Inheritance of Fiber Length and Fiber Output on Interspecies Hybrids F1 and F2 of G. Mustelinum Miers ex Watt with Interspecies Diversity of G.Hirsutum L.

Rafiyeva F.U., Rizayeva S.M.

Institute of Genetics and Plant Experimental Biology, Uzbek Academy of Science, Tashkent, Uzbekistan

Abstract: Wild G.mustelinum Miers ex Watt. is one of the five tetraploid cotton species, and it spread in the northeastern part of Brazil. Studies of the genetic potential of this species are very rare, because for several decades, as the genetic resources collected to assess the possibilities and use. One of the biological features of this species is to be a large number of substances such as aldehyde and terpenoid in the structure in comparing with other species of plants [8]. In addition, there are number of scientific papers about hydrating elite cultivars of G.mistelimum species in order to improve commercial indices of cultivars [10]. In our research, G.mustelinum Miers ex Watt. species of genetic-breeding research was conducted in order to take advantage of. As a result, the forms of the high cost of fiber length and fiber expenditure were selected.

Keywords: cotton, species, fiber length, fiber output

1. Introduction

Cotton is one of the more expensive and most important plants. It had been provided human with clothes and some other expensive materials. In early period scientists paid attention to cotton, that’s why this plant passed natural and artificial process. There are some important indices in cotton, they are length and output. It’s known that, the degree of heredity of characters taken into account during selecting work in breeding process. Length and output of fiber is quantitative character, this characters change according to factors of genotype and environment. If the characters of giving degree generation to generation were strong in this process, the selection works also gets effective [9]. In increasing of the cotton productivity the breeders should know the full information about degrees of relationship, average productive indices of forms which were selected as an object and various agrotechnic events with correlation [7]. According to hereditary potential and condition of producing the length of fiber can be 10 mm to 55 mm in cotton species and interspecies diversity [4]. X.Ashirbekov and E. Muqomov said that, the length of fiber depends on properties of cultivar and agrotechmics which are used in experiments, and characters passed generation to generation with hereditary, it will be smoothly in higher link then incentive link [3]. Hereditary of the length of fiber were noted according to distance than parents’ forms in F1 hybrids [2].

The ratio of fiber weight to cotton weigh is called fiber output. It depends on fiber’s weight and quantity. The fiber output can be 12-15% to 43-44% in different cotton forms [4].

As a quantity character the fiber expenditure surfaced effects of polygene genes and external factor also effected significantly [7].

2. Material and Methods

Scientific research had been made during 2011-2015 in laboratory condition and experimental area of Laboratory of Cotton Systematics and Introduction in Institute of Genetic and Plant Experimental Biology of Academy of Science of the Republic of Uzbekistan.

In research wild ssp.mexicanum var.nervosum of interspecies diversity of G.hirsutum L. tetraploid belonging to Magnibracteolata Tod. em.m section of subgenus of Karpas Raf. ampl.m. of Gossypium L. genus, ruderal ssp.punctatum, ssp.purpurascens var.el-salvador (West India), cultivated tropic ssp.paniculatum, ssp.glabrum var.marie-galante (Mexico Ahaco Anonta) and cultivated subtropic «Beshqahramon» cotton cultivar, wild G.mustelinum Miers ex Watt. species and F1, F2 hybrids which are taken on the basis of interspecies diversity hybrids of G.hirsutum L. with G.mustelinum Miers ex Watt. species were used as an object.

Perseverance of G.hirsutum L. interspecies diversity and G.mustelinum Miers ex Watt. species to photoperiod were different, that’s why for providing access to blossom and blossoming at the same time and for crossbreeding the artificial short day condition were created, and then plants were growth in Wagner pail and nurtured in short day condition (10 hours lightening) in special photoperiodic houses. Crossbreeding works were carried out in generally accepted methods.
Fiber length was implemented according to measure of each example seeds fiber in special velvet lap-board. Fiber output were found according to accounting ratio of fiber weight and raw materials of cotton in percentage.

Coefficient of dominant was accounted with following G.M.Beil, R.E.Atkins [11] formula in first link hybrids for traits:

\[ hp = (F_1-MP)/P-MP; \]

here \(hp\) -dominate coefficient;

\(F_1\)- average arithmetic indices of trait in first link;

\(MP\)- average arithmetic indices of trait of parents’ form;

\(P\)- average arithmetic indices of best paternal or maternal forms;

Trait hereditary were evaluated us follows in first link hybrid: Dominant position not observed (distance) \(hp = 0\); A little dominant \(0 < hp < 1\); Completely dominant \(hp = 1\);

Extremely dominant \(hp > 1\);

Indices of trait giving to generation were accounted according to S.N.Warner [12] formula in second link hybrid:

\[ h^2 = \frac{\delta^2F_2}{\delta^2P_2} \]

\(\delta^2F_1\)- dispersion of \(F_1\) hybrids

\(\delta^2F_2\)- dispersion of \(F_2\) hybrids

\(\delta^2P_1\)- dispersion of maternal forms

\(\delta^2P_2\)- dispersion of paternal forms.

3. Results

Fiber length. For this trait the highest indices \(G.\) _sp.glabrum\) var.marie-galante (35.3 ± 0.7 mm) and «Beshqahramon» cultivar in interspecies diversity of \(G.\) _hirsutum\) L. species, the lowest indices \(G.\) _sp.mexicanum\) var.nervosum (25.5 ± 0.3 mm) were noted. The fiber length was 34.5 ± 0.5 mm in \(G.\) _mustelinum\) Miers ex Watt species. Trait variation was small in all parent forms, and it performed 4.2-7.7% (Table 1).

Various results were taken for fiber length of hybrid plants \(F_1\) which were taken crossbreeding the interspecies diversity of \(G.\) _hirsutum\) L. species with \(G.\) _mustelinum\) Miers ex Watt. For example, in \(F_1\) combination of \(G.\) _sp.mexicanum\) var.nervosum x \(G.\) _mustelinum\) the fiber length was 34.5 ± 0.3 mm, and trait will hereditied like completely dominant of higher indicator \(G.\) _mustelinum\) (\(hp = 1.0\)). In reciproc combination of \(F_1\) \(G.\) _mustelinum x \(G.\) _sp.mexicanum\) var.nervosum the fiber length was relatively short (31.8 ± 0.4 mm), the heredity through tenned in the way of incomplete dominant of \(G.\) _sp.mexicanum\) var.nervosum (\(hp = 0.4\)). In \(F_1\) \(G.\) _sp.punctatum\) x \(G.\) _mustelinum\) combination according to fiber length the low indicator maternal form \(G.\) _sp.punctatum\)’s complete dominance (\(hp = -1.0\), in reciproc \(F_1\) \(G.\) _mustelinum x \(G.\) _sp.punctatum\) combination incomplete dominance of highest indices maternal forms were noted (\(hp = 0.7\)). \(G.\) _mustelinum\) species and «Beshqahraman» cultivar were mutually crossbreed in reciproc \(F_1\) combination for fiber length extremely dominance were observed, and positive heterosis made 105.8-109.3%.

Hereditary of fiber length in extremely dominant condition were noted in \(F_1\), \(G.\) _var.el-salvador\) x combination, \(hp = 7.73\), heterosis was 105.5 in reciproc \(F_1\), \(G.\) _mustelinum\) x \(G.\) _var.el-salvador\) combination contrarily revealed the presence of negative extremely dominance. The trait of fiber length were hereditied in distance of parental or maternal forms, none of them were preponderant in \(G.\) _mustelinum\) species combination with \(G.\) _var.marie-galante\) (\(hp = 0.0\)) were seen, in opposite combination it noted positive extreme dominant (\(hp = -2.50\)).

\(F_2\) generation of hybrid which are getting with crossbreeding of \(G.\) _mustelinum\) Miers ex Watt. species and \(G.\) _hirsutum\) L. growth interspecies diversity were growth by growing 176 and 200 plant in the open field condition according to 10 combination. Getting results were learned with dividing into 5 class, from 20.1-25.0 mm till 40.0-45.0. The highest indices was 36.2 ± 0.7 in combination of «Beshqahramon» cultivar x \(G.\) _mustelinum\) according to fiber length through learned 10 combination. In this, degree of giving traits generation to generation were higher (\(h^2 = 0.62\)). \(F_2\) «Beshqahramon» cultivar x \(G.\) _mustelinum\) combination depend on fiber length 35.1-40.0 mm plants 64%, from reciproc \(G.\) _mustelinum\) x «Beshqahramon» cultivar combination the plant which fiber length was 35.1-40.0 mm 44%, 40.1-45.0 mm plants arranged 5.9%, and then they were taken for the next researches.

According to fiber length the lowest result were noted in \(F_2\) \(G.\) _mustelinum\) x \(G.\) _var.el-salvador\) combination (30.2 ± 0.9 mm). Degree of giving generation to generation the trait was resulted middle (\(h^2 = 0.42\)).

In directly and indirectly combination of \(G.\) _sp.mexicanum\) var.nervosum, \(G.\) _sp.paniculatum, var.el-salvador, \(G.\) _sp.glabrum var.marie-galante\) interspecies diversity of \(G.\) _hirsutum\) L. and «Beshqahramon» cultivar with \(G.\) _mustelinum\) species there were reciproc difference. Like situation were not seen in directly and indirectly combination of this spics with \(G.\) _sp.punctatum\). We must say that, in combination which had noted reciproc difference, \(G.\) _mustelinum\) species as a maternal form were shown low indices. As a result using of \(G.\) _mustelinum\) species as a paternal in crossbreeding is more effective (Diagram 1).

Fiber output

The highest indices of trait of fiber output through diversity of \(G.\) _hirsutum\) L. was \(G.\) _sp.punctatum\) (36.9 ± 1.2%), and in «Beshqahramon» cultivar (36.5 ± 0.1%) the lowest indices
were noted like var. nervosum (17.4 ± 0.4%) form. The fiber output of G. mustelinum Miers ex Watt. species were arranged 26.4 -20.0 %. The highest indices of trait of fiber output in F1 hybrid were taken crossbreeding of G. hirsutum L. interspecies diversity of G. mustelinum with each other were noted in F1 G. mustelinum x ssp. punctatum (38.6 ± 1.0%) and «Beshkahramon» cultivar x G. mustelinum (38.6 ± 0.6%) combinations, the lowest indicator were noted in reciproc combination with var. nervosum of G. mustelinum (19.2 ± 0.6% and 22.7 ± 2.2%). The lowest indicator were seen in F1 combination which are taken var. marie-galante form and «Beshkahramon» cultivar that using G. mustelinum as a maternal form as compared indirectly combination, but in F1 directly combination which were taken var. nervosum and ssp. punctatum the highest indices were seen as compared with indirectly combination. For fiber output reciproc differences were defined in directly and indirectly combination of G. mustelinum species with ssp. paniculatum and var. el-salvador.

The fiber expenditure trait were hereditied like positive extreme dominant in F1 hybrid and maternal form. For example, in F1 ssp. punctatum x G. mustelinum combination incomplete dominant of high indicator ssp. punctatum on the contrary combination positive extremere dominant were noted. In complete dominant of low fiber output of ssp. mexicanum var. nervosum were seen in F1 var. nervosum x G. mustelinum combination and on the contrary combination incomplete dominant of high fiber output G. mustelinum were seen. Positive heterosis results were noted combination of G. mustelinum x ssp. paniculatum, ssp. paniculatum x G. mustelinum, var. marie-galante x G. mustelinum, G. mustelinum x var. marie galante (13.9%; 132.2%; 137.3%; 120.1%).

Fiber output of F2 generation of F1 hybrid which were taken crossbreeding of G. hirsutum L. interspecies diversity with G. mustelinum Miers ex Watt. species were divide into 7 classes from 20.1-25.0% to 50.0-55.0%.

![Image](148x272 to 447x570)

### Table 1: Fiber length and fiber output

<table>
<thead>
<tr>
<th>Parental forms and hybrid combinations</th>
<th>Fiber output, %</th>
<th>Fiber length, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X ± S X</td>
<td>limit</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental forms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssp. mexicanum var. nervosum</td>
<td>31.6 ± 0.3</td>
<td>23.6-36.7</td>
</tr>
<tr>
<td>G. mustelinum x ssp. mexicanum var. nervosum</td>
<td>31.6 ± 0.3</td>
<td>23.6-36.7</td>
</tr>
<tr>
<td>ssp. punctatum x G. mustelinum</td>
<td>31.6 ± 0.3</td>
<td>23.6-36.7</td>
</tr>
<tr>
<td>var. el-salvador</td>
<td>31.6 ± 0.3</td>
<td>23.6-36.7</td>
</tr>
<tr>
<td>ssp. paniculatum x G. mustelinum</td>
<td>31.6 ± 0.3</td>
<td>23.6-36.7</td>
</tr>
<tr>
<td>ssp. glabrum var. marie-galante</td>
<td>31.6 ± 0.3</td>
<td>23.6-36.7</td>
</tr>
<tr>
<td>Beshkahramon cultivar</td>
<td>31.6 ± 0.3</td>
<td>23.6-36.7</td>
</tr>
<tr>
<td>G. mustelinum Miers ex Watt.</td>
<td>31.6 ± 0.3</td>
<td>23.6-36.7</td>
</tr>
</tbody>
</table>

Average indicator of trait was from 32.9 ± 1.6% to 41.2 ± 1.8%, variation coefficient was 14.0-15.5%. The highest fiber output were seen in F2 «Beshkahramon» and reciproc combination of G. mustelinum species in directly combination average indicator was 41.2 ± 1.8%, changing degrees of trait was 14.4%, on the contrary combination it was 37.6 ± 1.7% and 14.7%. The higher length and output of fiber of expensive genotype were chosen in research and nowadays it is used in genetic and breeding research (Diagram 2).
Diagram 2: Variation of fiber output in interspecific hybrids $F_2$, %

4. Conclusion

To sum up we have to emphasis that by conducted experiment of heredity traits (fiber output and fiber length) giving from generation to generation mainly by atom have dominant feature and by effect of cytoplasm leads recessive gene control.

References


