

SEASONAL AND FLORAL PHENOLOGY IN PLOCAMA PENDULA AITON (RUBIACEAE, PUTORIEAE)

Interreg

MAC 2014-2020 Cooperación Territorial







INTRODUCTION

P. pendula, one of the taxa selected in MACFLOR and therefore it will be incluided in the Macaronesian Atlas of Reproductive Biology (www.macflor.com). It is distributed in Canary Islands except Lanzarote & La Palma (Pérez de Paz et al., 2017). This shrub of cardonal-tabaibal, tetraploid with 2n=44 (Larsen, 1958), is classified as Least Concern (Requena et al., 2017).

The white, bell & funnel-shaped flowers are **visited** by flies, bees and ants; the berries, with 2-3 seeds, first whitish and translucent, blackened when they dry, are dispersed by diplochory, lizards are primary dispersers, kestrel and shrikes are secondary (Hohmann et al., 1993; Padilla et al., 2012). In this specie **functional dioecy** has been described, which consist in two sexual phenotypes,

- putative male and female individuals (Mendoza-Heuer, 1987; Pérez de Paz et al., 2017): i) Hermaphroditic individual (H): with morphologically hermaphroditic flowers but functionally male, although some can set fruit, stamens fused to the corolla with many pollen grains and pistil, with close stigmatic branches, exceeds corolla.
- ii) Female individuals (F): with female flowers, anthers without pollen grain and pistil divided into 2-4 papillose stigmatic branches, exposed to pollinators. The female flowers are smaller than hermaphoditic flowers.

This taxon is in evolution towards dioecy from the hermaphroditism by pathway of the ginodioecy (Pérez de Paz et al., 2017).











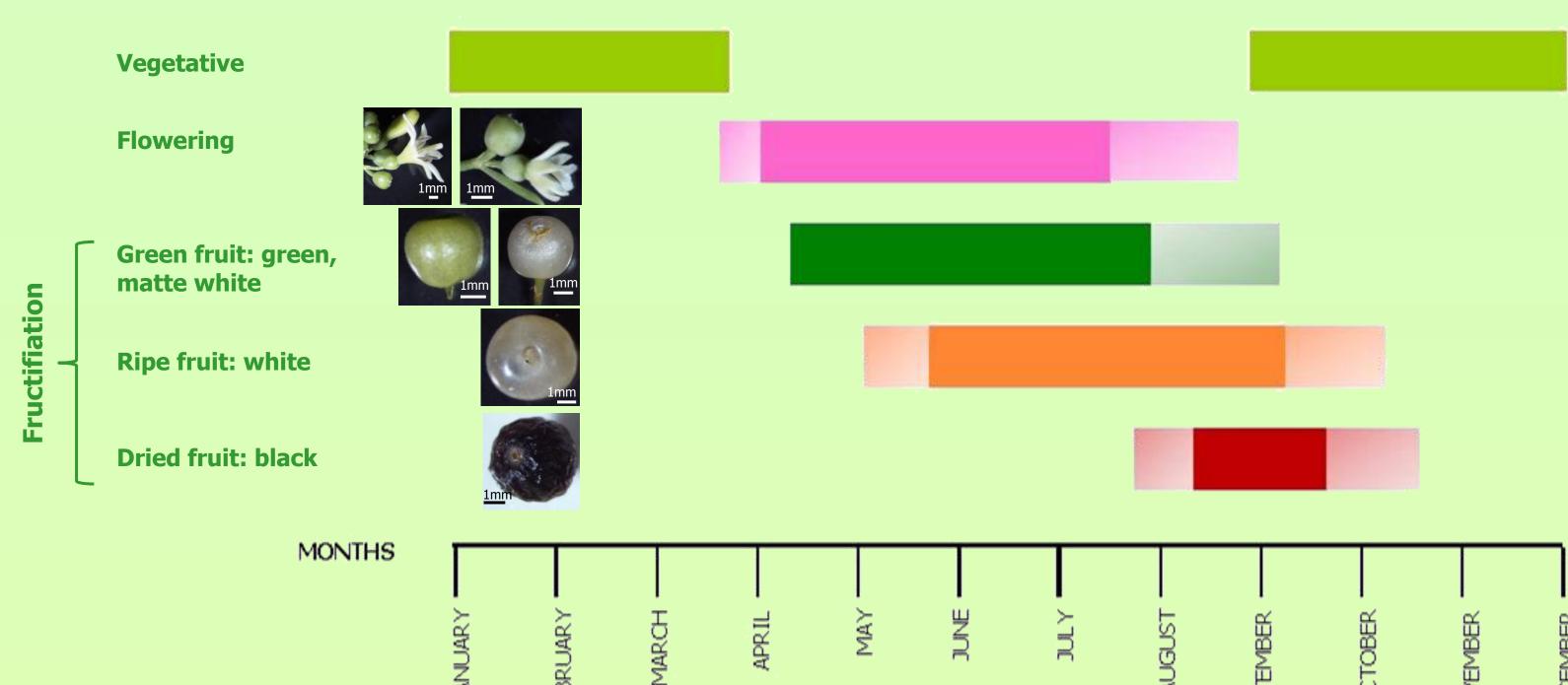




Barranco de Tirajana (Gran Canaria)

MATERIALS & METHODS

In natural populations, the UTM coordinates were taken, and photography with digital camera. Individuals, inflorescences or buds were marked (depending on the type of study), reproductive materials were collected (buds, flowers, fruits and seeds) and herbarium sheet. In the laboratories of the JBCVC the collected material was stored and processed, images were captured with stereomicroscope.



1. SEASONAL PHENOLOGY

Vegetative phenophase: between October and March, *P. pendula* is without flowers and fruits until the appearance of the first buds is observed on March, begining the life cycle of *P. pendula*.

Flowering: in general, the **onset** of flowering is in late March, although depending on climatic conditions it can be delayed until April, not being generalized in all individuals. The **peak** of flowering occurs during April and May, on July there are still flowers but not as intensely as in previous months, in late August, final flowering, some flowers can be observed, especially in hermaphroditic individuals.

Fructification: this phenophase begins shortly after the beginning of flowering, on April green fruits are observed and on May, white **matte fruits** are observed, later these fruits become transparent. The transparent white fruits, considered mature fruits are observed during June-August. In July, some ripe fruits begin to darken until they are completely black and shrivelled, they are considered dried fruits, they can be observed more abundantly during August.

2. FLORAL BIOLOGY. FLOWER & FRUIT PHENOLOGY (PHASES/STAGES)

2.1. Hermaphroditic flower functionally male

S0. Close bud: white color ~ 5mm. **S1.** Open bud: the petals open and the anthers and style are visible, the dehiscent white anthers are surrounding and touching the style. Its span is hours. S2. Young flower: the straight petals, parallel to the floral axis, are white, without fully unfolding. The dehiscent anthers, with much pollen, begin to separate from the style. The closed stigma does not exceed the corolla. Its span is hours. S3. Mature flower: the petals are completely unfolded, perpendicular to the floral axis, some curved or completely revolute. Anthers completely separated from the style, with less pollen or almost empty, black. Style exceeds the corolla, the stigmatic branches are together or some separate, some of

them can be functional. This phase lasts from 1 to 4 days, although the most frequent is 2 days. **S4.** Wilted flower: straight, yellowish petals, the flower is closing, the anthers are empty and the stigma exceeds the corolla. This phase conclude with



2.3. Fruit: this study is not concluded

S0. Green fruit (GF): if the ovules have been fertilized, the green ovary grows and later it change to matte white and it will continue to grow until reaching the final size. But if the ovules has not been fertilized, it changes to brown, wrinkles and it is considered an aborted ovary (AO). 2 months. S1. Riped fruit (RF): Once the maximum size is reached, the fruit changes to transparent white, allowing the black seeds to be seen inside. 3-4

S2. Dried fruit (DF): the fruit gradually changes to black and furrows until it is completely black and shrivelled. 2-3 months.

2.2. Female flower

S0. Closed bud: green color, ~ 4mm. **S1.** Open bud: the petals open and the straight stigma is visible, stigmatic branches are joined. Its last hours. S2. Young flower: straight petals are paralells to the floral axis, they are white, without fully unfolding. stigmatic branches are unfolded, straight or some revolute, but don't exceed the corolla. Its span is hours.

S3. Mature flower: the petals are perpendicular to the flower axis, curved or revolute. Revolute stigmatic branches exceed the corolla. It lastest 1 or 2 days.

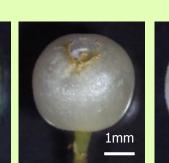
S4. Wilted flower: straight, yellowish petals, the stigma exceed the corolla, the flower is closing,. This phase conclude with the fall of corolla, the green ovary remains. This stage last from 1 to 2 days.

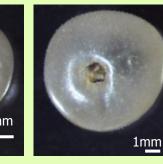


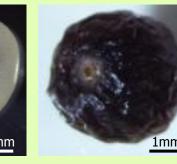


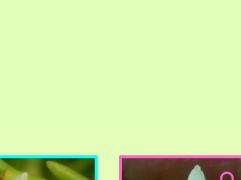




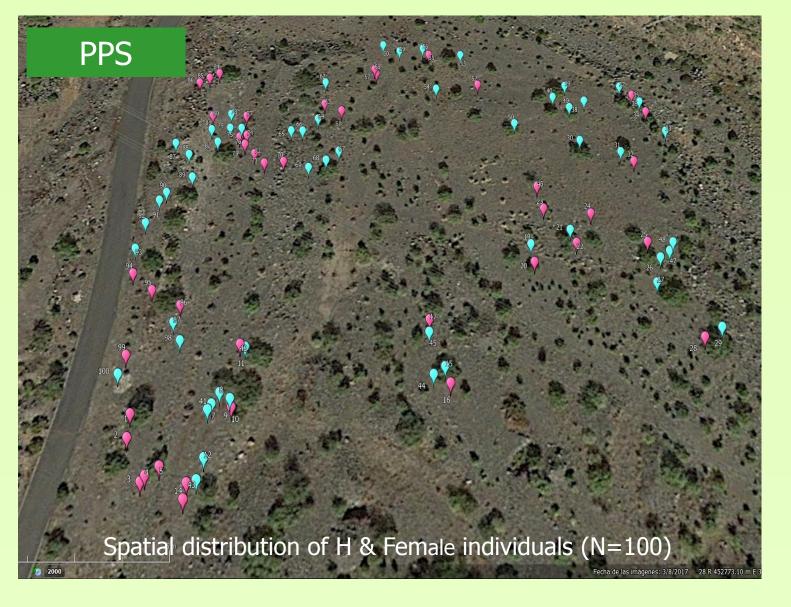








3. SEX RATIO: HERMAPHRODITE (H)/FEMALE (F)



POPULATION	Nº INDIVIDUALS	FREQUENCY OF HERMAPHRODITE (%)	FREQUENCY OF FEMALE (%)	SEX RATIO (H / F)
Bco. Arguineguin (PPA)	39	21 (54%)	18 (46%)	1.17
Bco. La Aldea (PPBA)	7	4 (57%)	3 (43%)	1.33
Jardín Botánico Canario (PPJ)	54	32 (59%)	22 (41%)	1.44
Bco. Tirajana (PPS)	100	56 (56%)	44 (44%)	1.27
La Isleta (PPI)	41	29 (71%)	12 (29%)	2.45



Our previous observations and census of sex ratios have confirmed the presence of the two sexual phenotypes (Pérez de Paz et al., 2017) in some natural populations in Gran Canaria (see Table). Previous data are confirmed in the two new populations presented in this poster, PPS and PPI. The frequency of females varied from 29% of PPI to 46% of PPA and the ratio of sexes varied from 1.17 to 2.45.

DISCUSSION & CONCLUSIONS

- 1. Seasonal phenology (Flowering & Fructification): with the evidence of climate change and its impact on the survival of plant species, the knowledge of seasonal phenology ad life-history is necessary for the design of management and mitigation strategies.
- 1.1. The annual cycle of P. pendula is divided between 6 months in vegetative phenophase, flowering and fruiting are overlaping. The flowering time lasts about 4 months and fruiting time about 6 months. 1.2. In P. pendula, differences in the onset of flowering have been detected, according to the natural population. In 2018, the onsets of flowering are more delayed in the populations of the northeast (PPI and PPJ), than in the
- population of the southeast (PPS), probably due to the influence of the trade wind, temperature and rainfall. 1.3. Fluctuations of the onset of flowering have been detected according to the year, depending on the greater or lesser rainfall. In 2011 in the JBCVC, with controlled irrigation conditions, flowering was observed on October, but it is necessary to follow up for several years and a correlation analysis with climatic variables to confirm it in natural populations.
- 2. Flower & Fruit phenology: Floral longevity (the length of time that flowers remain open and functional) is an important plant trait that influences the amount of pollen received and disseminated by a plant, and hence, its reproducive fitness
- (Schoen & Ashman, 1995). 2.1. Four stages or phenological phases have been established, both in the female flower. In both floral morphs the first stages (S1 and S2) are very short-lived (hours) and the last two (S3 and S4) can last 2-5 days. Summary, the hermaphrodite flower lasts about 3-5 days and the female flower lasts between 2 -4 days, in both cases, the floral longevity depends on the activity of the pollinators, since the pollination shortens the floral longevity and the conditions climatic, the floral longevity is shortened on dry and sunny days.
- 2.2. Three stages have been established in the fruit, over 6 months the fertilized ovary undergoes a series of morphological changes (size and color) to make it more attractive to dispersers (lizards and birds). The peak of fructification coincides with the onset of summer, when there is an increase in sun hours, temperature and drought, factors that probably bring on a greater activity of dispersers such as the lizard.
- 3. Sex ratio: Will sex ratios in natural populations change within the framework of global warming? This question posed by Munne-Bosch (2015) opens a new line of research into sexual dimorphisms. 3.1. In all the populations sampled, the percentage of hermaphroditic individuals is higher than that of female individuals. The causes for the bias between the sexes have been attributed to both environmental factors and the distribution of resources of
- both sexual morphotypes (Pérez de Paz et al., 2017). **3.2.** The presence of some putatively male individuals, with morphologically hermaphroditic flowers, with some functional stigmatic branches and set fruit and therefore functionally hermaphroditic, is consistent that this taxon is in evolution towards
- LITERATURE CITED: it is available on the Dina4 of the poster

dioecy from the hermaphroditism by of the ginodioecy pathway (Pérez de Paz et al., 2017).