**CV**

**RAJESH KUMAR TEWARI, (M.Sc., M. Phil., NET, Ph. D).**

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| **Address Office** | **Address Residence** |
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**Personal detail**

|  |  |
| --- | --- |
| Date of Birth | **February 25, 1975** |
| Gender (M/F/T) | **Male** |
| Category Gen/SC/ST/OBC | **General** |
| Whether differently abled (Yes/No) | **No** |

**Academic Qualification (Undergraduate Onwards)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Degree** | **Year** | **Subject** | **University/Institution** | **Division** |
| 1 | B. Sc. | 1994 | Botany, Chemistry, Zoology | University of Allahabad | First |
| 2 | M. Sc. | 1996 | Plant Science | University of Lucknow | First |
| 3 | M. Phil. | 1998 | Botany | University of Lucknow | First/Awarded |
| 4 | Ph. D. | 2004 | Botany | University of Lucknow | Awarded |
| 5 | NET | 1999 | Life Sciences | CSIR-UGC | Qualified |

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| --- | --- |
| Ph.D Thesis title | **Role of mineral nutrient elements in mulberry (*Morus alba* L.) plants with particular reference to oxidative metabolism.** |
| Ph.D. Supervisor | **Professor P.N. Sharma** |
| Institute/Organization/University | Department of Botany, **University of Lucknow** |
| Year of Award | **2004** |

**Citation Score**

|  |  |
| --- | --- |
| Total Number of Publications | **44** |
| Total citations | **2739** |
| Average citations per publication | **62** |
| **H-index** | **28** |
| **Cumulative IF** | **140.747** |

**Current Funding/Project**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of the Project/Chairs** | **Name of the Funding agency** | **Year of Award** | **Funds (INR in lakhs)** | **Duration** |
| Deciphering the role of nitric oxide in root development and zinc availability in rice plants | DST-SERB, New Delhi  (TARE project) | 2019 | 18.3 | 3 |
| Deciphering the role of reactive oxygen species in wood production in poplar plants | CSIR-HRDG, New Delhi | 2021 | 28.87 | 3 |
| Improvement of functional iron status in cereals through biochemical interventions | CoE: UP Higher Education Council | 2021 | 4.00 | 1 |
| Role of nitric oxide in iron fortification in maize | R&D: UP Higher Education Council | 2021 | 2.75 | 1 |
| **Total** |  |  | **53.92** |  |

**Work experience (in chronological order).**

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| **S.No.** | **Positions held** | **Name of the Institute** | **From** | **To** | **Pay Scale** |
| 1 | Research Assistant | University of Lucknow | 1999 | 2002 | ₹ 5000/m |
| 2 | SRF (CSIR) | University of Lucknow | 2002 | 2005 | ₹ 8000/m |
| 3 | Guest Faculty | University of Lucknow | 2005 | 2006 | ₹ 150/lec |
| 4 | PD Researcher | Chungbuk National University, Korea | 2006 | 2007 | ₩ 2000000/m |
| 5 | PD Researcher | Korea Basic Science Institute, Korea | 2008 | 2008 | ₩ 2000000/m |
| 6 | JSPS Fellow | Chiba University, Japan | 2008 | 2010 | ¥ 364000/m |
| 7 | Lise Meitner Fellow | University of Vienna, Austria | 2011 | 2012 | € 3750/m |
| 8 | BELSPO Fellow | SCK•CEN, Mol, Belgium | 2012 | 2013 | € 4698/m |
| 9 | Lise Meitner Fellow | University of Vienna, Austria | 2013 | 2014 | € 3750/m |
| 10 | Consultant Scientist | Jain Irrigation System Ltd., Jalgaon | 2015 | 2016 | ₹ 50000/m |
| 11 | Associate Professor | University of Lucknow | 2016 | 2019 | ₹ 37400-67000 + 9000 |
| 12 | Professor | University of Lucknow | 2019 | -- | ₹ 37400-67000 + 10000 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Name of Award** | **Awarding Agency** | **Year** |
| 1 | S.R.F. (CSIR) | C.S.I.R., New Delhi | 2002 |
| 2 | BK-21 Fellowship | Chungbuk National University, South Korea | 2006 |
| 3 | J.S.P.S. Fellowship | Japan Society for the Promotion of Science, Japan | 2008 |
| 4 | Lise Meitner Fellowship | Austrian Science Fund (FWF), Austria | 2011 |
| 5 | BELSPO Fellowship | Belgian Science Policy, Belgium | 2011 |
| 6 | Teachers Associateship for Research Excellence | DST-SERB, New Delhi | 2019 |
| 7 | Uddipan Award for best research paper | University of Lucknow, Lucknow | 2019 |
| 8 | Uddipan Award for best research paper | University of Lucknow, Lucknow | 2021 |
| 9 | Acclaim Research Award | University of Lucknow, Lucknow | 2019 |
| 10 | Sectional Editor | The Journal of Indian Botanical Society | 2020 |

**Publications (List of papers published in SCI and National Journals, in year wise descending order).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Author(s)** | **Title** | **Name of Journal** | **Volume** | **Page** | **Year** |
| 1 | Tewari RK, Yadav N, Gupta R, Kumar P | Oxidative stress under macronutrient deficiency in plants | Journal of Soil Science and Plant Nutrition  **IF: 3.872** | 21 | 832-859 | 2021 |
| 2 | Tewari RK, Horemans N, Watanabe M | Evidence for a role of nitric oxide in iron homeostasis in plants | Journal of Experimental Botany  **IF:6.992** | 72 | 990-1006 | 2021 |
| 3 | Tewari RK | Nitrogen nutritional status affect growth, water relations and carbohydrate fractions of mulberry plants. | Journal of Applied Bioscience | 45 | 29-36 | 2019 |
| 4 | Tewari RK | Nitric oxide mediated modulation of functional iron status in iron-deficient maize plants. | International Journal of Plant and Environment | 5 | 78-83 | 2019 |
| 5 | Tewari RK, Kumar P, Sharma PN | An effective antioxidant defence provides protection against zinc deficiency-induced oxidative stress in Zn-efficient maize plants. | Journal Plant Nutrition and Soil Science  **IF: 2.426** | 182 | 701-707 | 2019 |
| 6 | Tewari RK, Horemans N, Nauts R, Wannijn J, Van Hees M, Vandenhove H | The nitric oxide suppressed Arabidopsis mutants- *Atnoa1* and *Atnia1nia2noa1-2* produce nitric oxide in MS growth medium and on uranium exposure. | Plant Physiology and Biochemistry  **IF: 4.270** | 140 | 9-17 | 2019 |
| 7 | Sharma PN, Tripathi A, Kumar N, Gupta S, Kumar P, Chatterjee J, Tewari RK | Iron plays a critical role in stomatal closure in cauliflower. | Environmental and Experimental Botany  **IF: 5.545** | 131 | 68-76 | 2016 |
| 8 | Tewari RK, Horemans N, Nauts R, Wannijn J, Van Hees M, Vandenhove H | Uranium exposure induces nitric oxide and hydrogen peroxide generation in *Arabidopsis thaliana*. | Environmental and Experimental Botany  **IF: 5.545** | 120 | 55-64 | 2015 |
| 9 | Chatterjee J, Kumar P, Sharma PN, Tewari RK | Chromium toxicity induces oxidative stress in turnip. | Indian Journal of Plant Physiology | 20 | 220–226 | 2015 |
| 10 | Tewari RK, Bachmann G, Hadacek F | Iron in complex with the alleged phytosiderophore 8-hydroxyquinoline induces functional iron deficiency and non-autolytic programmed cell death in rapeseed plants. | Environmental and Experimental Botany  **IF: 5.545** | 109 | 151–160 | 2015 |
| 11 | Mobin M, Wu C-H, Tewari RK, Paek K-Y | Studies on the glyphosate-induced amino acid starvation and addition of precursors on caffeic acid accumulation and profiles in adventitious roots of *Echinacea purpurea* (L.) Moench. | Plant Cell, Tissue and Organ Culture  **IF: 2.711** | 120 | 291–301 | 2015 |
| 12 | Tewari RK, Satoh M, Kado S, Mishina K, Enami K, Misato A, Hanaoka M, Watanabe M | Overproduction of stromal ferredoxin:NADPH oxidoreductase in H2O2-accumulating *Brassica napus* leaf protoplasts. | Plant Molecular Biology  **IF: 4.076** | 86 | 627–639 | 2014 |
| 13 | Tewari RK, Kumar P, Sharma PN | Oxidative stress and antioxidant responses of mulberry (*Morus alba*) plants subjected to deficiency and excess of manganese. | Acta Physiologiae Plantarum  **IF: 2.354** | 35 | 3345–3356 | 2013 |
| 14 | Tewari RK, Hadacek F, Sassmann S, Lang I | Iron deprivation-induced reactive oxygen species generation leads to non-autolytic PCD in *Brassica napus* leaves. | Environmental and Experimental Botany  **IF: 5.545** | 91 | 74–83 | 2013 |
| 15 | Tewari RK, Singh PK, Watanabe M | The spatial patterns of oxidative stress indicators co-locate with early signs of natural senescence in maize leaves. | Acta Physiologiae Plantarum  **IF: 2.354** | 35 | 949–957 | 2013 |
| 16 | Tewari RK, Prommer J, Watanabe M | Endogenous nitric oxide generation in protoplast chloroplasts | Plant Cell Reports  **IF: 4.570** | 32 | 31-44. | 2013 |
| 17 | Tewari RK, Watanabe D, Watanabe M | Chloroplastic NADPH oxidase-like activity-mediated perpetual hydrogen peroxide generation in the chloroplast induces apoptotic-like death of *Brassica napus* leaf protoplasts. | Planta  **IF: 4.116** | 235 | 99–110 | 2012 |
| 18 | Tewari RK, Paek KY | Salicylic acid-induced nitric oxide and ROS generation stimulate ginsenoside accumulation in *Panax ginseng* roots. | Journal of Plant Growth Regulation  **IF: 4.169** | 30 | 396–404 | 2011 |
| 19 | Kumar P, Tewari RK, Sharma PN | Sodium nitroprusside-mediated alleviation of iron deficiency effects and modulation of antioxidant enzymes in maize plants. | AoB Plants  **IF: 3.276** |  | doi:10.1093/aobpla/plq002 | 2010 |
| 20 | Tewari RK, Kumar P, Sharma PN | Morphology and oxidative physiology of sulphur-deficient mulberry plants | Environmental and Experimental Botany  **IF: 5.545** | 68 | 301–308 | 2010 |
| 21 | Tewari RK, Kumar P, Sharma PN | Morphology and oxidative physiology of boron-deficient mulberry plants | Tree Physiology  **IF: 4.196** | 30 | 68–77 | 2010 |
| 22 | Jo E-A, Tewari RK, Hahn EJ, Paek KY | In vitro sucrose concentration affects growth and acclimatization of *Alocasia amazonica* plantlets. | Plant Cell Tissue and Organ Culture  **IF: 2.711** | 96 | 307–315 | 2009 |
| 23 | Tewari RK, Kumar P, Kim S, Hahn EJ, Paek KY | Nitric oxide retards xanthine oxidase-mediated superoxide anion generation in *Phalaenopsis* flower: an implication of NO in the senescence and oxidative stress regulation. | Plant Cell Reports  **IF: 4.570** | 28 | 267–279 | 2009 |
| 24 | Jo E-A, Tewari RK, Hahn EJ, Paek KY | Effect of photoperiod and light intensity on in vitro propagation of *Alocasia amazonica*. | Plant Biotechnology Reports  **IF: 2.010** | 2 | 207–212 | 2008 |
| 25 | Tewari RK, Kim S, Hahn EJ, Paek KY | Involvement of nitric oxide-induced NADPH oxidase in adventitious root growth and antioxidant defence in *Panax ginseng*. | Plant Biotechnology Reports  **IF: 2.010** | 2 | 113–122 | 2008 |
| 26 | Tewari RK, Kumar P, Sharma PN | Morphology and physiology of zinc-stressed mulberry plants. | Journal of Plant Nutrition and Soil Science  **IF: 2.426** | 171 | 286–294 | 2008 |
| 27 | Tewari RK, Hahn EJ, Paek KY | Function of nitric oxide and superoxide anion in the adventitious root development and antioxidant defence in *Panax ginseng*. | Plant Cell Reports  **IF: 4.570** | 27 | 563–573 | 2008 |
| 28 | Kumar P, Tewari RK, Sharma PN | Cadmium enhances generation of hydrogen peroxide and amplifies activities of catalase, peroxidases and superoxide dismutase in maize. | Journal of Agronomy and Crop Science  **IF: 3.473** | 194 | 72-80 | 2008 |
| 29 | Kumar P, Tewari RK, Sharma PN | Modulation of copper toxicity induced oxidative damage by excess supply of iron in maize plants. | Plant Cell Reports  **IF: 4.570** | 27: | 399–409 | 2008 |
| 30 | Tewari RK, Hahn E-J, Paek K-Y | Modulation of copper toxicity-induced oxidative damage by nitric oxide supply in the adventitious roots of *Panax ginseng*. | Plant Cell Reports  **IF: 4.570** | 27 | 171–181 | 2008 |
| 31 | Wu CH, Tewari RK, Hahn EJ, Paek KY | Nitric oxide elicitation induces accumulation of secondary metabolites and antioxidant defence in the adventitious roots of *Echinacea purpurea.* | Journal of Plant Biology  **IF: 2.434** | 50 | 636-643 | 2007 |
| 32 | Kumar P, Tewari RK, Sharma PN | Excess nickel induced changes in antioxidative processes in maize leaves. | Journal of Plant Nutrition and Soil Science  **IF: 2.426** | 170 | 796–802 | 2007 |
| 33 | Tewari RK, Lee SY, Hahn E-J, Paek KY | Temporal changes in the growth, saponin content, and antioxidant defense in the adventitious roots of *Panax ginseng* subjected to nitric oxide elicitation. | Plant Biotechnology Reports  **IF: 2.010** | 1 | 227-235 | 2007 |
| 34 | Lee S-H, Tewari RK, Hahn EJ, Paek KY | Photon flux density and light quality induce changes in growth, stomatal development, photosynthesis and transpiration of *Withania somnifera* (L.) Dunal. plantlets. | Plant Cell, Tissue and Organ Culture  **IF: 2.711** | 90 | 141–151 | 2007 |
| 35 | Tewari RK, Kumar P, Sharma PN | Oxidative stress and antioxidant responses in young leaves of mulberry plants grown under nitrogen, phosphorus or potassium deficiency. | Journal of Integrative Plant Biology  **IF: 7.061** | 49 | 313-322 | 2007 |
| 36 | Tewari RK, Kumar P, Sharma PN | Antioxidant responses to enhanced generation of superoxide anion radical and hydrogen peroxide in the copper-stressed mulberry plants. | Planta  **IF: 4.116** | 223 | 1145–1153 | 2006 |
| 37 | Tewari RK, Kumar P, Sharma PN | Magnesium deficiency induced oxidative stress and antioxidant responses in mulberry plants. | Scientia Horticulturae  **IF: 3.463** | 108 | 7–14 | 2006 |
| 38 | Tewari RK, Kumar P, Neetu, Sharma PN | Signs of oxidative stress in the chlorotic leaves of iron starved plants | Plant Science  **IF: 4.729** | 169 | 1037–1045 | 2005 |
| 39 | Sharma PN, Kumar P, Tewari RK | Early signs of oxidative stress in wheat plants subjected to zinc deficiency | Journal of Plant Nutrition  **IF: 1.707** | 27 | 449–461 | 2004 |
| 40 | Tewari RK, Kumar P, Tewari N, Srivastava S, Sharma PN | Macronutrient deficiencies and differential antioxidant responses – influence on the activity and expression of superoxide dismutase in maize. | Plant Science  **IF: 4.729** | 166 | 687–694 | 2004 |
| 41 | Singh PK, Tewari RK | Cadmium toxicity induced changes in plant water relations and oxidative metabolism of *Brassica juncea* L. plants. | Journal of Environmental Biology  **IF: 0.17** | 24 | 107–112. | 2003 |
| 42 | Tewari RK, Kumar P, Sharma PN, Bisht SS | Modulation of oxidative stress responsive enzymes by excess cobalt. | Plant Science  **IF: 4.729** | 162 | 381–388 | 2002 |

**Books/Reports/Chapters/General articles etc**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S. No | Title | Author’s Name | Publisher | Year of Publication |
| 43 | Role of nitric oxide in adventitious roots development. *In*: KY Paek, HN Murthy, JJ Zhong (eds.) Production of Biomass and Bioactive Compounds Using Bioreactor Technology | Tewari RK, Paek KY | Springer Science, pp. 429-443 | 2014 |
| 44 | Water Relations of Plants: Fundamental concepts and methods  ISBN 978-613-9-96355-3 | Sharma PN, Tewari RK, | LAP Lambert Academic Publishing, (omniscriptum) | 2019 |

**ABSTRACTS/ PAPER PRESENTED IN VARIOUS SYMPOSIA AND CONFERENCES**

1. Sharma PN, **Tewari RK**, Kumar P (2000) Oxidative stress in wheat plants subjected to deficiency and toxicity of zinc in solution culture and recovery therefrom. Joint Convention of ISAB & SGVR and National Symposia on Emerging Trends in Agricultural Biochemistry – Regulation of Metabolic Pathways for Crop Improvement and Recent Developments in Green Vegetation and Leaf Protein Research held on February 24-26, 2000 at C.S.A. University of Agriculture and Technology, Kanpur-208002, India
2. Sharma PN, Kumar P, **Tewari RK** (2000) Oxidative stress in cauliflower plants subjected to deficiency and toxicity of iron. Joint Convention of ISAB & SGVR and National Symposia on Emerging Trends in Agricultural Biochemistry – Regulation of Metabolic Pathways for Crop Improvement and Recent Developments in Green Vegetation and Leaf Protein Research held on February 24-26, 2000 at C.S.A. University of Agriculture and Technology, Kanpur-208002, India
3. Sharma PN, **Tewari RK**, Kumar P (2000) Relative susceptibility to deficiency and toxicity of zinc and its relation to the antioxidative responses in two maize cutivars. II Symposium on current advances in molecular biochemistry: Application in health, environment and Agriculture held on Nov. 9-11, 2000, at Department of Biochemistry, Lucknow University, Lucknow-226007, India.
4. Sharma PN, Kumar P, **Tewari RK** (2000) Antioxidative responses of maize plant subjected to deficiency and toxicity of iron in shade and light. II Symposium on current advances in molecular biochemistry: Application in health, environment and Agriculture held on Nov. 9-11, 2000, at Department of Biochemistry, Lucknow University, Lucknow-226007, India.
5. **Tewari RK**, Kumar P, Sharma PN (2003) Mulberry plants express some new isoforms of superoxide dismutase to combat magnesium deficiency induced oxidative stress. National conference on biodiversity and applied biology of plants held on Oct 8-10 at Department of Botany, Lucknow University, Lucknow-226007, India.
6. Kumar P, **Tewari RK**, Sharma PN (2003) Modulation of deficiency and toxicity of iron by copper in maize plants. National conference on biodiversity and applied biology of plants held on Oct 8-10 at Department of Botany, Lucknow University, Lucknow-226007, India.
7. **Tewari R.K.**, Ou SY, Shim KM, Hahn EJ, Paek KY (2007) Nitric oxide modulates copper toxicity by upregulating antioxidant defence protection in the adventitious roots of Panax ginseng C.A. Meyer CBN-1 line (Poster) Spring Symposium of the Korean Society of Plant Biotechnology (Seoul, Korea)
8. **Tewari** **RK,** Hahn EJ, Paek KY (2007) Function of Nitric oxide and superoxide anion in the growth and antioxidant enzyme activity of adventitious roots of Panax ginseng C.A. Meyer (Oral) Abs. published in Korean J Hortic Sci & Tech 25 (suppl) June 2007 Page 52, Conference of Korean Society of Horticultural Science, Spring 2007 (Korea University, Seoul, Korea)
9. **Tewari RK**, Lee EJ, Shim KM, Ou SY, Jeong JA, Hahn EJ, Paek KY (2007) Nitric oxide retards senescence of Phalaenopsis flower by modulating xanthine oxidase activity and antioxidant defence (Oral) Abs. published in Korean J Hortic Sci & Tech 26 (suppl.) October 2007 Page 38 Conference of Korean Society of Horticultural Science, autumn 2007 (Kangneung National University, Gangneung, Korea)
10. **Tewari RK**, Watanabe D, Watanabe M (2010) Generation of nitric oxide and hydrogen peroxide during the isolation and culture of Brassica napus leaf protoplasts (Poster). In: Annual meeting of the Japanese Society of Plant Physiologists, 2010 (Kumamoto University, Kumamoto, Japan).,
11. **Tewari RK**, Hadacek F (2012) Iron deprivation-induced superoxide anion generation and deoxyribonuclease, alkaline protease and caspase-3-like activities lead to cell death in the leaf of *Brassica napus* plants. *Plant Biology Congress* (July 29-August 3, 2012) Albert-Ludwigs-Univesity, Freiburg, Germany
12. **Tewari RK**, Horemans N, Nauts R, Wannijn J, Plevoets J, Van Hees M, Vandenhove H (2013) Uranium exposure induced reactive oxygen species and nitric oxide generation in *Arabidopsis thaliana.* In: *11th International Conference on Reactive Oxygen and Nitrogen Species in Plants*. July 17-19th 2013, at the Warsaw University of Life Sciences-SGGW (WULS-SGGW), Poland
13. **Tewari RK,** Horemans N, Nauts R, Wannijn J, Van Hees M, Vandenhove H (2017) The Nitric oxide suppressed *Arabidopsis* mutants-*Atnoa1*, and *Atnia1nia2noa1-2* produce nitric oxide in MS growth medium and on Uranium exposure. In: *3rd International Toxicology Conclave*. November 5-6, 2017 at CSIR-Indian Institute of Toxicology Research, Lucknow (U.P.), India
14. Tewari RK, Kumar P, Sharma PN (2017) An effective antioxidant defence provides protection against zinc deficiency-induced oxidative stress in Zn-deficiency-less-susceptible (Zn-DLS) maize plants. In: *International conference on functional biology and molecular interaction: Application in health and agriculture.* December 20 – 22, 2017 at Department of Biochemistry, University of Lucknow (U.P.), India
15. Tewari R.K. (2018) Relative effectiveness of different iron complexes in functional iron availability. In: Sixth International conference on Plant and Environmental Pollution (ICPEP-6). November 27-30, 2019 at CSIR-National Botanical Research Institute, Lucknow, India
16. Tewari R.K., Nauts R., Horemans N. (2020) Consequences of NO generation in Uranium-stressed Arabidopsis thaliana. In: Second National Conference on Climate Change: Agriculture, Biodiversity and Human Health. February 22-23, 2020 at CSIR-National Botanical Research Institute, Lucknow, India.

**RESEARCH HIGHLIGHTS**

I studied certain aspects of the physiology of plants, including involvement NO and reactive oxygen in root development, saponin synthesis and antioxidant responses of plants under nutritional stress (both deficiency and toxicity). Some of our significant findings are given here. (1) The supply of NO producers (SNP, sodium nitroprusside; SNAP, S-Nitroso-N-acetylpenicillamine; and sodium nitrite with ascorbic acid), NO scavenger (2-phenyl-4,4,5,5-tetramethylimidazoline-1-oxyl 3-oxide, PTIO) and NOS inhibitor (Nω-nitro-L-arginine methyl ester hydrochloride, L-NAME), revealed that NO is involved in the differentiation and induction of rootlets downstream to auxin action but it does not synthesized by nitric oxide synthase (NOS) in the adventitious roots of mountain ginseng (Plant Cell Rep 27: 563-573). (2) The fundamental role of NO in the activation NADPH oxidase and O2˙ˉ anion generation and their role in root development were elucidated for the first time. NO activates NADPH oxidase activity, resulting into higher O2˙¯generation that subsequently induced adventitious roots in root explants of mountain ginseng (Plant Cell Rep 27: 563-573 and Plant Biotechnol. Rep. 1: 227-235). (2) NO provides protection against copper toxicity by enhancing antioxidant defence (Plant Cell Rep 27: 171-181). (3) Exogenous application of nitric oxide (NO) retards H2O2-induced senescence of *Phalaenopsis* flower by down regulating activity of xanthine oxidase (Plant Cell Rep 28: 267-279). (4) SA accumulates ginsenosides in ginseng roots by elevating NO, O2˙ˉ, and H2O2 (J. Plant Growth Reg 30: 396–404). (5) Protoplast chloroplasts also exhibited endogenous accumulation of NO and ONOO‾ (Plant Cell Rep 32: 31-44). (6) We discovered the involvement of NADPH oxidase-like activity in H2O2 generation in the chloroplasts of *Brassica napus* leaf protoplasts (Planta 235: 99–110). This NADPH oxidase-like activity was subsequently identified as stromal ferredoxin NADP+ oxidoreductase (sFNR). The discovery of sFNR exhibiting NADPH oxidase-like function in chloroplast is a fundamental finding and it has great significance in redox homeostasis in the chloroplasts (Plant Mol. Biol. 86: 627–639).

My doctoral thesis topic was: Role of mineral nutrient elements in the Mulberry (*Morus alba* L) plants with particular reference to oxidative metabolism. Nutrient deficiencies produced typical morphological features such as – general paling of old leaves by N- or P-deficiencies (J Integr Plant Biol 49: 313-322); cessation of growth and death of apical meristem by Ca-deficiency; chlorosis and scorched margins of middle and old leaves by K-deficiency (J Integr Plant Biol 49: 313-322); interveinal chlorosis in young followed by necrosis in old leaves by Mg-deficiency (Sci Hortic 108: 7-14); yellowing and development of cup-shaped young leaves by S-deficiency (Environ Exp Bot 68: 301-308); interveinal chlorosis of young leaves by Fe-deficiency (Plant Sci 169: 1037–1045); mild interveinal chlorosis of middle leaves by Mn-deficiency (Acta Physiol Plant 35:3345–3356); chlorosis, necrosis and deformation of young leaves by Zn-deficiency (J Plant Nutr Soil Sci 171: 286-294); and deformation of leaf shape and development of cracks on midrib and major veins and formation of lenticels-like structure on the stem by B-deficiency (Tree Physiol 30: 68-77). The observations of my studies indicate that deficiencies of various essential nutrients increase the concentration of H2O2, but this did not necessarily increase lipid peroxidation in the leaves. Lipid peroxidation in leaves was found to be associated with the chloroplastic pigment or activities of Fe-enzymes, which is postulated to be an index of functional Fe (Plant Sci 169: 1037–1045; AoB Plants doi:10.1093/aobpla/plq002). Deficiency of Cu was found to specifically accumulate H2O2 in the middle portion of the trichomes of leaves (Planta 223: 1145–1153). Apart from this, deficiencies of certain nutrient element modulate the activity and induced some additional isoforms and suppress some of preexisting ones of superoxide dismutase (Plant Sci 169: 1037-1045; Sci Hort 108: 7–14; Planta 223: 1145-1153).

**Membership of academic societies/bodies**

1. Indian Science Congress (2017-till date)
2. Indian Botanical Society (2017-Till date)
3. International Society of Environmental Botanists (2017-till date)
4. Clean and Green Environmental Society (2017-till date)
5. American Society of Plant Biologist (2007)
6. International Society for Horticultural Science (2007)
7. The Japanese Society of Plant Physiologists (2010)

**Referee of journals**

1. Ecotoxicology and Environmental Safety (Elsevier)
2. Environmental and Experimental Botany (Elsevier)
3. Journal of Experimental Botany (Oxford University Press)
4. Journal of Plant Research (Springer Science)
5. Journal of Plant Physiology (Elsevier)
6. New Phytologist (John Wiley & Sons, Inc.)
7. Plant Cell, Tissue and Organ Culture (Springer Science)
8. Plant Physiology and Biochemistry (Elsevier)
9. Scientia Horticulturae (Elsevier)
10. Plant Biotechnology Journal (John Wiley & Sons Ltd)