

Inheritance of Panicle Inflorescence '*pi*' and Long Raceme Peduncle '*lp*' Genes in Lucerne (*Medicago sativa* L.)

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Genetic segregations in tetraploid plants like alfalfa (*Medicago sativa* L.; $2n = 4x = 32$) are complicated by modes of gamete formation not found in diploids. Conformably with, the type of segregation displayed for any one specific character as *pi*-or *lp*-type is not constant but is a function of the degree of homology existing between the chromatin materials derived from the two parental plants. For all that, we will be shedding little light on the inheritance of panicle inflorescence (*pi*-type) and long raceme peduncle (*lp*-type)-types throughout some crosses between *Medicago sativa* ssp. *sativa* versus *Medicago sativa* ssp. *falcata*. Therefore, hand pollinations were made with a hand emasculation and pollen was transferred by black photo film-paper as a boat shape among seven genotypes. Two non-recurrent parental plants {*pi*.2fr/1x72/11: *pi*-type (Panicle Inflorescence-type) and BC₁F₂-102: *lp*-type (Long Raceme Peduncle-type) and five recurrent parental plants (Giza-1, Ismailia-1, Ismailia-94, New Valley and Sewa) were crossed in a factorial mating design.

Inheritance of Panicle Inflorescence:

F₁-plants from all crosses under investigation had racemes normal-type (Table 1). Because of, the Polish mutation is nulliplex homozygote; *pi pi pi pi* (Staszewski and Bodzon, 1999) and recessive parent contributes only recessive alleles, the segregation ratios from our material were fit to these values only the triplex heterozygotes Egyptian germplasm; i.e.: *PI PI PI pi*. Segregation ratio 11:1 was obtained in the BC₁F₂ and BC₂F₂-generations for most crosses and its generations, except of BC₁F₂ in Ciza-1 x *pi*-type, indicated a simple tetrasomic inheritance for the recessive character. The genotypes of the parental plants for these crosses were designated *PI PI pi pi* and *PI pi pi pi* i.e.: duplex x simplex, because the observed segregations fit only the hypothesized 11:1 backcross ratios.

Table (1): Segregation pattern for panicle inflorescence-type (*pi*-type) genes from pooled data of alfalfa crosses involving *pi*-type and normal raceme parents.

Pooled data overall crosses	Observed number (o)		Expected number (e)		Deviation (o - e)		Ratio	P
	Normal	<i>pi</i> -type	Normal	<i>pi</i> -type	Normal	<i>pi</i> -type		
F ₁	All	---	---	---	---	---	---	---
BC ₁ F ₁ and BC ₂ F ₁ -pooled	All	---	---	---	---	---	---	---
BC ₁ F ₂ and BC ₂ F ₂ -pooled	1506	197	1513.78	189.22	-7.78	7.78	8 : 1	0.55

Apropos of the pooled data for all crosses (Table 1), because the original hypothesis could not account for the presence of *pi*-type in BC₁F₂ and BC₂F₂-pooled (8:1; $P = 0.55$), an alternative hypothesis was proposed. So, tetra-disomic inheritance had been considered for these data. Consequently, if the data from different studies or crosses is consistent, then, the pooled value will be very close to the total value. However, if the independent studies produce very different results, the pooled value will be quite different from the total value. Thus, the heterogeneity among studies will be high indicating that something, either due to sampling small numbers in each case, experimental error and / or different genetics in different crosses are causing the studies to vary. In the light of, we can concluded that, the heterozygous for one dominant factor only is necessary for normal raceme-type and homozygous recessive all factors for the *pi*-type. More than ever, two complementary dominant genes (Dudley and Wilsie, 1957) were assumed necessary for normal racemes; one gene was inherited in a disomic and the other in a tetrasomic manner. From the present point of view, although, the segregation ratios were arbitrary and although no progeny tests have been conducted for all generations to check the hypothesis suggested it seems logical to assume that in these crosses at least four recessive factors were involved in the *pi*-type and that inheritance was in part quantitative and in part qualitative.

Inheritance of long raceme peduncle:

F₁-plants resulting from the *sativa-falcata* crosses showed variation both between sibs and between parents for raceme length (Table 2) indicating that some of the parental plants were not completely homozygous for all the factors affecting raceme peduncle length. Where, the two types (normal-and *lp*-types) were noted in the F₁-generation of all crosses under investigation. Consequently, an exact description of each parent cannot be given. To comment this observation, the maximum expression for raceme length under our condition in Egypt (short day \cong 12 h) is 3–5 cm, while, the same materials (Egyptian germplasms) were ranged 3–9 cm under Polish condition (long day \cong 16 h). On the preceding, we can declared that, because of, lucerne is a long-day plant though the minimum photoperiod required to initiate flowering various among genotypes, the flower number and floral developments are also promoted by long photoperiods. Therefore, if photoperiod are long enough to promote long raceme, more flowers will be produced at higher irradiance. Then, the raceme length was more affected by long day or photoperiod. Observable, the racemes length and its development were more affected by the arise time of these racemes on the plant and its related with photoperiod. Where, we observed on the same plant large variation in raceme length; long, short and intermediate racemes. On account of, the variation in raceme peduncle length among crosses and generations, we can presumed that, it was caused by either environmental, genetic modification and / or their interaction of the *lp*-genotypes. According to the previous results, we can denoted that, the *lp*-factors followed a quantitative rather than a qualitative pattern expression and that whether inheritance was disomic or tetrasomic, the *lp*-parent carried factors for *lp*-type at more than one loci. However, an even large samples size than we used would be required to statistically distinguish between these two different types.

Table (2): Possible F₁-genotypes, backcross ratios and χ^2 -probability values for long raceme peduncle-type (*lp*-type) genes from pooled data of alfalfa crosses involving *lp*-type and normal raceme parents.

Pooled data overall crosses	Observed number (o)		Expected number (e)		Deviation (o - e)		Ratio	P
	Normal	<i>lp</i> -type	Normal	<i>lp</i> -type	Normal	<i>lp</i> -type		
F ₁	273	22	---	---	---	---	---	---
BC ₁ F ₁ and BC ₂ F ₁ -pooled	714	95	---	---	---	---	---	---
BC ₁ F ₂ and BC ₂ F ₂ -pooled	1620	351	1642.50	328.50	-22.50	22.50	5 : 1	0.17

References:

- Dudley, J. W. and C. P. Wilsie (1957):** Inheritance of branched raceme and vestigial flower in alfalfa. *Agron. Jour.*; 49: 320-323.
- Staszewski, Z. and Z. Bodzon (1999):** Inheritance of branch raceme inflorescence determined by a spontaneous mutation in *Medicago sativa* L. Proc. of the 22nd Eucarpia Fodder Crops and Amenity Grasses Section Meeting. New Approaches and Techniques in Breeding Sustainable Fodder Crops and Amenity Grasses. Petersburg, Russia, October 17-21, 1999; pp. 65-68.