Rekha R Warrier

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Educational Qualifications

Name of Institution (City/Country)	Period	Field of Study	Degree	Awards
Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India	1997-2002	Phytoremediation and Molecular Biology	Doctorate in Philosophy (Biochemistry)	
Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India	1996-1997	Phytoremediation	Master of Philosophy (Biochemistry)	
Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India	1994-1996	Biofertilisers	Master of Science (Biochemistry)	University Topper, Gold Medallist
Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India	1991-1994	Biochemistry Food Science and Nutrition	Bachelor of Sciences (Biochemistry) Bachelor of Science (Food Science and Nutrition)	University Topper, Gold Medallist

Ph.D. Dissertation : *Phytoremediation of metal finishing waters with water hyacinth (Eichhornia crassipes) and characterisation of the metal accumulating protein*
M.Phil. Dissertation: *Phytoremediation of industry effluents*
M. Sc. Dissertation: *Effect of Azospirillum and Phosphobacterium in improving seed germination and seedling vigour of Amla (Emblica officinalis)*

Professional Trainings

1. **Ecological Niche Modelling** (One week duration)- Centre for Ecological Sciences, Indian Institute of Sciences, Bengaluru during 2021.
2. **Introduction to Remote Sensing and GIS** (One week duration)- Indian Institute of Remote Sensing Indian Space Research Organisation, Dehradun, during 2021.
3. **Statistical Methods in Forestry Research** (One week duration) at Institute of Forest Genetics and Tree Breeding, Coimbatore during 2021.
4. **Climate Change: Challenges and Response** (One week duration) - DST sponsored Training for Women Scientists & Technologists Working in Government Sector Centre for Disaster Management (CDM), Lal Bahadur Shastri National Academy of Administration (LBSNAA), Mussoorie during 2020.

5. **Spatial approaches for assessing the status and trends of native tree species using CAPFITOGEN** (One week duration) at BinZhou City, Shandong Province, China organized by APFORGEN, Chinese Academy of Forestry, Bioversity International and partners during 2018.
6. **Advanced Statistical Methods including "R"** (One week duration) at Indian Council of Forestry Research and Education, Dehradun during 2018.
7. **Workshop on Science Writing** (Six days duration) at Current Science, Bangalore during 2016.
8. **Specialised training Programme on Genetic Engineering** (Two weeks duration) at Institute of Forest Genetics and Tree Breeding, Coimbatore during 2014.
9. **ERDAS IMAGINE Remote Sensing Software training** (Two days duration) at Institute of Forest Genetics and Tree Breeding, Coimbatore during 2013**.**
10. **Open source QGIS** (One week duration) at Institute of Forest Genetics and Tree Breeding, Coimbatore during 2011**.**
11. **Innovations in the management of planted teak forests** (Four days duration) - International training Programme organized by TEAKNET, KFRI, Peechi during 2011.
12. **Climate Change and Carbon Mitigation** (One week duration) - DST sponsored Training for Women Scientists & Technologists Working in Government Sector at ICFRE, Dehradun during 2010.
13. **Application of Genomics Technologies in Plant Breeding** (Two weeks duration) by Center of Excellence in Genomics (CEG) at ICRISAT, Patancheru, Andhra Pradesh during 2009.
14. **Eco-restoration of wastelands** (One week duration) at ICFRE, Dehradun during 2009
15. **Decision Support Tools and Techniques** (One week duration) - Department of Science and Technology sponsored training by Administrative Staff College of India, Hyderabad, India during 2007
16. **Biosafety concerns of transgenics and Detection of LMOs** (One week duration) - GEF – World Bank sponsored Training by National Bureau of Plant Genetics Resources, New Delhi during 2006
17. **Multimedia and Web Designing** (Three months duration) by Arena Multimedia, Coimbatore at Institute of Forest Genetics and Tree Breeding, Coimbatore during 2001-02.
18. **Familiarization of Forestry** (Three month duration) at State Forest Service College, Coimbatore 1999-2000.
19. **Research Methodology with Special Emphasis on Statistics** (One month duration) at Indian Agricultural Statistical Research Institute (I.C.A.R.), New Delhi during 1999
20. **Research Paper Writing** (Two days duration) at Institute of Forest Genetics and Tree Breeding, Coimbatore during 1999.

Research Areas

1. Application of Biotechnologies for large scale planting
2. Assessment and conservation of forest genetic resources
3. Seed physiology and biochemistry
4. Tree improvement in native species and medicinal plants
5. Stress physiology in trees

Professional Experience

I have been in various teams of IFGTB, undertaking different projects from various forestry agencies. I had opportunities to work in moist deciduous and evergreen ecosystems in the tropics. I have been working on different aspects of medicinal plants and their productivity, specifically in the field of metabolite production. The major activities include

- Managing Tissue culture facility for commercial production of difficult-to-propagate plants and in vitro production of secondary metabolites.
- Experience in developing and executing research projects on genetic improvement of medicinal trees for two decades.
- Experience in stress physiology, secondary metabolite production through transformation.
- Working on the concept of "Breeding without Breeding" for early prediction of orchard gains.
- Coordinating programs involving multidisciplinary fields.
- Participation in extension and training programs for foresters, research staff, students and farmers

Seed Handling of Forestry Species

- Developed seed handling procedures for rare, endangered and threatened (RET) species, commercially important medicinal species and recalcitrant species. The physiological and biochemical changes associated with seeds and their viability has also been studied.
- Established six seed production systems for medicinal plants and NTFPs to serve as a continuous source of supply of seeds and seedlings.

Tree Improvement

- Working towards Melia breeding programme, selected 175 candidate plus trees based on tree form and clear bole height. Genetic diversity parameters were studied to understand the genetic base. Established various field trials as research assets like provenance resource stands, progeny trials, and clonal multiplication areas at different locations. Currently twenty clones are mass multiplied. Individuals possessing outstanding growth were selected from seed source trials established by the AP Forest Department and recommended for their release.

- Developed guidelines for DUS testing (Distinctiveness, Uniformity and Stability) under the provisions of Protection of Plant Varieties and Farmers Rights Act, 2001 to facilitate registration of Melia varieties for granting legal ownership. The Protection of Plant Varieties and Farmers Rights Authority, Govt. of India has notified IFGTB, Coimbatore as a DUS Centre for Melia dubia under the Act to conduct DUS tests for applications received for registration of varieties.

Commercial production of forestry species through tissue culture

- Partnerships have been established with commercial tissue culture laboratories for mass multiplication and supply of identified and superior material of teak and bamboos. Associating with breeding programmes of Teak in the Institute,

established tissue culture stocks of fifteen clones. Expanded the existing tissue culture facility at the Institute which is the only laboratory in ICFRE multiplying and supplying teak at nominal rates to farmers. Presently the technology has been passed on to other Institutes under ICFRE for mass production of teak.

Secondary metabolite studies in medicinal plants

- Successfully developed a cell culture protocol for in vitro production of secondary metabolites under culture conditions from *Aegle marmelos*, the efficacy of which was tested against plant and human pathogens in comparison with extracts from the wild trees.

- ***Hairy root transformation*** protocols has been developed in three medicinal trees, where root is used as a raw drug. Tissue culture protocols for mass production have also been developed.
- ***Aegle marmelos*** – Cell culture protocols developed for production of secondary metabolites was advanced further for production of hairy roots from nodal segments co-cultivated with A4pHKN29. The metabolite profile of the wild and cultivated plants has been developed.
- ***Gmelina arborea*** – Hairy root transformation was successful with A4RSpHKN29 in leaf explants. The metabolite profile of the wild and cultivated plants has been developed.
- ***Oroxylum indicum*** - Hairy roots were produced using A4RSpHKN29 in leaf explants by dip and co-cultivation. The metabolite profile of the wild and cultivated plants has been developed.

Awards/ Fellowship Received/ Foreign visits

- Recipient of International travel grant to attend the Regional Workshop on Distributions and biology of Asian tree species: Translating research results into conservation plans organized under the auspices of the Asia Pacific Forest Genetic Resources Programme (APFORGEN), held in Beijing, China, in October 2019.
- Recipient of International grant to attend the Third Training Course of Forest Genetic Resource (TTC-FGR 2018) on Spatial approaches for assessing the status and trends of native tree species organised by Asia Pacific Forest Genetic Resources Programme (APFORGEN), the Chinese Academy of Forestry, Bioversity International and partners in October 2018.
- Recipient of International travel grant to attend the Regional Planning Workshop to Support the workshop organized under the auspices of the Asia Pacific Forest Genetic Resources Programme (APFORGEN), held in Kunming City, Yunnan Province, China, in March 2018.
- As a recognition of the contribution to various extension activities initiated in the Institute, namely development of Pradarshini, Tree Info Centre, and e-newsletter, received "**Best Extension Scientist Award**" from the Hon'ble Minister of Environment and Forests, GoI during 2010.
- Qualified the **Joint CSIR-UGC NET (Council for Scientific and Industrial Research- University Grants Commission - National Eligibility Test) for Junior Research Fellowship (JRF) and eligibility for Lectureship** in Life Sciences in 1996.
- Awarded the **Indian Council of Agricultural Research (ICAR) Junior Research Fellowship** in the subject of Biochemistry in 1994.

- Qualified for **M. Sc. Biotechnology programme** through National exam conducted by the Jawaharlal Nehru University, New Delhi in 1996.
- Recepient of **National Scholarship for Post Matric Studies in Hindi** from Govt. of India given to meritorious students from Non-Hindi Speaking States.

International Positions Held

- Internal Auditor, **Asia Pacific Association of Forestry Research Institutions (APAFRI) (2021-2024)**
- Co-Chair of the Board, **Asia Pacific Forest Genetic Resources Programme (APFORGEN) (2021-2024)**
- Assistant National Country Co-ordinator of the Asia Pacific Forest Genetic Resources Programme (APFORGEN)
- Liaison to the Central Secretariat of the India Chapter of **International Society of Tropical Foresters**
- **Vice Chair of Working Group 3**– Strengthening Tree Seed Programmes to Facilitate Ecosystem Restoration, Support Local Livelihoods and Climate Change Adaptation and Mitigation established by **APFORGEN** 2014-2016, to support the implementation of the **Global Plan of Action on Forest Genetic Resources (GPA FGR) in the Asia Pacific region (2014-2018)**.

Membership and activities in professional associations

1. Presently functioning as the Assistant National Country Co-ordinator of the APFORGEN, and a member of the research project on APFORGIS, coordinated by Bioversity International under APFORGEN, that aims to fill in the knowledge gaps in species distribution and biology through regional collaboration and the application of latest spatial analysis methods.
2. Functioned as the Vice Chair of Working Group 3 on Working Group 3 – Strengthening Tree Seed Programmes to Facilitate Ecosystem Restoration, Support Local Livelihoods and Climate Change Adaptation and Mitigation established by APFORGEN in a meeting of its National Coordinators in September 2014, to support the implementation of the Global Plan of Action on Forest Genetic Resources (GPA FGR) in the Asia Pacific region.

Publications

1. Annapurna, D., Warrier, R.R., Arunkumar, A.N. *et al.* Development, characterization, functional annotation and validation of genomic and genic-SSR markers using de novo next generation sequencing in *Melia dubia* Cav.. *3 Biotech* **11,** 310 (2021). https://doi.org/10.1007/s13205-021-02858-w
2. Warrier, R. R., Priya, S. M., & Kalaiselvi, R. (2021). *Gmelina arborea*– An indigenous timber species of India with high medicinal value: A review on its pharmacology, pharmacognosy and phytochemistry. Journal of Ethnopharmacology, 113593. doi:10.1016/j.jep.2020.113593
3. S. Mohana Priya, S. Indhu, R. Kalaiselvi and Rekha R. Warrier (2020). Agrobacterium-mediated transformation in medicinal trees. Ann. Phytomed., 9(1):27-31. http://dx.doi.org/10.21276/ap.2020.9.1.4

4. S. Arathi, M Muthubhavani, Sruthi, S and Rekha R Warrier. (2020). Sprouting Value Index – A tool to identify shoot initiation ability in *Saraca asoca.* Indian Forester 146(11): 1084-85.
5. Rekha R. Warrier, Geeta Joshi and A.N. Arunkumar (2019). DNA fingerprinting in industrially important medicinal trees. Ann. Phytomed., 8(1):19-35.
6. Priyadharshini, P., Ashok Raj, and Rekha R. Warrier. 2019. Phytochemical and antimicrobial efficacy of Aegle marmelos from *in vivo* and *in vitro* tissue. Annals of Phytomedicine. 8(1): 140-147.
7. R. Mahalakshmi, M. V. Vineetha, Rekha R. Warrier. 2018. Optimising gelling agents, light source and after-care to commercialise teak tissue culture. Plant Tissue Cult. & Biotech. 28(1): 13-24.
8. Rekha R Warrier, P. Samidurai , S. Jeevith , Jaya Livingston Raja, Kannan CS Warrier. 2018. Variation in coppice-shoot growth among clones of Melia dubia Cav. Myforest. 54(4): 29-37.
9. S. Geetha, KS Venkataramanan, Kannan CS Warrier, Rekha R Warrier. 2018. Propagation protocols for enhancing conservation and utilization of *Melia dubia* Cav. Journal of Tree Sciences. 32(2): 22-34.
10. Kannan CS Warrier, Jaya Livingston Raja, Rekha R Warrier. 2018. Genetic Divergence in Fruit and Stone traits of *Melia dubia* Cav. in India. International Journal of Genetics. 10 (10): 530-533.
11. Arunkumar A. N. Rekha R. Warrier, A. Shanthi, Geeta Joshi.2018. Allozyme Variations to Measure Genetic Diversity in Clonal Accessions of Indian Sandalwood (*Santalum album*). *International Journal of Forestry and Horticulture (IJFH)* 4 (1) : 1-8.
12. Rekha R. Warrier, R. Anandalakshmi, V. Sivakumar, B. Gurudev Singh. 2017. Seed dormancy and Storage Behavior of Strychnos potatorum – A Fast Depleting Tree resource. J. Tree. Sci.36 (1) : 52-57
13. C. Kunhikannan and Rekha R. Warrier. 2017. Poly-embryony influences plant vigor in Syzygium cumini (L.) skeels. Myforest 53 (1-2), 23-32.
14. Asma S. Banu, Rekha R. Warrier, Geeta Joshi and A.N. Arunkumar. 2017. Assessing natural variation in fruits of Terminalia chebula from Western Ghats. Myforest 53 (1-2), 33-42

Books / Chapters

1. Rekha R. Warrier, S. Geetha, V. Sivakumar, B. Gurudev Singh, and R. Anandalakshmi. 2020. Threatened tree species of Western Ghats: Status, Diversity, Conservation In: P.E. Rajasekharan and Shabir H Wani (Eds.) *Conservation and Utilization of Threatened Medicinal Plants*. 10.1007/978-3-030-39793-7.
2. J. Prasanth Jacob and Rekha R. Warrier. 2019. Insect Pests of Medicinal Plants and Their Management. Institute of Forest Genetics and Tree Breeding, Coimbatore. 64p.
3. Warrier, K.C.S. and Warrier, R.R. 2019. Sacred Groves – Repositories of Medicinal Plants. In: Medicinal Plants Cultivation and Conservation (Amruth, M., Raghu, A.V., Raveendran, V.P., Kunhi, M.K.V. and Viswanath, S. Eds). KSCSTE - Kerala Forest Research Institute, Peechi, Kerala, pp 72-102.