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Reproductive aspects in *Ipomoea asarifolia* (Desr.) Roem. & Schult. (Convolvulaceae) occurring in antropized caatinga area

Aspectos reprodutivos em *Ipomoea asarifolia* (Desr.) Roem. & Schult. (Convolvulaceae) ocorrentes em área de caatinga antropizada

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A B S T R A C T

Morphometry is a mechanism used to measure the differences between species from the study of the relationship between size and shape, creating comparative references, in addition to allowing adequate identification. The present study aimed to analyze and morphometrically describe possible reproductive variations in individuals of *Ipomoea asarifolia*. To this end, measurements of 250 flowers were performed with the aid of a manual caliper, ruler and tape measure, as well as equivalent photographs for evaluation in the laboratory. The results revealed that the species presented morphological attributes of monomorphism, being verified only one type of floral morph in the population, the condition of brevistily. The study demonstrates the importance of research to understand the variation of floral morphs within a population, even if it´s in an anthropized area because, although subtle, the changes can alter the entire reproductive system.

R E S U M O

A morfometria é um mecanismo utilizado para mensurar as diferenças existentes entre espécies a partir do estudo da relação entre tamanho e forma, criando referências comparativas, além de permitir a identificação adequada. O presente trabalho teve como objetivo analisar e descrever morfometricamente possíveis variações reprodutivas em indivíduos de *Ipomoea asarifolia*. Para tanto, foram realizadas medições de 250 flores com o auxílio de paquímetro manual, régua e fita métrica, além de fotografias equivalentes para avaliação em laboratório. Os resultados revelaram que a espécie apresentou atributos morfológicos de monomorfismo, sendo verificado apenas um tipo de morfo floral na população, a condição de brevistilia. O estudo demonstra a importância de pesquisas para o entendimento da variação de morfos florais dentro de uma população, mesmo que esta esteja em uma área antropizada pois, ainda que sutis, as mudanças podem alterar todo o sistema reprodutivo.

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Introduction

Most angiosperms have developed adaptive strategies that allow advantages to reproductive success, such as hermaphroditism, a characteristic that is useful, but does not totally prevent self-pollination. Thus, as a way to reduce this process, some reproductive strategies are presented by plants, such as heterostyle, where they can present morphs with reciprocal differences (hercogamy) in individuals of the same population (COELHO, 2013).

The heterostile mechanisms present characteristics, among which, preventive intentions to self-pollination and self-fertilization, as well as it´s considered a polymorphism that can manifest itself according to the amount of floral morphs, namely: distilia and tristilia. The first is the most commonly encountered condition, so that populations that are balanced tend to present half of their individuals with flowers with long stamens and short stilettos (brevistyles) and another part with flowers with short stamens and long stilettos (longistilas). The second (tristily), is characterized by presenting the formation of three types of flowers that differ in the reciprocal position of the sexual organs (BARRET, 1992; BARRET and SHORE, 2008).

With an important function for determining and knowing the different morphs existing in a floral population, morphometry is used to measure the differences existing within and between species from the study of the relationship between size and shape, creating comparative references, in addition to allowing adequate identification. In addition, it may show disproportionate growth among themselves, giving rise to a non-linear relationship between these characteristics (PERES-NETO, 1995).

Within this context, the genus *Ipomoea* L. stands out, one of the most relevant within the family Convolvulaceae. *Ipomoea* is characterized by presenting pollen grains of equine exina, consisting mostly of fickle climbing plants that inhabit the most varied environments, in addition to being frequently used in ornamental, agricultural, clinical and even food functions (FERREIRA and MIOTTO, 2009). Studies related to the reproductive morphometry of the genus *Ipomoea* are still incipient.

Among the various species that the genus composes, attention is drawn to *Ipomoea asarifolia*, a toxic plant of native and non-endemic origin, popularly known as “salsa-brava” (AZANIA et al., 2002; SOUSA et al., 2014), being easily found in anthropic areas, caatinga (*stricto sensu*), floodplain field, riparian forest or gallery and restinga, with distribution mainly in the Southeast, Midwest, North and Northeast regions of Brazil (SIMÃO - BIANCHINI and FERREIRA, 2015).

Considering the importance for the reproductive understanding of the group and the need for information that allows the identification of morphological changes, this study aimed

to analyze and describe possible morphological variations in reproductive biology in individuals of *I. asarifolia* in an anthropized area.

Materials and methods

Area of study

The work was carried out in an adjacent area of the State University of Alagoas (*Universidade Estadual de Alagoas*) - Campus II (9°22'31.05"S e 37°13'53.75"O) located in the county of Santana do Ipanema, mesoregion of the "*Sertão Alagoano*", with the "*Caatinga*" as the predominant vegetation (Figure 1). According to the classification proposed by Köppen and Geiger, county has a climate of the type Bsh, that is, hot and dry, with average annual rainfall of the backwoods (*sertão*) between 400 mm and 600 mm (BARROS et al., 2012).

Figure 1.

Place of collection Ipomoea asarifolia individuals in Santana do Ipanema - AL. (Coordinates: 9°22'31.05"S e 37°13'53.75"O).

Source: Google®EarthPro.

Data collection

Data collection occurred in a period of thirty (30) non-consecutive days between the months of August/2019 and September/2019. In five populations of *Ipomoea asarifolia* were selected and randomly marked 10 (ten) individuals per group, where 5 (five) flowers were collected per representative, totaling 250 (two hundred and fifty) flowers analyzed.

Floral morphometry

The measurements of the selected characters of the 250 flowers were performed with the aid of a manual caliper, ruler and measuring tapes, as well as equivalent photographs for morphometric evaluation in the laboratory. To obtain the data, we observed the number of flowers per individual, number of stamens, number of stigmas, stamen length and stigma length, in addition to the length and diameter of the corolla (SILVA, SÁ, CONSOLARO, 2013).

Figure 2.

Some of the morphometric parameters measured in I. asarifolia. A: Corolla lengths; B: Corolla width; C: Length of the corolla tube; D: Stamen length; E: Pistil length.

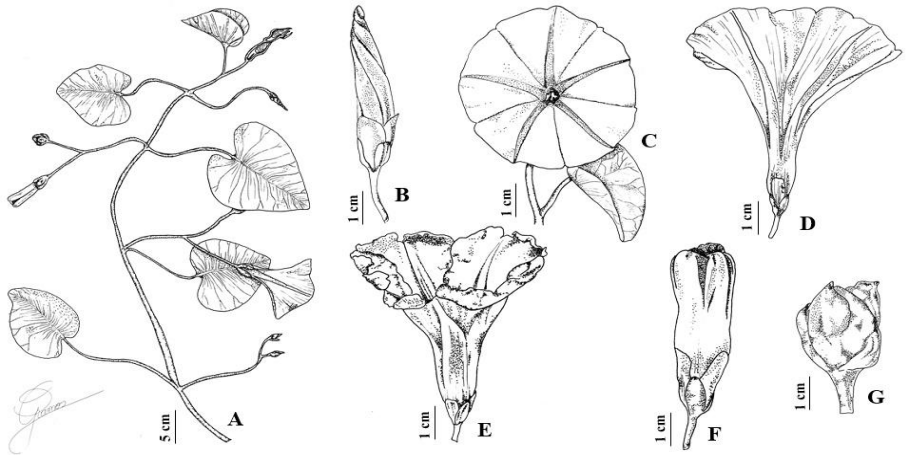
Source: File of GpTac.

Characterization of the species studied

I. asarifolia is characterized by being a prostrate perennial liana, which occurs spontaneously in open areas or edges of vegetation, due to its ruderal behavior. Its flowers are gathered in inflorescences that have three to 15 buds, where it occurred before four to eight flowers per day/inflorescence. The corolla is infundibuliform, usually inclined at an angle greater than 90° to the inflorescence rachis; it has the presence of osmophores that are odorless for humans and attractive to floral visitors and pollinators. The coloration varies from pink to lilac, inside the tube and interpetal region of purple to magenta coloration, which are characterized as nectar guides

Figure 3.

Floral stages and fruiting of Ipomaea asarifolia. A: Vegetative branch and the disposition of the reproductive organs; B: Flower bud in the process of opening; C: Front view of the corolla in full opening; D: Lateral view of the corolla in full opening revealing the non-recurved lobes; E: Lateral-frontal view of the corolla initiating the closure of the recurved corolla inward its lobes; F: Flower totally closed; G: Fruit.

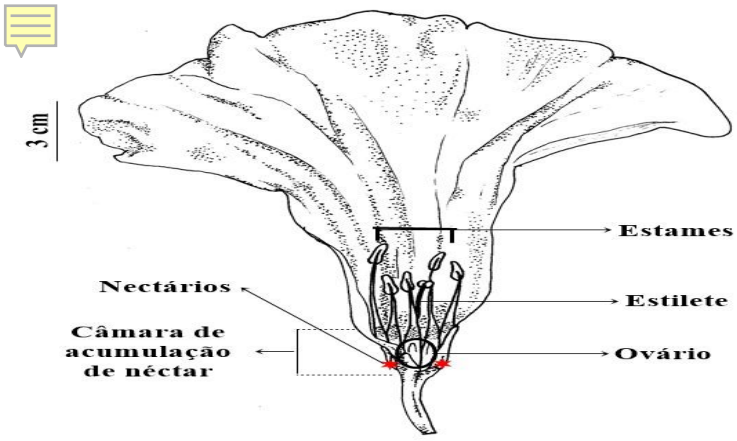


Source: File of GpTac.

The androcene is composed of five heterodynamous, epipetal stamens, with fillets that present dilation in the proximal region to the base and hairiness, which facilitates the formation of five access channels to the site of the nectariferous chamber that is located at the base of the corolla tube (ca. 8 mm compr.). Antera bitecas of rhyming dehiscence; superus, 4-ovulated ovary, fused styluses and 2-lobed stigmata, surrounded by stamens that are positioned below or at the same level as the anthers, where it occupies the central region of the tube (Figure 4).

Figure 4.

Longitudinal section of the flower of I. asarifolia revealing the floral scheme to understand the organization of its reproductive organs and location of excretory structures.



Source: File of GpTac.

Anthesis is diurnal and is observed from 5:00 and 7:00 a.m., where the slow unwinding of the edges of the corolla outward was observed (Figure 5b). At that moment, the pollen grains showed high viability, where the stigma was receptive, with the accumulation of small amounts of nectar in the basal region of the corolla tube. The flowers remained unchanged until around 10:30 a.m., where the process of floral senescence can be observed, detected by wilting and curving of the corolla inward, closing to the central part of the tube (Figure 5a). The duration of the open flower varied between five and six hours, and after the period of anthesis and observation of the visit. After a period of 24 to 32 hours there was a drop in the floral elements.

Figure 5.

Ipomoea asarifolia with closed corolla (A) and open corolla (B).

Source: File of GpTac.

Results and discussion

The results of the measurements performed in the individuals of the populations studied are shown in Table 1. Regarding the length of the flowers, some differences occurred between the morphs, however there was no pattern that could be superimposed on the species as a whole. In each population analyzed, the differences occurred in different parameters. In populations 1, 2 and 4 there was variation in the length of flowers from 4.0 cm to 8.0 cm, which differed from populations 3 and 5 that presented variation of 3.4 cm and 9.0 cm. It was found that population 3 presented greater alteration in relation to the others, where flowers with the smallest and longest length were found.

However, there was considerable variation in relation to the diameter of the flowers when the mean values of each population were compared, although no pattern was detected between them. Population 2 stood out by presenting the greatest variation in relation to diameter, with a discrepancy of about 11.7 cm between the largest and smallest size found. According to Kill and Ranga (2004), flowers with characteristics that make them showy as corolla more evident in display diameter, bright colors and even diurnal anthesis are attributes that condition the species to be more attractive to floral visitors, which although *I. asarifolia* is pollinated only by bees, its floral morphology facilitates the access of several other groups of visiting insects to floral resources (PAZ; PIGOZZO, 2012). In population 4, the smallest variation was observed, with about 4.0 cm between the largest and smallest size. The average observed among all populations differs from what was obtained by Kiill and Ranga (2003) where the flowers of this species presented 13 mm.

Table 1.

Measurements of I. asarifolia floral characteristics with mean value calculated for all flowers (250) and each population.

Structural parameters	Population 1	Population 2	Population 3	Population 4	Population 5
Length of flowers	4.5 ± 8.0	4.0 ± 7.5	3,4 ± 9.0	4.2 ± 7.7	4.02 ± 8.0
Diameter of flowers	13.0 ± 22.0	11.5 ± 23.2	12.0 ± 22.0	14.0 ± 18.0	12.6 ± 21.3
Stamen length	1.0 ± 3.6	1.0 ± 3.3	0.8 ± 3.5	1.1 ± 3.0	0.9 ± 3.3
Length of pistils	1.0 ± 2.6	1.0 ± 2.5	1.2 ± 2.5	1.0 ± 2.2	1.0 ± 2.4

Source: Own authorship.

All flowers of the analyzed individuals presented long stamens and short pistils. Among the populations evaluated, in relation to the pistil length, population 1 stood out for presenting the longest pistil when compared to the others. Based on these structural conditions, the species presented morphological attributes of monomorphism, being verified only one type of floral morph in the population, the condition of brevistily, a strategic process because the positioning of the stigma and anthers makes self-pollination impossible, so cross-pollination is favored by the contact of the anther and the stigma of the floral morph in distinct places on the body of the pollinator. It was observed in some individuals of populations 2, 3 and 4 the absence of reproductive organs, which may characterize a process of herbivory in which the reproductive system is compromised, and may reduce the formation of gametes, as well as compromise reproductive success (BARBOSA, 2009).

Final considerations

From the parameters analyzed in the present work, it was possible to identify the occurrence of morphological changes in the flowers of the studied species, especially in the case of the diameter of the flowers, which presented a more evident variation that, consequently, can influence the dynamics of floral visitors, since larger and more showy flowers tend to be more attractive.

Therefore, due to the incipience of studies on the reproductive morphometry of the family Convolvulaceae, especially for the genus *Ipomoea*, research is needed to understand the variation of floral morphs within a population, even if it´s in an anthropized area because, although subtle, the changes can alter all the versatility and reciprocity of its reproductive system.

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