



Seed Surface Analysis of Some Threatened Endemic Plants from Tahtalı Mountains (Adana-Kayseri/Turkey)

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Abstract

In this study, seeds morphology of the local endemic 8 species (*Anthemis antitaurica* Grierson, *Cirsium aytachii* H.Duman & R.R.Mill, *Jacobaea inops* (Boiss. & Balansa) B.Nord., *Grammosciadium confertum* Hub.-Mor. & Lamond, *Muscari macbeathianum* Kit Tan, *Silene balansae* Boiss., *Teucrium antitauricum* Ekim, *Verbascum hadschinense* Freny & Sint.) known only from Tahtalı range and the neighbouring mountains in South Anatolia were studied. These studied species has been presented with SEM pictures including both the general structures of the seeds and also the ornamentation details of them.

Key words: Endemic, ex-situ conservation, seed morphology, SEM, Turkey

Özet

Bu çalışmada, Güney Anadolu'da yer alan Tahtalı dağları ve yakın çevresinden bilinen 8 lokal endemik bitkinin (*Anthemis antitaurica* Grierson, *Cirsium aytachii* H.Duman & R.R.Mill, *Jacobaea inops* (Boiss. & Balansa) B.Nord., *Grammosciadium confertum* Hub.-Mor. & Lamond, *Muscari macbeathianum* Kit Tan, *Silene balansae* Boiss., *Teucrium antitauricum* Ekim, *Verbascum hadschinense* Freny & Sint.) tohum morfolojisi çalışılmıştır. Ayrıca çalışmada, tohumların genel görünüşleri ve ornamentasyon detaylarını gösteren SEM fotoğrafları da verilmiştir.

Anahtar kelimeler: Endemik bitki, ex-situ koruma, tohum morfolojisi, SEM, Türkiye

1. Introduction

Tahtalı mountains, containing a large number of regional and local endemic plants, are referred as an important endemism centre of Turkey. The 8 local endemic species, only known from Tahtalı range and neighbouring mountains, were studied in this article. These species are *Anthemis antitaurica* Grierson, *Cirsium aytachii* H.Duman & R.R.Mill and *Jacobaea inops* (Boiss. & Balansa) B.Nord. (Compositae), *Grammosciadium confertum* Hub.-Mor. & Lamond (Umbelliferae), *Muscari macbeathianum* Kit Tan (Liliaceae), *Silene balansae* Boiss. (Caryophyllaceae), *Teucrium antitauricum* Ekim (Labiatae) and *Verbascum hadschinense* Freny & Sint. (Scrophulariaceae). All these important endemic species have very small populations in their distribution areas. Also, they are under threat because of various reasons such as the lack of conservation measurements, serious habitat degradation and over grazing pressures. This study aims to collect the seeds, to determine their morphological characters and also to contribute the scientists who would like to study with these seed for any scientific purposes.

2. Material and Method

The seeds were collected by considering to sample the whole genetic diversity of the species during the dispersal season in 2008. All the specimens were identified by using some relevant literatures (Coode and Cullen, 1966; Davis and Parris, 1975; Davis et al., 1988; Ekim, 1982; Grierson and Yavin, 1975; Greuter and von Raab-Straube,

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2007; Güner et al., 2000; Hedge and Lamond, 1972; Huber-Morath, 1978; Tan, 1988; Matthews, 1975; Stuart and Davis, 1984). Also the following researches dealing with the seed morphology (Atera et al., 2007; Kaya and Dirmenci, 2008; Pinar et al. 2007; Prasad, 1976; Yıldız and Çırpıcı, 1998) were investigated. All the seed samples were sent to Central Research Institution Seed Bank in Ankara for conserving them under cold and dry conditions.

All the specimens were collected according to our previous phenological observations. The flowering time of *M. macbeathianum* in the mid March, whereas *C. aytachii* is flowered in late August. Moreover, the fruiting period varies from the mid May to the late September for each species. The dispersal seasons were determined as towards to the end of their fruiting periods (Figure 1).

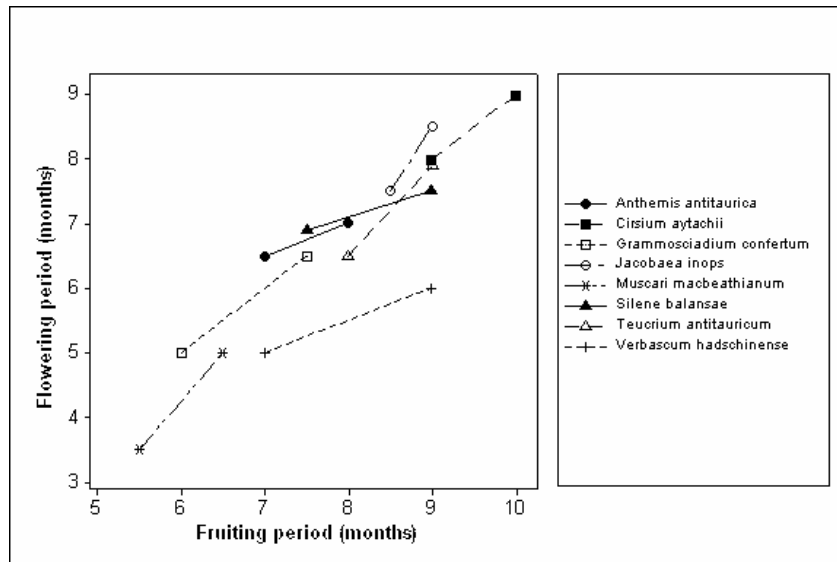


Figure 1. Relationship among flowering and fruiting seasons of the species

In order to determine the average seed sizes, 10 seeds from each species were measured (Table 1). For scanning electron microscopy (SEM) investigations (Figure 2-9), the seeds were examined with the model of Jeol JSM--6060 scanning electron microscope.

4. Results and discussion

Seeds of 8 threatened plant species from 6 families were studied. Among them, *A. antitaurica*, *M. macbeathianum* were gathered second times after type collection. These 2 species and also *G. confertum*, *J. inops* and *V. hadschinense* only distributed in Tahtalı mountains. While 3 of the species (*C. aytachii*, *S. balansae*, *T. antitauricum*) have also very small extent of occurrence in addition to Tahtalı mountains. *C. aytachii*, *S. balansae*, *T. antitauricum* were collected by several scientists from neighbouring areas which are very close to this range.

IUCN categories of the species are as follows; *C. aytachii*, *M. macbeathianum* are CR (Critically Endangered). *A. antitaurica*, *J. inops*, *S. balansae* and *V. hadschinense* are EN (Endangered), *G. confertum* and *T. antitauricum* are VU (Vulnerable) (Ekim et al., 2000).

4.1. Seed morphology of the species

Anthemis antitaurica

Achenes straw coloured to pale brown, oblong, 3.05-3.25 x 1-1.19 mm, 7 ribbed on both surfaces, corona 0.5-0.7 mm. Hilum elliptic; c. 0.5 mm. Sculpture ornamentation reticulate-alveolate. The ornamentation is characterised by the surface cells with mostly tetragonal walls and many transversal striae between lateral walls (Figure 2).

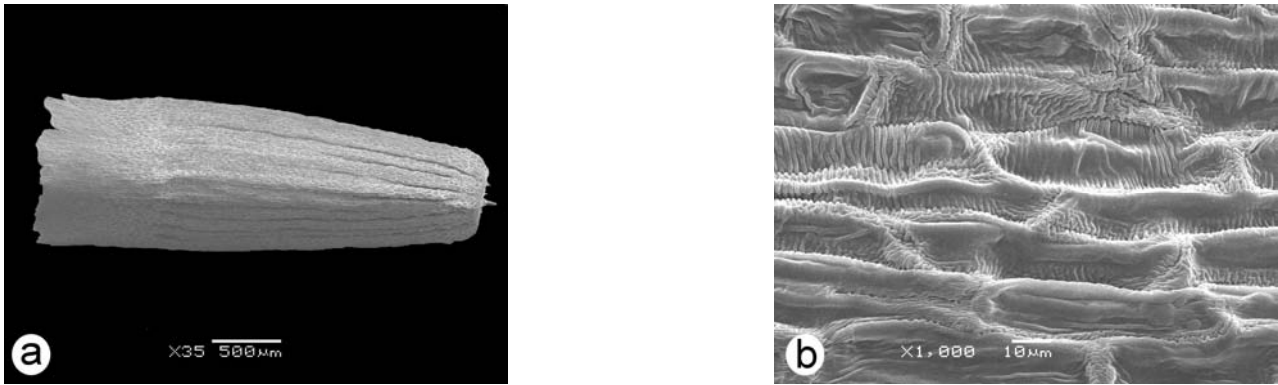


Figure 2. Achene of *Anthemis antitaurica*; general view (a), surface (b)

Cirsium aytachii

Achenes dark brown to blackish, elliptic, shiny, 5.5-6.16 x 2.2-2.5 mm. Hilum elliptic, oblique, 0.2-0.25 mm. Sculpture ornamentation finely striate (Figure 3).

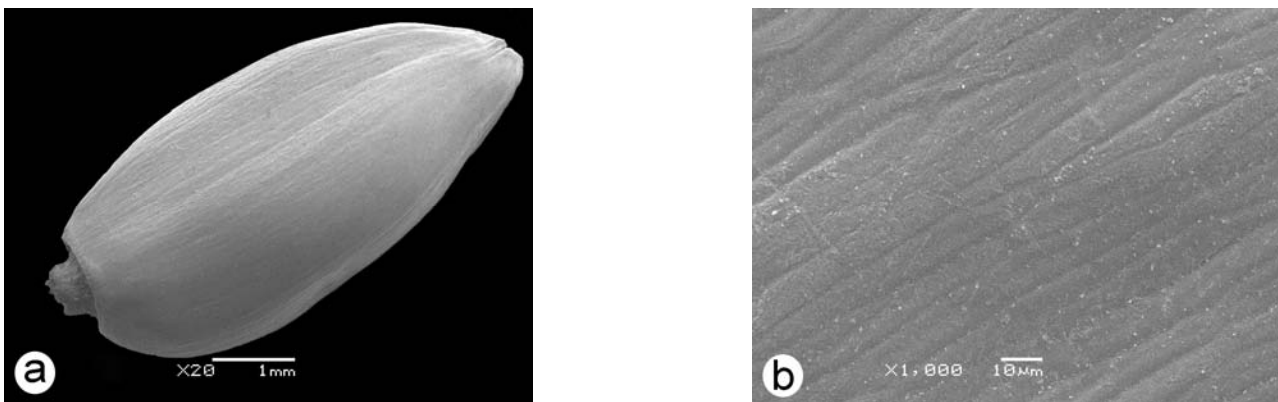


Figure 3. Achene of *Cirsium aytachii*; general view (a), surface (b)

Grammosciadium confertum

Mericarps straw coloured, narrowly oblong, narrowed towards the base, 9-13 x 1.5-2 mm. Hilum broadly elliptic to orbicular, 0.7-1.9 mm. Stylopodium 0.5-1 mm. Sculpture pattern irregularly arranged, finely striate and sparsely scrobiculate.

Mericarps dissimilar, outer mericarps with 5 primary ridges; second and fourth ridges ending in a horn. Inner with 3 conspicuous and 2 inconspicuous primary ridges; first, third and fifth ridges ending in a horn. Horns triangular and acute, 0.4-0.7 mm. Each mericarps with 4 filiform secondary ridges (Figure 4).

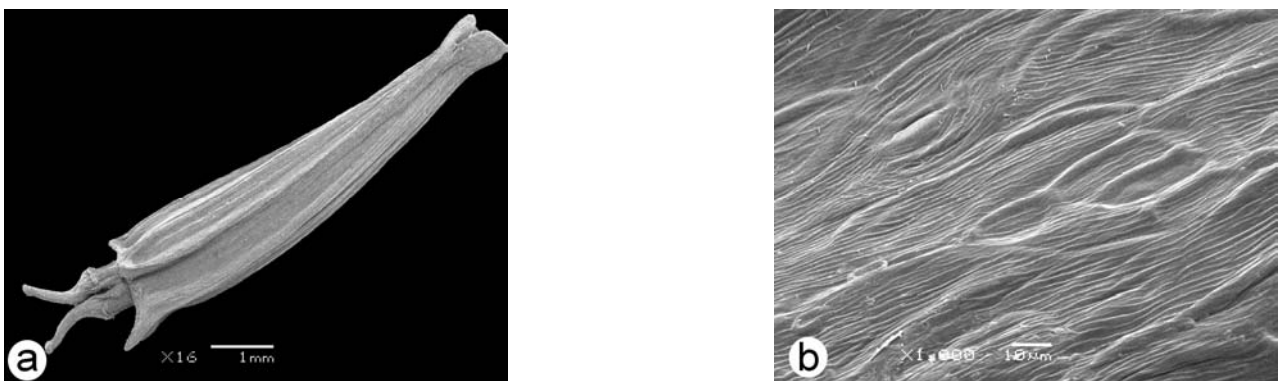


Figure 4. Seed of *Grammosciadium confertum*; general view (a), surface (b)

Muscari macbeathianum

Seeds black, elliptic, 1.4-2.4 x 0.6-0.9-1 mm. Hilum linear, oblique, 0.1-0.19 x 0.06-0.008 mm. Sculpture ornamentation rugose represented by irregular convex reticulated lines (Figure 5).

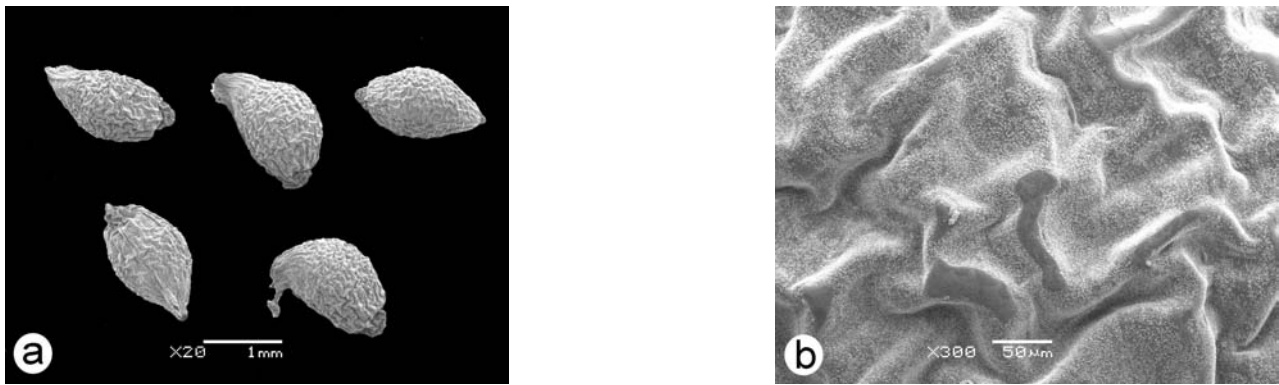


Figure 5. Seeds of *Muscari macbeathianum*; general view (a), surface (b)

Jacobaea inops

Achenes brown, oblong, hairy, 2-3 x 1.2-1.5 mm. Hilum elliptic. Sculpture ornamentation finely and irregularly striate (Figure 6).

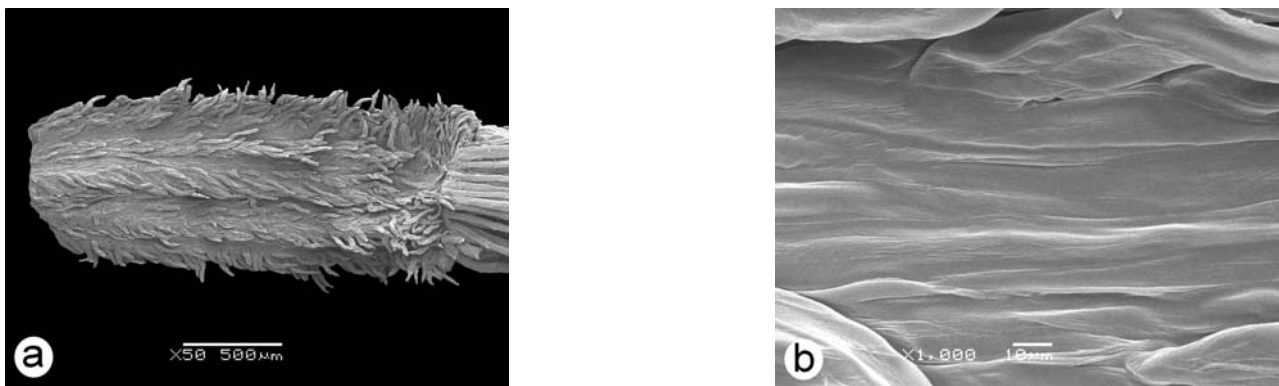


Figure 6. Achene of *Jacobaea inops*; general view (a), surface (b)

Silene balansae

Seeds pale to dark brown, reniform, 1.6-2.1 x 1-1.5 mm. Hilum semi-orbicular, 0.1-0.2 mm. Sculpture ornamentation pustulate which is characterised by the irregular surface cells with toothed margins (Figure 7).

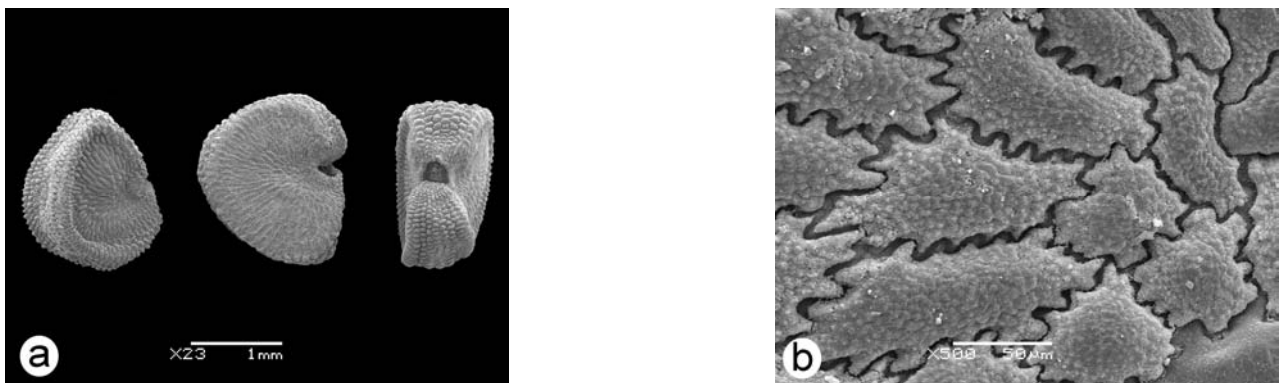


Figure 7. Seeds of *Silene balansae*; general view (a), surface (b)

Teucrium antitauricum

Nutlets brown, ovate to oblong, glandular, 1.2-1.9 x 0.5-1 mm. Hilum broadly ovate, 0.4-0.6 mm. Sculpture ornamentation reticulate-alveolate. The ornamentation is marked by pitted surface cells with mostly polygonal or orbicular walls (Figure 8).

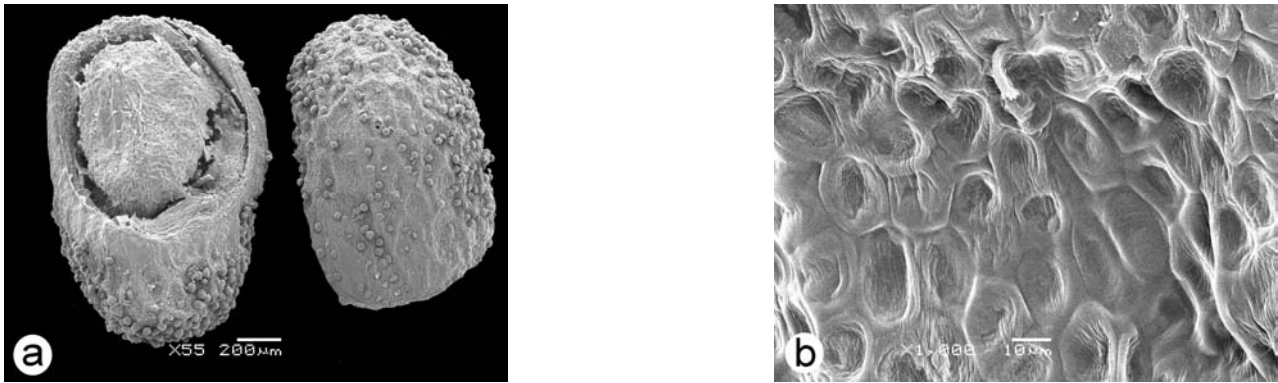


Figure 8. Nutlets of *Teucrium antitauricum*; general view (a), surface (b)

Verbascum hadschinense

Seeds dark brown, oblong, 0.6-0.8 x 0.4-0.5 mm. Hilum very small and orbicular. Seed coat sculpture is formed by tetragonal cells with regular radial walls showing a reticulate appearance. The walls surrounding each cell are characterized by blisters. The blisters are only found to the angles where two perpendicular walls reach each other (Figure 9).

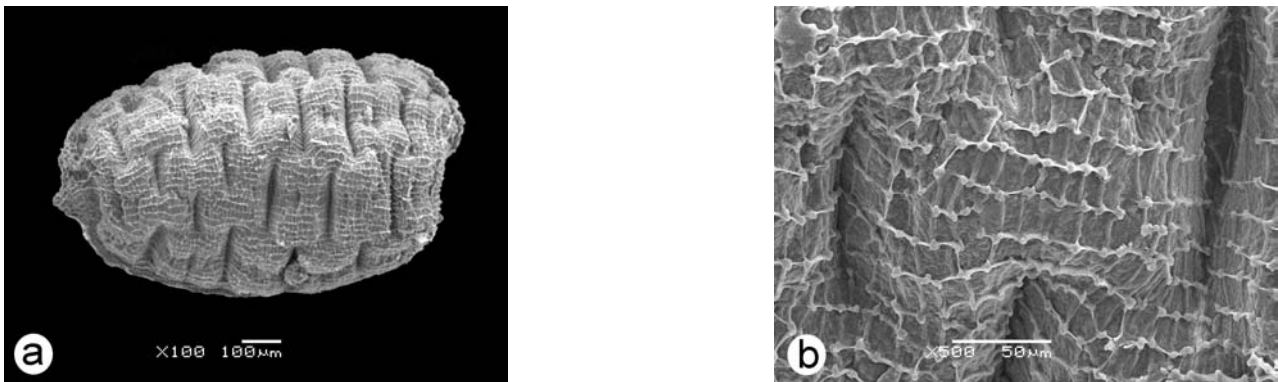


Figure 9. Seed of *Verbascum hadschinense*; general view (a), surface (b)

Table 1. Fruit types and seed characters

| Species | Fruit type | Colour | Shape | Size (mm) | Surface | Average weight (mg) |
|-------------------------|------------|------------------------------|-----------------|---------------------|--|---------------------|
| <i>A. antitaurica</i> | achene | straw coloured to pale brown | oblong | 3.05-3.25 x 1-1.19 | reticulate-alveolate | 0.935 |
| <i>C. aytachii</i> | achene | dark brown to blackish | elliptic | 5.5-6.16 x 2.2-2.5 | finely striate | 7.88 |
| <i>G. confertum</i> | mericarp | straw coloured | narrowly oblong | 9-13 x 1.5-2 | finely striate and sparsely scrobiculate | 10.26 |
| <i>M. macbeathianum</i> | capsule | black | elliptic | 1.4-2.4 x 0.6-0.9-1 | rugose | 0.545 |
| <i>J. inops</i> | achene | brown | oblong | 2-3 x 1.2-1.5 | finely and irregularly striate | 0.875 |
| <i>S. balansae</i> | capsule | pale to dark brown | reniform | 1.6-2.1 x 1-1.5 | pustulate | 1.43 |
| <i>T. antitauricum</i> | nutlet | brown | ovate to oblong | 1.2-1.9 x 0.5-1 | reticulate-alveolate | 0.36 |
| <i>V. hadschinense</i> | capsule | dark brown | oblong | 0.6-0.8 x 0.4-0.5 | reticulate | 0.11 |

Consequently, 4 fruit types (achene, capsule, nutlet and mericarp) and 7 ornamentation types (reticulate, reticulate-alveolate, finely striate, finely and irregularly striate, finely striate and sparsely scrobiculate, rugose, pustulate) were

determined. 4 of the seeds are oblong, 2 of them are elliptic, 1 of them are reniform and 1 of them is ovate to oblong in shape. Their average weights vary from 0.11 to 10.26 mg (Table 1). Also the relationship between seed length and seed width of the species is shown in Figure 10. *G. confertum* has the longest seeds, while the broadest seeds belong to *C. aytachii*. *V. hadschinense* has the shortest and the narrowest seeds (Figure 10).

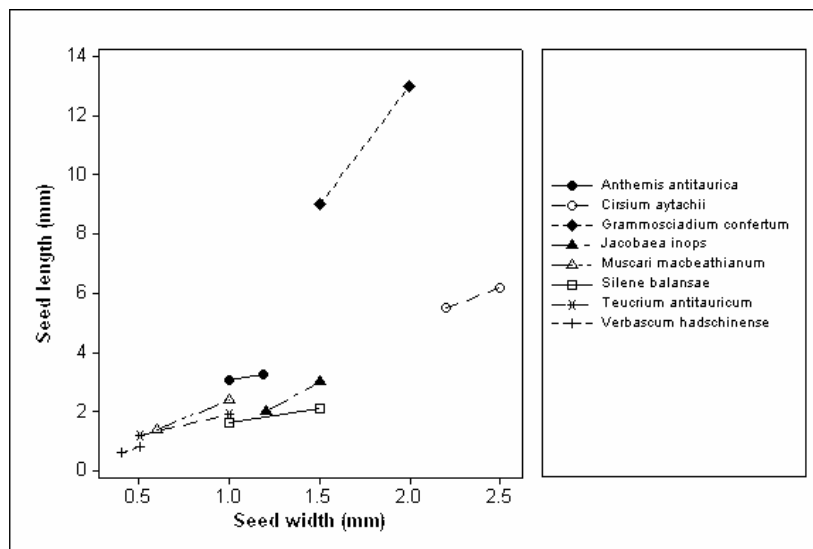


Figure 10. Relationship between seed length and seed width

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