The Rufford Foundation
Final Report

Congratulations on the completion of your project that was supported by The Rufford Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Maria de Lourdes Delgado Aceves
Project title	Conservation and sustainable use of threatened species of the genus *Agave*.
RSG reference	26560-1
Reporting period	October 2018 to October 2019
Amount of grant	£5000
Your email address	bmlda108@gmail.cim
Date of this report	October 08 2019

1. Please 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
Obtaining biological materials				Done.
Workshops with people in the area				Workshops were carried out in each area visited.
Establishment and micropropagation /				All species have been established and micro-propagated.
Somatic embryo induction				Obtaining new somatic embryogenesis protocols and waiting for results of experiments.
Shoot tips proliferation				All species and their protocol have been worked.
Cryopreservation of accessions				Three species of four have cryopreservation protocol.
2020 Transfer of biological material to germplasm bank				Preparing passport data for the transfer of biological material to CNRG.
Dissemination of protocols				Presentation of protocols in several meetings and editing a scientific article.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

- Community. Access to communities is limited, the inhabitants protect themselves. People outside the community represent intimidation for them and therefore it affects the credibility of the visit. We have been able to interact with the help of an inhabitant of the same community who gave us his confidence and interest in the subject for the region. Finally, on the second day and by offering support in their community, the inhabitants were generous and hospitable.

- Field. The access roads to reach the study area were complicated. We had to get a van to transport us and load reserve gasoline to avoid unforeseen events. The roads are rugged and dangerous. There are areas that are not recommended to cross. We spent too much time to arrive to the community.

Fortunately, we had the help of the local people who guided us and welcomed us kindly.

- Laboratory. Each species behaves differently, referring to growth and reaction to the growth regulators used, even when they are under controlled conditions, so carrying out experiments in a co-ordinated manner was complicated. However, we have achieved on time micropropagation protocols.

- Reagent availability. To acquire the necessary reagents for cryopreservation experiments, payment was delayed up to 4 weeks, due to the administration of money and bureaucratic processes within the association that supported us. To avoid delays we pay with money from other activities and buy them separately.

3. Briefly describe the three most important outcomes of your project.

First. The protocols generated helped to take action in communities that are concerned about the degradation of natural Agave populations. The inhabitants of the region are informed to value and restore areas where wild agaves were present and abounded. In the same way we have offered alternatives such as the optimal production of agave plants that will be used as raw material for the production of distilled beverages (mezcal) avoiding unsustainable extraction in wild areas. The community showed awareness and interest in these action plans, they are the most interested in conserving their ecosystems, however they did not have direct access to biotechnological tools that now confers advantages to the environment and benefits to them simultaneously.

Second. The long-term conservation of endemic species that are quickly exploited by various factors. Methodologies for the management of biological material and micropropagation were developed. In addition, conservation strategies were implemented to preserve species of ecological importance. The information generated will serve as a model for cryopreservation and storage of accessions in germplasm banks of several susceptible species of the genus for Mexico and around the world. We have developed a list of emerging species for conservation of the *Agave* genus in vulnerable areas although a more precise study is required.

Third. We create an awareness of all threats that affect gender and communicate the scope of biotechnological tools in society. We were able to approach the real problem by visiting communities. The interaction with the inhabitants and the relationship with the scientists of the area for the solution of problems was achieved. The dissemination of information and understanding for native people was a challenge, we were able to convert the scientific vocabulary to a simple and basic vocabulary to communicate with them and thus express our objectives. We

contribute to perpetuating traditions such as the production of beverages derived from agave by providing a sustainable option for the producer.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

The benefits provided to the community have been gratifying for us. The information offered for the knowledge of local agave species, helped to know morphological characteristics, distribution, ecological importance and forms of sustainable propagation for them. They have also been provided with in vitro plants of endemic species, cultivars of interest and lines selected for reforestation and crops. The in vitro propagation protocols of agave has allowed us to offer faster multiplication of plants without the need for them to wait for flowering (from 8 to 15 years) to extract the seeds and thereby unconsciously avoid seed dispersal in the natural area.

The interaction that has been established between the communities and the scientific area, has allowed us to work together in order to understand the needs of the local area where access is limited. The problem analysed with the workshops offered and visits to the community, we have obtained information that can be executed in a sustainable way in the area where they live. In addition, these communities are rich in culture and traditions, so they become a focus of interest for future projects and supports, as well as links with academic and social institutions.

5. Are there any plans to continue this work?

Yes, of course. We have succeeded in our project. We believe that this work should continue to conserve vulnerable species that have not yet been considered or registered by NOM-059 (Official Mexican Standard) and IUCN (Red List of Threatened Species).

There are about 18 species that must be conserved primarily for their ecological importance. Communities that have access to natural resources have a conscience to safeguard their ecosystems, however conventional techniques are no longer enough as demand is growing.

Therefore, with the progress and prospecting we have in the project, we can contribute towards society by doing science that can be executed in small communities and worldwide.

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

All results will be disclosed at three levels; in the community, science and society.

- The community. Make known by a list the established species and number of plants obtained by in vitro propagation. Offer informative posters about the management of endemic species. Establish and share plans for conservation, restoration and transfer of plants for their crops.

- Scientist. The protocols that were generated were and will be shared in:

    - International Congress for the Society for Cryobiology has great impact in the area of cryopreservation (Cryo 2019). In this work session the experts offered their help and collaboration in the project. To name a few; Christina T. Walters (Agricultural Genetic Resources Preservation Research: Fort Collins, CO), Bart Panis (Biodiversity International) and Valerie Pence (Cincinnati Zoo & Botanical Garden).

    - IV International Symposium of Agave, integral of sustainable use of agave (ISA 2019). Producers and farmers showed their interest in conserving their natural resources and establishing reforestation programs.

    - Scientific Publications. Agave somatic embryo protocol edition in PCTOC (editing), scientific poster exhibition.

    - Congress memories. Cryoletters (in process), Sustainable and Integral Exploitation of Agave (ISA 2019) by CIATEJ and CONACYT.

    - Academic seminars. The seminars are taught at the University of Veracruzana and the University of Guadalajara for bachelor and masters degree students.

    - Documentation. All the scientific information generated will be shared through a PhD thesis. This thesis will be part of literary collections of the University of Guadalajara with open access for anyone interested.

- Society. Talks in the city museum (invitation by Nakari) the main theme is to recognise the importance of our natural resources and raise awareness in society about the value of conserving our ecosystems. They are made aware of the short, medium- and long-term alternatives, as well as avoiding disturbing the natural areas.

http://www.actiweb.es/nakari/

https://www.facebook.com/sociedadjalisciencedecactologia/photos/a.1270604109752541/1957079541104991/?type=3&theater

- Participation in informative guides of botanical gardens (Ethnobotanical Garden of Oaxaca and The Huntington Botanical Garden).

https://www.huntington.org/verso/2019/08/strengthening-bonds-mexico-through-cryopreservation?fbclid=IwAR2lJrug2tTJs-RcTCc_pwcqtirPgK_pEyl9v-fguOmi9KH7oBcTX8_9yW4

http://jardinoaxaca.mx/

Attend the invitation of the RSG conference to spread our experience and knowledge generated from the project supported by The Rufford Foundation.

7. Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?

All our activities were carried out on time. Although we could have achieved our goals faster if access to the support provided was more practical. We take into account that we can work more effectively if you do not depend on an association to obtain resources since bureaucratic procedures are often complicated and slow. The setbacks we had were solved by the hard work I do in a technical team and the commitment of the team members. Our grant was used from November 2018-October 2019.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Information storage equipment	500	500		
International flights	400	400		
National fligths	300	300		
Ground transportation to	820	820		

cultivation areas				
Food	490	490		
Technical support	100	100		
Travel insurance	150	150		
Congresses, symposium, workshops	300	200	-100	We obtained an award and scholarship. Save money for laboratory equipment taxes
Scientific publications	470	380	-90	Transfer of surplus to another item
Accommodation	800	800		
Laboratory equipment	550	750	+200	Not considered taxes
Reagents	120	210	+90	Purchase of reagents not considered but necessary
Total	**5000**	**5100**	**+100**	

*We obtained additional support of CONACYT (scholarship Ph.D.), Society of cryobiology (student travel award), University of Guadalajara (facilities, reagents), University Veracruzana (facilities) and The Huntington Botanical garden (*in vitro* culture experiments and reagents).

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

Continue with other endangered and threatened species. We have a lot to work on our endemic species to conserve them and create a large-scale social awareness through more workshops, talks, information and links with institutions. There are many communities in Oaxaca and Michoacán where we want to work and generate an impact that benefits local people in their economy, customs and traditions. That local people continue to develop their artisan products in a sustainable way. Maintaining the relationship and contact with the communities in which we have worked as well as inviting new communities to work together, is and will be our priority. We intend to grow the project to offer advantages and opportunities in vulnerable areas. In addition, to collaborate scientists, conservationists and leaders of movements in favor of the environment.

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

Yes, conferences, audiovisual material, posters, teaching material and scientific publications. It is an honour to make a distinction to The Rufford Foundation and its support in our project. The opportunity it offers is essential for scientists, professionals and local people who have a commitment to the conservation and preservation of natural resources worldwide.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Dr. Liberato Portillo Martínez (University of Guadalajara) (University of Guadalajara). He helped in this project enormously by giving ideas for problem-solving, as well as discussing arising issues and design of experiments.

Dr. Raquel Folgado (The Huntington Library, Art Collections, and Botanical Gardens). She contributed to the development and improvement of protocols that will help ensure long-term conservation. Her knowledge, technological facilities and training at the Huntington Botanical Gardens were essential to carry out the cryopreservation experiments.

Mr. Felipe de Jesús Romo-Paz. He contributed to the design of experiments and technical support in the laboratory. Their participation in the executed techniques made the processes more efficient and successful.

Dr. Asdrúbal Burgos. (University of Guadalajara). He was valuable during the redaction stage and publication, as well as contributing to discuss results.

12. Any other comments?

We are very grateful to The Rufford Foundation for the support granted to our project. Your consideration enforced unattainable goals. We are sure that the objectives achieved will have an impact on several sectors; social, ecological and scientific. We will continue working in the same community and in other regions to generate more knowledge that benefits the conservation of our natural resources. We remain at your disposal and attentive to future invitations to meet new objectives.

UNIVERSIDAD DE GUADALAJARA

CENTRO UNIVERSITARIO DE CIENCIAS BIOLÓGICAS Y AGROPECUARIAS
DEPARTAMENTO DE BOTÁNICA Y ZOOLOGÍA
CUERPO ACADÉMICO NO. 22, BIOTECNOLOGÍA DE ZONAS ÁRIDAS

Sirva la presente para hacer constar que:

María de Lourdes Delgado Aceves

Expuso el tema:

Ciencia y comunidad: la conservación y el conocimiento popular de los agaves en México

Presentado durante el ciclo 2019A del Seminario del Cuerpo Académico No. 22 Biotecnología en Zonas Áridas.

A t e n t a m e n t e,

Zapopan, Jalisco a 04 de abril de 2019

Dr. Liberato Portillo Martínez
Coordinador de Seminario

M. en C. J. Jacqueline Reynoso Dueñas
Jefe del Departamento de Botánica y Zoología

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