Scholars Academic Journal of Biosciences
Abbreviated Key Title: Sch Acad J Biosci
ISSN 2347-9515 (Print) | ISSN 2321-6883 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Medical Oncology

Aristolochia Baetica: A Possible Current or Vestigial Carnivorous Plant?

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DOI: 10.36347/sajb.2023.v11i12.005 | **Received:** 02.10.2023 | **Accepted:** 09.11.2023 | **Published:** 14.12.2023

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Abstract **Original Research Article**

Aristolochia baetica is a Mediterranean plant characterized by its purple flowers with the shape of small bells. The objective of this study is to determine whether this plant presents the behavior and characteristics of carnivorous plants. In the results obtained, it should be noted that its flowers have the ability to capture and retain insects, presenting mechanisms for their retention (hairs). Likewise, other mechanisms have been detected that could serve or have served for the absorption of nutrients, such as pores in the utricle or absorbent hairs. Therefore, it is probable that Aristolochia baetica is currently, or may be a vestige of a species of carnivorous plant.

Keywords: Aristolochia baetica, Drosophila, insectivorous, carnivorous, vestigial plant.

INTRODUCTION

Aristolochia baetica is a phanerogamous plant typical of Mediterranean regions with a temperate climate. It is usually found in regions of pine forest in the form of a vine along with the Mediterranean pine. Its leaves are heart-shaped and its flowers have the morphology of small garnet-purple bells. Flowering usually occurs in winter months. According to some authors, insects have been found in this plant in its utricle, although it is unknown if this is accidental or if there is some mechanism for capturing insects with insectivorous purposes (Christodoulakis NS *et al.*, 2019).

The objective of this work is to study whether Aristolochia baetica presents mechanisms of insectivorous capture of different insect species, whether they are vestigial or currently with carnivorous purpose.

METHODS

For this experiment, 55 flowers of Aristolochia baetica were obtained at random, on which the presence or absence of insects in their utricle and the existence of hair systems that prevented their release were analyzed. These data were analyzed with SPSS 22.

In addition, the flowers were analyzed with a Motic binocular magnifying glass (Motic, Hong Kong), obtaining images of the flowers and the utricles, looking for structures that could justify their carnivorous characteristics. Likewise, staining with Lugol's iodine was carried out.

RESULTS

Regarding the results obtained, it should be noted that flowers that have hairs, have insects inside their utricle in a proportion of 50%, while those that did not have hairs, have not them. These results were significant with a $P < 0.05$ in Fisher exact test. Among the most frequently found insects, it is worth mentioning flies of the genus Drosophila (Figure 1).

In a more in-depth analysis of the flowers, these hairs can be observed, which are oriented inward, thus allowing the entry but not the exit of insects. When analyzing the utricle, finer hairs are observed. These hairs were stained internally with Lugol's stain, which leads us to think about the possibility that they can internalize juices and substances and may have an absorbent purpose. Inside the utricle, there are also some discontinuities in its epithelium that could correspond to cuticular pores that could have absorbent purposes.

A)

Insects/Hairs	Yes	No
Yes	18	0
No	16	21

B)

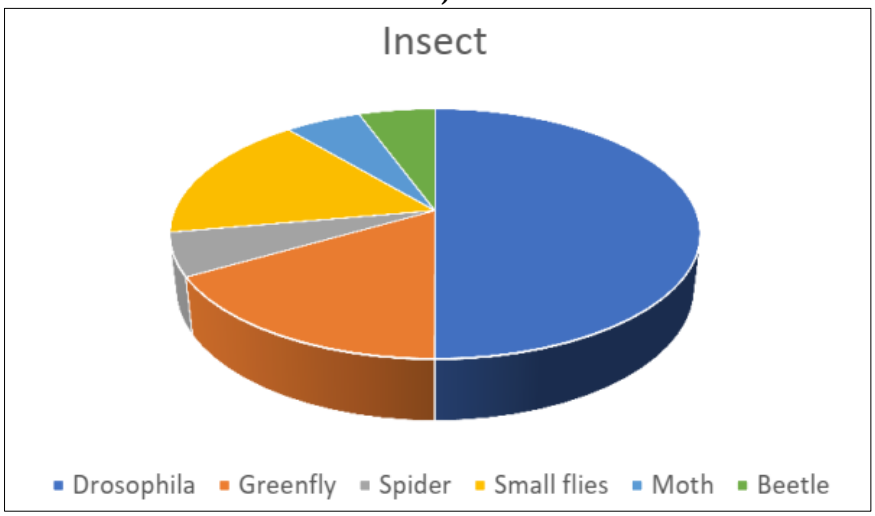

Figure 1: A) Table of flowers and insects inside them depending on the presence of hairs. B) Graphical representation of more frequent insects.

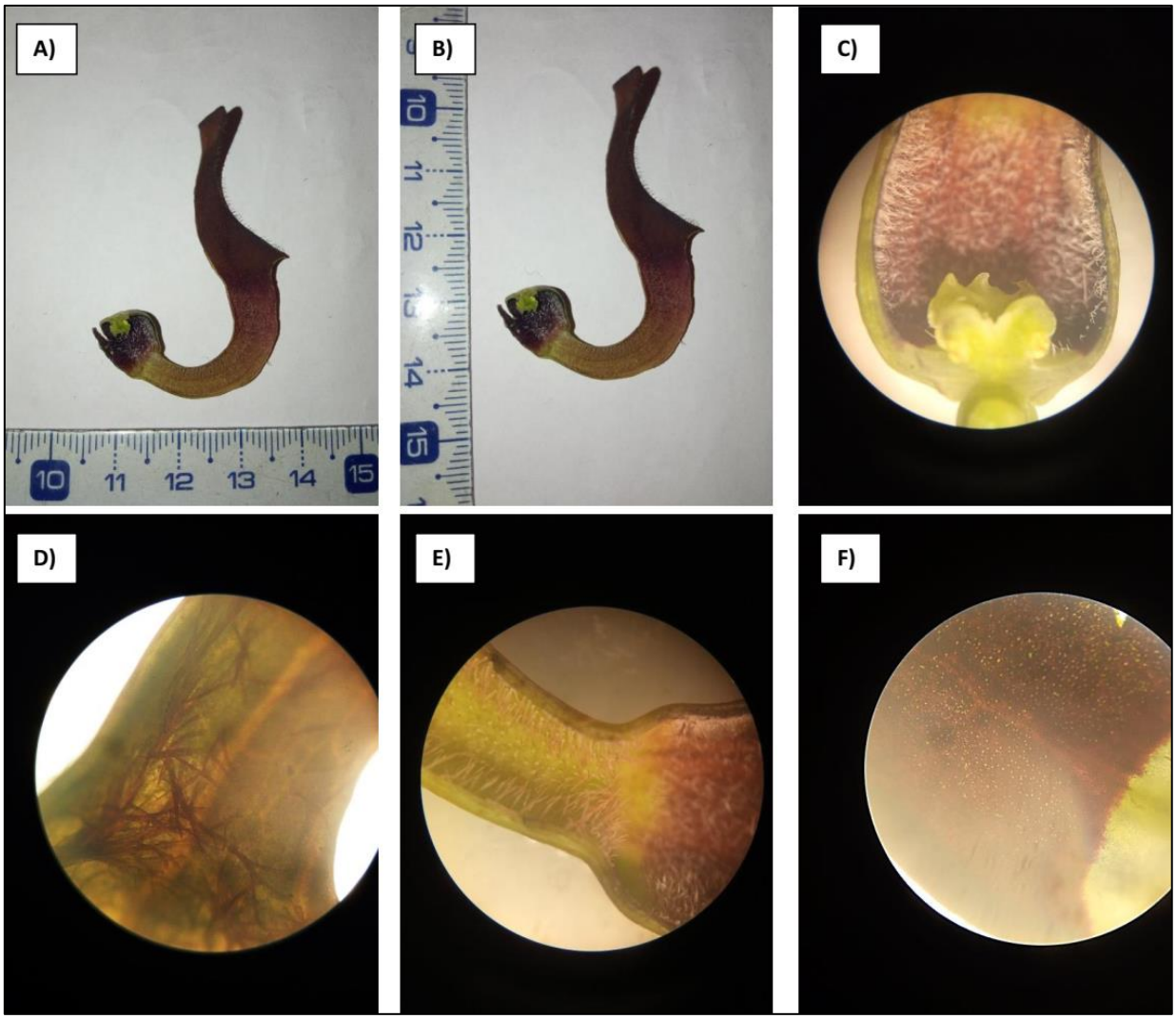

Figure 2: A &B) Sagital images of Aristolochia flowers. C) Image of the utricle. D) Utricle hairs stained with Lugol staining. E) Flower hairs oriented for allowing the entrance of insects but not the exit. F) Utricle pores (in green).

DISCUSSION

The results presented show that Aristolochia baetica is a plant with a great capacity to capture insects and that it presents mechanisms that guarantee their retention once they have penetrated the flowers (hairs and orientation). In fact, sarracenia, a widely known and studied carnivorous plant, has very similar structures (Gallie *et al*, 1997) (Figure 3). The presence or absence of these hairs seems related to the age of the flower, since the oldest flowers are those that lose these systems.

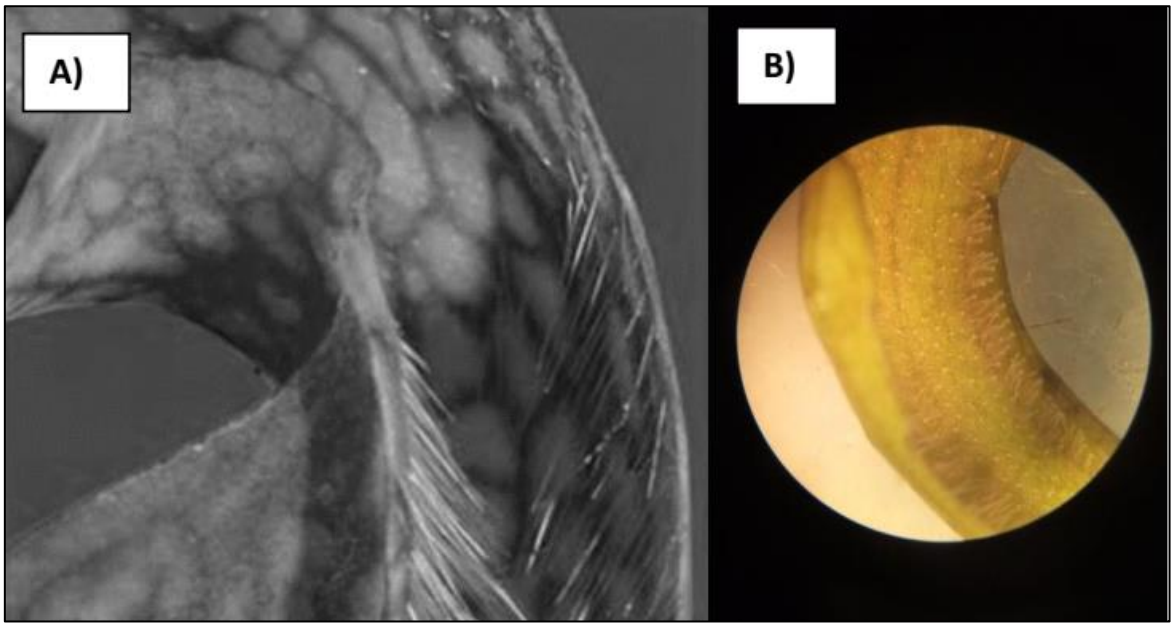

Figure 3: Sagital images of flower hairs of Sarracenia (A) (Modified from https://botany.org/home/resources/carnivorous-plants-insectivorous-plants/sarracenia-the pitcher-plants/sarracenia psittacina.html) and Aristolochia baetica (B).

In addition, the presence of cuticular pores in the utricle and the possible absorbent capacity of these utricular hairs indicate that it is possible that this plant could be carnivorous or have been insectivorous in an ancient time. These structures could be the vestiges of a possible living fossil.

Some authors such as Sakai (2002) have published about the possibility of a mechanism of capture and release of insects in other species of Aristolochia but arguing a pollination and reproductive role but not a carnivorous one.

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