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INHERITANCE OF FLOWER TYPE IN VINE SEEDLINGS FROM COMPLEX INTERSPECIES HYBRID COMBINATIONS

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Abstract

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Research has been carried out into the inheritance of flower type in 20 interspecies hybrid combinations. It has been found that the phenotypic decomposition by this trait corresponds to some of the known hypotheses in literature in only 11 of them in F_1 progeny, while in the remaining ones it differs. By means of a scale of the theoretically possible genotypes, in accordance with the known hypotheses, an attempt has been made at genotypic identification of each cultivar participating in the crosses. The obtained results can be applied in vine selection for the development of new hybrids resistant to diseases and low temperatures, as well as in analysis crosses for determination of the genotype of separate cultivars in regard to flower type.

Key words: interspecies hybrid combinations, flower type, variability, changeability, homogeneity, probable genotypes

Introduction

The efficiency of the selection process in vine depends to a significant extent on the flower type of the used parent cultivars and its inheritance in F_1 progeny. In cultivated vine, hermaphrodite flower is considered a very valuable quality, which is indispensable in the desired combination with other commercially significant traits. There are a number of hypotheses in literature related to determination of genotype and genetic mechanisms of the inheritance of flower type in sex hybridization between different vine cultivars (Muller-Thurgau and Kobel, 1924; Breider and Scheu, 1938; Berthmann, 1938; Kim, 1978). According to Oberle (1938), flower type in vine is determined by two genes – Sp (Sp and sp) and So (So and so), as the dominant allele So inhibits ovule development and causes sterility, and the dominant allele Sp determines the development of the male gametophyte – the formation of normal stamens with viable pollen. Negrul (1936) establishes that sex in vine is determined by several interconnected genes. The individuals of male sex have a pair of chromosomes (F and f), and the female ones – (f and f). Levadoux (1946, 1951) considers that sex in vine is determined by the presence of 3 alleles in one locus, of which M – functionally male, H – hermaphrodite and F – functionally female. Based on cytological research, Klinkovskaya (1971) presents a hypothesis, which states that sex in vine is determined by two non-homologous chromosomes: **x** – female and **y** – male. According to Shterbakov (1968, 1974), sex is determined by 2 linked genes Sp (Sp, sp), as the dominant allele Sp forms male fertility, and the recessive one sp – male sterility; the dominant So (So and so) – determines female fertility, and so – female sterility. The damaging of the genetic balance is manifested best in interspecies hybridization where the balanced interaction of genes is disrupted. In contemporary vine selection, cultivars with complex origin are increasingly used for the purposes of sex hybridization. The objective of the current research is to establish the character of the inheritance of flower type in complex interspecies hybrid combinations.

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Materials and Methods

The research into the inheritance of flower type encompasses a sufficient number of seedlings from a total of 20 hybrid combinations between European and interspecies cultivars and rootstocks, including 6 hybrid combinations with functionally female ♀ **x** hermaphrodite ⚥, 6 – hermaphrodite ⚥ **x** hermaphrodite ⚥, 4 - hermaphrodite ⚥ **x** functionally male ♂ , 4 – functionally female ♀ **x** typically male ♂♂. Data on the flower type (sex) of the seedlings from each hybrid combination is collected. The percentages of the separate types are calculated, as well as their ratios. Analyses are carried out in the different crosses in terms of verification of the validity of the zero hypothesis through χ^2 /Chi-square/, and also in terms of homogeneity in crosses with identical theoretical ratios (Roytchev, 2003, 2005). In hybrid combinations where the ratios do not correspond to the known hypotheses, the criterion χ^2 is calculated on the basis of the most favourable theoretical ratio, where $\chi^2_{experimental} < \chi^2 = 3.84$, corresponding to $P_{0,05}$.

In regard to flower type, Negrul (1936) defines as theoretically possible the following genotypes: 2 ⚥ (hermaphrodite) – homozygous and heterozygous, 1 ♀ (functionally female) and 2 ♂ (functionally male) – homozygous and heterozygous. According to Oberle's hypothesis (1938), they are: 2 hermaphrodite genotypes (⚥), 4 functionally female (♀), 4 functionally male (♂) and 1 – sterile (⚲) (Table 1). According to Levadoux (1946, 1951) – 2 ⚥(hermaphrodite), 2 ♀ (functionally female) and 2 ♂ (functionally male) genotypes. Klinkovskaya (1971) states that 36 of the chromosomes in vine are homologous and 2 (**x**, **y**) – non-homologous, which makes possible gametes with 18+x, 18+y, 18+xy and 18+0 chromosomes, and the following possible genotypes – 2 ⚥ (hermaphrodite), 2 ♀ (functionally female) and 2 ♂ (function-

Table 1
Theoretically possible genotypes and phenotypes in accordance with the known hypotheses on flower type inheritance in vine

Flower type Author	⚥ Hermaphrodite (androgynous)	♀ Functionally female	♂ Functionally male	⚲ Sterile
Negrul, 1936	FnFn homozygous	Ff homozygous	Ff homozygous	-
	Fnf	-	FnF heterozygous	-
Oberle, 1938	SpSpsoso homozygous	SpSpSoSo homozygous	SpSpSoSo homozygous	spspSoSo homozygous
	Spspsoso heterozygous	SpspSoSo heterozygous	SpspSoSo heterozygous	sosoSoso heterozygous
	-	SpspSoso heterozygous	SpspSoso heterozygous	-
	-	SpSpSoso heterozygous	SpSpSoso heterozygous	-
Levadoux, 1946	I-HF homozygous	II-FF homozygous	III-HM heterozygous	-
	HH homozygous	-	MF heterozygous	-
Klinkovskaya, 1971	XXV homozygous	XX homozygous	XV homozygous	-
	XXVV heterozygous	-	XVV heterozygous	-
Shterbakov, 1974	S′pS′pS′oS′o homozygous	s′ps′pS′oS′o homozygous	S′pS′ps′os′o homozygous	s′ps′ps′os′o homozygous
	S′ps′pS′oS′o heterozygous	s′ps′pS′os′o heterozygous	S′ps′ps′os′o heterozygous	-
	S′ps′pS′os′o heterozygous	-	-	-
	S′pS′pS′os′o heterozygous	-	-	-

Table 2
Theoretically possible phenotypic and genotypic decomposition by flower type in vine

№	Hybrid combinations	♀	♀	♂	⚥	Negrul, 1936
1	⚥ homozygous x ⚥ homozygous	1	0	0	-	FnFn x FnFn
2	⚥ homozygous x ⚥ heterozygous	1	0	0	-	Fn Fn x Fnf
	⚥ homozygous x ⚥ heterozygous	1	0	0	-	
	⚥ homozygous x ⚥ heterozygous	1	0	0	-	
3	⚥ heterozygous x ⚥ heterozygous	1	0	0	-	
4	⚥ homozygous x ⚥ homozygous	1	0	0	-	
	⚥ homozygous x ⚥ homozygous	0	0	1	-	
5	⚥ homozygous x ♂ heterozygous	0	0	1	-	
6	⚥ heterozygous x ♂ homozygous	1	0	0	-	
7	♀ homozygous x ⚥ homozygous	1	0	0	-	ff x FnFn
8	♀ homozygous x ⚥ heterozygous	1	0	0	-	
9	♀ heterozygous x ⚥ homozygous	1	0	0	-	
10	⚥ homozygous x ♂ homozygous	1	0	0	-	
11	⚥ homozygous x ♂ heterozygous	1	0	1	-	FnFn x Ff
12	⚥ homozygous x ♂ heterozygous	1	0	1	-	FnFn x FnF
	⚥ homozygous x ♂ heterozygous	1	0	1	-	-
13	♀ heterozygous x ♂ homozygous	1	0	1	-	-
	♀ heterozygous x ♂ homozygous	1	0	1	-	-
14	⚥ heterozygous x ♂ heterozygous	1	0	1	-	Fnf x FnF
15	♀ homozygous x ♂ heterozygous	1	0	1	-	ff x
16	♀ heterozygous x ♂ homozygous	1	0	1	-	FnF
17	♀ homozygous x ⚥ homozygous	1	1	0	-	-
	♀ homozygous x ⚥ heterozygous	1	1	0	-	Ff x Fnf
	♀ homozygous x ⚥ heterozygous	1	1	0	-	-
18	♀ heterozygous x ⚥ heterozygous	1	1	0	-	Ff x Fnf
19	♀ homozygous x ♂ heterozygous	1	1	0	-	
20	♀ homozygous x ♂ heterozygous	0	1	1	-	ff x Ff
21	⚥ heterozygous x ♂ heterozygous	1	1	2	-	-
22	⚥ homozygous x ♂ homozygous	2	1	1	--	-
23	⚥ homozygous x ⚥ homozygous	3	1	0	-	-
24	⚥ heterozygous x ⚥ heterozygous	3	1	0	-	Fnf x Fnf
25	⚥ heterozygous x ♂ heterozygous	3	1	0	-	-
26	⚥ heterozygous x ♂ heterozygous	3	0	1	-	-
27	⚥ heterozygous x ♂ heterozygous	1	0	3	-	-
28	⚥ heterozygous x ♂ heterozygous	0	1	3	-	Fnf x Ff
29	⚥ heterozygous x ♂ heterozygous	0	0	3	1	-
30	⚥ heterozygous x ♂ heterozygous	3	1	3	1	5
31	♀ heterozygous x ⚥ heterozygous	4	2	1	1	Fn Fn x FnFn
32	♀ homozygous x ♂ homozygous	1	1	1	1	Fn Fn x Fnf
33	♀ homozygous x ♂ heterozygous	1	1	1	1	
34	♀ heterozygous x ♂ homozygous	1	1	1	1	
35	♀ heterozygous x ♂ heterozygous	0	0	3	1	

Oberle, 1938	Levadoux, 1946	Klinkovskaya, 1971	Shterbakov, 1974
SpSpsoso x SpSpsoso	HH x HH	XXV x XXV	S′pS′pS′oS′o x S′pS′pS′oS′o
	HH x HF	XXV x XXVV	S′pS′pS′oS′o x S′ps′pS′oS′o
-	-	-	S′pS′pS′oS′o x S′ps′pS′os′o
-	-	-	S′pS′pS′oS′o x S′pS′pS′os′o
-	-	-	S′pS′pS′oS′o x S′pS′pS′os′o
-	-	-	S′pS′pS′oS′o x S′pS′ps′os′o
SpSpsoso x SpSpSoSo	-	-	-
SpSpsoso x SpspSoSo	-	-	S′pS′pS′oS′o x S′ps′ps′os′o
Spspsoso x SpSpSoSo	-	-	S′ps′pS′oS′o x S′pS′ps′os′o
spspsoso x SpSpsoso	FF x HH	-	s′ps′pS′oS′o x S′pS′pS′oS′o
-	-	XX x XXVV	s′ps′pS′oS′o x S′pS′pS′os′o
-	-	-	s′ps′pS′os′o x S′pS′pS′oS′o
-	-	-	S′pS′pS′oS′o x S′pS′ps′os′o
SpSpsoso x SpspSoSo	-	-	-
SpSpsoso x SpspSoso	HH x HM	XXV x XVV	-
SpSpsoso x SpSpSoso	HH x FM	-	-
-	-	XXVV x XV	s′ps′pS′os′o x S′pS′ps′os′o
-	-		S′pS′pS′os′o x S′pS′ps′os′o
-	HF x HM	XXVV x XVV	-
spspsoso x SpSpSoso	-	-	-
-	-	-	s′ps′pS′os′o x S′pS′ps′os′o
-	-	XX x XXV	-
spspSoso x Spspsoso	FF x HF	-	s′ps′pS′oS′o x S′ps′pS′oS′o
-	-	-	s′ps′pS′oS′o x S′ps′pS′os′o
-	-	-	s′ps′pS′os′o x S′ps′pS′oS′o
-	-	-	s′ps′pS′oS′o x S′ps′ps′os′o
-	FF x FM	-	-
-	HF x FM	-	-
-		XXV x XV	-
-	-	XXV x XXV	-
Spspsoso x Spspsoso	HF x HF	-	S′ps′pS′oS′o x S′pS′pS′os′o
-	-	-	S′ps′pS′oS′o x S′ps′pS′oS′o
-	-	-	S′pS′pS′os′o x S′ps′pS′oS′o
Spspsoso x SpSpSoso			-
-	-	-	-
Spspsoso x SpspSoSo	-	-	-
Spspsoso x SpspSoso		-	-
spspSoso x SpspSoso	-	XX x XV	-
-	-	XX x XV	-
spspsoso x SpspSoso		XX x XVV	-
Spspsoso x Spspsoso	-	-	s′ps′pS′os′o x S′ps′ps′os′o
Spspsoso x SpspSoso	-	-	-

Table 3
Inheritance of flower type in the studied hybrid combinations

Hybrid combinations	Number of plants	♂		♀		⚥		Theoretically			χ^2 P
		number	%	number	%	number	%	♂	♀	⚥	
♀ Kober 5 BB x ⚥ Danube lazur	165	-	-	73	44.24	92	55.76	-	1	1	$2.20>P_{0.10}$
♀ Kober 5 BB x ⚥ Srebrostrui	111	-	-	52	46.85	59	53.15	-	1	1	$0.44>P_{0.50}$
♀ Kober 5 BB x ⚥ Danube gamza	238	-	-	122	51.26	116	48.74	-	1	1	$0.15>P_{0.50}$
Total	df = 3										$2.79>P_{0.25}$
Combined	df = 1										$0.78>P_{0.25}$
Homogeneity	df = 2										$2.01>P_{0.25}$
⚥ Seyve Villard 12375 x ⚥ Cardinal	23	-	-	2	8.70	21	91.30	-	1	3	$3.26>P_{0.08}$
⚥ Plevenski favorit x ♂ Kishmish luchistii	27	-	-	3	11.11	24	88.89	-	1	3	$2.78>P_{0.10}$
⚥ Augustin x ♂ Kishmish moldovskii	28	-	-	5	17.86	23	82.14	-	1	3	$0.76>P_{0.25}$
⚥ Augustin x ♂ Kishmish luchistii	25	-	-	4	16.00	21	84.00	-	1	3	$1.08>P_{0.25}$
Total	df = 4										$7.88<P_{0.05}$
Combined	df = 1										$7.14<P_{0.05}$
Homogeneity	df = 3										$0.73>P_{0.75}$
♀ Chaush x ♂♂ 196-17	20	13	65.0	-	-	7	35	3	-	1	$0.02>P_{0.90}$
♀ Chaush x ♂♂ SO4	25	19	76.0	5	20.0	1	4.00	3	1	1	$4.27>P_{0.10}$
♀ Chaush x ♂♂ 140 Rudzheri	35	25	71.4	5	14.29	5	14.29	3	1	1	$1.90>P_{0.50}$
♀ Chaush x ♂♂ 1003 P	33	25	75.8	6	18.18	2	6.06	3	1	1	$0.48>P_{0.75}$
Total	df = 6										$6.65>P_{0.05}$
Combined	df = 2										$3.88>P_{0.10}$
Homogeneity	df = 4										$2.77>P_{0.50}$
♀ Kober 5 BB x ⚥ Rkatsiteli	121	-	-	49	40.50	72	59.50	-	1	2	$2.09>P_{0.15}$
♀ Kober 5 BB x ⚥ Pomoriiski biser	148	-	-	58	39.19	90	60.81	-	1	2	$2.28>P_{0.12}$
♀ Kober 5 BB x ⚥ Druzhba	159	-	-	52	32.70	107	67.30	-	1	2	$0.03>P_{0.75}$
Total	df = 3										$4.40>P_{0.20}$
Combined	df = 1										$0.03>P_{0.75}$
Homogeneity	df = 2										$4.40>P_{0.10}$
⚥ Seyve Villard 12375 x ⚥ Pleven	23	-	-	1	4.35	22	95.65	-	1	4	$3.52>P_{0.05}$
⚥ Naslada x ⚥ Jubilee moldovskii	23	-	-	1	4.35	22	95.65	-	1	4	$3.52>P_{0.05}$
⚥ Naslada x ⚥ Strashinski	26	-	-	2	7.69	24	92.31	-	1	4	$2.46>P_{0.10}$
Total	df = 3										$9.50<P_{0.25}$
Combined	df = 1										$9.38<P_{0.01}$
Homogeneity	df = 2										$0.11>P_{0.90}$
⚥ Naslada x ⚥ Plevenski favorit	28	-	-	-	-	28	100	-	-	1	-
⚥ Seyve Villard 12375 x ⚥ Muscat plevenski	27	-	-	-	-	27	100	-	-	1	-
⚥ Augustin x ♂ Nedelchev VI-4	28	-	-	-	-	28	100	-	-	1	-

Legend: ⚥ - hermaphrodite (androgynous); ♀ - functionally female; ♂ - functionally male; ♂♂ - typically male (rootstocks)

Table 4
Theoretically possible genotypes of the studied vine cultivars according to the data of the known hypotheses

Cultivar / Author	Negrul, 1936	Oberle, 1938	Levadoux, 1946	Klinkovskaya, 1971	Shterbakov, 1974
♀ Kober 5 BB	Homozygous - ff	Homozygous - SpSpsoso Heterozygous - spspSoso	Homozygous - FF	Homozygous - XX	Homozygous - s′ps′pS′oS′o Heterozygous - s′ps′pS′os′o
♂ Danube lazur	Heterozygous - Fnf	Homozygous - Spspsoso	Homozygous - HF	Heterozygous - XXVV	Heterozygous - S′ps′pS′os′o Heterozygous - S′ps′pS′oS′o
♂ Srebrostrui	-	Heterozygous - Spspsoso	Homozygous - HF	Heterozygous - XXVV	Heterozygous - S′ps′pS′oS′o
♂ Danube gamza	-	Heterozygous - Spspsoso	Homozygous - HF	Heterozygous - XXVV	-
♂ Seyve Villard 12375	Heterozygous - Fnf	Heterozygous - Spspsoso	Heterozygous - HF	-	Heterozygous - S′ps′pS′oS′o
♂ Plevenski favorit	-	Heterozygous - Spspsoso	Heterozygous - HF	-	Heterozygous - S′pS′pS′os′o
♂ Augustin	Heterozygous - Fnf	Heterozygous - Spspsoso	Heterozygous - HF	-	Heterozygous - S′pS′pS′os′o
♂ Kishmish moldovskii	Heterozygous - Fnf	Heterozygous - Spspsoso	Heterozygous - HF	-	Heterozygous - S′pS′pS′os′o
♂ Kishmish luchistii	Heterozygous - Fnf	Heterozygous - Spspsoso	Heterozygous - HF	-	Heterozygous - S′pS′pS′os′o
♂ Cardinal	-	-	-	-	Heterozygous - S′ps′pS′oS′o
♂ Naslada	Homozygous - FnFn	Homozygous - SpSpsoso	Homozygous - HH	Homozygous - XXV	Homozygous - S′pS′pS′oS′o
♂ Plevenski favorit	Heterozygous - Fnf	Homozygous - SpSpsoso	Homozygous - HH	Homozygous - XXV	Heterozygous - S′ps′pS′oS′o
♂ Seyve Villard 12375	Heterozygous - Fnf	Homozygous - SpSpsoso	Homozygous - HH	Homozygous - XXV	Heterozygous - S′ps′pS′os′o
♂ Muscat plevenski	Heterozygous - Fnf	Homozygous - SpSpsoso	Homozygous - HH	Homozygous - XXV	Heterozygous - S′pS′pS′os′o
♂ Augustin	Heterozygous - Fnf	Homozygous - SpSpsoso	Homozygous - HH	Homozygous - XXV	Heterozygous - S′pS′pS′os′o
♂ Nedelchev VI-4	Heterozygous - Fnf	Homozygous - SpSpsoso	Homozygous - HH	Homozygous - XXV	Heterozygous - S′pS′pS′os′o

ally male), respectively homozygous and heterozygous. Shterbakov (1968, 1974) suggests that sex is determined by the following genotypes – 4 ♂ (hermaphrodite), one of which homozygous and three heterozygous, 2 ♀ (functionally female) – homozygous and heterozygous, 2 ♂ (functionally male) – homozygous and heterozygous, and 1 ♀ (female and male sterility). Theoretically analyzing crosses between known genotypes are conditionally accepted and the possible genotypes are obtained. Through the established theoretical ratios by phenotype, the probable genotypes of the cultivars participating in the experimental hybrid combinations are identified, corresponding in terms of the degree of phenotypic decomposition to the mentioned hypotheses.

Results and Discussion

According to the presented hypotheses, the theoretical ratio 1♂:1♀ is possible in the following hybrid combinations: ♂ homozygous x ♂ homozygous, ♀ homozygous x

⚥ heterozygous and ♀ heterozygous x ⚥ heterozygous with the corresponding genotypes (Table 2). Data on the phenotypic decomposition shows that this ratio is identical in the hybrid combinations ♀ Kober 5 BB x ⚥ Danube lazur, ♀ Kober 5 BB x ⚥ Srebrostrui and ♀ Kober 5 BB x ⚥ Danube gamza (Table 3). Under some provisionality, the genotype of the cultivar-rootstock ♀ Kober 5 BB according to the separate authors is: Negrul – homozygous (ff); Oberle – homozygous (SpSpsoso) or heterozygous (spspSoso); Levadoux – homozygous (FF); Klinkovskaya – homozygous (XX); Shterbakov – homozygous (s'ps'pS'oS'o) or heterozygous (s'ps'pS'os'o) (Table 4). The cultivars ⚥ Danube lazur, ⚥ Srebrostrui and ⚥ Danube gamza have the following probable genotype under the order of the authors – heterozygous (Fnf); heterozygous (Spspsoso); homozygous (HF); heterozygous (XXVV); heterozygous (S'ps'pS'os'o) or heterozygous (S'pspS'oSo).

In the hybrid combinations ⚥ Seyve Villard 12375 x ⚥ Cardinal, ⚥ Plevenski favorit x ♂ Kishmish luchistii, ⚥ Augustin x ♂ Kishmish moldovskii and ⚥ Augustin x ♂ Kishmish luchistii, the phenotypic decomposition is 3⚥:1♂ at $\chi^2_{experimental} > P_{0.05}$ and homogeneity $\chi^2 = 0.73 > P_{0,75}$. The theoretically possible genotypes of the separate cultivars participating in these crosses according to the studied trait, are heterozygous: ⚥ Cardinal – (S'ps'pS'oS'o) and the remaining cultivars – (Fnf); (Spspsoso); (HF); (S'pS'pS'os'o).

In the hybrid combinations ⚥ Naslada x ⚥ Plevenski favorit, ⚥ Seyve Villard 12375 x ⚥ Muscat plevenski and ⚥ Augustin x ♂ Nedelchev VI-4, 100% ⚥ plants with hermaphrodite flowers are obtained, and the genotype of the cultivars is homozygous (FnFn) and heterozygous (Fnf); homozygous (SpSpsoso); homozygous (HH); homozygous (XXV); homozygous (S'pS'pS'oS'o) and heterozygous (S'pS'pS'oso). The cultivar ⚥ Augustin, when crossed with ♂ Kishmish moldovskii and ♂ Kishmish luchistii, has the following genotype in accordance with the separate hypotheses – (Fnf); (Spspsoso); (HF); (S'pS'pS'os'o – by Shterbakov), and when crossed with ♂ Nedelchev VI-4 – (Fnf); (SpSpsoso); (HH); (XXV); (S'pS'pS'os'o). Probably the recessive allele, which also determines heterozygosity, influences phenotype in some hybrid combinations, and due to this genotype is not fully manifested. It should be noted that the experimental data obtained by a number of authors in relation to the establishment of flower type inheritance in vine, differ from the genetic principles reflected in the hypotheses applied in this research.

In the hybrid combinations ♀ Chaush x ♂♂ SO4, ♀ Chaush x ♂♂ 140 Rudzheri, ♀ Chaush x ♂♂ 1003 P, the phenotypic decomposition coincides with the theoretical one 3♂:1♀:1⚥, with $\chi^2 = 0.48\text{-}4.27$ at $>P_{0.10}\text{-}P_{0.75}$ and homogeneity at df = 4, $\chi^2 = 2.77 > P_{0,50}$. In the hybrid combinations of the rootstock ♀ Kober 5 BB with the cultivars ⚥ Rkatsiteli, ⚥ Pomoriiski biser and ⚥ Druzhba, the phenotypic decomposition is 1♀:2⚥ at $\chi^2 = 0.03\text{-}2.28$ and $P_{0,12}\text{-}P_{0,75}$, and homogeneity at df = 2, $\chi^2 = 4{,}40 > P_{0,10}$. In the hybrid combinations ⚥ Seyve Villard 12375 x ⚥ Pleven, ⚥ Naslada x ⚥ Jubilee moldovskii and ⚥ Naslada x ⚥ Strashinski, the theoretical phenotypic decomposition is 1♀:4⚥, exceeding $\chi^2 = 3.84 > P_{0,05}$. It is most likely that the genotype of each cultivar in these crosses is homozygous or heterozygous, and the dominant alleles which determine hermaphroditism, prevail over recessive ones. This is also confirmed by the fact that 100% plants with hermaphrodite flowers are obtained from the cultivars ⚥ Seyve Villard 12375 and ⚥ Naslada, combined with ⚥ Plevenski favorit and ⚥ Muscat plevenski. The genotype of the cultivars from the hybrid combinations ⚥ Naslada x ⚥ Plevenski favorit, ⚥ Seyve Villard 12375 x ⚥ Muscat plevenski and ⚥ Augustin x ♂ Nedelchev VI-4, by flower type – hermaphrodite, corresponds to a theoretical combination homozygous x heterozygous.

Golodriga et al. (1975) suggest that flower type in vine can change throughout the process of individual development of the hybrid offspring, depending on the hereditary information of parents, environmental conditions and physiological state of plants during the period of fertilization and zygote development. Kozma (1974) reports that in the process of inheritance of flower type, a number of cases are observed in the various vine cultivars, which differ from Mendel's schemes. Guzun (1984) mentions that deviations from the theoretically expected decomposition can be explained by point mutations and combinations between them at the time of merging of sex chromosomes. The obtained experimental data shows that, in some of the studied hybrid combinations, the phenotypic manifestation of the researched trait does not coincide with any of the known hypotheses for flower type inheritance. The decomposition in crosses between the complex interspecies hybrids ⚥ Naslada x ⚥ Strashinski, ⚥ Naslada x ⚥ Plevenski favorit and ⚥ Seyve Villard 12375 x ⚥ Pleven, is in a ratio 22⚥:1♀. Probably the discordance with the theoretically possible decomposition is caused by the genetic instability of this trait, determined by the fact that these are cultivars obtained by complex interspecies hybrids, and by the significance of paratype factors on genes influencing this trait.

Conclusions

From the analyzed 20 interspecies hybrid combinations by the trait flower type, the phenotypic decomposition of only 11 of them in F_1 progeny coincides with

some of the known hypotheses in literature, while in the remaining ones – it differs. By means of a scale of the theoretically possible genotypes, an attempt has been made at genotypic identification of each cultivar participating in the crosses. The obtained results can be used in vine selection for the development of new hybrids, resistant to diseases and low temperatures, and in analysis crosses for establishment of the genotype of separate cultivars in relation to this trait.

In the hybrid combinations of the rootstock ♀ Kober 5 BB x ♂ Danube lazur, x ♂ Srebrostrui, x ♂ Danube gamza, the ratio between the flower types 1♂:1♀ coincides with the known hypotheses, and the genotype of ♀ Kober 5 BB is ff; SpSpsoso or spspSoso; FF; XX; s'psp'S'oS'o or s'ps'pS'os'o. The cultivars ♂ Danube lazur, ♂ Srebrostrui and ♂ Danube gamza have genotype Fnf; Spspsoso; HF; XXVV; S'ps'pS'os'o or S'ps'pS'oS'o. In the hybrid combinations ♂ Seyve Villard 12375 x ♂ Cardinal, ♂ Plevenski favorit x ♂ Kishmish luchistii, ♂ Augustin x ♂ Kishmish moldovskii and ♂ Augustin x ♂ Kishmish luchistii, the phenotypic decomposition is 3♂:1♂. The theoretically possible genotypes of the separate cultivars are as follows: ♂ Cardinal – S'ps'pS'oS'o, and the remaining ones – Fnf; Spspsoso; HF; S'ps'pS'oS'o or S'pS'pS'os'o.

In the hybrid combinations ♂ Naslada x ♂ Plevenski favorit, ♂ Seyve Villard 12375 x ♂ Muscat plevenski and ♂ Augustin x ♂ Nedelchev VI-4, the probable genotype in regard to flower type of all cultivars is FnFn and Fnf; SpSpsoso; HH; XXV; S'pS'pS'oS'o, S'ps'pS'oS'o, S'pS'pS'os'o. In the hybrid combinations ♀ Chaush x ♂♂ SO4, x ♂♂ 140 Rudzheri, x ♂♂ 1003 P, the phenotypic decomposition is 3♂:1♀:1♂, in ♀ Kober 5 BB x ♂ Rkatsiteli, x ♂ Pomoriiski biser, x ♂ Druzhba – 1♀:2♂, and in ♂ Seyve Villard 12375 x ♂ Pleven, ♂ Naslada x ♂ Jubilee moldovskii and ♂Naslada x ♂ Strashinski – 1♀:4♂. In these crosses, the genotype of each cultivar can be homozygous or heterozygous, and dominant alleles determining hermaphrodite flower type, prevail over recessive ones.

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