Job offer –Post-doctorate in
Multi-omics to decipher the immune responses controlling Corynespora Leaf Fall disease of rubber tree (*Hevea brasiliensis*)
(*For non-French scientists only*)

Research Project Short Title as Submitted to CEFIPRA: " Multi-omic Immune Responses of *Hevea* to *Corynespora* (MIRHECO)**"**
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Project description

- **Keywords** : Multi-Omics, *Hevea brasiliensis*, *Corynespora cassiicola*, immune responses, pathotypes, molecular interactions.

- **Context** : *Hevea brasiliensis* is one of the world's most important and strategic crops, producing natural rubber (NR) for over 50,000 industrial products. A major limitation to NR productivity is the susceptibility of high yielding clones to biotic stresses and more specifically fungal leaf diseases. Selection programs are being developed in order to create new rubber tree clones combining both good yield in latex production and better tolerance to the leaf diseases.

  The necrotrophic fungus *Corynespora cassiicola* causes important leaf damages affecting both rubber yield and growth of susceptible clones. Previous studies revealed the important genetic diversity of the fungus and the existence of pathotypes with distinct virulence profiles on the same range of clones. On the plant side, the sensitivity varies significantly between clones. A good comprehension of the molecular dialogs occurring between the rubber tree and the various fungal pathotypes could help developing more efficient selection strategies. The muli-omics approach provides a holistic view of the molecular networks in biological system. It could be a powerful method to decipher the molecular mechanisms of the *Hevea-Corynespora* interactions and may help developing relevant diagnosis and selection tools.

- **Abstract of the Research Project**: This project is funded by the Indo-French Center for the Promotion of Advanced Research (CEFIPRA/IFCPAR) and coordinated by two principal collaborators with complementary expertise in the field of molecular physiology of the rubber tree in the context of biotic stresses. The Indian collaborator is Dr Bindu C. Roy from the Rubber Research Institute of India (Kottayam, India). The French collaborator is Dr Valerie Pujade-Renaud from the Center for International Research in Agronomy and Development (CIRAD, Montpellier, France). Three French joint collaborators with strong expertise in bioanalysis and bioinformatics are also involved in the project: Dr Benedict Favreau, Dr David Lopez and Dr Jean-François Dufayard. An Indian PhD student, recruited in September 2023, is working partly in India (2 years) and in France (1 year), to generate and analyze multi-omics data (transcriptomics, proteomics and metabolomics) from contrasted rubber clones challenged with *Corynespora* isolates representing different pathotypes.

  A post-doctoral position is opened in CIRAD (Montpellier, France) for the last year of the project. The successful candidate will assist the PhD student in the integrative analysis of the multi-omic data and the identification of relevant markers, predictive of susceptibility/resistance of rubber trees to *C. cassiicola*.

- **Scientific Objectives of the Project:** The project aims at deciphering the molecular networks of immune responses occurring during compatible or incompatible interactions, in two rubber tree clones inoculated with two *C. cassiicola* isolates from India, representative of distinct pathotypes, through a multi-omics integrative approach.

The specific objectives of the projects are:

1. To characterize pathotypes among *C. cassiicola* isolates colonizing rubber trees in India.
2. To generate multi-omics data (metabolomics, transcriptomics and proteomics) from two control and inoculated rubber clones displaying various levels of susceptibility depending on the inoculating pathotype.
3. To perform integrative analysis of the Omics data in order to discover crucial genes involved in susceptibility/tolerance.
4. To develop markers predictive of susceptibility/resistance to *C. cassiicola* in rubber trees.
5. To provide training and workshops for students/scientists in the field of multi-omics.

The post-doctorate will assist the PhD student in the Objectives 3 and 4. More specifically, the post-doctorate will perform gene network analysis based on the transcriptomics data, in association with the other omic data. The PhD student and the post-doctorate will jointly identify key genes potentially predictive of the rubber clone susceptibility.

- **Methodology and Timeline of the Project**

- Year 1: Recruitment of the PhD student (September 2023); *in vitro* pathotyping assays, by inoculating detached leaves from 5 clones with 38 *Corynespora* isolates collected in Indian rubber plantations; selection of two contrasted clones and two isolates representative of distinct pathotypes, based on PCA analysis of the measured symptoms; phylogenetic characterization of the isolates; Training Programs (for falculty members and students) delivered in India.
- Year 2: *In vivo* inoculations of the selected clones with the selected isolates; collection of leaf samples from inoculated and mock-inoculated plants, at two different time-points, as well as collection of pure fungal mycelium; generation of transcriptomics, proteomics and metabolomics data for all samples; training of the PhD student to the analysis of differential responses (in India).
- Year 3: recruitment of a post-doctorate for 1 year, in France; joint analysis (by the PhD and post-doctorate, in France) of each individual omics dataset; integration of all omics results and characterization of networks; identification of key genes and analysis of their polymorphism among a large range of clones; development of specific markers predictive of susceptibility/tolerance; writing of publication(s) (at least one will be co-authored by both the PhD student and the post-doctorate). Training session and closing seminar in India.

Candidate profile

- Candidates can be all nationalities except French. In case of double nationality (French and another one), the candidate is not eligible. In the context of CEFIPRA, Indian candidates are preferred
- Applicants for post-doctorate must have a PhD degree (or be in the process of obtaining one)
- No competence in French language is required
- Candidate competences:
    - Solid background in plant biology and physiology, biotic stress, biostatistics and bioinformatics for omics analysis
    - Interest for plant-pathogen molecular dialogs
    - Good oral and written communication skills in English
    - Scientific curiosity, motivation, precision.
    - Ability to work both independently and as part of a team
- Candidate know-how: RNA seq data analysis, gene network analysis, WGCNA, R language
- Expected starting date: 01-09-2025
- Expected duration: 12 months

How to candidate ?

Documents to be provided :

i. A cover letter (reasons for the candidature, professional project …) max 2 pages
ii. A copy of the master's degree or a proof of the program followed (and expected date of end) OR A copy of the PhD degree or a proof of the PhD program followed (and expected date of defense) max 1 page
iii. A copy of results for previous scholarship (max 3 pages)
iv. International curriculum vitae (max 2 pages)
v. Two letters of recommendation: one from any Indian institution and one from the French institution planned to host the candidate –mandatory- (max 2 pages)
vi. All should be submitted within 1 pdf file of no more than 10 pages.

Applications should be submitted to the following email address: msi@ifindia.in mentioning the reference number of the Job offer clearly.

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Candidates are requested to contact the French scientific principal investigator of the project before submission. A recommendation letter from the scientific principal investigator is mandatory.

Benefits:

- Monthly allowance of 2400 euros for Post-Doc
- Travel allowance
- University fee
- Carte de séjour fee
- Campus France management fee
- Registration to the French social security scheme

Selection process:

Selection is made by a dedicated selection committee of at least 4 persons. Decisions will be transmitted by the Embassy of France to CEFIPRA. **No consideration will be given for candidates with no recommendation letter from the French institution.**

Criteria for applicants' selection:

Academic excellence

- Excellence of the Academic background, Academic records, Honors, Letters of support, Participation to international research projects, exchange programmes and conferences.

Motivation and qualities

- Academic maturity: appropriation of the thesis project (stakes and contexts) • Quality of the presentation (oral expression, skills for synthesis, English level) • Maturity of the professional project: capacity to project her/himself within five years in terms of career development.

About CEFIPRA:
Indo-French Center for the Promotion of Advanced Research (CEFIPRA/IFCPAR) is an Indian body which promotes scientific cooperation between France and India in advanced fields of Science and Technology. It is supported by the Department of Science and Technology, Government of India and the Ministry of Europe and Foreign Affairs of the French government