

Biological Features and Economic Valuable Traits of Intraspecific Diversity of Afro-Asian and Indo-Chinese Species of Cotton

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Abstract: Use of the valuable cotton germplasm of wild relatives in works of improvement of cultivars and develops of new ones, meeting modern requirements, is for the present limited by a blank in our knowledge of all biological and morphological diversity. On the basis of studying and an estimation to morphological and biological and economic-valuable traits of representatives of an intraspecific diversity of species *G. herbaceum* L. and *G. arboreum* L. It is determined that as a whole, are characterized by photoperiodicity, low indicators of cotton raw weight per boll, length and a fiber output. Low indicators of components of productivity, photoperiodicity and late maturity indicate in their wild nature. Attraction of wild forms as an initial material in genetic and breeding research gives the chance for enrichment of genotypes in development of new high-quality and highly productive cultivars.

Keywords: evolution, cotton, subspecies, varieties, cotton fiber

1. Introduction

Cotton has a huge diversity of genetic resources of the world cotton. However, these features are not used to completely. Wild and semi-wild perennial forms cotton- single gene is-important source of such features as resistance to *Verticillium* wilt and gummosis, piercing-sucking insect pests, frost, have very steady and fine fiber. However, success can be achieved only by using a selection methods and laws of modern genetics [1-5].

Decisive in the phenotypic expression of genetic traits of an organism in ontogeny was determined the environmental factor: temperature, light, humidity, power, geographical location of the area, as well as other physical conditions of upholstered [7]. In the course of a long evolution that took place in connection with the promotion of cotton to the north, east and south of the equator, formed "one-year" early ripe form. However, these varieties of cotton are closer to the neutral category because of their ability to reproduce in a very wide amplitude of day- length, while for the vast majority of initial tropical species are characterized by their pronounced adaptability to reduction day [7-8].

It is important to say that wild species occupy narrow ranges, and some endemic species are very rare and are gradually disappearing. Their habitats are steppe, desert, dry savanna. They grow on the beams, at the foot of the hills, stone- places, coasts of oceans, preserved only in places inaccessible to livestock. A large number of wild, semi-wild and cultural and tropical species is localized in the New World, Africa and Australia.

Noting the role of the social environment in the formative process, gradually, but for thousands of years, due to natural and artificial selection was created ruderal cotton- anthro- chore and its more absolute cultural forms [8].

However, these diversity forms and species are not exhausted in the selection. In that way, the use of valuable germplasm of wild relatives of cotton for improving cultivars and new meeting modern requirements, while still li-

imited gaps in our knowledge of all biological and morphological diversity. Unexplored link, there are still intraspecific polymorphic, diploid species of *G. herbaceum* L. and *G. arboreum* L., and were not studied the characteristics of their biological inheritance and domestic valuable features.

Long-term observations and morphological descriptions were revealed features of reproductive period of plants grown under the natural photoperiod and photoperiod (10 h light per day) in the greenhouse and vegetative field.

In this article, the aim of our research was to assess morphological valuation of the representatives of intraspecific diversity Indochinese cotton on the basis of which will be allocated to the most valuable forms for their involvement in the honors of initial material in selection and genetic research to enrichment of genotypes in the creation of new high-quality and high-yielding varieties.

2. Materials and Methods

The object of the research were intraspecific diversity Indochina cotton stored in the gene pool IGEBP AS RUz, members of the species *G. herbaceum* L. wild form ssp. *africanum* (Watt) Mauer, perennial ruderal form- ssp. *pseudoarboreum* Mauer and ssp. *pseudoarboreum* f. *harga*, cultivate form ssp. *euherbaceum* (cultivar «377»); as well as members of the species *G. arboreum* L.: wild form- ssp. *obtusifolium* (Roxb.) Mauer and ssp. *obtusifolium* var. *indicum*, the perennial ruderal form ssp. *perenne* (Blanco) Mauer, polysymphodial and sympodial tropical form- ssp. *neglectum* (Tod.) Mauer and ssp. *neglectum* f. *sanguineum*, sympodial subtropical form ssp. *nanking* (with brown fiber) and a variety of cultural form- cultivar «VIR 1372».

During the research carried out phenological observations, analyzes of the field and laboratory and were assessed the main morph biological and valuable economical attributes of cotton. Evidence generated data were statistically processed by the standard methods [6].

3. Results

The assessment studied representatives of the Indochinese cotton was revealed the difference and the wide variation in morphological and economically valuable traits such as: length of the vegetation period, the length of the fiber, a lint output and weight of raw cotton per one boll. The lower results of these morphological features were led.

The duration of the vegetation period

It is structurally complex trait and was determined by the following elements: the duration of period, the necessary of conversion of the bud into a flower and a day ovary in the disclosed boll. Traits vary greatly depending on soil and climatic conditions and farming. We have studied the results- length of the vegetation period of intraspecific varie-

ties and species *G. herbaceum* L. *G. arboreum* L., where has been defined the wide variation from 117 to 146 days. Initial wild forms and their subspecies variations ssp. *africanum* was characterized by weak-photoperiod and the current trait showed the variability from 134 to 138 days. But among the cultural forms of tropical species of *G. herbaceum* L. was educed the early maturity form- ssp. *euherbaceum* (cultivar of «377») and ssp. *pseudoarboreum* with vegetation period 117 and 119 days respectively. Medial-maturity was signed in the form ssp. *pseudoarboreum* f. *harga* (122 days) (Table 1.). Showing trait of «the duration of the vegetation period» in the form of intraspecific varieties *G. arboreum* L. was different. High exactingness on photoperiod was showed in the subspecies ssp. *neglectum*, which was with late-maturity of the vegetation period from 138,0 to

Table 1: The duration of the vegetation period and fiber length of the intraspecific representatives of the species *G. herbaceum* L. and *G. arboreum* L.

Subspecies and forms	50% germination - maturation, days				Fiber length, mm			
	$X \pm S_x$	limit	S	V%	$X \pm S_x$	limit	S	V%
<i>ssp. africanum</i>	136,0 ± 0,49	134-138	1,56	1,1	25,0 ± 0,26	24,0-26,0	0,82	3,2
<i>ssp. pseudoarboreum</i>	119,0 ± 0,60	117-122	1,89	1,5	24,1 ± 0,24	23,0-25,3	0,77	3,1
<i>ssp. pseudoarboreum f. harga</i>	122,0 ± 0,67	118-124	2,11	1,7	19,6 ± 0,25	18,6-21,0	0,79	4,0
<i>ssp. euherbaceum</i> (cultivar «377»)	117,0 ± 0,58	115-120	1,83	1,5	21,6 ± 0,25	20,3-22,6	0,79	3,6
<i>ssp. obtusifolium</i>	130,0 ± 0,56	128-133	1,76	1,3	25,0 ± 0,36	23,6-26,5	1,13	4,5
<i>ssp. obtusifolium var. indicum</i>	138,0 ± 0,47	137-140	1,49	1,0	24,0 ± 0,34	22,6-26,3	1,07	4,4
<i>ssp. perenne</i>	130,0 ± 0,70	128-134	2,21	1,7	24,8 ± 0,34	24,0-26,6	1,07	4,3
<i>ssp. neglectum</i>	146,0 ± 0,52	144-148	1,63	1,1	22,0 ± 0,36	20,3-23,6	1,13	5,1
<i>ssp. neglectum f. sanguineum</i>	119,0 ± 0,56	117-122	1,76	1,4	23,8 ± 0,31	22,6-25,0	0,97	4,0
<i>ssp. nanking</i> (с бурым волокном)	119,0 ± 0,30	119-121	0,94	0,8	21,3 ± 0,45	19,6-24,0	1,41	6,6
Cultivar «ВИР 1372»	117,0 ± 0,47	116-120	1,49	1,2	22,5 ± 0,18	22,0-23,6	0,57	2,5

Table 2: Fiber output and raw cotton weight per one boll of the intraspecific representatives of the species *G. herbaceum* L. and *G. arboreum* L.

Subspecies and forms	Fiber output,%				Raw cotton weight per one boll, g.			
	$X \pm S_x$	limit	S	V, %	$X \pm S_x$	limit	S	V, %
<i>ssp. africanum</i>	20,0 ± 0,22	19,0-21,0	0,71	3,5	0,9 ± 0,03	0,9-1,1	0,09	8,8
<i>ssp. pseudoarboreum</i>	26,5 ± 0,11	26,1-27,3	0,35	1,3	1,7 ± 0,04	1,5-1,9	0,14	8,0
<i>ssp. pseudoarboreum f. harga</i>	23,4 ± 0,03	23,3-23,5	0,09	0,4	1,2 ± 0,02	1,1-1,3	0,08	6,4
<i>ssp. euherbaceum</i> (cultivar «377»)	14,1 ± 0,05	13,8-14,3	0,16	1,1	1,1 ± 0,02	0,9-1,1	0,07	6,3
<i>ssp. obtusifolium</i>	20,6 ± 0,12	20,0-21,0	0,39	1,9	1,1 ± 0,04	1,0-1,3	0,12	10,2
<i>ssp. obtusifolium var. indicum</i>	22,5 ± 0,03	22,4-22,7	0,11	0,5	1,0 ± 0,04	0,8-1,2	0,14	14,1
<i>ssp. perenne</i>	29,0 ± 0,07	28,7-29,5	0,23	0,8	2,1 ± 0,09	1,8-2,6	0,29	13,6
<i>ssp. neglectum</i>	21,2 ± 0,04	21,0-21,4	0,12	0,6	1,9 ± 0,07	1,8-2,5	0,22	10,9
<i>ssp. neglectum f. sanguineum</i>	24,1 ± 0,04	23,9-24,3	0,13	0,6	1,5 ± 0,06	1,2-1,8	0,18	11,8
<i>ssp. nanking</i> (с бурым волокном)	18,6 ± 0,09	18,2-19,1	0,27	1,4	1,4 ± 0,08	1,2-1,9	0,25	17,3
Cultivar «ВИР 1372»	26,6 ± 0,22	25,6-27,6	0,70	2,6	1,7 ± 0,08	1,7-2,5	0,25	14,0

146,0 days. Short vegetation period was observed in subspecies *ssp. neglectum f. sanguineum* and *ssp. nanking* (with a brown fiber), as well as in the variety «VIR 1372», which was shown the present trait was at the level of 117-119 days. It was found that the wild, ruderal and cultural-tropical intraspecific varieties and forms of *G. herbaceum* L.

G. arboreum L. characterized by photoperiod and middle-maturity while cultivated varieties of the earliest maturity and have a neutral reaction to the length of daylight.

Fiber length

This trait is changed by growth conditions and within the plants depending on the location of the plant boll, within the

lacinula limits and within the even seeds. In our research, a trait of «fiber length» at the intraspecific varieties of the researched species was showed a wide variability in the range of 19,6 to 25,0 mm. Subspecies and species form of *G. herbaceum* L was not different with the current trait: from the wild form it was 25,0 mm, from the ruderal form- within from 19,6 to 24,1 mm, and cultural-tropical forms (*ssp. euherbaceum* (cultivar «377»)- 21,6 mm. Representatives of the intra-species varieties of *G. arboreum* L., is also characterized high fiber length by relatively (21,3-25,0 mm). Relatively high fiber length formed in wild and ruderal forms (*ssp. obtusifolium*- 25,0 mm, *ssp. obtusifolium var. indicum*- 24,0 mm, *ssp. perenne*- 24,8 mm) and relatively short-

cultural subtropical forms (ssp. *nanking* (with brown fiber)- 21,3 mm) (Table 1.).

Fiber output

This trait is one of the main economical valuable of fiber cotton, defining harvest from per unit area. Fiber output is complex trait, determined by the mass of seeds and fiber index. Study of this trait was carried out in wild, ruderal and cultural-tropical species *G.herbaceum* L. and *G.arboreum* L., where there is a wide variability in the output fibers from 14,1 to 29,0%. Parameters of fiber output of the representatives of species *G.herbaceum* L. were different (14,1-26,5%). Variability of the researched-trait in the intraspecific species *G.arboreum* L. was signed within the range from 18,6 to 29,0%. The highest output fiber among the given set of samples was watched in ssp. *perenne*- 29,0%, and at the least- ssp. *euherbaceum* (cultivar «377»)- 14,1%. The other representatives of this species fiber output was ranged from 20,6 to 26,6% (Table 2.).

Raw cotton weight per one boll

The productivity of raw cotton is the most difficult trait, and it is determined by the number of bolls per plant and the raw cotton weight per one boll. However, productivity also depends on many other traits- early maturity, resistance to diseases and pests, the plant's ability adapts to varying environmental conditions. In our research, the parameter among the representatives of the intraspecific varieties of the species *G.herbaceum* L. and *G.arboreum* L. showed the variability in the range of 0,9 to 2,1 g. The raw cotton weight per one boll of the intraspecific representatives of the species *G.herbaceum* L. was noted in the range of 0,9 to 1,7 g. The large bolls was formed by ruderal form (1,7 g), medium- in cultural forms (1,1 g) and small- the wild forms (0,9 g). The variability of the studied trait in the intraspecific variety of *G.arboreum* L. was characterized by a range of 1,0 to 2,1 g. It was noted that the large bolls in ruderal form (ssp. *perenne*- 2,1 g) and cultural - tropical forms ssp. *neglectum*- 1,9 g) and small in the native wild form- ssp. *obtusifolium* and ssp. *obtusifolium* var. *indicum*- 1,0-1,1 g.

Based on the research and the evaluation of the morphological and economically valuable feature of the representatives of intraspecific variety of species *G.herbaceum* L. and *G.arboreum* L. was found that, in generally, was characterized by photoperiod, lower- raw cotton weight per one boll, length and output of fiber. Low parameters of fertility components, photoperiod and lateness was showed on their wildlife.

It should be noted that many wild cotton species, including the species of *G.herbaceum* L. and *G.arboreum* L. have an interest for genetic and breeding research, as they have genes carrying an extremely valuable traits, absence in cultural forms: high quality fiber, adaptation potential to abiotic and biotic factors outer environmental. Attraction of these forms in hybridization in the future will allow to combine the most valuable features and traits, far fragmented in the course of evolution, and develop a wide variety of valuable hybrid generation.

References

- [1] Abdullaev A.A., Omelchenko M.V., Lazereva O.N. Use of Genetic Potential of Genus *Gossypium* L. in Genetic and Breeding Research on Development of Perspective Cotton Cultivars.//Theoretical Base of Applied Genetics and Breeding of Cotton.- Tashkent.: Fan UzSSR, 1983.- P. 3-11. [ru]
- [2] Abdullaev A.A. Historical Aspects of Cotton Earliness Evolution.//Evolution and Breeding Aspects of Cotton Earliness and Adaptability: Proceedings of the International Conference.- Tashkent: Fan, 2005.- P. 5-8. [ru]
- [3] Abdullaev A., Abdullaev A.A., Salakhutdinov I., Rizaeva S., Kuryazov Z., Ernazarova D., Abdurakhmanov I.Y. Cotton Germplasm Collection of Uzbekistan.//The Asian and Austral. J. of Pl. Sci. and Biotech.- Cotton Research in Uzbekistan.- Egamberdieva D., Abdurakhmonov I. (Eds).- Vol. 7.- Sp. Issue 2.- Global Science Book, 2013.- P. 1-15. [en]
- [4] Abdurakhmonov I.Y., Abdullaev A., Buriev Z., Shermatov Sh., Kushanov F.N., Makamov A., Shapulatov U., Egamberdiev Sh.S., Salakhutdinov I.B., Auybov M., Darmanov M., Rizaeva S.M., Abdullaev F., Nomozov Sh., Khalikova M., Saydaliev H., Avtonomov V.A., Snamyan M., Duiosenov T.K., Musaev J., Abdullaev A.A., Abdurakhmonov A. Cotton Germplasm Collection of Uzbekistan.//In book: World Cotton Germplasm Collection.- Chapter 11.- Ed. Abdurakhmanov I.Y.- Intech, 2014.- P. 289-309. [en]
- [5] Campbell B.T., Saha S., Percy R., Frelichowski J., Jenkins J., Park W., Constable C., Dillon S., Abdurakhmonov I.Y., Abdurakhmonov A., Rizaeva S.M., Barroso P.A.V., Padua J.G., Hoffmann L.V., Podolnaya L. Status of the Global *Gossypium* ssp. Germplasm Resources.//Crop Science, 2010.- Vol. 50.- P. 1161-1179. [en]
- [6] Dospekhov B.A. Field Experiment Methods.//Moscow: Agropromizdat, 1985.- 351 p. [ru]
- [7] Konstantinov N.N. Morphologic and Physiologic Bases of Cotton Ontogenesis.//Moscow: Nauka, 1967.- 292 p. [ru]
- [8] Mauer F.M. Cotton. Origin and Systematics of Cotton.//Vol. 1.- Tashkent: Publisher of AN UzSSR, 1954.- 384 p. [ru]