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Seed Anatomy of Five Vicia L. (Leguminosae) Species

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Abstract: In this study, the seeds of five *Vicia* L. (Leguminosae) species were anatomically investigated. The present work deals with the following species: *Vicia cracca* subsp. *cracca* L., *V. tetraspermae* (L.) Schreb., *V. hirsuta* (L.) S.F. Gray., *V. hybrida* L. and *V. sativa* subsp. *nigra* L. Seed sections (10-15 μ m) were obtained and used to establish tissue and cell features. Our data indicate that the seed coat of *Vicia* species have a rough cuticle surface and a rigid structure. The structure of seed coat shows that there are significant differences among species based on the layers and cell sizes of seed coats.

Key words: Vicia, seed anatomy, leguminosae

Introduction

Seed feature is one of the certain important characters used in the plant taxonomy. It has been known that the seed shape and the size are key to species. Also, the surface shapes of the seeds, sometimes, have been used to distinguish varieties from each other (Cutter, 1971).

Seeds coated hard seed coat are not only more resistant to enviromental factors, but also they preserve their shape a long time. Generally speaking, most of the Leguminosae members possess hard seed coat and contain less moisture. In this family, the seeds develop from ovules with two integuments, outer and inner. When the outer integument differentiates into the certain layers during seed development, the inner integument disappears (Esau, 1965). The seeds of Leguminasae are very hard and impermeable to water. In the seeds of the family members, water may only get into the seeds by hylum or cracking cuticle which is present in the outer side of the testa (Mayer and Poljakoff-Mayer, 1982).

The anatomical features of Leguminasae seeds show differences when compared with other groups of the same family. In this family, epidermis cells resembled to parenchyma cells of seed testa are composed of macrosclereids. However, the cells formed subepidermis are made up from osteosclereids. Parenchyma cells take place under the subepdermis (Cutter, 1971).

Detailed studies concerning anatomical features of Leguminasae seeds are scare. However, it was reported that the seed anatomy of some *Astragalus* species were examined (Çobanoglu, 1986; Çobanoglu and Altan, 1989). Metcalfe and Chalk (1972) have reported that some anatomic features of Leguminosae has been mentioned such as leaf, stem and wood anatomy, except seed anatomy.

No studies on the seed anatomy of *Vicia* have previously been reported. The main objective of the present paper was to investigate the seed anatomy of some *Vicia* species comparatively.

Materials and Methods

Vicia species (*Vicia cracca* subsp. *cracca* L., *V. tetraspermae* (L.) Schreb., *V. hirsuta* (L.) S.F. Gray., *V. hybrida* L. and *V. sativa* subsp. *nigra* L.) examined in this study were collected in the vicinity of Trabzon in 1993. The specimen were fixed in FAA (90 ml 50% Ethanol, 5 ml glacial asetic acid, 5 ml Formol) at 24 h and then stocked in 70% Ethanol. Some of these specimen were also preserved as herbarium materials. The seeds were removed from FAA solution and passed through alcohol-xylol series. A good many of cross sections (10-15 μ m) were taken from paraffin blocks with microtome. Staining was carried out in safranin-fastgreen (Algan, 1981).

Photos were taken by camera Olympus BH2 and figures were drawn from permanent slides. The herbarium materials and the permanent slides were deposited in the department of Biology, Karadeniz Technical University, Trabzon.

Results

The seeds of *Vicia* species examined are spherical. The colours of the seeds range from green to dark-brown and their surfaces are generally covered with dark-brown spots. Their testa are as hard as other Leguminosae members. The cells formed epidermis of testa are composed of macrosclereids in a row, and under this, cell line are formed by osteosclereids. Followingly, a tissue formed of parenchyma cells which have large intercellular cell space, in different size and shape is located.

This paper deals with seed anatomy of the following species.

Vicia cracca subsp. *cracca* L.: The seeds are 2.2-2.8 mm in diameter. The thickness of the cuticle that is % out of testa is 4-5 μ m and undulate. Macrosclereids are long cylindric, compact arrangement, with large nucleus and 70-85 μ m in length. Osteosclereids are generally 32-41 μ m in length and quadrangle shape (Fig. 1).

Vicia tetraspermae (L.) Schreb.Spic: The seeds are 1.4-1.6 mm in diameter. The cuticle thickness is 4.1-5.8 μ m. Macrosclereids are compact arrangement, cylindric and 51-74 μ m in length. Osteosclereids are 17-26 μ m (Fig. 2).

Vicia hirsuta (L.) S.F. Gray: The seeds are 1.9-2.2 mm in diameter. The cuticle thickness is 4.1-5.8 μ m. Macrosclereids are 50-55 μ m in length and cylindric. Osteosclereids are 23.5-26.4 μ m in size (Fig. 3).

Vicia hybrida L.: The seeds are 4.2-4.8 mm in diameter. The cuticle thickness vary between 5 and 6 μ m. Macrosclereids are 99.2-105.8 μ m in length and osteosclereids are also 23-29 μ m in length (Fig. 4).

Vicia sativa subsp. *nigra* L.: The seed size range between 2.2-2.4 mm in diameter. The thickness of the cuticle vary between 4.7 and 5.8 μ m. Macrosclereids and osteosclereids are 62-70 and 32-35 μ m in length, respectively (Fig. 5).



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Fig. 1-5: Cross sections of the seeds of five Vica L. Species; a) photograph, b) drawings; cu: cuticle, n: nucleus, ms: macrosclereid, os: osteosclereid, p: parenchyma. 1. Vicia cracca subsp. cracca L., 2. V. tetraspermae (L.) Schreb., 3. V. hirsuta (I.) S. F. Gray, 4. V. hybrida L., 5. V. sativa subsp. nigra L.

Table 1: Morphological and anatomical data of five Vicia L. species (Means of three different extraction and determinations. Means were compared within each column of the data, not rows

Species	Seed diam. (mm)	Cuticle thickness (µm)	Makrosklereid size (µm)	Ostesklereid size (µm)	Total Thickness (µm)
Vicia cracca					
subsp. <i>cracca</i>	2.36 ± 0.3	4.93 ± 0.7	73.00 ± 6.9	35.45 ± 5.4	119.00 ± 10.1
Vicia tetrasperma	1.46 ± 0.1	5.29 ± 0.7	51.74 ± 1.6	22.34 ± 4.5	75.00 ± 3.8
Vicia hirsuta	1.96 ± 0.2	5.17 ± 0.8	50.11 ± 4.6	24.69 ± 3.4	93.46 ± 3.2
Vicia hybrida	4.42 ± 0.6	5.99 ± 0.2	101.72 ± 2.6	25.87 ± 5.7	138.04 ± 7.1
Vicia sativa	2.36 ± 0.1	5.4 ± 0.5	69.97 ± 2.4	32.04 ± 2.1	102.90 ± 2.11
subsp. <i>nigra</i>					
LSD (0.05)	0.32	*	5.73	9.56	7.95

Significantly not important (p<0.05)

Discussion

All morphological and anatomical data presented to ANOVA for evaluating. Differences among species were found to be significantly different (p = 0.05), except cuticle thickness (Table 1).

The results showed that the seeds of *Vicia* species have thick and hard testa. Out of the testa, a thick and undulate cuticle layer is present. The epidermis cells of the seeds are in a row, compact arrangement and cylindric shaped. In some studies, these cells are called as macrosclereids which resemble to palizade cells (Cutter, 1971). According to our results, the cells formed the epidermis are macrosclereids downed with vertical angles to the surface. In the testa, the subepidermis formed osteosclereids in a row takes place.

In some studies, the occurence of the layer related to the anatomical features of Leguminosae seeds was also reported (Cutter, 1971; Esau, 1965). Nevertheless, the layer has not been mentioned in a study concerned the seed anatomy of *Astragalus* L.

In this study, according to the results obtained from 5 *Vicia* species, the thickness of the testa, length of cells forming this layer and the size of the seed vary among the species. *V. hybrida* has the greast seed size. Also, the macrosclereids of this species are the longest. Although the seed size of *V. sativa* and *V. cracca* are similar, the thickness of the testa, the length of the macrosclereids and osteosclereids are different in these species (p = 0.05). While the seed size of *V. hirsuta* and *V. tetraspermae* are very different, the length of the macrosclereids in these species are rather similar.

These results shows that no correlation between the size of the seeds and the cells formed the seed's layers was

found. Even in the species of the same size seeds, it has been known that the size of the cells are different.

In the present study, the seed anatomy of five *Vicia* species were investigated comparatively. The results might be used as a support element in comparative seed anatomy in the groups, which are doubtful in terms of their systematic level.

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