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IRIS SUAVEOLENS BOIS. & REUT. - MORPHOLOGICAL FEATURES FOR ATTRACTING AND SUPPORTING POLLINATORS

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Abstract

In this study, a Romanian dwarf specie of the genus Iris (Iris suaveolens Bois. and Reut.) is analysed regarding the floral morphology and pollinators relationship. This specie is known as very important ornamental plants due to their flowers and dwarf habitus. The Iris flower is considered a floral complex or a pseudo-inflorescence because of their three pollination canals which serve like an independently zygomorphic flower. The floral elements were investigated with regarding the dimensions and pollination adaptation through a population observation and microscopical analysis of the flower elements. The three standards are longer and wider than falls. The falls are reflexed and covered with a band of coloured hairs (beards). These floral complexes are very attractive not only for insects but also for their aesthetic potential The whole floral complex is as tall as the scape and is highly specialised in attracting insects in several ways, by providing food or protection. Studied and using wild Iris species in gardens is beneficial choice for both species population and also for pollinators support.

Key words*: flowers, Iris, morphology, ornamental, pollinators.*

INTRODUCTION

The Irises are flowering plants with an important symbolistic, artistic and scientific history, very deep related with the entire life and spirituality. In the last centuries the irises were fascinating also the scientific society, being intense studied, classified and being included in important ornamental plant breeding programs.

The Irises are well known as medicinal and ornamental garden plant in the Romanian area for centuries (Butură, 1979; Ardelean & Mohan, 2008).

Iris L. genus is largest monocot genus in the *Iridaceae* family, that gathers together about 300 species. This large genus provide species which are important members in the wild flora of many countries, including the Romanian one (Goldblatt et al., 2008).

Along the evolution, the majority of the Iris species have developed highly specialised strategies for entomophilous pollination. The reproductive self-incompatibility of the Iris species facilitated the development of a mutually beneficial relationship with the pollination insects.

The upper tepals calls standards protect the reproductive structures and the lower tepals called falls provide a landing support for insects (Robu, 2005; Uno, 1982).

Latest studies from worldwide shows us that the useful entomofauna and particularly the pollination insects, cross a difficult period due to different types of pollution (www. environment. ec. europa. eu).

In this context, study the floral structures and morphology that attract insects, can provide important information about the plant species that can help to conserve the wildlife in its large complexity and to support the concept of resilient gardens with a specific of each natural areas.

In the last years the studies highlighted the importance of Romanian wild Irises, in the context of decreasing the natural Iris population across Europe and the need of increasing the conservation efforts to protect our local species (Crișan et al., 2017).

The conservation approaches includes studied the local species, gather information about their biology and the benefits of using them in the gardens for both ornamental or ecological traits.

The aim of this article is to provide information about an important wild Iris specie in Romanian flora and to highlight its morphological and ecological traits that upgrade it at the rang of both ornamental and wildlife supportive specie.

MATERIALS AND METHODS

Iris suaveolens Bois. & Reut. is a dwarf perennial rizomatous specie, growing wild in Balkans area, included Romania (Dobrogea, South-Est region), on steppe areas or calcareous substrates, being a xerophyte specie.
The local authors and not only, described its flower with purple or yellow delicate tepals, growing in clusters. It show glaucous light green leaves, ensiform and ribbed by the protuberant parallel venations (Colasante, 2018).
It blooms in middle spring (April-May) and is a very important specie regarding the Romanian biodiversity (Prodan & Nyarady, 1966; Matew, 1981).
Due to its complexity, some authors consider the Iris flower as a pseudo inflorescence, consisting in three pollination units, called meranthia, each serving like an independently labiate or zygomorphic flower (Uno, 1982; Guo, 2015).
A population of *Iris suaveolens* Bois. & Reut. was located in the Botanical Garden of the University of Agronomic Sciences and Veterinary Medicine of Bucharest, originated from North Dobrogea (Tulcea County) and was studied during a couple of vegetation seasons.
The Botanical Garden of the University is located in Bucharest, in South region of Romania, in the oak - forest zone, with temperate climate with excessive tendencies for the last decade.
The soil in city area is developed under the action of natural and artificial factors, getting loamy and alluvial due to humus erosion by the surface water (www.pmb.ro).
For understanding the way this specie developed and supports the wild life regarding the pollination insects, there were conducted a series of morphological observations, regarding the dimension, shape, colour of the floral elements through biometric determinations and microscopical investigations regarding the flower elements adaptation to the entomophilous pollination, the way that the floral structure attract the insects and provide them several rewards.
The *Iris suaveolens* population was studied regarding the anthesis period, to understand how long the insects can benefit from this flower support.
The morphological features were studied at the full anthesis and illustrated in the article in the detailed photos.
The detailed images were obtained by replacing the background and separating each elements for highlighting the main features, using an editing program.
The microscopical analysis of bearded tepals (falls) was made by investigating the epidermal structure adapted for attracting insects (stripes and hair) with electronic microscopy methods.

RESULTS AND DISCUSSIONS

Iris suaveolens Boiss and Reut is a dwarf specie, is included in the Miniature Dwarf Bearded category for plant breeding works.
The entire plant height in the studied population, varied between 11-14 cm, with an average by 12.5 cm (Table 1).

Table 1. External morphology analysis of *Iris suaveolens* Bois. & Reut.

Analyzed organs	Average of length (cm)	Average of width (cm)
Plant height	12.5	-
Perigon	6.5	4.5
Perigon tube	6.5	0.5
Standards	4.5	2.7
Falls	4.5	1.7
Fillaments	1.8-2	-
Anthers	1.5	-
Ovary	1.2	0.7
Stile	1.7	1.3
Capsule	4.0	1.8

From this entire height, only the flower riches, an average about 6.5 cm long (Table 1).
As many authors have written, the iris flower can be described as a floral complex, consisting different structures, which were studied in the local population regarding their dimensions. The three standards (upper tepals) can achieve an average 4.5 cm in length and 2.7 cm in width. At the flowering time, the standards are united together at the top, creating a dome like flower architecture.

The purple standards have visible venation, wavy and turned outwards margins (Table 1).

Figure 1. *I. suaveolens* flower (St- standards)
(Source: original photo)

The lower tepals (falls), purple in colour as well, are curved down (reflected), oblong in shape and riches an average length of 4.5 cm and width of 1.7 cm. The three falls act in the flower like a landing platform for insects.
Together with the dome like standards, it can provide home and shelter to the entomophilous visitors. The width of falls is enough to support the insect. Besides that, the falls are thicker than standards, character that can facilitate supporting weight of the insect.

Figure 2. *I. suaveolens* falls
(Source: original photo)

Every fall, in order to contribute in attracting pollinators, developed a visible network of dark purple to brown strips and a band of white hairs (Figure 2.b).
At the basis of the falls, the colour is getting progressively light green and the hairs colour, too.
The fall is developed directly from the perigon tube, which is also light green, almost circular and every fall is continuously growing from each tube canal, breakaway from the trilocular ovary.

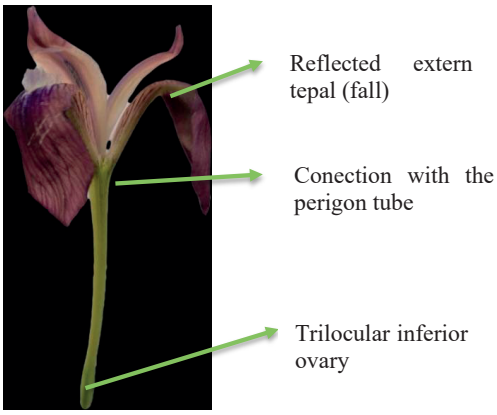

Figure 3. *I. suaveolens* perigon tube and falls
(Source: original photo)

The falls seems to provide the highest specialization to the entomophilous pollination. Their auxiliar structures and chromatic act together like signals for insects (Robu, 2005).
The microscopical analysis of the external tepals at the hair band, shows the pluricellular, turgid hairs (Figure 4-a, c) and the dark purple stripes.

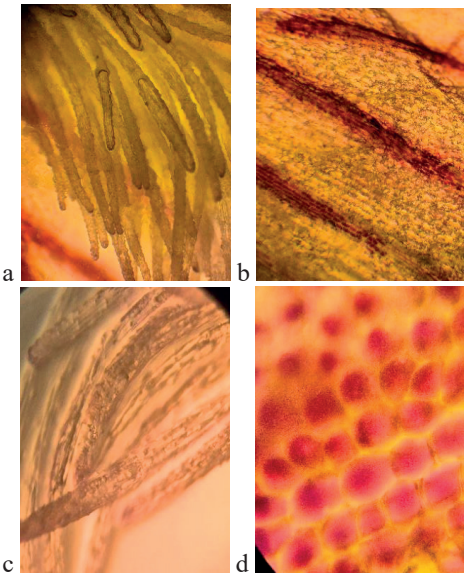

Figure 4. Microscopical view of falls hairs (a,c) and anthocyanin stripes (b,c)
(Source: original photo)

The Figure 3, illustrates microscopic images of the bearded hairs and the stripes nearby. It can be observed that the stripes are compound by several (4-8) rows of anthocyanin content cells, in the tepals parenchyma.
The colored strips serve like a visual signal for insects and the pluricellular hair band could provide the pollen dispersal, a tactile stimulation or helping the smaller insects to land or stay on the fall surface.
The stile dimensions observations indicate an average about 1.5 cm in length and 1.3 cm in width (Table 1).
The stile and stigma are described having petaloid aspect, oblong shape and entire, concave aspect and thicker on a longitudinal darker strip, looking like a protuberant keel (Săvulescu et al., 1966).
Along the stile, in the middle region the structure becomes thicker and darker in color, this is a canal that make the connection between the stigma and the perigon tube (Figure 5).

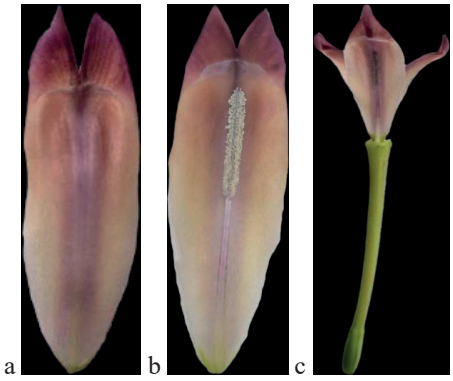

Figure 5. Stile and stigma (a, b); connection with the perigon tube (c)
(Source: original photo)

The stigma is a bilobed structure, each lobe has triangular shape, the color is purple, like the tepals, concave but in the opposite direction regarding the stile. The two lobes of the stigma are apart one of the other by a large angle and the margins are serrates (Figure 5).
Underneath each one of the three stigma structures of the flowers, is located one stamen. This is shorter and completely covered by the stile, intimately following the concave line but not reaching the upper part of the stigma, this fact could represent one of the arguments of the self-incompatibility and the need for a pollination agent (Figure 5b).
As previously mentioned and as many authors highlighted along the studies, the flower in Iris genus consist in a three structure unit, which is replicated three times.
Every unit is composed by a group: stigma, stamen and fall, protected by the dome like standards (Figure 6).
This unit act in the pollination process like an independent labiate flower. Authors named these pollination units and consider the hole flower being a pseudo inflorescence (Goldblatt et al.,1998; Guo, 2015).
In the current study, every pollination unit of the *I. suaveolens* flower was disassembled in component parts (Figure 6a), to understand the each one role in the pollination process.

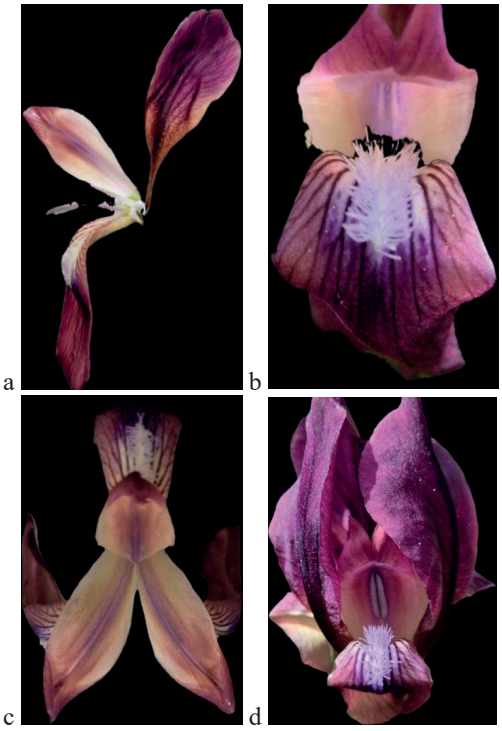

Figure 6. *I. suaveolens* flower (a-pollination unit disassembled, b-pollination unit entire, c-the three pollination units, d-entire flower, pollination unit foreground) (Source: original photo)

In the Figure 6(a) the pollination unit is observed disassembled, compound by the fall, which support the stationary insects, the reproductive organs, stamen and stile upwards the fall and a

standard from the three ones, that protect the reproductive organs system.
The pollination insects can be faithful to one pollination unit or can visit any of the unit of ine flower (Uno, 1982).
The way that the stigma is curved over the fall, facilitates the direct contact with the dorsal part of the insect and provide the existing pollen to get in the pollenic tube towards the ovary.
Because the nectar is not easy accessible to the insect, in many species the nectary structure are located to the base of perigon tube, these species can be pollinated by having a deep access in the flower unit, to provide the anther to touch the dorsal part of the insect body.
In the Figure 6d, can be easily observe the position of the anther under the stigma, located just above the de hair band of the fall.
As usual in nature, the mutual beneficial relationship between Iris flowers and pollination insects, both parties are advantaged.
If the flower specie reproductive success depends on the insect visitors, the insect land on the flower structure for a reward.
Studies shows that in the genus Iris the pollinator support can vary from the nectar, pollen or even shelter or home for the small ones (Dabrowska et al., 2019).
Regarding this information, the pollination unit described before and the protective dome like standards, look like having the architecture of a shelter/home for some visitors (Figure 6d).
The flowering period or the anthesis lasting was registered in the two vegetation periods regarding the number of days from the flower buds stage to the end of flowering (fecundation phenophase).

Table 2. Phenological phases of flowering at *I. suaveolens* and duration along the spring time

Flower phenophase	First season (2024)			Second season (2025)		
	April (day)		May (day)	April (day)		May (day)
	1-14	15-30	1-15	1-14	15-30	1-15
Flower buds						
Open flower						
End of flowering						

In Table 2, can be observed that in the first season, the flower bud occurrence was observed in the first two weeks of April, comparing with the second study season, when this phenophase was observed in the middle to the second part of April.
The full flowering open occurred, both seasons in the second half of April, the full flowering period analyzed at the entire population last about 14 days and analyzed at a single flower it last about 5 days.
The third stage of the anthesis, end of flowering, in the first study season occurred in the first half of May and in the second season was longer, starting earlier, by the end of April.
In 2024 spring season, when the whether conditions were less rainy and warmer the I. suaveolens population achieved a longer flowering period, compared with the 2025 spring season, which is more rainy and cold, so the flowering period last less. This flowering conditions highlight the xerophytic character of the *I. suaveolens*.
The anthesis period description show that in warm springs, an *I. suaveolens* population can provide shelter and food to pollination insects during almost two weeks, by periodic flowering.

CONCLUSIONS

Iris suaveolens Boiss and Reut is a dwarf specie and the entire plant height in the studied population, varied between 11-14 cm, with an average by 12,5 cm.
As many authors have written, the iris flower can be described as a floral complex. At the flowering time, the purple standards can achieve an average 4,5 cm in length and 2,7 cm in width, are united together at the top, creating a dome like flower architecture.
The purple falls are curved down (reflected), oblong in shape and riches an average length of 4.5 cm and width of 1.7 cm. The three falls act in the flower like a landing platform for insects. Every fall, in order to contribute in attracting pollinators, developed a visible network of dark purple to brown strips and a band of white pluricellular hairs, being highly specialised in entomophilous pollination.
The stile and stigma are described having petaloid aspect, oblong shape and entire, concave aspect and thicker on a longitudinal

darker strip, looking like a protuberant keel, that entirely cover the stamen.

The pollination units are composed: stigma, stamen and fall, protected by the dome like standards, which can attract the insects and provide food and protection.

This subject needs further studies in the structure and ultrastructure of the Iris tepals, to provide a complete understanding of the relationship and behaviour of the insects visitors in the Iris floral complex.

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