

Final Evaluation Report

Your Details	
Full Name	Nantenaina Rindra Harilanto
Project Title	Plant-Galls-Lemur frugivore interactions (2 nd part)
Application ID	40056-B
Date of this Report	October 2 nd 2024

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
<p>Determine how the presence of galls on trees influences the seed dispersal of these trees by lemurs in terms of quantity of seeds dispersed</p>				<p>We successfully completed all activities related to this objective and collected the necessary field data during lemur feeding and defecation events. Our preliminary results suggest that while the presence of galls on trees can influence lemur feeding behaviour, it does not impact seed dispersal.</p>
<p>Determine how the presence of galls on trees influences the seed dispersal of these trees by lemurs in terms of germination post-dispersal</p>				<p>To address this objective, we successfully collected comprehensive data both in the field and in the lab. Field data included tracking lemurs specifically during feeding and defecation events, assessing galls on feeding trees, and conducting germination experiments on seeds found in lemur faeces. In the lab, we performed DNA extraction and utilized microsatellite-primed polymerase chain reaction (PCR). Preliminary results suggest that seeds from gall-infected trees have higher germination rate compared to those from non-infected trees. Further data analysis will confirm this trend.</p>

2. Describe the three most important outcomes of your project.

a). Comprehensive training and data collection

We trained six local technicians and four research assistants collecting scientific data on lemur and gall ecology and using scientific tools (GPS, compass, CanopyCover app, hand lens microscope, etc.). Additionally in the lab, two Malagasy research assistants were trained in DNA extraction and Polymerase Chain Reaction.

b). Technical reports

We submitted technical reports with conservation recommendations for *Varecia variegata* and its habitats to local forest managers and the Ministry of Environment in Madagascar. We are awaiting feedback.

c). Conference presentation

Our abstract related to objectives 1 and 2 of the first part of this project is accepted as oral presentation at the British Ecological Society annual meeting in December 2024.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

In the original proposal, we aimed to focus on the seed dispersion of *Grewia cuneifolia* (Malvaceae). However, upon arriving in the field, we found that this species was not yet bearing fruit. During this period, "karambitto", later identified as *Allophylus cobbe* (Sapindaceae), was the most preferred species for *V. variegata*. Additionally, we detected that some individuals of "karambitto" were infected by galls, making this species suitable for our objective of determining how the presence of galls on trees influences seed dispersal by lemurs. To save time and resources, we decided to focus on "karambitto" instead of waiting for *G. cuneifolia* to bear fruit.

During our laboratory work, we also encountered some challenges. Our species identification of "karambitto" was confused with *Macaranga* sp., leading us to order microsatellite primers isolated from *Macaranga* species. Consequently, we were unable to perform Polymerase Chain Reaction (PCR) with the initially ordered microsatellite primers. To address these issues, we double-checked our target plant taxonomy with a specialist at the Department of Plant Biology and Ecology, Université d'Antananarivo. The identification revealed that our target plant is *Allophylus cobbe*, belonging to the family Sapindaceae. However, there were no studies on the microsatellites of *Allophylus* yet, so we subsequently ordered and used microsatellite primers isolated from a congeneric genus, *Paullinia*. While some of these newly ordered primers were working, others were not, but we were able to continue our research with the primers that were functioning. Therefore, this study is the first to report microsatellite primers that work with the genus *Allophylus*, and the PCR conditions used in this research may serve as a reference for future studies on *Allophylus* microsatellites.

4. Describe the involvement of local communities and how they have benefited from the project.

Local communities at Ihofa forest involved in several ways, as:

- Local technicians/guides: I collaborated with six local individuals who are members of the V.O.I. (local forest managers). After training them, they assisted in collecting rigorous scientific data.
- Local porters: due to the limited access of vehicle to our campsite, we must walk for 7km long. Therefore, we hired local porters to carry our food provisions, equipment, and other supplies.
- Local sellers: whenever it is possible, we purchased food from local sellers, including fish, poultry, fruits, and green vegetables.
- V.O.I. FITAMA – local Forest manager: we also worked closely with local forest managers. They were not only provided us with members who involved as technicians/guides, but also granted us permission to conduct research in the forest they managed.

5. Are there any plans to continue this work?

Certainly! Undertaking this research has provided me with numerous ideas and inspiration to continue this work. I am currently preparing the manuscript of our findings and developing outreach projects for the local communities where this research was conducted. These efforts are part of my ongoing commitment to the conservation of black-and-white ruffed lemurs in its natural habitat.

6. How do you plan to share the results of your work with others?

I plan to share the results of this second part of my project through the following approaches:

- Outreach Activity: Creating poster comics in Malagasy to present to the local communities in Ihofa, where this project was conducted.
- PhD Thesis: Including this project as one chapter in my PhD thesis, which will later be submitted at the University library in Antananarivo, Madagascar.
- Scientific Article: Submitting a scientific article, with an abstract in Malagasy, to the American Journal of Primatology.
- Conference Presentation: Giving a talk at the International Primatological Society conference, which will be held in Antananarivo Madagascar in 2025.

7. Looking ahead, what do you feel are the important next steps?

Looking ahead, the important next steps for our project are as follow:

- Finalising data analysis and writing up the manuscript.
- Submitting the article to an international journal, probably at the American Journal of Primatology.
- Simultaneously, I should focus on finalizing my thesis writing. This includes synthesizing all the findings from our two consecutive projects funded by the Rufford Foundation and adding some reviews about galls conception to frugivores in general.
- Submitting the thesis book to the PhD committees for review and approval.
- Preparing for the thesis defense. This involves rehearsing the presentation, anticipating potential questions, and ensuring that all supporting materials are ready.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

In addition to what was reported in the previous reports, I always encourage students working with me to apply for funding at The Rufford Foundation. Knowing that three of my projects have been funded by this Foundation has greatly inspired them to continue their research. Some students are now developing their own research proposals and preparing applications to the Rufford Foundation.

9. Provide a full list of all the members of your team and their role in the project.

Project Coordinator: I am the project coordinator. I manage the entire process of the project, from data collection in field, as well as in the lab, to publication.

Project Advisors: As this project constitutes one of my PhD research chapters, I am always supported by my PhD advisor from the University of California, Berkeley, Dr. Onja Razafindratsima. She has made intellectual contributions in the design and implementation of this project and provided guidance throughout the execution of this project. I also have two academic advisors from the University of Antananarivo, Madagascar, Prof. Verohanitra Rafidison and Prof. Vonjison Rakotoarimanana. They have contributed to improve the methods used for field data collection and facilitate all academic procedures at the University.

Research Assistants: The following students played crucial roles as research assistants, helping me lead the team during the lemur follow in three sites, monitoring the germination experiments and managing the campsite during my absence in the field. They also helped me entering data into Excel. Two of them received training and aided with DNA extraction and Polymerase Chain Reaction (PCR) analysis in the laboratory.

- Bodovola Marie Mazzarello (Université de Fianarantsoa, Madagascar)
- Tojonirina Fenonaina (Université de Fianarantsoa, Madagascar)

- Mioranirina Francois Nambinintsoa (Université de Toamasina, Madagascar)
- Raelinjanakolona Njato (association Ary Saina, Madagascar)

Local Technicians/Guides: These six local technicians and guides were instrumental in collecting rigorous data and performing the germination experiment during the fieldwork:

- Ratonganirina Gerdaya Sylvin (V.O.I. FITAMA Ihofa, Madagascar)
- Randriamanantena Sedraniaina Mamitiana (V.O.I. FITAMA Ihofa, Madagascar)
- Ndrenasoa Kotonandrasana (V.O.I. FITAMA Ihofa, Madagascar)
- Rakotonirina Jean Eugene (V.O.I. FITAMA Ihofa, Madagascar)
- Rafanomezantsoa Herison (V.O.I. FITAMA Ihofa, Madagascar)
- Randrianantenaina Nirina Joseph (local from village nearby Ihofa)

Collaborators: Dr. Jadelys Tonos (University of California, Berkeley) has made intellectual contributions in the design of the molecular analysis part. Dr. Jenny Rakotonirina (Université d'Antananarivo, Madagascar) and Prof. Jean Michel Leong Pock Tsy (FOFIFA, Madagascar) provided guidance throughout the execution of the molecular work at Plant Molecular Biology Lab, University of Antananarivo, Madagascar.

10. Any other comments?

We would like to extend our gratitude to The Rufford Foundation for their support, as well as to the local communities and research team members whose contributions were invaluable to the success of this project. We are also grateful to the association Ary Saina for their assistance with logistics and administrative support.