

Micromorphological structure of seeds in some taxa of *Vicia* L. (Fabaceae) occurring in Azerbaijan

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Abstract: For the first time, micromorphology of seed samples and structure of seed surface of the following 17 species and subspecies of the wild vetch (*Vicia* L.) occurring in the flora of Azerbaijan were studied: *V. bithynica* (L.) L., *V. sativa* subsp. *cordata* Wulf ex Hoppe, *V. elegans* Guss., *V. hirsuta* (L.) S. F. Gray, *V. hybrida* L., *V. lutea* L., *V. monantha* Retz. (*V. cinerea* M. Bieb.), *V. narbonensis* L. (*V. johannis* Tamamsch.), *V. pannonica* Crantz, *V. peregrina* L., *V. sativa* L. subsp. *nigra* (L.) Ehrh. (*V. angustifolia* Reichard), *V. sativa* L. subsp. *sativa*, *V. tetrasperma* (L.) Schreb., *V. tenuifolia* Roth subsp. *variabilis* (Freyn et Sint. ex Freyn) Dinsm., *V. villosa* Roth subsp. *varia* (Host) Corb. (*V. dasycarpa* auct.), *V. villosa* Roth subsp. *villosa*, and *V. loiseleurii* (M. Bieb.) H. Lindb. (*V. meyeri* Boiss.). Seed samples were collected in 2015-2017 on 11 routes from different region of Azerbaijan (Zaqatala, Ordubad, Khizi, Shamakhi, Masalli, Qabala, Lerik, and Tovuz). Collected taxa belong to two subgenera (subg. *Vicia*, subg. *Vicilla*) and 8 sections (*Vicia*, *Hypechusa*, *Peregrinae*, *Faba*, *Narbonensis*, *Cracca*, *Lenticula*, and *Ervum*). In the samples, the surface structures, shape, density or waxy layer of papillae (buds with suction surface) were studied by scanning electron microscopy (SEM). Morphological characters, including general shape, color and size of seeds, were studied under a stereomicroscope. The main form of the seed's surface of the vetch patterns was papilla. However, the size of the ribs in the papillas and the density of papillas were different in different taxa. Four morphological characters of seed (the relative size and shape of the hilum, relative location of the micropile (seed entrance) relative to the hilum and the position of the hilum on the surface of the seed) have been stable. It has been established that the microscopic examination of the seed coat has important taxonomic significance and can be used to clarify the status of subgenera and sections. However, other characteristics of seeds (shape, color, seed size, etc.) can be

also used in identification of the taxa.

Key Words: *Vicia*, seed micromorphology, SEM, taxa, section, species

INTRODUCTION

Vetch (*Vicia* L.) is one of the most widespread genera of the family Fabaceae Lindl. As with other leguminous plants, taxa of *Vicia* are also selected for their nitrogen-fixing properties. In the roots of the plant, there are nitrogen-fixing bacteria that adopt the atmospheric free nitrogen and convert it into a mineral form that plants can use. During the vegetation period, vetches release these mineral substances into the soil through the roots that enriches the microflora of the soil and fertilize it. Due to this, the productivity of plants grown on the soil after the vegetation period and the quality of crop products rises [Hümbətov, Hüseyinov, 2013]. Representatives of the genus *Vicia* L. are considered to be good predecessors. This genus contains 150-210 species occurring in Europe, Asia, North America, temperate regions of South America, and partly in tropical Africa [Hanelt, Mettin, 1989; Kupicha, 1976; Perrino et al., 1984]. It has been established that in the flora of Azerbaijan the genus *Vicia* is represented by 2 subgenera, 11 sections, 39 species, 5 subspecies and 8 varieties ranging in their distribution from the sea level to mid-mountain zones [Asadova, Asgarov, 2018; Əsgərov, 2011; Əsgərov, 2016].

The monographic study of the genus was carried out by F. K. Kupicha [Kupicha, 1973, Kupicha, 1975; Kupicha, 1976]. Using the classic methods, Kupicha, based on selected morphological signs, subdivided *Vicia* into two subgenera: *Vicia* and *Vicilla* (*Cracca*). These subgenera differ in the relative length of the inflorescence and the presence or absence of nectar spots on the stipule. In their taxonomic studies of the genus *Vicia*, many scientists used the seed morphology [Büyükkartal, 2013; Gunn, 1970; Jaaska, Leht, 2007; Leht, 2005; Leht, 2009; Leokene, 1966; Perrino et al., 1984; Willis, 1973; Zertova, 1962], including micromorphology of the seed texture [Chernoff et al., 1992; Gunn, 1969; Gunn, 1970; Güneş, Ali, 2011; Hosseinzadeh et al., 2008; Kikbride et al., 2003; Lersten, 1979; Lersten, Gunn, 1981; Mettin, Hanelt, 1964; Utkin, 1965].

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The purpose of the seed is the size, general appearance, size of the hilum, and so on based on some morphological features. In the classification of species, in the phylogenetic relationships of intraspecific taxa the signs of the seed can be used as an important indication. In the first description of some vetches, as well as in “Flora” [Boissier, 1872; Grossqeym, 1952; Tamamshian, 1954], in their characteristics do not show signs of seed. In this article, the morphology and in particular micromorphology of vetch seeds were investigated and the structure of the seeds of these species was studied using SEM and were detected constant morphological characters (shape, size of the seeds; shape, location of the hilum in the seeds, and the sculpture of the seed surface).

MATERIAL AND METHODS

Specimen collection. The material for the study consisted of seeds of species of *Vicia* (*V. sativa* subsp. *cordata*, *V. sativa* subsp. *nigra*, *V. sativa* subsp. *sativa*, *V. pannonica*, *V. hybrida*, *V. lutea*, *V. peregrina*, *V. bithynica*, *V. narbonensis*, *V. tenuifolia* subsp. *variabilis*, *V. villosa*, *V. varia*, *V. monantha*, *V. elegans*, *V. hirsuta*, *V. loiseleurii*, *V. tetrasperma*), which we collected during the expeditions to different regions of Azerbaijan (Zaqatala, Ordubad, Khizi, Shamakhi, Masalli, Qabala, Lerik, and Tovuz) under the guidance of A. Asgarov in 2015-2017. We indicated information on the collection area, biotope, geographic coordinates and altitude of each seed sample in the special descriptions. Hip-sometric altitude and area coordinates were measured with a Garmin eTex 20 model GPS device according to WGS-84 (G873) (World Geodetic System). The most commonly accepted classification is the classification of Kupicha, so we accepted that classification in our work [Kupicha, 1976]. However, it should be noted that new phylogenetic results indicate that the genus *Vicia*, as traditionally understood, is not monophyletic [Endo, 2010; Fedoronchuk, 2018; Fedoronchuk, Mosyakin, 2018; Schäfer et al., 2012]. We used terminology adopted by some authors cited in our article [Chernoff et al., 1992; Fedoronchuk, Mosyakin, 2018; Güneş, Ali, 2011; Hosseinzadeh et al., 2008; Jalilian, 2011; Jalilian et al., 2010; Jalilian, Rahiminejad, 2012; Leht, 2009; Lersten, 1979; Maxted, 1993; Tamamshian, 1954; Voronchikh, 1988].

Microscopic studies. SEM analysis of plant seeds has been done on a microscope JEOL JSM 6610 LV. Modern plant seeds (both living and herbarium specimens) usually do not require special treatment for SEM. They are sufficiently dried in air. Seeds were transferred with

a special tool to previously prepared special tables covered with double adhesive carbon tape. To minimize the static effect, the samples were sprayed with golden powder for 1-2 minutes through the JEOL JFC-1100E (JEOL Ltd., Tokyo, Japan) ion sputter coater. Seeds can also be examined in the low vacuum mode without metal spraying. After that the table was placed in a microscope for SEM analysis. A general view of the seed surface and the observed features of the sculpture at high and low magnifications were photographed with a JEOL JSM6610 LV electron microscope (JEOL Ltd., USA). This microscope photographed nearly 1500 times or more in order to explore the microstructure of the seed's surface. Sometimes it was found useful to tilt the table; for example, to consider a weakly expressed sculpture. Also, on the cracked objects we can see the internal structure of the shells, which is also more convenient to do by tilting the table. The obtained data were stored on removable storage media. General shape, color and size of seeds were studied under a stereomicroscope Leica EZ4D (USA).

RESULTS AND DISCUSSION

During expeditions were collected seeds of 17 taxa of *Vicia* belonging to 2 subgenera and 8 sections (according to the system of Kupicha): *V. sativa* subsp. *cordata*, *V. sativa* subsp. *nigra*, *V. sativa* subsp. *sativa* (sect. *Vicia*); *V. hybrida*, *V. lutea*, *V. pannonica* (sect. *Hypochusa*); *V. peregrina* (sect. *Peregrinae*); *V. bithynica* (sect. *Faba*); *V. narbonensis* (sect. *Narbonensis*); *V. tenuifolia* subsp. *variabilis*, *V. villosa*, *V. varia*, *V. monantha*, *V. elegans* (sect. *Cracca*); *V. hirsuta*, *V. loiseleurii* (sect. *Lenticula*), and *V. tetrasperma* (sect. *Ervum*). The distribution of *Vicia* taxa collected from different research areas (by subgenera and sections) and descriptions of the collected seed samples are provided below:

Subgenus: *Vicia*

Sect.: *Vicia* – Annual or perennial, often climbing. Stipules without a dark nectariferous spot. Leaflets usually many-paired, small or medium-sized. Peduncle shorter than the usually 1 to few flowers, or absent. Flowers yellow to purple-violet. Calyx teeth subequal to unequal. Style compressed, usually with a tuft of hairs on the lower side towards the apex. Legumes with coriaceous valves, not torulose, less than 13 mm broad, glabrous or hairy; seeds few to many.

Seed pattern: *V. sativa* L. subsp. *cordata* Wulf ex Hoppe
Locality code AZE17St2; Collection area Lerik region,

Piran village; Biotope Rock crumple; GPS coord.: N 38°73'369; E 48°66'735; Altitude 207 m

Seed pattern: *V. sativa* L. subsp. *nigra* (L.) Ehrh.
Locality code AZE17M6; Collection area Masalli region, Gizilagaj village; Biotope meadow GPS coord.: N 39°03'0; E 48°49'4; Altitude 23 m

Seed pattern: *V. sativa* L. subsp. *sativa*
Locality code AZE17K20; Collection area Shamakhi region, Mirzandiya village; Biotope meadow; GPS coord.: N 40°34'737; E 48°43'648; Altitude 584 m

Sect.: *Hypechusa* (Alef.) Aschers. & Graebner – annual plant, stems with partial replacement of cortical vascular bundles at the nodes. Leaves tendrillous; leaflets many-paired. Inflorescence many to 1-flowered. Flowers pedunculate or sessile in leaf-axils, yellowish or very rarely purplish, calyx irregular; legume rhomboidal (sutures not parallel). Seeds with medium to short hilum; micropile on opposite side of the seed from the hilum; testa smooth.

Seed pattern: *V. hybrida* L.
Locality code AZE16D6; Collection area Shamakhi district, Shamakhi-Agsu highway; Biotope roadside; GPS coord.: N 40°38'550; E 48°28'450; Altitude 794 m

Seed pattern: *V. lutea* L.
Locality code AZE17K19; Collection area Shamakhi region, Pirgulu village; Biotope forest; GPS coord.: N 40°46'864; E 48°36'168; Altitude 1430 m

Seed pattern: *V. pannonica* Crantz
Locality code AZE17K20; Collection area Shamakhi region, Mirzandiya village; Biotope meadow; GPS coord.: N 40°34'737; E 48°43'648; Altitude 584 m

Sect.: *Peregrinae* Kupicha – annual plant, stems with complete replacement of cortical vascular bundles at the nodes. Leaves tendrillous, multijugate. Inflorescence 1-flowered, not pedunculate but flowers are on fairly long pedicels. Flowers whitish, pale yellow or dark violet. Calyx irregular; legume rhomboidal. Seeds with very short hilum; micropile near the hilum; testa smooth.

Seed pattern: *V. peregrina* L.
Locality code AZE17K20; Collection area Shamakhi region, Mirzandiya village; Biotope meadow; GPS coord.: N 40°34'737; E 48°43'648; Altitude 584 m

Sect.: *Faba* (Miller) Ledeb. – Annuals, seldom climb-

ing. Leaflets 1-3- paired, larger than Sect. *Vicia*. Peduncle shorter or sometimes longer than the large (16-30 mm) flowers. Flowers purplish or bicoloured. Calyx teeth subequal to unequal. Style compressed, with a tuft of hairs on the lower side towards the apex. Legume (with coriaceous hairy valves) and seeds usually larger than in other Sections.

Seed pattern: *V. bithynica* (L.) L.
Locality code AZE17M6; Collection area Masalli region, Gizilagaj village; Biotope meadow GPS coord.: N 39°03'0; E 48°49'4; Altitude 23 m

Sect.: *Narbonensis* (Radzhi) Maxted – Annual. Erect; stem stout. Stipules semi sagittate; Leaf 7-126 mm; apex tendrilous; 2-12 leaflets per leaf; Peduncle with 1-6 flowers. Calyx mouth oblique; Flowers 14-36 mm; all petals approximately equal length; standard cream, blue or purple. Legume; rectangular or rhomboid; valves pubescent; hairs tuberculate; septa absent or present; 2-9 seeds per legume. Seeds round; hilum less than quarter of seed circumference; micropyle positioned near hilum; testa surface smooth.

Seed pattern: *V. narbonensis* L. (*V. johannis* Tamašsch.)
Locality code AZE17Z9; Collection area Qabala region, Amirvan village; Biotope bank of river; GPS coord.: N 40°40'906; E 47°08'421; Altitude 535 m

Subgenus: *Vicilla* (Schur) Rouy
Sect.: *Cracca* S. F. Gray – Annual to perennial, often climbing. Stipules without a dark nectariferous spot. Leaflets few- many- paired, small to large. Peduncle usually much longer than the 1- many flowers. Flowers usually blue- lilac to purplish- red, rarely yellow. Calyx usually irregular and gibbous. Style compressed, equally pubescent all round near the apex. Legumes with coriaceous, glabrous or hairy valves, not torulose; seeds few to many.

Seed pattern: *V. tenuifolia* Roth subsp. *variabilis* (Freyn & Sint. ex Freyn) Dinsm.
Locality code AZE17K19; Collection area Shamakhi region, Pirgulu village; Biotope forest; GPS coord.: N 40°46'864; E 48°36'168; Altitude 1430 m.

Seed pattern: *V. villosa* Roth subsp. *villosa*
Locality code AZE17K20; Collection area Shamakhi region, Mirzandiya village; Biotope meadow; GPS coord.: N 40°34'737; E 48°43'648; Altitude 584 m

Seed pattern: *V. villosa* Roth subsp. *varia* (Host) Corb. (*V. dasycarpa* auct.)

Locality code AZE15Z2; Collection area Zaqatala region, Yukhari Tala village, Parzivan area; Biotope roadside; GPS coord.: N 46°35'29; E 41°34'227; Altitude 358 m

Seed pattern: *V. monantha* Retz. (*V. cinerea* M. Bieb.)

Locality code AZE16D6; Collection area Shamakhi district, Shamakhi-Agsu highway; Biotope roadside; GPS coord.: N 40°38'550; E 48°28'450; Altitude 794 m

Seed pattern: *V. elegans* Guss.

Locality code AZE16E4; Collection area Ordubad region, Tivi village; Biotope foothills; GPS coord.: N 39°06'476; E 45°54'702; Altitude 1920 m

Sect.: *Lenticula* Aschers. & Graebn. (=Genus *Ervilia* Link, sect. *Ervilia* (Link.) W.D.J.Koch)– Annual, apex tendrilous; leaflets are narrow and linear. The flowers are small, in long flower pedicels; single or multiple. Legume is rhombic; with 2-3 seeds.

Seed pattern: *V. hirsuta* (L.) S. F. Gray (*E. hirsuta* (L.) Opiz)

Locality code AZE17TM6; Collection area Tovuz region, Asrik village; Biotope grassland; GPS coord.: N 40°47'430; E 45°35'560; Altitude 1150 m

Seed pattern: *V. loiseleurii* Boiss. (*V. meyeri* Boiss.) (= *E. loiseleurii* (M.Bieb.) H.Schaeff.)

Locality code AZE16E1; Collection area Ordubad region, Paragha village; Biotope roadside; GPS coord.: N 39°05'10; E 45°05'13; Altitude 1644 m

Sect.: *Ervum* (L.) S. F. Gray (=Genus *Ervum* L., sect. *Ervum* (L.) Taub.) – Slender annuals, with habit and inflorescence similar to Sect. *Cracca*, but peduncle 1-6-flowered. Flowers smaller (2-14 mm), calyx not gibbous. Style shorter (less than 3 mm) and terete, shortly pubescent all round or rarely glabrous. Legumes oblong- rhomboid or linear, frequently torulose, with coriaceous valves; seeds few.

Seed pattern: *V. tetrasperma* (L.) Schreb. (= *E. tetraspermum* L.)

Locality code AZE16E5 ; Collection area Khizi region, Vardah village, the road to the plateau; Biotope roadside; GPS coord.: N 40°53'402; E 48°05'959; Altitude 991m.

Micromorphological structure characteristics of seeds have been analyzed and important diagnostic ele-

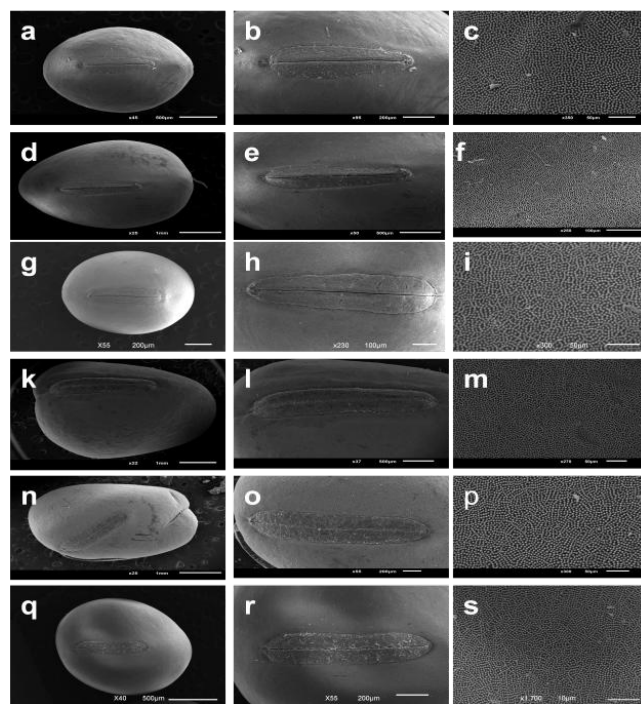


Figure 1. General shape, hilum shape and seed sculpture some of examined taxa: a-c. *V. sativa* subsp. *cordata*, d-f. *V. sativa* subsp. *sativa*, g-i. *V. sativa* subsp. *nigra*, k-m. *V. hybrida*, n-p. *V. lutea*, q-s. *V. pannonica* Scale bars: a-c. 500, 200, 50 μ m; d-f. 1mm, 500, 100 μ m, g-i. 200, 100, 50 μ m; k-m. 1 mm, 500, 50 μ m; n-p. 1 mm, 200, 50 μ m; q-s. 500, 200, 10 μ m.

ments have been identified that may be useful for systematics of controversial taxa. In this work were studied morphology and in particular micromorphology of seeds in order to investigate the relationships between intraspecific groups of the genus *Vicia*. Morphological characters of seed samples from 17 vetch taxa and the microsculpture of the seed coat were analyzed using SEM. It has been demonstrated that the seed characters of important taxonomic significance are: the size and shape of the seed, the size and shape of the hilum, and the microscopic appearance of the seed coat.

The majority of seed samples are spherical and oblong. The largest seeds are found in *V. narbonensis*, and the smallest ones in *V. tetrasperma*. Seeds are stained and striped. Hilum can be different of different patterns: long, loose or oval.

In all seed samples, the seed coat is papillate. Papillae are large and small. Density, size and shape of papillae differ depending on the type of the papilla. The density of the papillae is estimated to be moderate to high.

In this study, some characteristics of the seeds were used for the taxonomic delimitation and the identifica-

tion of them was held according to these characteristics (Table 1). Oblong-ovate hilum was observed in *V. sativa* subsp. *cordata*, *V. sativa* subsp. *nigra*, *V. sativa* subsp. *sativa*, which belong to section *Vicia*. Broad-ovate hilum was observed in *V. bithynica* (belonging to sect. *Faba*), *V. narbonensis* (sect. *Narbonensis*), and *V. loiseleurii* (sect. *Lenticula*). Oblong-elliptic hilum

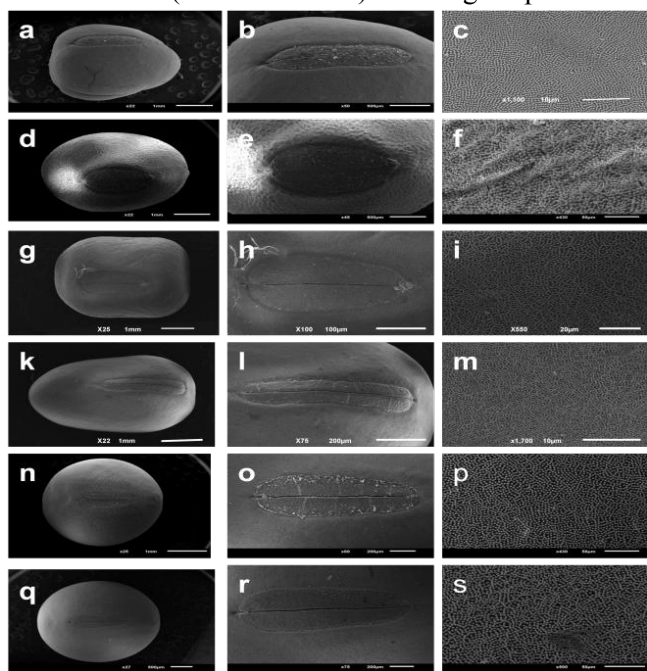


Figure 2. General shape, hilum shape and seed sculpture some of examined taxa: a-c. *V. peregrina*, d-f. *V. bithynica*, g-i. *V. narbonensis*, k-m. *V. tenuifolia* subsp. *variabilis*, n-p. *V. villosa*, q-s. *V. varia*.

Scale bars: a-c. 1mm, 200, 50 µm; d-f. 1 mm, 500, 100 µm; g-i. 200, 100, 50 µm; k-m. 1mm, 500, 50 µm; n-p. 1mm, 200, 50 µm; q-s. 500, 200, 10 µm.

is peculiar to *V. hirsuta* (sect. *Lenticula*), *V. tenuifolia* subsp. *variabilis*, *V. villosa* subsp. *villosa*, *V. monantha*, and *V. elegans* (sect. *Cracca*). Elliptic hilum was observed in *V. pannonica*, *V. hybrida*, *V. lutea* (sect. *Hypochusa*), and *V. peregrina* (sect. *Peregrinae*), but ovate hilum was found in *V. tetrasperma* (sect. *Ervum*) and *V. villosa* subsp. *varia* (sect. *Cracca*). The papillae with medium density were observed in *V. narbonensis* and *V. tenuifolia* subsp. *variabilis* (Fig. 2. g-i, k-m). Dense papilla were observed in *V. sativa* subsp. *cordata*, *V. sativa* subsp. *sativa*, *V. sativa* subsp. *nigra* (Fig. 1. a-c, d-f, g-i), *V. hybrida*, *V. lutea*, *V. pannonica* (Fig. 1. k-m, n-p, q-s), *V. peregrina* (Fig. 2. a-c), *V. bithynica* (Fig. 2. d-f), *V. loiseleurii* (Fig. 3. k-m), *V. tetrasperma* (Fig. 3. n-p), *V. villosa* subsp. *villosa* (Fig. 2. n-p), *V. monantha*,

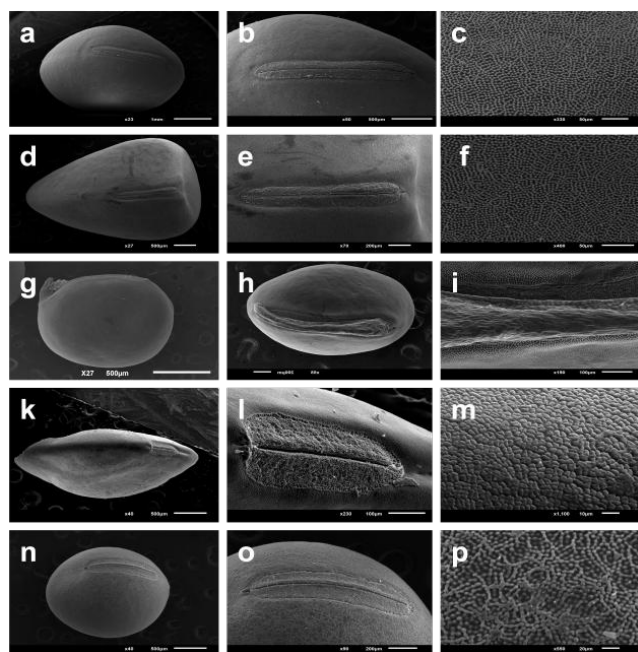


Figure 3. General shape, hilum shape and seed sculpture some of examined taxa: a-c. *V. monantha*, d-f. *V. elegans*, g-i. *V. hirsuta*, k-m. *V. loiseleurii*, n-p. *V. tetrasperma*

Scale bars: a-c. 1 mm, 500, 50 µm; d-f. 500, 200, 50 µm; g-i. 200, 100, 10 µm; k-m. 500, 100, 10 µm; n-p. 500, 200, 20 µm.

and *V. elegans* (Fig. 3. a-c, d-f). Low density papillas are in *V. hirsuta* (Fig. 3. g-i). The result showed that 8 taxa had conical, multirib papillas with waxy specks: *V. sativa* subsp. *cordata*, *V. sativa* subsp. *nigra*, *V. sativa* subsp. *sativa*, *V. lutea*, *V. bithynica*, *V. narbonensis*, *V. loiseleurii* and *V. villosa* subsp. *villosa*. However, truncate conical papilla were observed in *V. hirsuta*, *V. loiseleurii* and *V. tetrasperma*.

CONCLUSIONS

The results demonstrated that the microscopic examination of the seed coat has important taxonomic significance and can be used to clarify the status of subgenera and sections. However, other characteristics of seeds (shape, color, seed size, etc.) can be also used in identification of the taxa. Seed characters can be used for taxonomic delimitation and identification of some infrageneric and species-rank taxa, but these characters should be used with caution and preferably in combination with other macro- and micromorphological characters.

Table 1. Testa texture of examined taxa.

Signs	Seed shape	Seed size (mm)	Seed colour	Density of papillas	Shape of papillas	Texture	Shape of hilum	Hilum size (mm)
Seeds								
<i>V. sativa</i> subsp. <i>cordata</i>	round	1.991 x 1.614	black	density	conical, multirib, with waxy speckled	papillose	oblong-ovate	0.938 x 0.298
<i>V. sativa</i> subsp. <i>nigra</i>	spherical	2.422	dark brown, with spot	density	conical, multirib, with waxy speckled	papillose	oblong-ovate	1.503 x 0.437
<i>V. sativa</i> subsp. <i>sativa</i>	compressed spherical	4.150 x 2.678	brown, velvety	density	conical, multirib, with waxy speckled	papillose	oblong-ovate	1.961 x 0.425
<i>V. pannonica</i>	spherical	4.138	black, velvety	density	conical, multirib	papillose	elliptic	2.243 x 0.569
<i>V. hybrida</i>	round	4.946 x 3.768	brown, with dark spot, marble	density	conical, multirib	papillose	elliptic	2.977 x 0.591
<i>V. lutea</i>	compressed round	4.017 x 2.325	dark brown, low marble	density	conical, multirib, with waxy speckled	papillose	elliptic	1.923 x 0.522
<i>V. peregrina</i>	round	4.627	dark brown, marble	density	conical, multirib	papillose	elliptic	1.857 x 0.384
<i>V. bithynica</i>	spherical	4.089 x 3.076	dark green, with brown spot	density	conical, multirib, with waxy speckled	papillose	broad-ovate	1.941 x 1.145
<i>V. narbonensis</i>	spherical	4.556 x 4.145	black, velvety	medium	large conical, with waxy speckled	papillose	broad-ovate	2.145 x 1.189
<i>V. hirsuta</i>	compressed spherical	2.2	dark brown	low density	truncate conical	tiny papillose	oblong-elliptic	1.656 x 0.258
<i>V. loiseleurii</i>	compressed spherical	2.815 x 1.250	dark brown	density	truncate conical, with waxy speckled	papillose	broad-ovate	0.428 x 0.225
<i>V. tetrasperma</i>	low compressed	1.915 x 1.740	green, with black spot	density	truncate conical	tiny papillose	ovate	1.113 x 0.247
<i>V. tenuifolia</i>	spherical	4.168 x 2.760	light brown, with black spot	medium	small conical multirib	papillose	oblong-elliptic	2.115 x 0.424
subsp. <i>variabilis</i>	elliptic							
<i>V. villosa</i> subsp. <i>villosa</i>	spherical	3.240 x 3.048	black, with brown spot	density	conical multirib	papillose	oblong-elliptic	1.297 x 0.448
<i>V. villosa</i> subsp. <i>varia</i>	round	2.821 x 2.771	black	density	conical, multirib, with waxy speckled	papillose	ovate	1.319 x 0.467
<i>V. monantha</i>	spherical	3.903 x 3.711	light brown, with dark spot	density	small conical, multi rib	papillose	oblong-elliptic	2.040 x 0.309
<i>V. elegans</i>	ovate	3.947 x 3.083	black, marble	density	broad conical	papillose	oblong-elliptic	1.462 x 0.281

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Azərbaycanda yayılan bəzi lərgə taksonlarında toxumların mikromorfoloji quruluşu

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İlk dəfə olaraq, Azərbaycan florasında yayılan 17 yabanı lərgə (*Vicia* L.) növü və yarımövünə aid (*V. bithynica* (L.) L., *V. sativa* subsp. *cordata* Wulf, ex Hoppe, *V. elegans* Guss, *V. hirsuta* (L.) S. F Gray, *V. hybrida* L., *V. lutea* L., *V. monantha* Retz (*V. cinerea* Bieb.), *V. narbonensis* L. (*V. johannis* Tamamsch.), *V. pannonica* Crantz, *V. peregrina* L., *V. sativa* subsp. *nigra* (L.) Ehrh. (*V. angustifolia* Reichard), *V. sativa* subsp. *sativa* L., *V. tetrasperma* (L.) Schreb., *V. tenuifolia* subsp. *variabilis* (Freyn et Sint.) Dinsm., *V. villosa* subsp. *varia* (Host) Corb. (*V. dasicarpa* auct.), *V. villosa* subsp. *villosa* Roth, *V. loiseleurii* (M. Bieb.) H. Lindb. (*V. meyeri* Boiss.)) toxum nümunələrinin mikromorfologiyası və toxum səthinin quruluşu skan elektron mikroskopu (SEM) vasitəsilə tədqiq edilmişdir. Toxum nümunələri 2015-

2017-ci illərdə Azərbaycanın müxtəlif bölgələrindən (Zaqatala, Ordubad, Xızı, Şamaxı, Masallı, Qəbələ, Lərik, Tovuz) 11 marşrut üzrə toplanılmışdır. Toplanılan toxum nümunələri 2 yarımçins (*Vicia*, *Vicilla*) və 8 seksiyaya (*Vicia*, *Hypechusa*, *Peregrinae*, *Faba*, *Narbonensis*, *Cracca*, *Lenticula*, *Ervum*) aiddir. Toxum nümunələrində səthin quruluşu, papillaların (toxum səthində əmzik şəkilli çıxıntılar) forması, sıxlığı, səthin kəsikli və ya mumlu təbəqəsi skan elektron mikroskopiyaya metodu (SEM) vasitəsilə öyrənilmişdir. Tədqiqat zamanı toxumun morfoloji əlamətləri, o cümlədən ümumi forması, ölçüsü, rəngi stereomikroskop vasitəsilə müəyyən edilmişdir. Lərgə taksonlarında toxum səthinin başlıca forması papillalar olmuşdur. Lakin papillalarda yan kəsiklərin ölçüsü və papillaların sıxlığı müxtəlif taksonlarda fərqli olmuşdur. Toxumun dörd morfoloji əlaməti: hilumun nisbi ölçüsü və forması, mikropilenin (toxum girişinin) hiluma nəzərən nisbi yerləşməsi, hilumun toxum səthində tutduğu mövqe sabit olmuşdur. Müəyyən edilmişdir ki, toxum təbəqəsinin mikroskopik tədqiqi mühüm rol oynayır və yarımçins və seksiyaların statusunun dəqiqləşdirilməsində istifadə oluna bilər. Toxumun digər əlamətləri (forması, rəngi, toxumun ölçüsü) isə taksonların təyin olunmasında qiymətli hesab edilir.

Açar sözlər: *Vicia*, toxum mikromorfologiyası, SEM, takson, seksiya, növ

Микроморфологическое строение семян некоторых таксонов вики распространенных в Азербайджане

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Впервые проведено детальное микроморфологическое исследование образцов семян и анализ структуры семенной поверхности 17 видов и подвидов дикой вики (*Vicia* L.), представленных во флоре Азербайджана (*V. bithynica* (L.) L., *V. sativa* subsp. *cordata* Wulf, ex Hoppe, *V. elegans* Guss, *V. hirsuta* (L.) S. F Gray, *V. hybrida* L., *V. lutea* L., *V. monantha* Retz (*V. cinerea* Bieb.), *V. narbonensis* L. (*V. johannis* Tamamsch.), *V. pannonica* Crantz, *V. peregrina* L., *V. sativa* subsp. *nigra* (L.) Ehrh. (*V. angustifolia* Reichard), *V. sativa* subsp. *sativa* L., *V. tetrasperma* (L.) Schreb., *V. tenuifolia* subsp. *variabilis* (Freyn et Sint.) Dinsm., *V. villosa* subsp. *varia* (Host) Corb. (*V. dasicarpa*

auct.), *V. villosa* subsp. *villosa* Roth, *V. loiseleurii* (M. Bieb.) H. Lindb. (*V. meyeri* Boiss.)). Образцы семян были собраны на 11 маршрутах из разных регионов Азербайджана (Закалата, Ордубад, Хызы, Шамахи, Масаллы, Габала, Лерик, Товуз) в 2015-2017 годах. Собранные образцы семян относятся к 2 под родам (*Vicia*, *Vicilla*) и 8 секциям (*Vicia*, *Hypochusa*, *Peregrinae*, *Faba*, *Narbonensis*, *Cracca*, *Lenticula*, *Ervum*). В образцах структура поверхности, форма, плотность или воскообразный слой сосочков (почки с поверхностью всасывания) были изучены методом сканирующей электронной микроскопии (СЭМ). Морфологические признаки, в том числе общая форма, цвет и размеры семян были изучены под стереомикроскопом во время исследования. Основной формой семенных поверхностей у исследованных

таксонов были папиллы. Тем не менее, размер ребер в сосочках (в папиллах) и плотность папилл были разными у разных видов. Четыре морфологических признака семян были стабильными: относительная длина и форма хилума (hilum), относительное расположение микропиле (вход семян) с хилума и положение хилума на поверхности семян. Установлено, что микроскопическое исследование семенной оболочки имеет важное таксономическое значение и эти данные могут быть использованы при уточнении статуса подродов и секций, а остальные признаки семян (форма, цвет, величина семян и т. д.) являются важными при определении внутривидовых и видовых таксонов.

Ключевые слова: *Vicia*, микроморфология семян, SEM, таксон, секция, вид