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Air Cavity as a Sign Determining Stoneiness and Intensity of Appearance of Seeds, As Well As Advanced Species of the Genus Gossypium L

Nina Viktorovna Grabovets

Tashkent State Pedagogical University named after Nizami, Tashkent, Uzbekistan

*Corresponding author.Email: kamsadegi@yahoo.co.uk

Abstract

The problem of studying and preserving cotton biodiversity, recognized by the world community at the end of the 20th and the beginning of the 21st century, is the basis of agricultural and economic development and an essential component of food security in each country. After the independence of our country, certain successes have been achieved in the development of agriculture and the acceleration of the agrarian industry. On the basis of the implemented program activities in this direction, certain important results have been achieved, including in the creation of new varieties with high yields and resistant to stress factors. In the strategy of actions for the further development of the Republic of Uzbekistan, "the importance of rational development of agricultural production and a significant increase in the export potential of the agricultural sector" [1] is emphasized. Based on these tasks, it is important to organize scientific work to identify diagnostic signs of seeds associated with the pollution of cotton fiber and to search for early maturing cotton donors, as well as to introduce them into production.

Keywords: air cavity, Gossypium L, which determines rockiness, intensity of seed germination, advancement

Introduction

These methodological recommendations to a certain extent serve to fulfill the tasks provided for in the Law "On seed production" dated April 6, 2006, by the Decree of the President of the Republic of Uzbekistan UP-4947 "On the strategy of actions for the development of the Republic of Uzbekistan dated February 7, 2017, as well as other regulatory documents adopted in this area.

B the composition p. *Gossypium* L., according to one of the latest classifications, there are more than 50 species that grow in tropical and subtropical zones of 5 continents of the world. Representatives p. Gossypium L. are distinguished by great morphological diversity. The variety of wild species and forms of cotton, many of which are carriers of valuable economic and biological traits, is a richest source of genetic resources. However, the rate of use of these resources in the improvement and creation of new vital varieties of cotton in the world is extremely low. In practice, mainly 4-5 representatives (out of 50) are used, which served as the basis for the creation of varieties of past and present selection, the so-called cultivated tetraploid species – G. *hirsutum* L.(mexican), G. *barbadense* L.(peruvian) и diploid – G. *arboreum* L. (indian), G. *herbaceum* L. (afro-asian). B world practice is dominated by varieties created on the basis of mexican (G. *hirsutum* L.), accounting for 90% of the annual cotton crop. The rest of the genus Gossypium L., especially, wild-growing ones are still a potential gene pool. The limited use of the biodiversity available in nature leads to the genetic uniformity of modern varieties, degeneration and other negative consequences and is a disadvantage of modern domestic and foreign breeding (Carlos B. Armijo, 2009; Clif Boykin, 2010; Frank E. Groves, 2010; Patil, Pravin, 2015).

The use of valuable germ plasma of wild cotton relatives in improving cultivated varieties and creating new ones that meet modern requirements is still limited by a gap in our knowledge of the entire biomorphological diversity and, in particular, the rich and valuable intraspecific potential of wild diploid species. Despite the considerable attention paid by scientists over the years, the level of development of theoretical issues of taxonomy, evolution and phylogeny on a global scale is not high enough.

Methods and materials

The experiments were carried out from 2010 to 2017. Seed material was obtained from the collection of the cotton gene pool of the Laboratory of Cotton Taxonomy and Introduction. It is known that the peel of the seeds of wild species is stony. Therefore, the seeds were germinated in a thermostat at a temperature of 25-270 C in Petri dishes, the micropilar part of the seeds was preliminarily trimmed, then the seeds were processed in a weak solution of potassium permanganate and rinsed in distilled water. Sprouted seeds were planted in cups with an earthen mixture (soil - 1 part, sand - 2 parts). Seedlings, which formed 2-3 true leaves, were transplanted into Wagner's vessels. We studied 10 plants of each species grown in Wagner vessels under greenhouse conditions and under photoperiodic trailers. During the growing season, labeling, phenological observations, and counts were carried out. For anatomical analysis, mature seeds were fixed (in 50% ethanol). Anatomical examinations were performed according to the accepted method (Barykina R.P.). During the research microscopes were used «CEIS». The structural elements of the integuments of the ovules and the skin of mature seeds were measured using a screw eyepiece of an MOB-15 micrometer. Statistical processing of quantitative data was carried out using generally accepted criteria, using a personal computer (MS Excel).

The object of the study was wild representatives of diploid and tetraploid species of the genus *Gossypium*.

Diploid representatives from the subgenus Gossypium, section Indica Tod. Subsection *Indica* Tod.:

1. *G. herbaceum* L. (2n=26): subsp. *africanum*, subsp. *pseudoarboreum*, subsp. *frutescens*;
2. *G. arboreum* L. (2n=26): subsp. *obtusifolium*, subsp. *perenne*, subsp. *neglectum*, subsp. *nanking*.

Representatives of tetraploid species from the subgenus *Karpas* Raf. Section *Magnibracteolata* Tod.:

3. *G. hirsutum* L. (2n=52): subsp. *mexicanum*, subsp. *punctatum*, subsp. *paniculatum*;
4. *G. barbadense* L. (2n=52): subsp. *ruderale*.
5. G. *darwinii* Watt.

Wild diploid species of Africa:

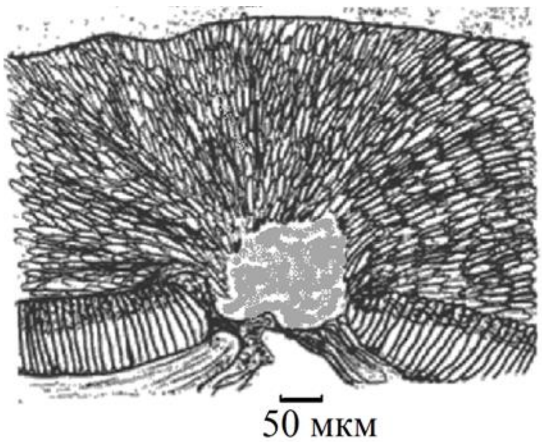
6. G. *incanum* (Sch.), Hillc.
7. G. *soudanense* Watt.
8. Wild diploid species of America
9. G. *klotzschianum* Anderss.
10. G. *raimondi*i Ulbr.
11. Wild diploid species of Australia
12. G. *australe* F. Müll.
13. G. *bickii* Prokh.

The main part of the research

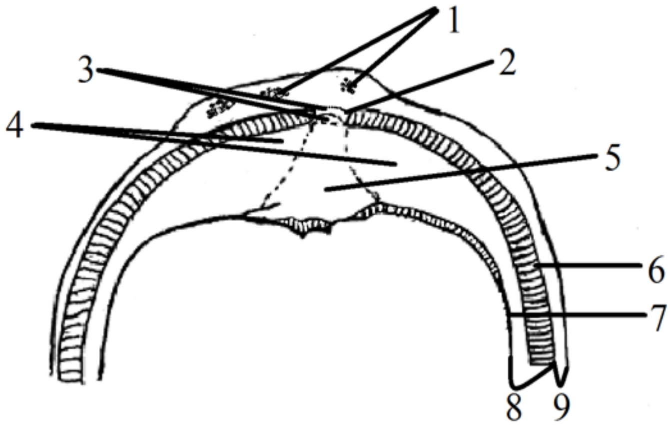
The habitats of wild cotton species occupy small areas located on one side or the other of the equator, and most are narrow and very narrow endemics and are even gradually disappearing. Their habitat is steppes, deserts, dry savannas. They grow on gullies at the foot of hills, rocky areas of the coasts of the oceans, remaining only in places inaccessible to livestock. Seeds are cuboid or ovate, covered with one or two tiers of unicellular hairs, sometimes completely naked. The peel of the seed is “very strong”.

The chalazal part of the seed peel is much thinner than the middle one and differs in that many representatives have thinner or no mechanical tissue (NEVI) there (Fig. 1). NI cells at the base in the chalazal part in the form of chains come to the palmate-branched conducting bundle of the seed stalk; in the ripe seed, these cells are destroyed and form an air cavity. The film covering the embryo, formed from VEVI, is easily separated from the seed coat, but in the chalazal part is firmly attached to it. The reason for such a strong connection is that the cells of the HEVI are strongly compressed by the cells of the NEVI. The thickness of the seed coat in the chalazal part changes little from 20 days of age until the maturation of the seed. The cells of the chalazal part are not absorbed during its development. The reason for a slight decrease in the thickness of the seed coat is a strong pigmentation of the cells, which is usually accompanied by their compression. In the area of the base of the external integument, a free space or air cavity is formed.

In the course of work, data from 18 wild diploid and tetraploid species were analyzed for 5 traits (see table 1. и 2.)



А



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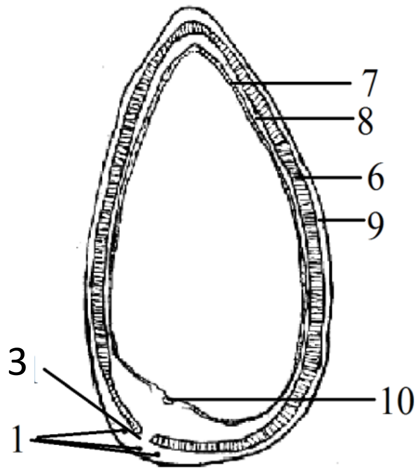

В

Rice. 1 Skin structure of mature seed

А – photo of the halazal part
Б – chalazal part scheme
В – ripe seed scheme
1 – conductive beams
2 – air cavity
3 – base of the external integument
4 – asteroid cells
5 – base of internal integument
6 – palisade
7 – membranes
8 – internal integuments
9 – external integuments
10 – hepostasis

Table 1.Structural features of the peel of mature seeds of wild representatives of the genus Gossypium L.

View	p/ view	Seed length / width, mm	Thick. leather in the middle part, microns	Tel. code in halase part, µm	Shire. air cavities, microns	Sowing-germination-current, days
1. G. herbaceum	*africanum**	6/3	502,8±37,8	475,7±43,1	-	8
	pseudo-arboreum	7/4	473,5±36,8	387,0±36,9	39,9±3,4	7
	frutescens	7/5	284,0±45,1	194,4±24,6	51,2±4,8	-
2. G. arboreum	*obtusifo-lium**	6/4	415,1±37,5	367,9±41,9	-	9
	perenne	7/5	378,5±34,3	318,3±25,0	77,2±3,2	7
	neglectum	7/4	450,9±21,9	354,7±38,4	91,3±9,1	6
	nanking	9/5	413,6±38,4	302,4±34,1	<u>56,5±2,7</u> <u>50,5±1,5</u>	7
3. G. hirsutum	*mexicanum**	8/4	278,1±26,2	251,2±26,7	111,7±16,1	6
	punctatum	9/4	295,6±3,6	239,6±24,1	131,2±14,5	5
	paniculatum	9/4	314,5±24,8	265,5±19,1	148,2±14,7	5
G.barbadense subsp. Ruderale		9/5	307,5±4,9	238,1±22,6	70,9±4,6	7
*G. darwinii**		8/5	297,9±1,9	249,7±15,3	-	8

*representatives with a stony seed skin (Atlas)

- the underlined data means that this representative has two air cavities.

Table 2. Structural features of the peel of mature seeds of wild representatives of the genus Gossypium L

View	Length seed width, mm*	Peel thickness		Shire. air cavities, microns	Sowing-sprouting-current, days
		in the middle, microns	in the halasal part, microns		
G. *incanum**	5/4	217,3±11,7	196,4±10,1	92,3±10,3	3
G. *soudanense*	5/3	374,5±33,6	291,4±25,1	27,6±9,6	did not sprout
G. *raimondii**	8/5	197,0±17,3	151,3±6,4	66,7±3,4	4
G. *klotzschianum*	6/4	250,4±22,8	161,2±12,5	36,2±0,7	4
G. *bickii*	4/2	164,4±17,3	123,2±7,6	16,8±0,3	5
G. *australe*	4/2	120,9±11,6	97,4±6,2	30,3±1,9	3

*representatives with a stony seed skin ("Atlas of the genus Gossypium L." Abdullaev A.A., Dariev A.S. et al., 2010)

*Data from the "Atlas of the genus Gossypium L." Abdullaev A.A., Dariev A.S. et al., 2010

Such a trait as small-seededness is a sign of primitive, primordially wild subspecies. In this case, subspecies such as africanum and obtusifolium have this feature. Comparing wild diploid and tetraploid subspecies, it can be concluded that smaller seeds in the diploid representatives of G. herbaceum and G. arboreum.

And also species such as G. bickii and G. australe have this feature. Comparing wild diploid species of different continents, we can conclude that the diploid representatives of Australia have smaller seeds (Table 2).

The absence of an air cavity is a sign of the primordially wild representatives of the species. The larger the size of the air cavity, the more advanced the representative. Thus, such representatives as africanum, obtusifolium, mexicanum, G. darwinii, which are primitive representatives and have a "stony" peel, do not have an air cavity. According to F.M. Mauer's intraspecific diversity of G. barbadense is somewhat less than that of G. hirsutum, especially in the group of early maturing subtropical forms. He explains this by the later appearance and more limited distribution of these forms in comparison with the euhirsutum forms. The rest of the ecological-geographical groups in this species are no less diverse than in G. hirsutum. The data obtained in the research work on the structure of the peel of a mature seed contradict the opinion of F.M. Mauer. The dimensions of the air cavity are larger in representatives of the species G. hirsutum than in G. barbadense, which indicates the advancement of G. hirsutum.

In wild representatives, the smaller the difference between the dimensions of the width (thickness) of the seed coat in the middle and chalazal parts, the more “stony” the seed. If the difference in wild representatives corresponds to the value of 0<x>60 µm, then the seed will be "stony". It can also be said that the greater the specified difference in thickness, the more advanced the representative. When comparing both diploid and tetraploid primordially wild subspecies, we can say that according to this trait, africanum has the most "stony" peel (Table 1), and G. incanum and G. raimondii (Table 2).

Germination (the number of days from sowing to germination) is influenced, namely, by the ratio of the size of the seed and the air cavity, since it is in this place that water accumulates for the embryo, which in turn gives nutrition to the embryo, and under pressure pushing it, pushes it out of the chalazal part with micropilar. And the embryo tears the skin of the mature seed from the micropilar part.

And so according to the formula

"ab" / "c",

Where, a is the length of the seed;

b - Seed width

c - The size of the air cavity.

Analyzing the obtained tabular data (Table 1.), according to the above-mentioned formula, we can say that if this ratio is 0≥0.3, then the number of days from sowing to germination will be 1-3 days less than that of representatives with an index 0.3≥1. The lowest given ratio index is in the American representatives and G. australe, in which the seeds germinate 3 days after sowing. And also, the smallest given ratio index is in representatives of G. hirsutum, which emerge 5-6 days after sowing. And so, the higher the index, the more days from sowing to germination. With the exception of those representatives who do not have an air cavity. These representatives (africanum, obtusifolium, mexicanum, G. darwinii) have the largest number of days from sowing to germination (8-9 days).

Thus, we can say that:

the presence or absence of an airway is a significant diagnostic sign;

the larger the size of the air cavity, the more advanced the representative;

the smaller the difference in the size of the thickness of the peel of the ripe seed in the middle part and the chalazal, the harder the peel of the seed;

the greater the index of the ratio of the size of the seed and the air cavity, the more days during germination. With the exception of those representatives who do not have an air cavity, their seeds germinate the longest.

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