COMPARATIVE MORPHOLOGICAL STUDIES ON SOME SPECIES OF THE GENUS FUMARIA

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Abstract

Morphological studies using a stereomicroscope performed on flower and fruit parts of the 7 species belonging to Fumaria genus revealed some differences and similarities. In this genus the zygomorphic flowers include 4 petals and 2 sepals which were different in size. The colors of their flowers range from white (Fumaria parviflora Lam.) to purplish pink (Fumaria rostellata Knaff.) or deep pink (Fumaria schleicherii Soy.Will). The sepals length varies among the species ranging from 0.1-0.5 mm (Fumaria vaillantii Loisel.) to 4-4.5 mm (Fumaria capreolata L.). The fruits are different in shape, length and width but some species present erect fruit pedicels while for other species the fruit pedicels are arched. Also the length of pedicel bracts is a specific character for each of these species.

Keywords: Fumaria, fruits and flowers morphology, stereomicroscope

Introduction

In Europe, the Fumaria genus (Fam. Fumariaceae) includes 56 different species and subspecies [13] characterized as herbaceous and annual plants [10], presenting recumbent or ascending stems [7].

The *Fumaria* species have branched stems, alternate and petiolate leaves [9]. They have small zygomorphic white, pink or red flowers including 2 persistent or caducous sepals [8]. The racemic blossoms include short flowers formed of 4 petals, [6] presenting a spurred superior petal while the inferior petal does not have a spur [2]. The fruits are small and indehiscent nucules with straight or curved pedicels [4].

Given the morphological similarities between species, the identification of different taxons is difficult [4] and based on several specific morphological characters: presence or absence of sepals, their length, the shape of the fruit, the length of the fruit pedicel [14] and the length of the fruit pedicel bracteole.

In order to avoid possible confusions between *Fumaria* genus, our study aims for a comparative morphological characterisation of flowers and fruits of the following species: *Fumaria rostellata* Knaff., *Fumaria parviflora* Lam., *Fumaria vaillantii* Loisel., *Fumaria schleicheri* Soy.Will., *Fumaria officinalis* L., *Fumaria jankae* Hausskn and *Fumaria capreolata* L.

**Materials and Methods**

The aerial parts of *Fumaria rostellata* Knaff., *Fumaria parviflora* Lam., *Fumaria vaillantii* Loisel., *Fumaria schleicheri* Soy.Will., *Fumaria officinalis* L., *Fumaria jankae* Hausskn and *Fumaria capreolata* L. were harvested from the spontaneous flora of Romania, Belgium and France as follows: may 2009 *Fumaria schleicherii* Soy.Will. from Cojocna, Cluj county, Romania; june 2009 *Fumaria vaillantii* Loisel from Bistrița, Bistrița-Năsăud county, Romania; may 2010 *Fumaria rostellata* Knaff. from Virșoț, Sălaj county, Romania); *Fumaria parviflora* Lam. from Săcuieni, Bihor county, Romania; *Fumaria jankae* from Săcuieni, Bihor county, Romania; april 2011 *Fumaria capreolata* L. from Brest, Finistere department, France; may 2011 *Fumaria officinalis* L. from Liege province, Belgium. The species were identified by the Department of Botany, Faculty of Pharmacy, University of Medicine and Pharmacy “Iuliu Hațieganu” Cluj-Napoca, Romania.
The characteristics of flower and fruit parts for the seven species were morphologically compared. A series of photos of the sepals, fruits and fruit pedicels were realized with the assistance of the Wild M3B (X6) stereomicroscope connected to a digital camera DP 200.

**Results and Discussion**

Morphological studies on flower and fruit parts of the seven *Fumaria* species revealed some similarities and differences (Figure 1-7). The primary parts of the flowers are similar. They are hermaphrodite and composed of four petals and two sepals when the upper petal is spurred and the lower petal is spatulate. The corolla colors for these species are different, ranging from white (*Fumaria parviflora* Lam.) to purplish pink (*Fumaria rostellata* Knaff.) or deep pink (*Fumaria schleicherii* Soy.Will). The calyx and corolla sizes are also different.

![Figure 1](image1.png)

**Figure 1**
Flower (1A-Corolla, 1B-Sepals) and fruit (1C) of the species *Fumaria vaillantii* Loisel

![Figure 2](image2.png)

**Figure 2**
Flower (2A) and fruit (2B) of the species *Fumaria officinalis* L.
Figure 3
Flower (3A-Corolla, 3B-Sepals) and fruit (3C) of the species *Fumaria parviflora* Lam.

Figure 4
Flower (4A) and fruit (4B) of the species *Fumaria rostellata* Knaff

Figure 5
Flower (5A-Corolla, 5B-Sepals) and fruit (5C) of the species *Fumaria schleicherii* Soy.Will.

Figure 6
Flower (6A-Corolla, 6B-Sepals) and fruit (6C) of the species *Fumaria jankae* Hausskn
Figure 7
Flower (7A) and fruit (7B) of the species *Fumaria capreolata* L.

The fruits of this genus are nucules and the pedicels of fruits are patent, erect or arched-recurved. The 7 species are differentiated by 11 characters as shown in Table I.

Table I
Floral and fruit morphological characters of seven *Fumaria* species

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Flowering</td>
<td>May-October</td>
<td>May-September</td>
<td>June-September</td>
<td>May-September</td>
<td>June-July</td>
<td>April-October</td>
<td></td>
</tr>
<tr>
<td>Petals color</td>
<td>Pale-pink</td>
<td>Purplish or deeper pink</td>
<td>White or tinged with pink</td>
<td>Purplish pink</td>
<td>Deep pink</td>
<td>Pink</td>
<td>White or creamy white</td>
</tr>
<tr>
<td>Wings of upper petal and apex of inner</td>
<td>Blackish-red-purple</td>
<td>Blackish-purple</td>
<td>Blackish-red or purple</td>
<td>Blackish-purple</td>
<td>Dark-purple with green stripe</td>
<td>Blackish-purple with green stripe</td>
<td>Blackish-red</td>
</tr>
<tr>
<td>Corolla length</td>
<td>4.5-5.5 mm</td>
<td>6-7 mm</td>
<td>4-5 mm</td>
<td>8.5-9.5 mm</td>
<td>4.5-5.5 mm</td>
<td>3-4 mm</td>
<td>11-12 mm</td>
</tr>
<tr>
<td>Sepals length</td>
<td>0.1-0.5 mm</td>
<td>2.5-3 mm</td>
<td>0.3-0.6 mm</td>
<td>3.5-4 mm</td>
<td>0.5-1 mm</td>
<td>0.5-1 mm</td>
<td>4-4.5 mm</td>
</tr>
<tr>
<td>Fruits shape</td>
<td>Globulous, smooth, with apex obtuse</td>
<td>Keel-shaped with apex emarginate</td>
<td>Subglobose to ovoid with apex short mucronulate</td>
<td>Ovoid with apex mucronulate</td>
<td>Spherical, smooth with apex acipulate</td>
<td>Ovoid with apex apiculate</td>
<td>Subglobose to ovoid, smooth with apex, obtuse</td>
</tr>
<tr>
<td>Fruits width</td>
<td>1.7-1.9 mm</td>
<td>2.4-2.6 mm</td>
<td>2.1-2.2 mm</td>
<td>2.2-2.2 mm</td>
<td>1.9-2.1 mm</td>
<td>1.9-2 mm</td>
<td>2.1-2.3 mm</td>
</tr>
<tr>
<td>Fruits length</td>
<td>2-2.1 mm</td>
<td>2.6-2.8 mm</td>
<td>2.3-2.5 mm</td>
<td>2.2-2.4 mm</td>
<td>2.1-2.3 mm</td>
<td>2.3-2.5 mm</td>
<td>2.4-2.6 mm</td>
</tr>
<tr>
<td>Fruits pedicels</td>
<td>Erect</td>
<td>Erect</td>
<td>Erect</td>
<td>Erect</td>
<td>Erect</td>
<td>Erect</td>
<td>Arched-recurved</td>
</tr>
<tr>
<td>Fruits pedicels length</td>
<td>0.7-0.9 mm</td>
<td>2.9-3.1 mm</td>
<td>2.1-2.3 mm</td>
<td>2.4-2.6 mm</td>
<td>3.3-3.5 mm</td>
<td>1.9-2.1 mm</td>
<td>Arched-recurved</td>
</tr>
<tr>
<td>Fruits bracts length</td>
<td>0.7-0.8 mm</td>
<td>1.8-2 mm</td>
<td>1.6-1.7 mm</td>
<td>2.1-2.2 mm</td>
<td>0.9 -1.1 mm</td>
<td>1.3-1.5 mm</td>
<td>Arched-recurved</td>
</tr>
</tbody>
</table>
Every species included in this study bears an individual morphological feature as follows: *Fumaria vaillantii* Loisel. has small size sepals ranging from 0.1 mm to 0.5 mm the fruit of *F. officinalis* L. species is keel-shaped with apex emarginated, the corolla of *F. parviflora* Lam species is white, *F. rostellata* Knaff. presents well developed calyx and corolla with sepal length between 3.5-4 mm and petal length between 8.5-9.5 mm. The individual morphological features of *F. schleicherii* Soy.Will. concern the fruit pedicel and the fruit pedicel bracteola: the fruit pedicel length ranges between 3.3-3.5 mm and the fruit pedicel bracteole length ranges between 0.9-1.1 mm which is 1/3 of the fruit pedicel length. *F. capreolata* L. has a curved fruit pedicel, and *F. jankae* Hausskn. is a hybrid and shows intermediate characteristics belonging to *F. schleicherii* Soy.Will. and *F. rostellata* Knaff..

Conclusions

The results of our study designate the fact that each seven *Fumaria* species examined presents individual morphological features. Morphological similarities prove the existence of phylogenetic links between *Fumaria* species while morphological differences point out individual characteristics which allow avoiding possible confusions.

Only the species *Fumaria officinalis* L., officinal in the European Pharmacopoeia 7 Edition, [5] exhibits differential characters regarding the sepal length in the range 2.5-3 mm and globular or keel-shaped fruit with emarginated apex. These features allow the precise identification of this species and avoid substitution with other species belonging to the genus *Fumaria*.

References


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