Report
on
Monthly Seminar
conducted
by
ICFRE-RFRI
Jorhat (Assam)

INSTITUTE LEVEL

Venue	ICFRE - Rain Forest Research Institute
Theme	Genetic Improvement & Tree Breeding
Presentation Team	**Dr. Rakesh Kumar Prajapat, Scientist-B**, Genetics and Tree Improvement Division of the Institute
Broad structure	1. Opening session: Welcome and overview 2. Introductory remarks by the Director (or senior scientist in the Director's absence) of the institute 3. Presentations by the speaker 4. Discussion on the presentations 5. Closing Remarks by the Director (or senior scientist in the Director's absence) of the institute 6. Vote of thanks
Periodicity	Once in a month
Duration	Half day
Expected outcomes of the seminar	i) Identification of research needs ii) Formulation of future strategies/ road map iii) Networking research options & opportunities **(Attached, Page number 5)**
Coordinator	1. Sh. R K Kalita, Head, Extension Division 2. Dr. Satyam Bordoloi, Head GTI Division 3. Ms. Tara Kumari, Nodal Officer (Monthly Seminars) 4. Supporting staff of Extension Division
Proceedings	**(Attached, Page number 2)**

Proceedings of the Monthly Seminar

Date: November 28, 2025 & Time 3:00 PM onwards

Venue: Rhino Hall, ICFRE-RFRI, Jorhat

Theme: Genetic Improvement & Tree Breeding

ICFRE-Rain Forest Research Institute, Jorhat (Assam) conducted the monthly seminar on 28th November 2025 at Brahmaputra Hall of ICFRE-RFRI, Jorhat campus. The seminar was attended in physical and virtual mode by the scientists, officers, technical, subordinate staffs, researchers and students along with the members of its centers i.e. BRC, Mizoram and LEC, Tripura. The Coordinator of the seminar Ms. Tara Kumari, Scientist, conducted the program. The program was chaired by Dr. R. K. Borah, Group Coordinator (Research), ICFRE-RFRI.

Dr. Rakesh Kumar Prajapat, Scientist-B from Genetics & Tree improvement Division of ICFRE-Rain Forest Research Institute, Jorhat (Assam) delivered a comprehensive lecture on "Biotechnological interventions for the genetic improvement of *Aquilaria malaccensis* (Agarwood)". Lecture started with the importance and taxonomic features of the species with economic importance at global level. He also explained the significance of agarwood in ecological protection, cultural heritages and in global market chain. Dr. Prajapat also explained the artificial and conventional methods involved in agarwood resin induction in vary simpler way and showed the comparative assessment of the quality of product developed using these methods. Further, how the agarwood utilizes varieties of stresses during growth and development and convert the same into economic product which have high value during the trade.

Dr. Prajapat covered all the aspects of genetic improvement through modern biotechnological tools like plant tissue culture, genomics, transcriptomics, bioinformatics, epigenomics, marker assisted breeding & genome editing in *A. sinensis* etc. during the lecture. Although, most of the molecular studies was done on *Aquilaria sinensis*, so cited good examples from the same. Subsequently, he also emphasized how these advanced molecular tools can be explored for species identification and genetic improvement of *A. malaccensis*. Being a pioneer institute in field of forestry research and education from North eastern region of India, ICFRE-

RFRI, Jorhat is involved in the genetic improvement of *A. malaccensis* since more than two decades. Institute also has developed the technology for artificial inoculation of agarwood through microbial inoculation which is the key for quality agarwood development. Dr. Prajapat also summaries the work of ICFRE-RFRI, since its establishment for genetic improvement of *A. malaccensis*. He also shown the tentative molecular pathways operating in agarwood development through some transcriptome studies which is supported by recently published articles. He explained the role of critical enzymes, related genes and their expression behavior and pathways involved for biosynthesis of sesquiterpene and PECs. During the lecture, he emphasizes the importance of DNA barcoding technique for accurate and rapid identification of species. The most commonly used molecular markers/loci are *matK, rbcL, ITS*, and t*rnH–psbA*, which can differentiate closely related *Aquilaria* species (e.g., *A. malaccensis*, *A. crassna*, *A. sinensis*) that are often morphologically similar as summaries by Dr. Prajapat.

Dr. Prajapat also shown the current status of the species which is critically endangered need immediate effort for conservation of natural population and plantation areas of the species with sustainable utilization for the future need. Certain case studies from *A. sinensis* were presented and showed the practical utility of advanced biotechnological tools like Omics approaches and sequencing platform for genetic improvement of *Aquilaria* species.

Further, he elaborated about RNA seq-based molecular bioprospecting techniques which can be used for identification of regulatory genes and explain how variations in biosynthetic gene expression profiles influence metabolite content. Furthermore, how metabolomic analyses are performed to identify key secondary metabolites essential for the distinct scent of agarwood— for example, chromones and sesquiterpenes. Subsequently, improvement of agarwood induction technology should emphasize on two aspects that are to further improve the induction efficiency and to screen more responsive lines of *Aquilaria* for resin production under breeding program. Further, improvement of agarwood induction efficiency should accompany with the development of efficient molecular markers which could identify non-responsive trees at early stages.

The presentation was followed by an insightful discussion and important points related to agarwood research also been shared by shared by the participants. Dr. Satyam Bordoloi, Head of the GTI Division and Dr. Dhruba Jyoti Das, Head, FE&CC Division commended Dr. Rakesh for his excellent presentation. In his remarks, Dr. R. K. Borah, GCR, appreciated the quality and

relevance of the talk, and encouraged to develop a research proposal on this important theme. Dr. Borah also asked to develop the technologies for field identification of Jati sanchi and Bhola Sanchi. The session concluded with a formal vote of thanks delivered by Ms. Tara Kumari, the coordinator of the program, marking its successful completion.

Expected outcomes of the seminar

1. *Identification of Research Needs:*

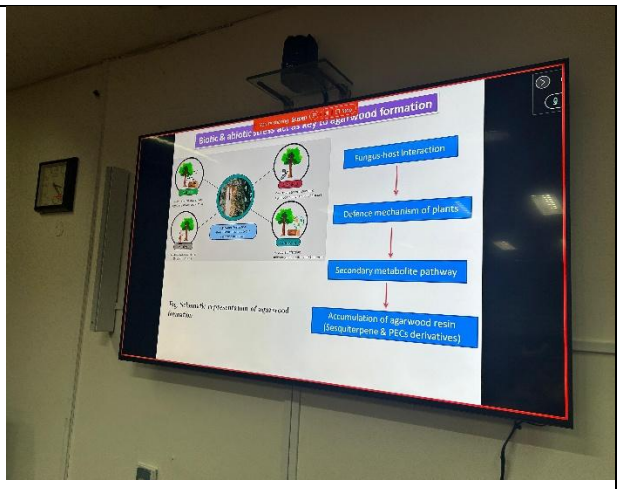
- ✓ Limited study on the interaction between endophytic microorganisms and host plants during resin induction.
- ✓ Lack of metabolic profiling and biomarker identification for early detection of agarwood formation.
- ✓ Limited genomic and transcriptomic data available for *A. malaccensis*, limiting understanding of genes involved in agarwood formation.
- ✓ Inadequate knowledge of molecular mechanisms and signaling pathways governing resin biosynthesis and induction.
- ✓ Few studies on genetic diversity assessment using advanced molecular markers across natural and cultivated populations.
- ✓ Limited progress in genetic transformation and genome editing (e.g., CRISPR/Cas) for trait improvement.
- ✓ Minimal integration of biotechnological tools with field-based breeding and conservation programs.

2. Formulation of Future Strategies / Road Map:

- ✓ Develop a comprehensive genomic database of *A. malaccensis* to support molecular breeding and gene discovery.
- ✓ Apply CRISPR/Cas and other gene-editing tools to enhance resin yield, disease resistance, and growth traits.
- ✓ Need to strengthen research on endophyte-based and elicitor-induced resin formation for sustainable agarwood production.
- ✓ Integrate omics technologies (genomics, transcriptomics, metabolomics) to decode and further regulate the resin biosynthesis pathways.
- ✓ Promote biotechnology-driven conservation programs to preserve genetic diversity and restore natural populations.
- ✓ Foster industry–research collaborations for commercialization of improved planting materials and resin induction technologies.

3. *Networking Research Options & Opportunities*:

- ✓ **Collaborations programme on Genomic & Proteomic**: Associate with institutions working on *Aquilaria* genome sequencing and proteomic profiling for agarwood formation
- ✓ **Breeding & Germplasm Exchange**: Networking with germplasm banks and forestry institutes for improved *Aquilaria* breeding programs and stress-tolerant lines
- ✓ **Computational biology & Data Sharing**: Joint projects on transcriptomics, ESTs, and metabolomics databases to identify candidate genes for resin biosynthesis
- ✓ **Genetic Improvement Programs:** CRISPR/Cas9 and marker-assisted selection for disease resistance and stress tolerance in *Aquilaria*
- ✓ **Metabolic Engineering:** Research on biosynthetic pathways of sesquiterpenes and chromones to optimize resin yield.
- ✓ **Tissue Culture & Micropropagation:** Opportunities to scale clonal propagation of elite agarwood-producing lines for commercial plantations.
- ✓ **Pharmacological Applications:** Collaboration with pharmaceutical industries exploring agarwood's bioactive compounds for medicinal application.
- ✓ **Industry-Academia Partnerships:** Link with fragrance, pharmaceutical, and biotech companies for translational research.
- ✓ **Capacity Building:** Training programs and workshops on bioinformatics, molecular breeding, and sustainable agarwood production.



(Tara Kumari)
Scientist-B & Nodal Officer
Monthly Seminar
ICFRE-RFRI, Jorhat (Assam)