon*) of Raiganj, West Bengal, INDIA .

Based on experimental evidences (breeding lines analysis based on classical genetics, pl see Fig. 1-6) we propose a new model (Hypothesis) of black rice origin. That-

Black rice (mainly indica type) of Indian subcontinent originated independently through natural out crossing, gene-flow and artificial selection in the course of domestication from the wild rice of India not from China.

Vision: Rice Breeding for Zero Hunger & Better Health
Climate Ready Varieties for Food and Nutritional Security

Mission: Widening the rice gene pool through wide hybridization [cross with wild rice *Oryza rufipogon* i.e., Pre-breeding] for the development of new varieties with Abiotic and Biotic stress Tolerant Gene/QTLs for accelerating Food and Nutritional Security in this Climate Change Environment.

Objectives: Enhancing Crop Productivity and Quality by using Advanced Techniques of Molecular Breeding and Genomic Research [Whole Genome Sequencing/Bioinformatics analysis/Genomic assisted breeding (GAB) and Marker assisted selection (MAS)] to release new improved rice varieties.

Mandate: i. Alien gene transfer into *O. sativa* from *O. rufipogon* (wild rice) for broadening the genetic base of the cultivars to increase their adaptive genetic buffer through the introgression of untapped alleles from the CWR.

ii. Marker Assisted Selection (MAS) can be employed to screen the breeding lines for background and foreground selection using SSR and SNPs markers in the RIL and BIL/NIL lines.

- iii. Proteomics & Transcriptomics for gene expression analysis to increase the productivity, profitability and sustainability of rice cultivation in West Bengal.
- iv. Whole Genome Re-sequencing (WGS/GWAS)- for the analysis of trait specific allelic SNPs variation, and phylogenetic relationship with other varieties.
- v. GWAS for trait specific gene or QTL mapping and/or identification [Biotic/Abiotic traits] for the improvement of climate ready crop varieties.
- vi. Double Haploid (DH) production from F1 to select Homozygosity lines for genetic analysis and improvement purpose.
- vii. Biofortification for making rice healthier with high iron and zinc, other Nutraceutical-Antioxidants from **Black rice, Red rice** to reduce **Hidden hunger**.

Prof. (Dr.) Subhas Chandra Roy

Professor of Botany

Genetics & Molecular Breeding Laboratory, Department of Botany, University of North Bengal, PO- NBU, Siliguri-734013, WB, India. Subhascr2011@gmail.com, M: 9434140841.

24. **Proposed Text Book** (Will be published by **Ane Book, New Delhi**) Agreement signed

