

## THE REVISION OF THE GENUS *EMINIUM* OF TURKEY

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**ABSTRACT.** This study comparatively makes a revision of the *Eminium* (Araceae) species [(*Eminium spiculatum* (Blume) Schott var. *spiculatum*, *E. intortum* (Banks & Sol) O. Kuntze, *E. rauwolffii* (Blume) Schott var. *rauwolffii*, *E. rauwolffii* (Blume) Schott var. *kotschyi* (Schott) H. Riedl, *E. koenenianum* Lobin and P. C. Boyce)] grow in Turkey. The plant material including these taxa was collected from different localities of Turkey. Such as Hatay, Osmaniye, Şanlıurfa, Artvin, Mersin, Erzurum. In the morphological examination tuber, leaf, scape, spathe, and spadix were detail explained. The pollen morphological characteristics of these taxa were examined by using scanning electron microscope (SEM). Besides, palynological data, was indicated.

**Keywords:** *Araceae*, *Eminium*, Revision, Turkey

### INTRODUCTION

The Araceae family includes 105 genera and 330 species. About 90% of its genera and about 95% of its species are found in tropical regions. Aroids are one of the groups of monocotyledons that differ structurally and ecologically the most. Their habitat varies greatly. They contain taxa that encapsulate geophyte, climber, epiphyte, helophyte, and aquatic life forms [1]. Spanning tropical and subtropical regions, the Araceae family is known for its wild taxa and ornamental plants [2].

The antimicrobial and antioxidant effects of the essential oils and extracts of various plants [3-6] are also prevalent in *Eminium* taxa [7]. Aroids are medicinal plants and used in traditional medicine applications of various cultures [8]. They can also be used as food. They also contain some species that have toxic effects [9-10].

Contrary to the other Aroid members, the *Eminium* genus grows in relatively more barren regions. Its native land is Turkey, Iran, Iraq, Israel, Egypt, Syria, Afghanistan, Tajikistan, Kazakhstan, Uzbekistan, and Turkistan [11].

Mill (1984) categorizes the *Eminium* genus in the Turkish flora based on its tuber and leaf structure, scape, appendix, and petiole characteristics [12].

*Eminium* pollen grains are generally characterized by their uniformity. We consider the size of the pollen grains, the height and base length of the spine on them, and the thickness of the exine and intine as descriptive characters that can also be used at the species level.

In this study, pollen of taxa belonging to the genus *Eminium* was examined at Scanning Electron Microscope (SEM) and light microscope. Lobin and Boyce (1991) reported the pollen characteristics of the taxon *Eminium koenenianum* as inaperturate, prolate, intine thick, and exine thin [13].

In this study, the taxa of the Turkish *Eminium* genus have been analyzed based on their morphological features.

## MATERIAL AND METHOD

The *Eminium* genus taxa were collected from different localities during vegetation periods between 2008 and 2010 (Table 1).

**Table 1.** The locality information of the *Eminium* genus taxa

No	Taxon	Locality
1	<i>Eminium spiculatum</i> var. <i>spiculatum</i>	<b>C7 Şanlıurfa:</b> Birecik, Çiftlik Village, pine nut orchard, 580 m, 37°05'968"N, 037°55'840"E
2	<i>Eminium spiculatum</i>	<b>C8 Şırnak:</b> Güçlü Konak Belkısana Hot spring, Bush, 430 m, 37°31'518"N, 41°51'154"E
3	<i>Eminium spiculatum</i> var. <i>spiculatum</i>	<b>C6 Hatay:</b> Antakya: Yaylaca, Close to Şenköy , 1000 m
4	<i>Eminium intortum</i>	<b>C5 Osmaniye:</b> Çona Village, Bozkele Hill 1448 m
5	<i>Eminium intortum</i>	<b>C5 Osmaniye:</b> Çolaklı Village, 8 km close to Hasanbeyli
6	<i>Eminium rauwolffii</i> var. <i>rauwolffii</i>	<b>C7 Şanlıurfa:</b> Büyükhan Village Hills, 600 m, 37°06'142"N, 038°25'743"E
7	<i>Eminium rauwolffii</i> var. <i>rauwolffii</i>	<b>C5 Osmaniye:</b> Çona Village, Bozkele Hill, 1448 m, 37°06'046"N, 036°19'801"E
8	<i>Eminium rauwolffii</i> var. <i>kotschyi</i>	<b>C5 İçel:</b> Close to Şamlar, 400 m
9	<i>Eminium koenenianum</i>	<b>A8 Artvin:</b> Yusufeli, Kılıçkaya (Ersis), forest wayside, 1865 m, 40°42'757"N, 41°32'580"E (M. Öztürk)
10	<i>Eminium koenenianum</i>	<b>A8 Erzurum:</b> İspir-Devedağı way, Güllübağ Village, wayside 11. km, 44°30'654"N, 41°3'064"E, 13.vi.2004 (M. Öztürk)
11	<i>Eminium intortum</i>	<b>C5 Osmaniye:</b> Çolaklı Village, 8 km close to Hasanbeyli
12	<i>Eminium intortum</i>	<b>C5 Osmaniye:</b> Çona Village, Bozkele Hill, 1448 m, 37°06'046"N, 036°19'801"E
13	<i>Eminium intortum</i>	<b>C5 Osmaniye:</b> Çona Village, Bozkele Hill, 1448 m, 37°06'046"N, 036°19'801"E

Besides the samples collected from the land, the samples that were grown in the HUB (the Hacettepe University Herbarium) and ANK (the Ankara University Herbarium) herbariums were also analyzed. Pictures of the types of the *Eminium* taxa and other samples from the British Museum (BM) and the Berlin Herbarium (B) were obtained.

Definitive characters having taxonomical values for the *Eminium* genus were determined (tuber shape, plant height, leaf base shape, leaf blade length-width, leaf vein pattern, leaf lobe number and whether they are patchy or not, petiole length and features of its surface, spathe shape-color-dimensions and whether they have warts or not, scape length and thickening status on the lower spathe region, spadix length, appendix shape-length-color, stamen length, sterile zone length, pistil length) as a result of analyzing both the samples that were collected during the land studies and the samples that came from herbariums in differing localities. General descriptions of the taxa were put forward by writing the values that these characters received for each analyzed sample.

The phylogenetic relationship between the *Eminium* taxa and the *Acorus* taxon was investigated by assessing the data obtained from morphological studies. For the *Eminium* taxa, 36 characters were determined concerning life form, subsoil organs, tuber, leaf, scape, spathe, and spadix, having taxonomical values. The values reflected by these characters for six taxa have been arranged in a 36 x 6 data table (Table 2). *Acorus calamus* was used as the external group.

***Morphological Characters Used in Numerical Taxonomy***

*-Habitat*

1- Terrestrial (0), aquatic (1)

*-Subsoil Organs*

2- Tuber (0), rhizome (1)

3- Adventitious root; yes (0), no (1)

4- Initial direction of the roots; upward (0), downward (1)

*-Tuber*

5- Tuber shape; vertical (0), globose (1), flat-globose (2), ovate (3)

6- Tuber width (mm)

7- Tuber height (cm)

*-Leaf*

8- Speckles on the stem; yes (0), no (1)

9- Stem; yes (0), no (1)

10- Stem length (cm)

11- Stem width (mm)

12- Leaf blade shape; ovate-lanceolate (0), oblong-lanceolate (1), lanceolate (2), linear-lanceolate (3)

13- Leaf lobe number

14- Side-lobes; simple (0), complex (1)

15- Leaf blade; fragmental (0), three main lobes (1), whole (2), without lobes (3), ovate-elliptic (2), ovate-sagittated (3), spearhead (hastate) (4), linear-lanceolate (5)

16- Leaf blade width (cm)

17- Leaf blade length (cm)

18- Spots (patches) on the leaf; yes (0), no (1)

19- Leaf scent; yes (0), no (1)

20- Membranous rammenta on the leaf base; yes (0), no (1)

*-Scape*

21- Length (cm)

22- Width (cm)

23- Thickening on its tip; yes (0), no (1)

*-Spathe*

24- Shape; ovate-oblong (0), ovate-lanceolate (1), wide ovate-lanceolate (2), lanceolate-deltoid (3), lanceolate (4)

25- Inner color; dark reddish-purplish (0), chocolate brownish (1), brown (2), dark violet (3), green (4), dark violetish-green (5), dark greenish to purplish-brown (6)

26- Outer color; green (0), smudged violet (1)

27- Spathe tube base; adjacent (0), separate (1)

28- Tube inner color; dark purplish-red and smudged white (0), green (1), greenish-black dark purple striped (2), smudged (3)

*-Spadix*

29- Spadix length (cm)

30- Appendix; yes (0), no (1)

31- Appendix shape; sub-cylindrical (0), cylindrical-slightly conic (1), cylindrical-distinctly conic (3), spindle-shaped (4), cylindrical (5)

32- Appendix length (cm)

33- Appendix color; blackish purplish (0), dark brown or purple blackish (1), blackish violet (2), green (3)

34- Pistil length (cm)

35- Stamen length (cm)

36- Sterile zone length (cm)

The mean values of the morphological characters for each taxon were determined and conveyed to the NTSYS-PC version 2.02 (Applied Biostatistics, Exeter Software, Setauket, New York, USA) package software. After standardizing the obtained data, phenograms that reflected the phylogenetic relations of the taxa were created.

### ***Scanning Electron Microscope Method (SEM)***

The pollen samples belonging to species were examined by scanning electron microscopy and taxonomically important microfeatures were evaluated to differentiate taxa. Flowering herbarium materials were used for pollen. Pollen was placed on sticks with double-sided adhesive tape under a stereomicroscope. The pollen samples were coated in Kayseri Erciyes University Technology Research and Application Centre (TEKMER) 5 times with 9 Å thick gold and scanned with 10 kW power using the device Oxford Leo 440 SEM and images were recorded on Mitsubishi CK700 cards with Mitsubishi PK700L film using the device Mitsubishi CP750.

## **RESULTS AND DISCUSSION**

### ***General Characteristics of the *Eminium* (Blume) Schott Genus***

#### *Eminium* (Blume) Schott

Its tubers are perennial. The whole lower sections of its scape and stem are covered by ramenta (like those on an onion). The leaf lamina is generally three-lobed and seldom whole, its central lobe is generally whole and wider than the side-lobes which are linear and narrowly deltoid and bend inward. Side-lobe separation in the young taxa is either underdeveloped or almost nonexistent. Spathe fades before the fruit ripens. Its appendix is cylindrical-conical. Its flowers are unisexual with no perianth. Its pistil and stamen are separated by the sterile zone. There are no sterile flowers between the appendix and the stamen. The stamen consists of two locules, while the ovary consists of one locule and two ovules.

The number of chromosomes:  $2n=28$ . The pollens are spheroidally shaped and their ornamentations are echinate.

The systematic hierarchy of the *Eminium* genus:

Kingdom: Plantae

Division: Spermatophyte (seed plants)

Class: Monocotyledons (monocots)

Order: Arales

Family: Araceae

Genus: *Eminium* (Blume) Schott

#### *The Turkish *Eminium* Genus Taxa List*

1- *Eminium spiculatum* (Blume) Schott var. *spiculatum*

2- *E. intortum* (Banks & Sol) O. Kuntze

3- *E. rauwolffii* (Blume) Schott var. *rauwolffii*

- 4- *E. rauwolffii* (Blume) Schott var. *kotschy* (Schott) H. Riedl  
 5- *E. koenianum* Lobin and P. C. Boyce

*The Identification Key of Species under the Eminium Genus*

1. The leaves are lobed and there are no whitish patches on them.  
 2. The inner spathe has a blistered and warty structure; the sterile flowers are 7 mm, half-cylindrical, and bend inward irregularly.....**1. spiculatum**  
 2. The spathe is flat and velvety-soft feathered; the sterile flowers are 4-5 mm and slightly bend upward or downward.  
 3. The scape thickens on the immediate lower region of the spathe; the posterior leaf lobes may break into secondary lobes; the appendix is generally conical.....**2. intortum**  
 3. The scape thickens on the immediate lower region of the spathe; the posterior leaf lobes do not break into secondary lobes; the appendix ± cylindrical.....**3. rauwolffii**  
 1. The leaves are whole (without lobes) and has whitish patches on them.....**4. koenianum**

*The morphological features of the species under the Eminium genus*

*Eminium spiculatum* (Blume) Schott var. *spiculatum*

The tubers are flat-globose. The stem is 16-33 cm and has purplish-red speckles or is purple-colored; the leaf blade is fragmented; the two side nerves on the base are more developed compared to the others and are 7-9 x 9-16 cm; the middle lobe is oblong-lanceolate 7-10 x 2-3.5 cm; the side lobes elongate upward over the central lobe, break into deep fragments, are linear-lanceolate and pointed, and their pointed-like fragments are thickened. The scape is 15-24.5 cm. It thickens on the immediate lower region of the spathe; the spathe tube is colored in some species and its blade (lamina) is ovate-oblong, its outer region is green, the base of its inner region is blackish-purple, and the spathe blade is distinctly blistered and warty. The spadix is 8-11 cm and malodorous. The sterile flower zone length is 30-40 mm, the stamen length is 8-12 mm, and the sterile flowers are 10-18 mm. The sterile flowers bend upward and downward (the bends get distinct as the flower gets closer to fading). The appendix is cylindrical, slightly conical, whitish-purple colored, and has short stems (Fig. 1). The fruit has a grape-like texture.

Flowering Period: April-May

Habitat: Rocky steppes, calcareous hills, cereal fields

Elevation: 500-1000 m

Conservation Status: LR (Lower Risk)

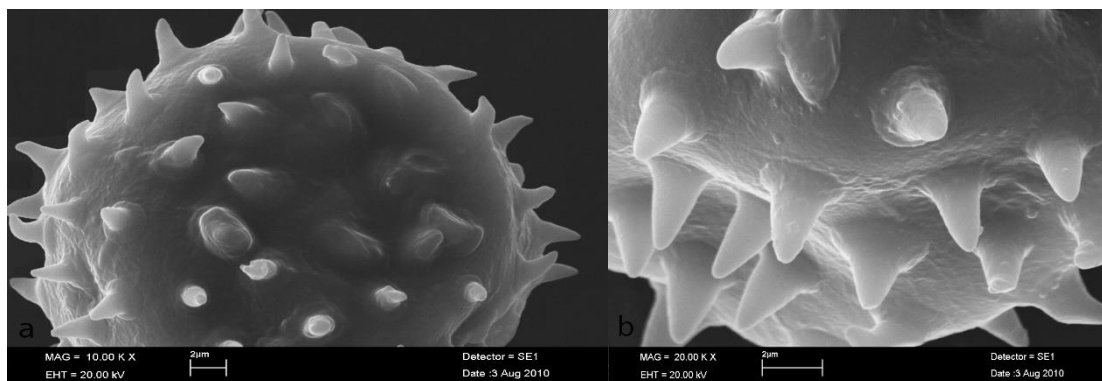
Endemism Status and Spread: Not endemic. Turkey, Syria, Iran

Phytogeographical Region: Irano-Turanian element



**Fig 1.** The natural appearance of the *Eminium spiculatum* var. *spiculatum* taxon

Structure of Pollen: The pollen of the taxon *Eminium spiculatum* var. *spiculatum* is large, spheroidal, inaperturate (without aperture) and its ornamentation is echinate. The height of the spines (thorns) forming the echinate ornamentation is 2.97  $\mu\text{m}$  and the base length is 2.64  $\mu\text{m}$ , the exine thickness (Ex) is 3.16  $\mu\text{m}$  and the intine thickness (In) is 0.52  $\mu\text{m}$ . The pollen size is 51.34  $\mu\text{m}$  (Fig. 2).



**Fig. 2.** SEM image of *Eminium spiculatum* var. *spiculatum* taxon.  
a- General view, b- Detailed view

*Eminium intortum* (Banks & Sol.) O. Kuntze

Its tuber are globose. The stem is 11-18 cm and purplish-red, has no speckles and generally gets violet-colored toward the base. The leaf blade has three main lobes; the central lobe is oblong-lanceolate and slightly pointed-like, the nerves branch out toward the mid-section of the leaf blade after separating from the middle nerve. The side lobes are linear, pointed, upward, while the posterior lobes may be more fragmented. The lower region of the leaf blade generally has blackish-brown speckles. The scape is 6-15 cm and thickens on the immediate lower region of the spathe. The spathe blade is ovate-lanceolate, its outer region is green while its inner region is brownish-purple and has a velvety flat surface. The spadix is 5-8(10) cm, the pistil length is 11-13 mm, the sterile zone length is 20-24(35) mm, the stamen length is 7-8(10) mm, and the sterile flowers are 4-5 mm. The appendix is cylindrical, distinctly conical, dark chocolate brown or blackish-purple, and has short stems (Fig. 3). The fruit has a grape-like texture.

Flowering Period: April-May

Habitat: Rocky slopes

Elevation: 820-1700 m

Conservation Status: LR (Lower Risk)

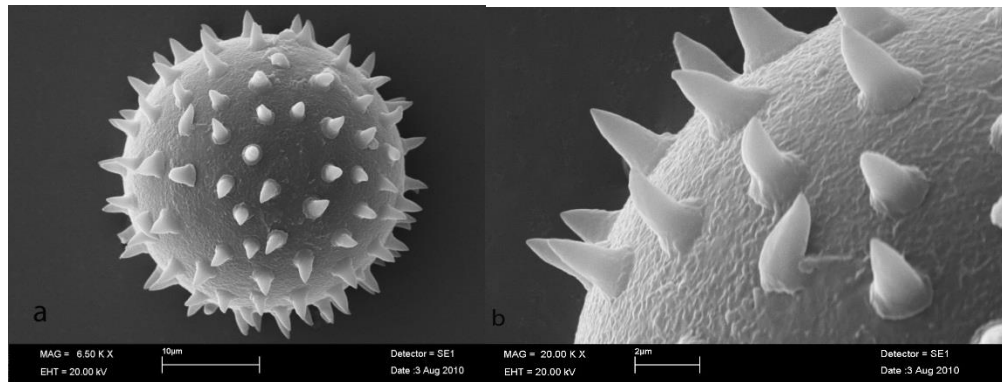
Endemism Status and Spread: Not endemic. Turkey, Syria

Phytogeographical Region: Irano-Turanian element



**Fig. 3.** The natural appearance of the *Eminium intortum* taxon

Structure of Pollen: The pollen of the taxon *Eminium intortum* is relatively large, spheroidal, inaperturate (without aperture) and its ornamentation is echinate. The height of the spines (thorns) forming the echinate ornamentation is 2.37  $\mu\text{m}$  and the base length is 2.20  $\mu\text{m}$ , the exine thickness (Ex) is 3.05  $\mu\text{m}$  and the intine thickness (In) is 0.67  $\mu\text{m}$ . The pollen size is 46.07  $\mu\text{m}$  (Fig. 4).



**Fig. 4.** SEM image of *Eminium intortum* taxon.  
a- General view, b- Detailed view

#### *Eminium rauwolfii* (Blume) Schott

Its tubers are generally globose. The stem is (8)9-17 cm and purplish-blackish, has no speckles, and gets violet-colored toward the base. The leaf blade has three main lobes; the middle lobe is oblong-lanceolate, partly pointed, or somewhere between pointed and circular; the side lobes are sub-equal or shorter than the central lobe. The scape is 5-19 cm and thickens distinctly in the lower region of the spathe; the outer region of the spathe is green and its inner region is purplish-brown; the spathe blade has a velvety flat surface; the spadix is 4.5-7 cm; the pistil length is 10-20 mm and the stamen length is 5-9(10) mm, while the sterile flowers are 4-5(6) mm. The appendix is cylindrical and very slightly conical and it has a dark-purplish color and short stems. The fruit has a grape-like texture.

1. The appendix is cylindrical and very slightly conical and has short stems.....**var. rauwolfii**

1. The appendix is generally distinctly conical and has no stems (may have short stems when dry).....**var. kotschyi**

- *var. rauwolffii*

Flowering Period: April-May

Habitat: Uncultivated land, rocky high hills, cornfields

Elevation: 335-1750 mm

Conservation Status: LR (Lower Risk)

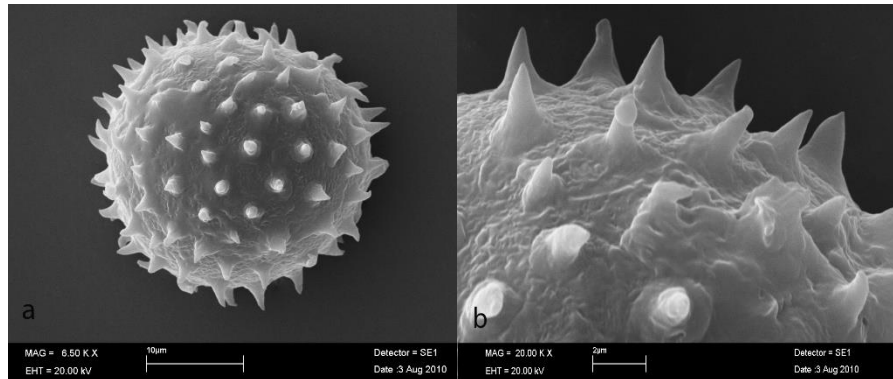
Endemism Status and Spread: Not endemic. Syria, Iran, Iraq, Palestine

Phytogeographical Region: Irano-Turanian element



**Fig. 5.** The natural appearance of the *Eminium rauwolffii* var. *rauwolffii* taxon

Structure of Pollen: The pollen of the taxon *Eminium rauwolffii* var. *rauwolffii* is relatively large, spheroidal, inaperturate (without aperture) and its ornamentation is echinate. The height of the spines (thorns) forming the echinate ornamentation is 2.23  $\mu\text{m}$  and the base length is 2.35  $\mu\text{m}$ , the exine thickness (Ex) is 2.54  $\mu\text{m}$  and the intine thickness (In) is 0.53  $\mu\text{m}$ . The pollen size is 42.08  $\mu\text{m}$  (Fig. 6).



**Fig. 6.** SEM image of *Eminium rauwolffii* var. *rauwolffii* taxon.

a- General view, b- Detailed view

-*var. kotschyi* (Schott)

(Fig. 7)

Flowering Period: April-May

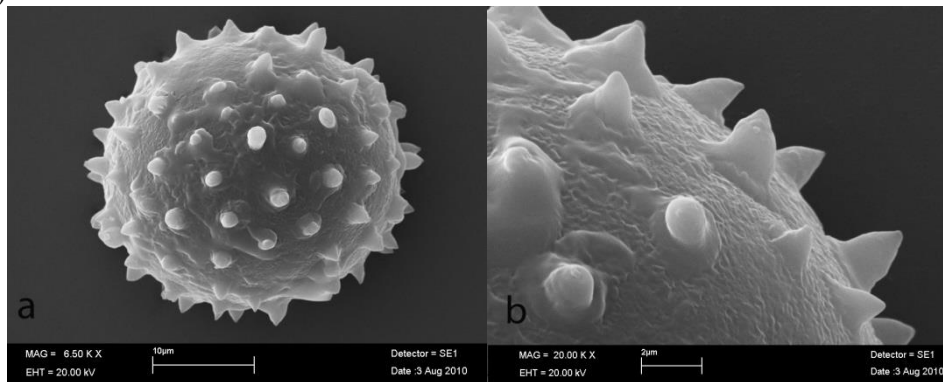


Habitat: Uncultivated land, rocky high hills, cereal fields  
Elevation: 335-1750 mm  
Conservation Status: LR (Lower Risk)  
Endemism Status and Spread: Not endemic. Syria, Iran, Iraq, Palestine  
Phytogeographical Region: Irano-Turanian element



**Fig. 7.** The natural appearance of the *Eminium rauwolffii* var. *kotschyi* taxon

Structure of Pollen: The pollen of the taxon *Eminium rauwolffii* var. *kotschyi* is relatively large, spheroidal, inaperturate (without aperture) and its ornamentation is echinate. The height of the spines (thorns) forming the echinate ornamentation is 2.12  $\mu\text{m}$  and the base length is 2.76  $\mu\text{m}$ , the exine thickness (Ex) is 2.27  $\mu\text{m}$  and the intine thickness (In) is 0.71  $\mu\text{m}$ . The pollen size is 46.55  $\mu\text{m}$  (Fig. 8).



**Fig. 8.** SEM image of *Eminium rauwolffii* var. *kotschyi* taxon.  
a- General view, b- Detailed view

#### *Eminium koenenianum* Lobin & P. C. Boyce

Its tubers are flat-globose (1.1) and 1.5-2 cm in diameter. The height of the leaves are bigger than their width, they are lanceolate and 3.0-7.0 x 1.3-2.5 cm; the lamina is dull green, while it is bright green when young and generally has distinct white patches; the first vein pattern is sub-parallel while the second vein pattern is web-like. The stem is 9-35 cm long and is generally violet-colored toward the base. The scape is 4.7-13.6 cm long and widens in the lower region of the spathe. The spathe is 5.5-9.3 cm long and flat. The spadix is 12.3-23.3 cm long. The appendix is

elongated-clavate (height longer than width, clavate, swells toward the tip), generally has a rough surface and short stems, is 7-14 mm x 1.8-2.5(-4) mm long and blackish dark brown (Fig. 9). The fruit has a grape-like texture.

Flowering Period: April-May

Habitat: Open, dry, rocky fields

Elevation: 1300-1900 m

Conservation Status: VU (Vulnerable)

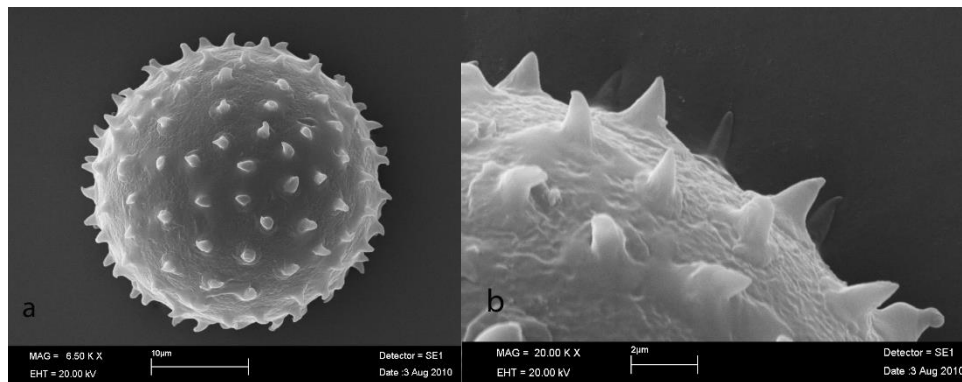
Endemism Status and Spread: Endemic, Turkey

Phytogeographical Region: Irano-Turanian element



**Fig. 9.** The natural appearance of the *Eminium koenenianum* taxon

Structure of Pollen: The pollen of the taxon *Eminium koenenianum* is medium-sized, spheroidal, inaperturate (without aperture) and its ornamentation is echinate. The height of the spines (thorns) forming the echinate ornamentation is 2.26  $\mu\text{m}$  and the base length is 2.32  $\mu\text{m}$ , the exine thickness (Ex) is 2.71  $\mu\text{m}$  and the intine thickness (In) is 0.78  $\mu\text{m}$ . The pollen size is 38.97  $\mu\text{m}$  (Fig. 10).



**Fig.10.** SEM Image of *Eminium koenenianum* taxon.  
a- General view, b- Detailed view

### ***The Evaluation of Taxonomic Characters***

#### ***Habit and Habitat***

The taxa of the Turkish *Eminium* genus are perennial tuber plants. The *Eminium* taxa are approximately 20-60 cm long. They grow in fields 330-1800 m above sea level, rocky slopes and steppes, limestone slopes, and cereal fields. They generally have an ascendant-vertical character and

are non-feathered malodorous plants that do not branch. The taxa of this genus expand over the northeastern, southeastern, and southern regions of Anatolia.

#### *Tuber*

The tubers of each genus analyzed have generally similar characteristics to each other in terms of structure. They are globose and flat-globose and have no adventitious roots. The initial direction of the roots is upward from the tuber.

#### *Leaves*

The leaves differ based on whether they have speckles, patches, and additional lobes, and their size. These are genus-based differences. The size, shape, and lobe number of the leaves provide distinguishing characters.

#### *Scape*

The scape length, width, and thickness on the tip of the scape in the taxa of the *Eminium* genus provide distinguishing characters within certain limits.

#### *Spathe*

Whether the inner region of the spathe is blistered or flat and has a soft-feathered texture is a genus-based distinguishing character. The shape, inner color, outer color, and size of the spathe provide distinguishing characters within certain limits.

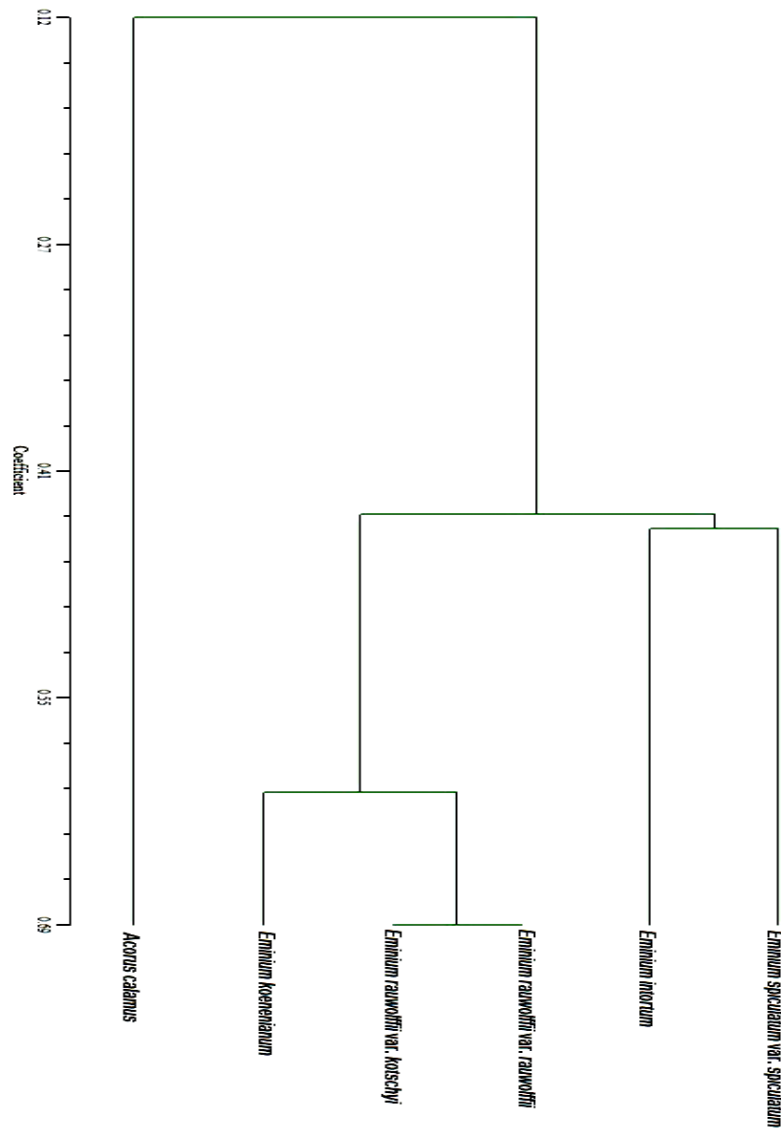
#### *Spadix*

The spadix of each genus analyzed have generally similar characteristics to each other in terms of structure. The shape of the appendix and whether it has stems or not are significantly distinguishing genus-based characters. The color and length of the appendix are among distinguishing characters within certain limits. The lengths of the pistil, stamen and sterile zone are among distinguishing characters (Table 2).

**Table 2.** The characters used in the numerical taxonomy of the *Eminium* genus taxa

NO	<i>E.spiculatum</i>	<i>E.intortum</i>	<i>E.rauwolfii</i> var. <i>rauwolfii</i>	<i>E.rauwolfii</i> var. <i>kotschyi</i>	<i>E.koenenianum</i>	<i>A.calamus</i>
1	0	0	0	0	0	1
2	0	0	0	0	0	1
3	1	1	1	1	1	0
4	0	0	0	0	0	1
5	2	2	1	1	2	9
6	45	25	40	40	15	9
7	30	28	25	25	20	9

8	0	1	1	1	1	9
9	1	1	1	1	1	0
10	24	15	11	11	11	9
11	3.2	3.4	3.1	3.2	2.7	9
12	0	0	1	1	2	3
13	4	2	0	0	0	0
14	1	0	9	9	9	9
15	0	1	1	1	2	3
16	12.5	2.7	4.1	3.9	2	1.2
17	8	6.5	9.5	9.4	5	9
18	1	1	1	1	0	1
19	1	1	1	1	1	0
20	0	0	0	0	0	1
21	13.5	12.5	11.3	12	8.2	75
22	0.7	0.7	0.7	0.7	0.6	9
23	0	0	0	0	0	9
24	0	1	2	2	3	9
25	0	1	2	2	3	4
26	0	0	0	0	1	0
27	1	1	1	1	1	9
28	0	0	0	0	0	1
29	10.5	7	6	5.9	5.5	9
30	0	0	0	0	0	1
31	1	2	0	1	0	9
32	1.7	2.3	3	2.9	2.1	9
33	2	1	0	0	0	9
34	2.2	1.6	1.8	1.7	1.9	9
35	0.6	0.9	0.6	0.6	0.5	9
36	2.3	2.7	2.4	2.4	2.9	9



**Fig. 11.** The phenogram obtained by evaluating 36 characters of the *Eminium* genus

Upon analyzing the phenogram based on the morphological data (Fig. 11), it can be seen that the *Eminium* taxa are divided into two groups. The *Eminium spiculatum* var. *spiculatum* taxa, which are in the first group, have fragmented and speckled leaves. Besides, it is distinct from the other taxa in that the inner region of the spathe has a warty structure.

The *Eminium intortum* taxa in the first group generally have secondary branching on their leaves.

The *Eminium rauwolfii* var. *rauwolfii* and the *Eminium rauwolfii* var. *kotschyi* in the second group are extremely similar to each other morphologically except for the appendix shape.

The *Eminium koenenianum* in the second group is distinct from the other taxa in terms of its leaf structure and appendix shape.

Upon analyzing the phenogram based on the morphological data, it can be seen that the taxa that are morphologically similar to each other are arrayed under the same group.

## CONCLUSION

Comprehensive morphological studies have been conducted on the samples of the Turkish *Eminium* genus within the frame of its revision. The morphological descriptions, useful identification keys, flowering periods, elevations, habitat characteristics, conservation, and endemic statuses, and phytogeographical regions of each genus naturally growing in Turkey have been determined within the scope of revision studies. The *Eminium* genus was represented by four genera in Turkey according to the Turkish flora, but today it is represented by five genera in Turkey with the addition of the *Eminium koenenianum* Lobin & P. C. Boyce, which was introduced to the scientific world as a new genus in 1991 [14].

The conservation statuses of the genera have been determined based on the IUCN (2001) criteria. The CR (Critically Endangered) status has been recommended for the *Eminium rauwolfii* var. *kotschyi* genus, while the LR (Lower Risk) category has been recommended for the *E. intortum*, *E. rauwolfii* var. *rauwolfii*, and *E. spiculatum* genera. No changes have been made in the conversation statuses of the other taxa [15].

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