



Website of MACFLOR Project

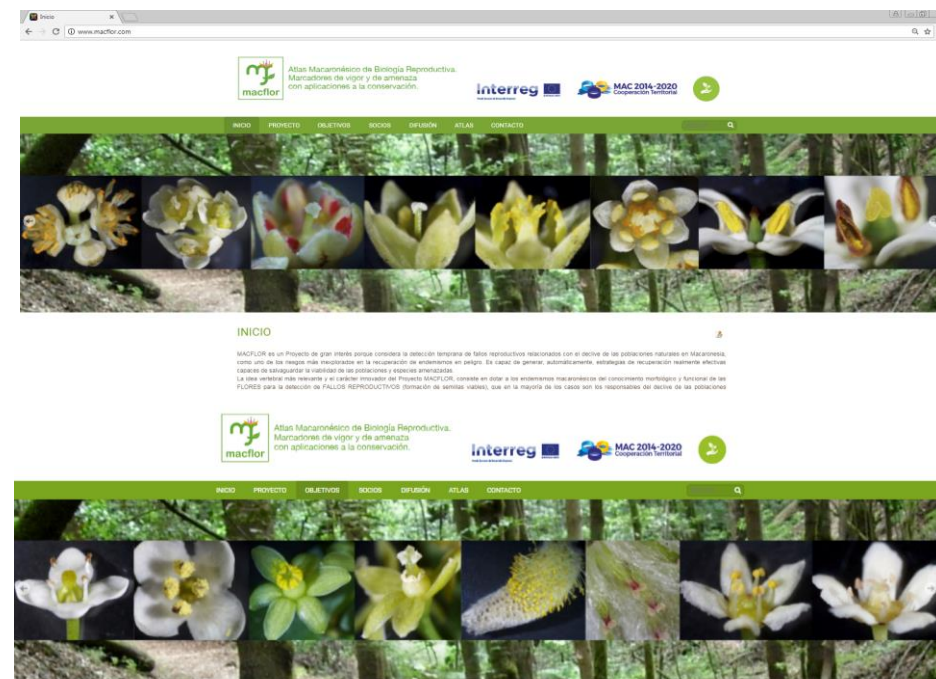
Febles R.¹, Fernández-Palacios O.¹, Olangua-Corral M.¹, Roca Salinas, A.², Casimiro, P.G.P.³, Freitas, C.F.³, Gouveia, M.⁴ & Sequeira, M.⁴ & Pérez de Paz J.¹

¹ Dpto Biología Reproductiva y Micro-Morfología & ²Banco de Germoplasma, Jardín Botánico Canario "Viera y Clavijo" JBCVC. Cabildo de Gran Canaria. E-mail: rfebles13@gmail.com.

³ Jardim Botânico do Faial. pedro.qp.casimiro@azores.gov.pt catia.f.freitas@azores.gov.pt. ⁴ Universidade da Madeira mgouveia@uma.pt sequeira@uma.pt

The **website of MACFLOR** Project is presented: <http://www.macflor.com>

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This Project involves the Jardín Botánico Canario "Viera y Clavijo"-ua CSIC (Cabildo de Gran Canaria), which acts as leader, the Jardim Botânico do Faial (AZORINA Sociedade de Gestão Ambiental e Conservação da Natureza SA, Direção Regional do Ambiente, Azores) and the Universidade da Madeira. The project has a duration of four years (2017-2020).

OBJECTIVES & ACTIVITIES

The general and main **OBJECTIVE** of MACFLOR "**MACARONESIAN ATLAS OF REPRODUCTIVE BIOLOGY**" is to develop the most relevant reproductive traits of the Macaronesian Flora.

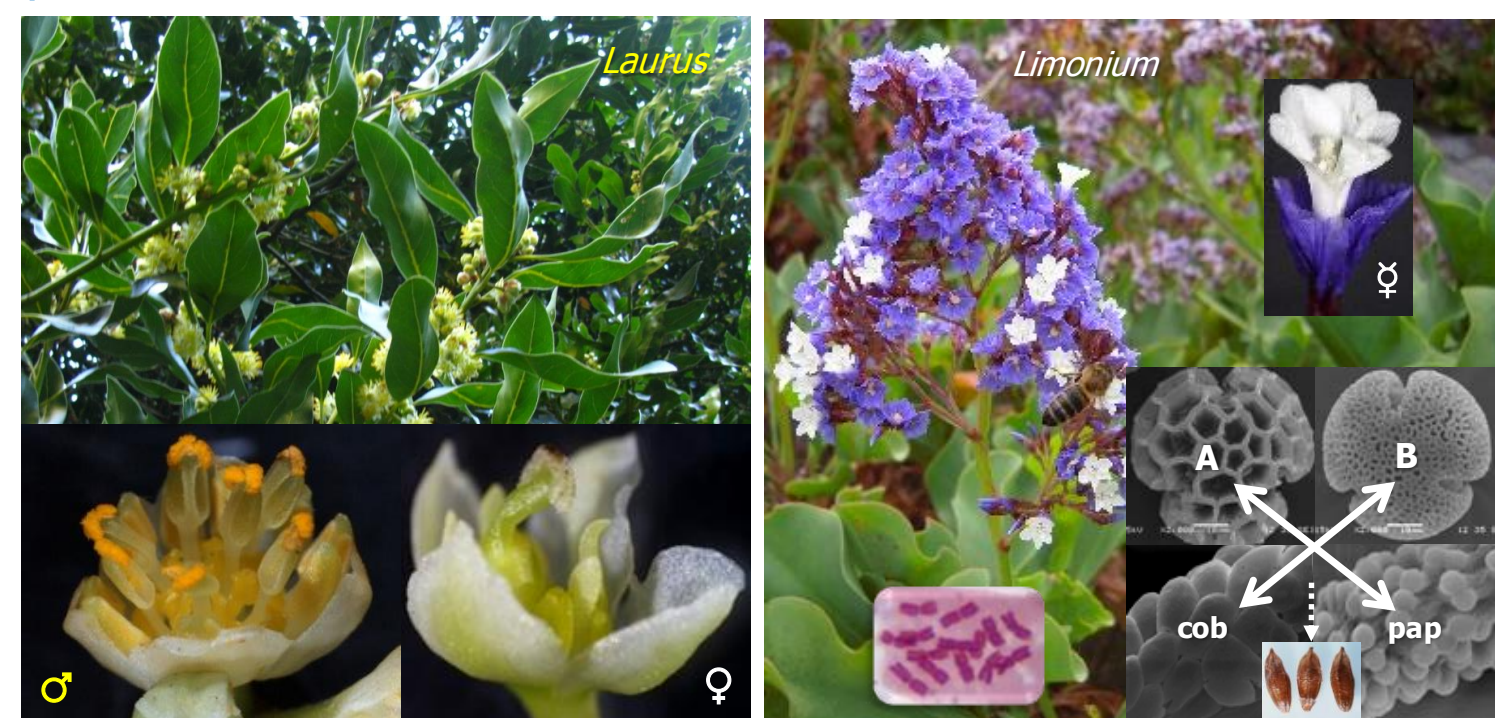
This involves the analysis **MORPHOLOGICAL** and **FUNCTIONAL** of the **FLOWERS** and their elements -calyx (sepals), corolla (petals), androecium (stamens, pollen) and gynoecium (pistils, ovules)- to know its capacity to produce fruits and seeds. This knowledge allows to detect **REPRODUCTIVE FAILURES** and so to design **EFFECTIVE RECOVERY STRATEGIES** of endangered species.

This **general objective** considers **three partial specific objectives** and a series of associated **activities**:

The **FIRST PARTIAL OBJECTIVE** include:

❖ **THE CHOICE OF TAXA & POPULATIONS TO STUDY**

Principally, Macaronesian endemic plants with **Sexual polymorphisms** and **Self-incompatibility Systems** were selected, because these reproductive syndromes are more susceptible to reproductive failure. Populations in Sites of Natura 2000 Network, Laurel forest ecosystems and/or Biosphere Reserves are priorities.



Bibliographic background
Highlight the activity aimed at the exhaustive search of bibliographic antecedents. In addition to basic references on reproductive biology, original descriptions, chorology, etc., it is important to review the **molecular phylogenies** due to the predictive character of the evolutionary history of the morphological and physiological traits of the flower.

❖ **NATURAL POPULATIONS & REPRODUCTIVE SAMPLING**

To **characterization** each **population**, data of location (UTM coordinates, altitude), orography, size, etc. are checked. The **seasonal phenology** (flowering & fructification) is determined and **reproductive sampling** (inflorescences, buds, flowers, fruits and seeds) and herbarium sheet are carried out. The different sexual (hermaphrodite or unisexual flowers: ♂ & ♀) or incompatibility phenotypes (pin-thrum, pap-cob) are identified and the sexes or morphs ratio evaluated.



❖ **FLOWERS, FRUITS & SEEDS. MICRO-MORPHOLOGICAL CHARACTERIZATION. LABORATORY**

Different **preparations** of the floral whorls, as well as fruits and seeds, are elaborated for their observation and capture of images in:



MACFLOR Macaronesian Atlas of Reproductive Biology

CHOICE OF ENDEMISMS (according to sexual systems and self-incompatibility) **FLOWERS & SEXUAL SYSTEMS** (characterization)

Choice of species and populations. Bibliographic background	Natural populations (characterization, seasonal phenology and sampling)	Flower. Micro-morphology and formation of fruits
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FLORAL BIOLOGY & PHENOLOGY BREEDING SYSTEMS. AUTO-INCOMPATIBILITY (detection)

Dichogamy. Pollination & floral visitors <i>Neochamaelea</i> . Paternity analysis. Pollen gene flow between sexual phenotypes	Autogamy & xenogamy rate. Self-incompatibility (detection) <i>Andryala</i> . Genetic diversity of genus in Madeira
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RECOVERY STRATEGIES Survival of populations

REPRODUCTIVE EFFICIENCY (formation of fruits and viable seeds according to reproductive phenotypes)	
Pre-emergent reproductive success (Fruit/Flor ratio & Seed/Ovule ratio)	Post-emergent reproductive success (seeds germination & survival of seedlings)
Germplasm Banks (<i>ex situ</i> Conservation)	

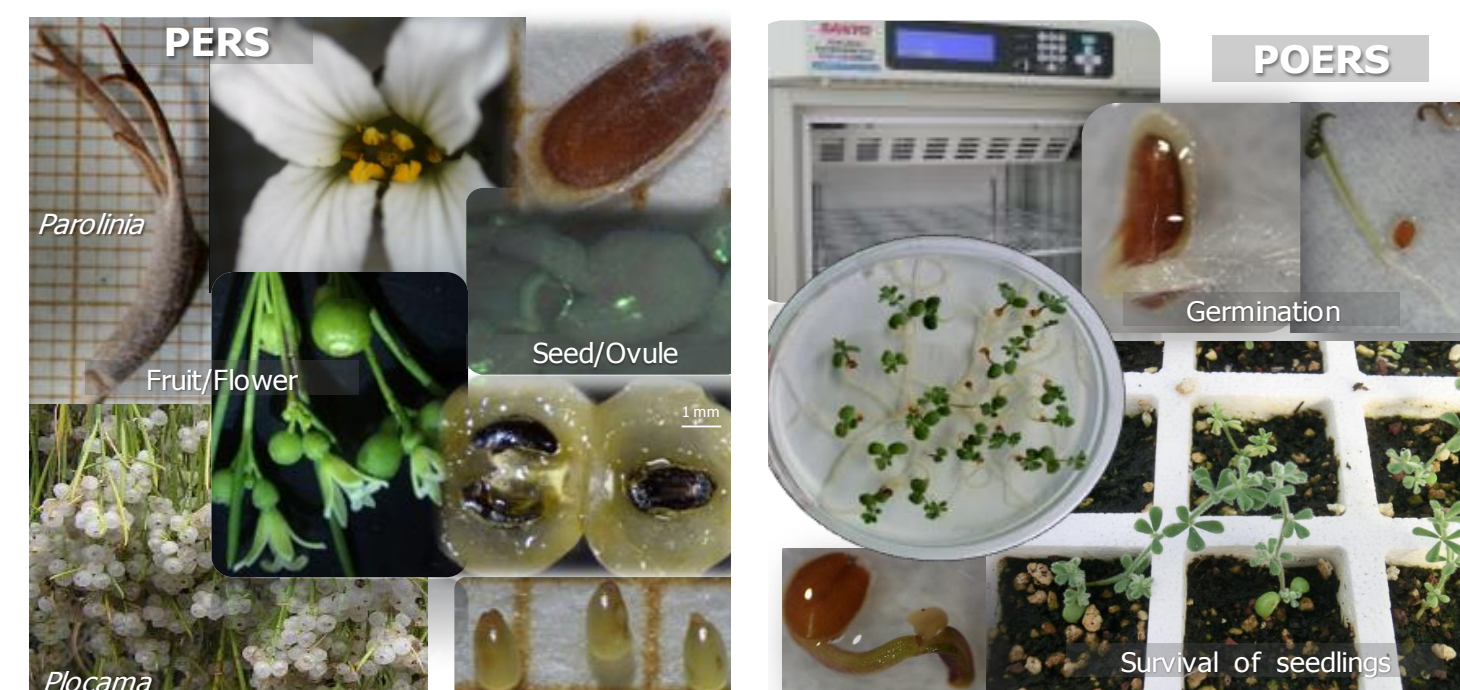
The **THIRD PARTIAL OBJECTIVE** is aimed at:

❖ **EVALUATION OF FEMALE REPRODUCTIVE SUCCESS (SEED SET)**

• **Pre-emergent (PERS):** evaluation of flowers which form fruits and ovules that form seeds:
Fruit/Flower x Seed/Ovule

• **Post-emergent (POERS):** evaluated by seeds germination and survival of seedlings

The types of individuals according to sexual or self-incompatibility systems will be compared (hermaphrodite *vs* female, cob *vs* pap, pin *vs* thrum).



❖ **THE SEED BANKS (*EX SITU* CONSERVATION)**

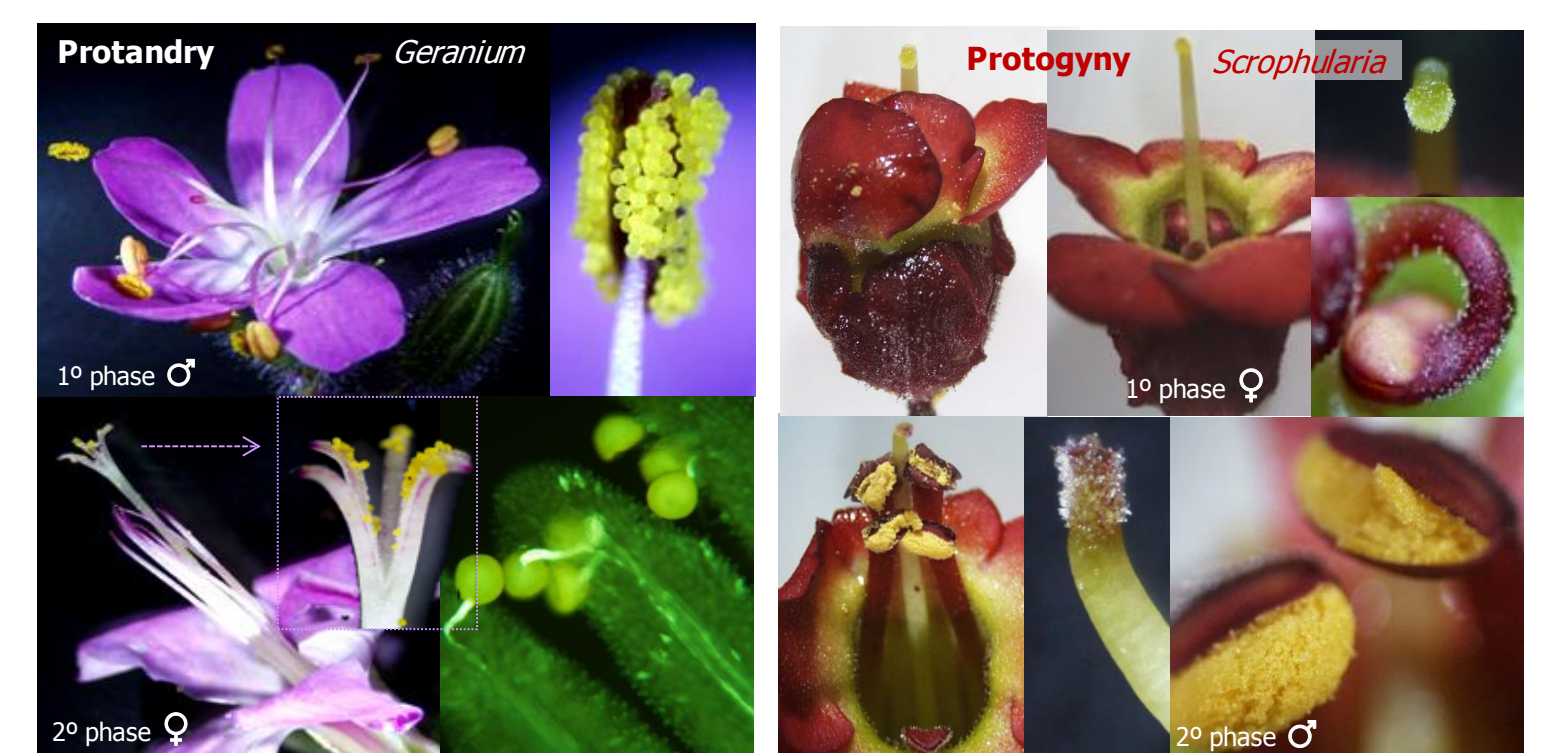


The **SECOND PARTIAL OBJECTIVE** are focused:

❖ **FLORAL BIOLOGY & PHENOLOGY. FLORAL VISITORS AND DICHOGAMY**

Floral phenology studies require observations in the field (or nursery) and in the laboratory, using specific techniques. **Morphological** and **chromatic changes** that occur in the **floral whorls** (calyx, corolla, androecium and gynoecium) are detected and its physiological meaning is interpreted.

Dichogamy (protandry or protogyny) is analysed in hermaphrodite and monoecious individuals, as a mechanism that potentially prevents interferences between the androecium and gynoecium and promotes the xenogamy.



The evaluation of changes in floral whorls, resources of the androecium and gynoecium allow to identify the **syndromes** and reveal the possible **pollination vectors** (anemophily, entomophily and/or ornithophily).

❖ **BREEDING SYSTEMS. SELF-INCOMPATIBILITY**

The breeding systems (**autogamy-xenogamy**) will be evaluated by **Pollen/Ovule ratio (P/O)** and, in some species, also by **experimental pollination** with detection of self-incompatibility.



It is possible to confirm the **nature of the self-incompatibility** observing (MO fluorescent staining) the interruption of the **pollen tubes** in the gynoecium of self-pollinated flowers.

❖ **NEOCHAMAELEA. PATERNITY ANALYSIS.**

In *Neochamaelea*, with a complex sexual system, where four sexual phenotypes are present (duodichogamous-DD, protandrous-PA, protogynous-PG and male-M individuals), **genetic paternity analysis** (microsatellites) will be carried out to check the **pollen donors** and crossings between sexual phenotypes.

❖ **ANDRYALA. GENETIC DIVERSITY OF GENUS IN MADEIRA**

The study of the population genetic diversity in *Andryala* from Madeira using the ISSR molecular markers, will allow to characterize the variability and genetic structure of the populations in Madeira, to test the hybridization between endemic species.

ATLAS & RECOVERY STRATEGIES

The detection of erosive processes in the **REPRODUCTIVE CYCLE** (flowering and fructification) associated with the loss of reproductive success or failures in the formation of viable seeds, closely related with the morphological and functional traits of flowers, will allow to design **RECOVERY STRATEGIES** in the macaronesian endemic species studied in MACFLOR.

These **RECOVERY STRATEGIES** provides concrete and effective solutions (possibility of low cost) since it would be enough to reinforce the population with those phenotypes or suitable individuals that can "correct" the lack of reproductive success, not only in the short term, but also in the medium and long term, guaranteeing the survival of populations and species

Finally, **ATLAS** will gather in files all the information related to the **REPRODUCTIVE BIOLOGY** and other interesting aspects of the selected Macaronesian endemics, including those dates obtained by previous studies and projects. At the end of the project, the files of the Atlas will be attached to the web.

Appoint the dynamic nature of the Atlas, new data generated in future projects will be incorporated.