



## Cotton and honey bees in a single mutually beneficial biocenosis

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### ABSTRACT

The article presents the results of the author's theoretical and field research and the experience of foreign countries in studying the pollination of cotton varieties by bees and their nectar productivity. Field studies on the study of the nectar productivity of cotton varieties and their cross-pollination by bees were carried out in two farms in the Alat district of the Bukhara region. The results of the research established the relationship between the ten-day pollinating activity of bees with the seasonal nature of nectar secretion and varietal differences in nectar content. A technique has been developed for placing crossed cotton varieties in the cross-pollination area.

### Keywords:

cotton, variety, honey bee, nectar, nectar release, over-pollination, heterosis, entomophilous.

### 1. Introduction

The current agrarian policies of the developed countries of the world, including the Republic of Uzbekistan, require scientists and specialists to take urgent measures to sharply increase the productivity of crops and the quality of

products. One of these methods to increase cotton yields is the use of the pollinating activity of honey bees in cotton growing. Because in the life of all higher plants, one of the most important factors in the fruiting and quality of the seeds formed is the process of

pollination and fertilization. The solution to the problem of productivity is closely connected with their knowledge and regulation. The main way to achieve this is through the correct use of general biological laws and phenomena, taking into account the biological specificity of a particular plant species.

Established by the works of many researchers (A.G. Mannapov, O.S. Larionova, 2011, CEMorris, JMMonier, 2003, A.G. Mannapov, 2011, etc.), features in the structure of the flower and the biology of flowering of cotton characterize it as a facultative cross-pollinating plant with pronounced entomophily. There are many works in the literature devoted to the negative consequences of long incubation and the usefulness of alien pollination of cotton (A.M. Kuliev, 1952, D.V. Ter-Avanesyan, 1957, etc. KEUsmanov, Imomova N.Sh., Imomov Sh.J., 2021, A.G. Mannapov, O.S. Larionova, Z.A. Zalilova, 2011, etc.). This allows us to consider that cross-pollination is useful for cotton, and self-pollination is an evolutionary adaptation to reproduction in conditions unfavorable for cross-pollination.

It has been established that the main role in this belongs to pollinating insects, and depending on the type and density in the fields of pollinating insects, and especially domestic bees, the size of cross-pollination of cotton plants can vary from 3-5 to 100% (D.V. Ter-Avanesyan, 1960; A.V. Trushkin, 1971, A.G. Mannapov, O.S. Larionova, R.A. Rapiev, 2011, GD Inglis etc., 1993, JNS tendifer, 1980 and others).

Therefore, it is possible to increase the pollination of plants by proper management of agrotechnical factors and an increase in the number of beneficial pollinating insects in the fields.

It must be said that at the current stage of cotton production, when an integrated system for combating harmful entomofauna has been introduced into wide practice, ensuring the prohibition of the use of pesticides in the fields throughout the entire period of cotton flowering and the expansion of the use of biological control against it, the composition and density of the natural pollinating fauna is

increasing dramatically. The delivery of bee colonies to cotton plantations during the flowering period of cotton is also stimulated, which is the most reliable means of mass cross-pollination of cotton.

Our long-term research in this direction shows great potential for the use of bees as cotton pollinators, which, unfortunately, is currently underused.

In addition to honey collection (honey production reaches 80–100 or more kg per hectare), bees carry out intensive pollination. This ensures an increase in plant productivity by 10-17% and an improvement in the technological qualities of the fiber, as well as the sowing and yielding qualities of seeds. At the same time, the experiments convince us of the close dependence of the final results on the nectar productivity of cotton varieties, which is the reason for the attendance of flowers by bees and hence the intensity of cross-pollination.

## 2. Materials and methods

Field experiments on the study of methods for obtaining rose heterohybrid cotton seeds were carried out by us in 2016-2019. in the Bukhara region. In field experiments, cotton varieties belonging to two botanical species were used: *G. Herbasium* L. and *G. Barbadense* L. and honey bees of the Carpathian people. Field studies, as well as all phenological records and observations, were carried out according to the methodology of SoyuzNIHI, 1981 Analyzes of nectar productivity were carried out using the micropaper method (according to M.A. Kuliyeu, 1952). A single sample for determining the amount of nectar was made up of 40 flowers and the analyzes were repeated in the morning, afternoon and evening hours.

**Object of study:** In order to study in detail the nectar productivity and cross-pollination of varieties of different species and to calculate the effect of the cross-pollination of these cotton varieties by bees at the sites for the creation of heterotic hybrid seeds, we conducted special studies in two cotton-growing farms of the Alat district of the Bukhara region (farms "Oltin tuprok" and "Sardorbek Ruziev" the first of them in 2016-

2018. varieties of two botanical cotton species Bukhara-6 (*G. hirsutum* L.) and C-6037 (*G. barbadense* L.) were grown. In the same years, varieties of one botanical species (species *G. hirsutum* L.) - Bukhara-6 and Bukhara-8 were grown in the second farm in the same years. In both farms, varieties were placed on the same plot with two-row plots alternating according varieties.

### 3. Result and discussion

The largest amount of nectar, as can be seen, is released in the flowers of the fine-fiber cotton

variety (C-6037) of the species *G. Barbadense* L., but the concentration of total sugar in it is much lower than in medium-fiber varieties (Bukhara-6, Bukhara-8) of the species *G. hirsutum* L. In addition, in the fine-fiber variety, the largest amount (62.3-64.7%) of nectar is in the share of intra-cup nectaries, which necessitates more frequent visits by bees to the intra-cup parts of the flower, and this increases their cross-pollination. Comparative data on nectar productivity in the varietal section are given in table-1.

**Table 1.** Nectar productivity of the studied varieties

Varieties	2016 year		2017 year		2018 year		% sugar in some container
	Total number of containers in a flower,mg	Including inside the cup nye,%	Total nectar in the flower, mg	Including inside the cup nye,%	Total nectar in the flower, mg	Including inside the cup nye,%	
Farm "Oltin tuprok"							
S-6037	20.1	62.0	21.2	63.6	21.8	64.3	28.5
Buk-6	8.3	27.3	9.15	27.0	9.68	28.3	30.2
Farm "Sardorbek Ruziev"							
Buk-6	9.1	28.34	9.76	27.26	10.07	25.8	30.6
Buk-8	8.4	28.6	8.92	26.03	9.18	29.7	32.9

Medium-fiber varieties almost did not differ from each other in nectar productivity, and the Bukhara-8 variety looked somewhat better in terms of nectar sugar content. In both varieties

of this species, with a rather low total nectar productivity, the largest share of the allocated nectar falls on the preflower and subcup nectaries (Table 2).

**Table 2.** Daily rhythm of nectar release from flowering nectaries in the context of cotton varieties (average data for 2 years).

Cotton varieties	Observation time denia, clock, (from-to)	Amount of allocated nectar by flowering nectaries, mg.				Share vnu tricup nectar nicknames, %
		Intracalyx nectaries	Bracts nectaries	Subcalyx nectaries	Total	
Bukhara-6	9-11	2.35	3.06	2.96	8.37	28.07
	11-13	3.18	3.59	3.43	10.20	31.17
	13-15	1.60	1.84	1.70	5.14	31.13
	15-17	0.62	0.70	0.57	1.89	32.8
Bukhara-8	9-11	1.93	3.17	2.74	7.84	24.61

	11-13	2.98	3.58	3.11	9.67	30.81
	13-15	1.36	1.44	1.67	4.47	30.42
	15-17	0.49	0.54	0.62	1.65	29.7
	9-11	9.67	5.21	2.34	17.22	56.16
S-6037	11-13	15.41	5.9	2.71	23.71	65.0
	13-15	10.48	3.78	1.46	15.72	66.7
	15-17	4.32	1.26	0.97	6.55	66.0

These data indicate that in the conditions of the Bukhara region, the most intensive nectar production of flowering nectaries is observed from 11 am to 1 pm. At the same time, the proportion of intracalyx nectaries gradually increases during the day. Obviously, this is due to the fact that the outer flowering nectaries are the most accessible to insects, and besides, the evaporation of water from the nectar is more intense in them than in the intracalyx nectaries. There is an obvious genetic regularity in cotton in the process of flowering

and nectar production, which provides the possibility of cross-pollination with the help of insects.

Our observations on the attendance of cotton flowers by bees at a high saturation of the fields (Table.

-3) make it possible to link the activity of the ten-day pollinating activity of bees with the seasonal nature of nectar secretion and varietal differences in nectar content (especially in intracalyx nectaries).

**Table 3.** The number of bees that visited cotton flowers and the attendance of intracup nectaries for 1 hour on an area of 1 m<sup>2</sup>

Cotton varieties	Observation time denia, clock, (from-to)	Number of bees visiting the cotton plant, pieces						Attendance of intracup nectaries, %		
		Total			including intracalyx nectaries			15.07	25.07	05.08
		15.07	25.07	05.08	15.07	25.07	05.08			
Farm "Oltin tuprok"										
	9-11	49.6	92.7	78.4	17.3	31.8	25.6	34.9	34.3	32.6
S-6037	11-13	74.1	156.4	105.4	37.2	104.2	60.0	50.2	66.6	56.9
	13-15	59.6	132.7	89.5	29.1	92.8	49.4	48.8	69.9	55.2
Buk-6	9-11	31.5	67.8	44.2	7.4	20.1	12.5	23.5	29.6	28.3
	11-13	52.4	93.7	69.0	17.2	37.7	24.6	32.8	40.2	35.6
	13-15	34.5	72.5	53.2	12.9	34.6	20.4	37.4	47.7	38.3
Farm "Sardorbek Ruziev"										
Buk-6	9-11	32.6	65.5	46.7	8,75	20.9	13.8	26.8	31.9	29.6
	11-13	56.0	116.4	76.7	22,1	53.5	33.7	39.4	46.1	43.9
	13-15	45.6	99.7	67.4	19,2	46.5	30.4	42.1	46.6	45.1
Buk-8	9-11	34.7	62.75	42.0	10,0	19.8	11.5	28.8	31.6	27.4
	11-13	55.0	102.5	64.2	22,0	46.5	27.0	40.0	45.4	42.0
	13-15	46.5	92.6	58.0	20,8	44.6	27.0	44.7	48.1	46.5

It is noteworthy that the attendance of intracalyx nectaries by bees in the period from 09:00 to 13:00, when intensive opening of corollas and pollination of flowers, ranged from

22.3 to 52.7% in medium fiber varieties and from 32.1 to 72.5%. in the fine fiber variety. Both in medium-fibered and, especially, in fine-fibered varieties, the attendance of intracup

nectaries gradually increases towards noon. The reason for this is that all external nectaries are accessible to any other insects and, moreover, they have a much higher evaporation of water from the nectar.

The results of ten-day observations showed that the most intensive work of bees on cotton flowers is observed in the middle of the flowering phase, when nectar secretion and other factors that ensure the active work of bees will be optimal.

#### 4. Conclusions

Summarizing the above data, we can conclude that the effect of pollination of cotton with the help of bees depends on how amicably they visit flowers of one or another variety, which is

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