Final Evaluation Report

Your Details	
Full Name	Methee Phumthum
Project Title	Supporting Thai ethnic communities for conservation of *Kadsura coccinea* (Lem.) A.C.Sm. (Schisandraceae)
Application ID	41279-1
Date of this Report	30 September 2024

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

Objective	Not achieve	Partially achieve	Fully achieve	Comments
1. Study distribution of *K. coccinea*.			✓	The project proposal expected to study in Chiang Rai province, but I could do observations in Chiang Rai and additional observations in Chiang Mai province.
2. Study microorganisms that would impact on growth of the plant.		✓		Soil samples were collected from field sites. The samples were sent to an institution for study diversity of microorganisms based on DNA materials. It takes longer time than expected. And there must be an analysis of the results after that.
3. Propagation of the plant from seeds.	✓			The project was approved and signed in October 2023 (which was the late season to collect the fruits). I could collect only a few rotten fruits which the seeds might be infected by many bacteria and fungi. This might lead the failure of the experiments.
4.Creating policies for the plant conservation by villagers			✓	Villagers in the village having a population of the plant agreed to protect the plant. They realized on the value of the plant. The villagers agreed to share the plant resources (i.e. collecting the fruits) and do not cut the living individuals including seedlings.

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

a). In the villagers' meeting, many villagers shared benefits from the plant (mostly economic value). This made other villagers realized the importance of the plant for their communities. This will lead to a future conservation strategy that to develop the plant uses for economic purposes, which will encourage the villagers to conserve the plant and harvest the plant sustainably. Villagers from a village that have the biggest plant population from this study's observation created and agreed on their local policies to protect the plant individuals including seedlings, and share rights and benefits from the plants among the villagers.

b). During the field observations, many villagers who reported that they used to use the plant or consume its fruits said that the plant was in their villages when they were children, but now they could not find the plant. So, they wanted the plant's seedlings to cultivate in their village areas. This is a good sign to initiate the plant conservation in their communities.

c). The information from most visited villages was that the plant was not found in/near their village anymore. There were only a few villages reported that there were only one or two individuals in the areas. However, this study found two big populations of the plant in two different areas. These populations would maintain the biggest plant genetic diversity in Thailand. This will be opportunities to study ecological factors that are suitable for the plant survivals to conserve the plant populations and genetic diversities. And I think it should be the urgent study because the plant's population sizes might be reduced fast because of the global warming and anthropological activities. So, I would propose this continuous project for the priority.

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

This project was approved by the Rufford in August, but the contract was signed in October, and I could start the project after that. That was not a perfect time to start this project because it was the late season to collect *Kadsura coccinea*'s seeds. Villagers participating in this project could collect only the plant's seeds form a few rotten fruits on the grounds (Figure 1). This would lead to getting infections by bacteria and fungi resulting in failure for the seed germination experiments.

After the workshop on the sciences of seed germinations, villagers hypothesize that cold temperature during November - February would be the factor stimulating the plant's seed germination. The fruits ripen in October-November and fall to the grounds and past the wintertime which the temperature drops to 5-10 °C in December-February. Then, the seeds will germinate and grow in rainy season.

The villagers designed their own simple experiment to study the effect of cold temperature on the plant seed germination. They compared germination rate of the seeds in the room temperature and ones that were put in a refrigerator for one month before cultivating the seeds (Figure 2). I replicate

their experiment by modifying treatments as putting in a refrigerator at 0 °C, 10 °C, and keeping in the room temperature.

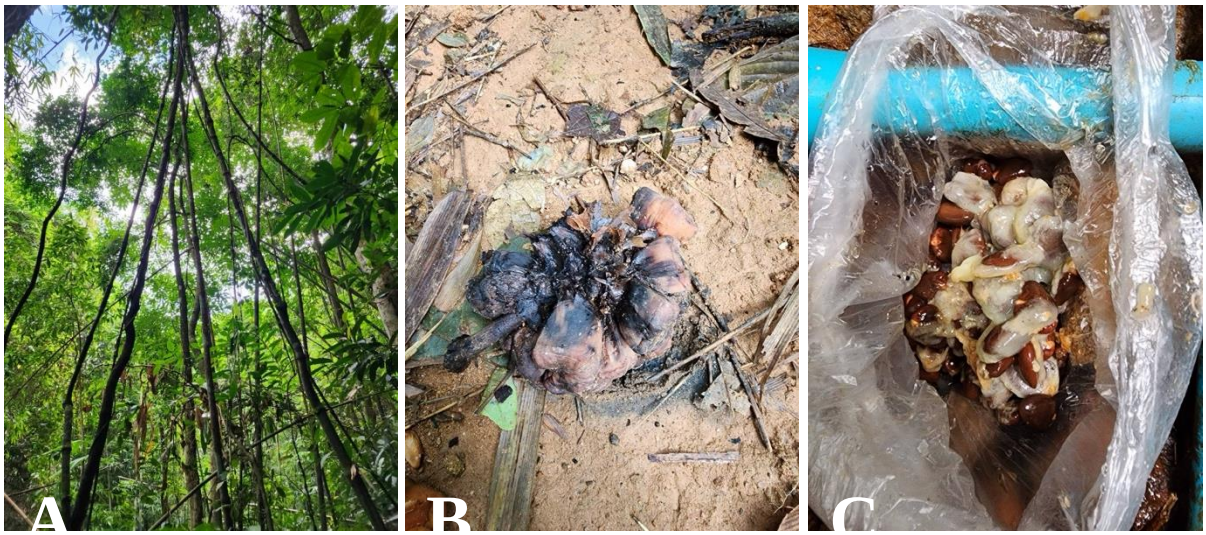

Figure 1 *Kadsura coccinea* (A) individual lianas in natura habitat (B) rotten fruits on grounds in natural habitat and (C) seeds collected from rotten fruits.

Figure 2 Experiments designed by the villagers (A) the villagers were putting seeds on soil (B) treatments with two replicates the two baskets on the left were treated in a refrigerator for one month and the other two baskets on the right were untreated seeds.

Unfortunately, all the seeds were infected by bacteria and fungi (Figure 3) although I have tried to cultivate the seeds using standard aseptic techniques in plant tissue cultures (Figure 4). It leaded to the hypothesis that the seeds were infected from rotten fruits on the grounds and the fungi could penetrated their hypha through the seeds' hilum and infected in embryos. A previous study was successful on the study of seed germination using plant

tissue culture techniques and found that seed coat components blocked the *Kadsura coccinea* seed germination (He et al., 2023). I applied scarification techniques in another experiment and found that there was easier to get bacterial infection at the seed's scars (Figure 5).

He, T., Zhong, W., Shao, F., Guo, H., Yan, C., Ge, X., Wang, J. and Wang, S., 2023. Seed Dormancy Characteristics of Kadsura coccinea (Lem.) AC Smith, a Unique Medicinal Plant in Southeast Asia. *Forests*, *14*(10), p.1928.

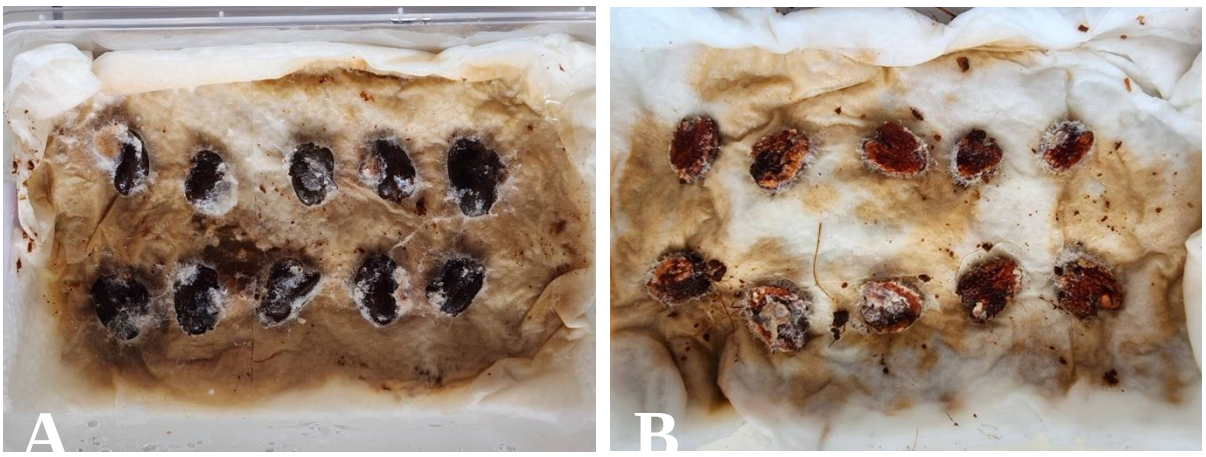

Figure 3 Seeds infected by fungi after cultivated for 10 days (A) cultivated seeds with seed coat (B) cultivated seeds without seed coat.

Figure 4 (A) Cultivated seeds using aseptic techniques in plant tissue culture (B) seed contaminated by fungus infection.

Figure 5 (A) A seed germination experiment using the scarification technique (B) bacterial infections on the seed's cotyledons on the scars after two days.

From all information above, I strongly suggest the further study should collect clean seeds from fresh fruits in early season of the fruit ripening to prevent microorganism infections in the plant's seeds. Also, although the plant's seed coat can inhibit or delay the germination process, it can protect the embryo from bacterial infections. Removing the seedcoat would accelerate seed gemination but I would recommend using clean seeds and cultivated them in aseptic conditions.

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

This project works directly with local communities. There were two main parts. The first part was the observations in many local villages in various ethnic groups to find out where the plant was distributed or used to be distributed and used. Villagers were happy to provide information (Figure 6).

Figure 6 Observations on the uses of the plant in many villagers.

The second part of the project was working with a selected local community in Chiang Rai, Thailand. The villagers realized the importance of the plant. There were two small populations of the plant in their community. The bigger population had around ten individual lianas (Figure 1A) while the smaller population had only two individuals in the same clone, which the bigger clone liana was cut by an outsider. Therefore, the villagers were happy to participate in this conservation project. They joined a meeting to create and make agreement on local policies to protect the plant in the community. They leaded me to show the secret plant populations in their community. They

collected the seeds for the experiments. And they joined the plant propagation experiment together (Figure 7)

Although this small project failed to propagate the plant seedling to help them to increase plant individuals in their community for this time, the villagers said that they were looking forward to participating other future projects to conserve this plant in their community

Figure 7 (A) Villagers showed the plant in natural habitat, (B) seeds collected by villagers, and (C) villagers

5. Are there any plans to continue this work?

There are many plans to continue on conservation of this plant.

1. The observations

According to the observations in Chiang Mai and Chiang Rai provinces in this project, many villagers informed that they used to see the plant in their village areas. However, there were only people from a few villages mentioned that the plant was still found in the village areas in the year of the observation (2023). Many informants said that they could see the plant or its fruits from other provinces or in Myanmar when they were children. There were only a few plant specimens in BKF and QBG herbaria. So, we still have very little information on the plant distribution? how many living plant individuals in the country, what are suitable environments for the plant survival? Numbers of observation in other provinces in Thailand are needed. Also, suitable environments for the plant survival are urgently needed for the study. I hypothesize that the plant needs to grow in high moisture forest near a stream. If this is true, maintaining the suitable environments for the plant will not only protect the plants but also maintain microecology in target villages.

2. The plant propagations

This project fails to propagate the plant from seeds because of microbial infections. The next project should collect the plant's seeds in fresh fruits to cultivate. And, it would be a higher chance to success if a microbiologist can join this part the project.

3. Adding economic value of the plant

Fruits of the plant are edible, and many villagers used to eat them. A study reveals that fruits of the plant have high nutrients and antioxidants. Seeds of the plant have very low germination rate in nature. Therefore, collecting fruits will have least effect on the plant's population sizes. On the other hand, people will be more aware about the plant when they can get income from the plant. However, the villagers should have agreements and policies to collect the plant sustainably.

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

The results from observations in many villages in Chiang Mai and Chiang Rai provinces are sufficient to prepare a manuscript for a small journal or present in a conference. However, I think adding more observation from other provinces and ethnic groups would provide stronger results. So, I would wait for more data collected from other areas in the future rather than publishing this small information, except I could not get another research grant by these two years. I will have to publish the information that, hopefully, other scientists or organizations can continue the work as soon as possible. Although we have insufficient data on the plant distribution in the country, I can assume that the plant individuals are rare and risk for extinction from natural habitat in Thailand.

A lot of information that we have known about the plant was shared to villagers in the target village in this study.

This project also provide experience for undergrad students as field research assistants. The project is incubating young plant conservation scientist. The students want to continue working on this project. If the result is satisfied, I will encourage them to present at a conference venue in Thailand.

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

The most important step in conservation of this plant species is to make people realize on importance of the plant. Regarding my observations in many villages, some people told me that they saw the plant, but they did not use the plant. They only saw small rodents ate its fruits. So, sometimes, they unintentionally cut the plant without any purposes. If we can add value of the plant in any aspects to local people, they will automatically conserve the plant and its suitable environments.

As motioned above, the plant distribution and populations of the plant need to be urgently study to collect the plant's seeds to propagate for conservation of the plant's genetic diversity.

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?

I have not used the logo yet. So far, I only introduce the project and mentioned the Rufford among peers, collaborators, and villagers participated activities of this project. The logo will be used in the future for presentation of

the results generated from this project at any scientific meetings and conferences.

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

1. Dr. Varangrat Nguanchoo: Collaborating for field data collection and scienc of seed germination.
2. Ms. Jutatip Plaengcheep: Supporting for a septic plant tissue culture experiment.
2. Ms. Boopor : Coordinating with villagers for all activities.

10. Any other comments?

If it is possible, I think the project should not be strict for only a one-year period. Sometimes researchers might miss flowerings and fruiting seasons of wild plants, which means they will need to wait for the season for the next year. I think the foundation should provide flexible extension period for future researchers.

This project has spent an over budgeting cost for field observation and materials.

I strongly suggest for the continuous project to study ecological factors for plant survivals.