IAPT RESEARCH GRANT APPLICATION FORM 2020

General Information

First name: **Samara**
Surname: **Silva de Matos Aquino**
Academic degree: **Master degree in Plant Biodiversity**
Tel.: **+55 87 999365387**
Email: **samaramatos@live.com**
Institution: **Federal University of Rio Grande do Norte (UFRN), Brazil**
Address: **University Campus, Av Sen. Salgado Filho, 3000 - Lagoa Nova, Natal – Rio Grande do Norte, 59064-741.**

Field of Specialization: **Systematic and Plant Evolution**
Employment status: **Ph.D. Student (dependent of a public fellowship, formally unemployed)**

List of up to four relevant publications:

1) SANTOS FJ, SANTOS GS, SOUZA PCSS, **MATOS SS**, MELO AL, VALE VLC, ANDRADE MJG. Leguminosae: Subfamily Papilionoideae. IAPT Chromosome Data 30/9. In: Marhold, K. & al., IAPT Chromosome Data 30. Taxon 68 (5): 1129, E17-E21. DOI https://doi.org/10.1002/tax.12156.
2) MATOS SS, MELO AL, SANTOS-SILVA J. Caesalpinioideae and Cercidoideae (Leguminosae) in Mata da Pimenteira State Park, Semiarid of Pernambuco, Brazil. Rodriguesia, 70, 2019: 1-21.
3) MATOS SS, MELO AL, SANTOS-SILVA J. Clado Mimosoide (Leguminosae-Caesalpinioideae) in the Mata da Pimenteira State Park, Semiarid of Pernambuco, Brazil. Rodriguesia, 70, 2019: 1-17.
4) CORDEIRO WPFS, ZICKEL CS, **MATOS SS**, MELO R, CALDAS DRM, MELO-JÚNIOR M, GOMES APS, MELO AL. Aquatic flora of two temporary lagoons. In: Parque Estadual Mata da Pimenteira: Riqueza Natural e Conservação da Caatinga.1 ed. Recife: EDUFRPE, 2013, v.único, p. 65-80.

Names of people providing recommendation letters: **Leonardo de Melo Versieux and Juliana Santos Silva**

Project Details

Title of proposed project: **Taxonomic revision, phylogeny and adaptations of *Neptunia* Lour. (Leguminosae, Caesalpinoideae)**

Description of the project in less than 50 words: ***Neptunia* Lour. is a genus of Leguminosae-Caesalpinioideae, with apantropical distribution, with about 12 species. In order to understand the generic limit and the circumscription of species, to test for the monophyletism of the genus and to elucidate how internal relationships among the species are, we are conducting a revision of the genus and hope to reduce the inaccuracy in the delimitation of taxa, thus contributing with taxonomy and representative phylogeny for genus.**

Total buget request: **US$ 2,000.00**

Taxonomic revision, phylogeny and adaptations of *Neptunia* Lour. (Leguminosae, Caesalpinoideae)

Introduction

Neptunia has a pantropical distribution with 12 species that occur in Argentina, Africa (Angola, Sudan), Australia, Brazil, United States, Mexico, and in some countries of the Asian continent: India, Indonesia and the Philippines (Windler, 1966; Lewis et al., 2005). These species are grouped into sections: *Neptunia* sect. *Neptunia* (5 spp.), widely distributed in the tropics, and *Neptunia* sect. *Pentanthera* Windler (6 spp.), which is restricted to Australia except for two Philippine collections, differentiated basically by the number of stamens, ten (10) and five (5) respectively (Windler, 1966).

Broader taxonomic studies for the genus date back more than half a century. The first treatment performed was elaborated by Bentham (1842), which recognized seven (7) species, three of which were later transferred to genera *Acacia* Mill., *Desmanthus* Willd., and *Mimosa* L., and he also described three (3) new species: *Neptunia gracilis* Benth., *N. pubescens* Benth., *N. tenuis* Benth. Subsequently, Windler (1966) revised the genus and expanded the number of species (now 11 spp.), as well as the knowledge about the geographical distribution of taxa.

Over time, several authors have justified the inclusion of *Neptunia* species in different genera, such as *Acacia* Mill., *Desmanthus* Willd. and *Mimosa* L., and tribes due to their common characteristics and despite Windler's (1966) treatment solving part of the delimitation and nomenclatural problems of the genus, there is still a great difficulty in their identification. *Neptunia oleracea* and *N. plena*, for example, have characteristics that are difficult to identify in the geographic domain of the caatinga, particularly using the characters designated by Windler (1966) to differentiate these species, such as: petiolar nectary, number of leaflets per leaf and number of notes not only at registered in the collections (L. Coradin et al. 5866 and R.M. Harley et al. 19075) (Queiroz, 2009).

About 50 names are associated with the genus (https://www.tropicos.org/), which reinforces a nomenclatural and/or taxonomical problem. Also, due to the use of cryptic and polymorphic characters for species separation, other studies may be limited with the genus or use wrong species determination.

To better understand the generic limit and the circumscription of species a full revision of the genus is in course and it is necessary to consult the main North American and European collections: Herbarium of the National Museum of Natural History (P), Herbarium of the Royal Botanical Garden (K), Herbarium of the Museum of Natural History (BM) and the Herbarium of the Royal Botanical Garden of Edinburgh (E). More than 580 records are related to these institutions, including type collections and undetermined genus materials and materials such as K 000791030 (*Neptunia gracilis*), K 000791025 (*Neptunia monosperma*) and BM 000952356 (*Neptunia oleracea*), which are essential for our analysis. Most collections are not sending types to Brazil, and it is of the utmost importance that this funding help us to achieve our goals.

Objectives

- Collect, describe and illustrate the important characters for identification of taxa.
- Characterize in detail the morphology of the species, including new anatomical data.
- Discuss data on the geographical distribution of species.
- To investigate the monophyly and the systematic *Neptunia* position based on a larger sample, based on a phylogeny derived from macromolecules.
- Test for the monophyly of the proposed sections for the genus.

- If pertinent, propose an infrageneric classification that reflects the kinship relationships obtained.

Methods

Neptunia genus will be included for taxonomic, anatomical and phylogenetic studies, with the objective of presenting robust results for an integrative taxonomy.

***Field work**:* So far 4 field expeditions have been conducted in Brazil and Paraguay.

Herbaria collections revision: Visits to collections will provide important data for our analysis as observing characters, measurements and distribution data will be essential for determining the taxa. All species identifications will be based on standard collections and data from protologues.

***Micromorphological studies**:* Samples of the vegetative and reproductive structures of species occurring in Brazil were collected in the field at different stages of development, in order to characterize the micro morphologies of the stem, leaves, nectaries and flowers in transversal or paradermic sections, including scanning electron microscopy analyzes. This process started since June 2018 at the Center for Nuclear Energy in Agriculture, CENA, USP, Piracicaba and is nearly concluded.

***DNA extraction, DNA sequencing**:* Samples of the species *N. plena*, *N. oleracea*, *N. pubescens* and *N.* sp., were collected and the DNA of the other representatives of the genus will be extracted from herbarium samples, with the due consent of the collections. The target regions of the nuclear genome will be the ETS and ITS markers, and in the plastidial genome the *trnD-T* and *trnL-F* spacers. These molecular work will be done in Brazil and a partnership with researchers from Australia is also being constructed, so all species will be sampled and the final phylogeny will be complete.

Relevant Information

The Ph.D project started in March 2018 and its conclusion is scheduled for January 2022. In the first years, we visited some of the most representative collections for the genus in Brazil CGMS, ESA, SP, SPF and UEC, starting anatomical studies of species that occur in Brazil at the Center for Nuclear Energy in Agriculture (CENA / ESALq) at the University of São Paulo (USP). For conducting phylogenetic studies, a partnership with Prof. Alice Calvente from our department at UFRN, will enable the entire infrastructure of laboratories for DNA extraction and amplification.

This project is expected to increase knowledge of taxonomy, adaptations and elucidate evolutionary relationships between species and sections of *Neptunia*. We intend to produce three chapters that will result in three high impact publications, and the first will comprise a full revision, including an identification key, descriptions with comments on geographic distribution, environments, phenology, morphological relationships and illustrations of the species, as well as maps with their distribution and their respective conservation status, the second will be based on macromolecules of plastidial DNA (*trnD-T* and *trnL-F*) and nuclear (ITS and ETS) and will aim at understand the evolutionary relationships between species. While the third will deal with adaptations and micromorphological characterization of at least three South American species.

To conduct this project, it is particularly important to raise funds to allow the proponent to visit such collections, since several large herbaria are not sending loans to Brazil. We expect that this project will generate very fruitful results, helping to reduce the inaccuracy in the delimitation of taxa, contributing to the taxonomy, new species description, enhance of

collections and conservation of the genus. We appreciate any assistance the IAPT can provide for such achievement.

Travel Budget

Specification	Value (US$)
Flight ticket (NAT - LRH)	U$$ 780
Flight ticket (LRH - ORY)	U$$ 195
Train tickets (London - Edinburgh)	U$$ 160
Accommodation (1 month visit to K, BM, E)	U$$ 580
Accommodation in Paris (1 week visit to P)	U$$ 285
Total	U$$ 2.000

Literature Citations

Bentham, G. 1842. Notes on Mimosaceae, with a synopsis of species. **London Journal of Botany 1**: 517–523.

Lewis, G. P.; Schrire, B.; Mackinder, B.; Lock, M. 2005. **Legumes of the World**. Royal Botanic Gardens, Kew, 577 p.

Queiroz, L. P. **Leguminosas da Caatinga**. Feira de Santana, Bahia: UEFS/Kew: R. Bot. Gard. 2009. 913 p.

Robinson, B, L. 1898. Revision of the North American species of *Neptunia*. **Proc. Amer. Acad. Sci.** 33: 332-334.

Windler, D. R. 1966. A revision of the genus *Neptunia* (Leguminosae). **Australian Journal of Botany 14**: 379-420.