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GENETIC ANALYSIS FOR OPIUM AND SEED YIELD AND THEIR COMPONENT TRAITS IN OPIUM POPPY (*PAPAVER SOMNIFERUM* L.)

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ABSTRACT

Gene effects were studied for eight characters in 10 crosses of opium poppy consisting diversed genotypes. Additive type gene action was operative in the inheritance of capsule size, number of capsule per plant and number of effective lancing per capsule. Dominance and additive x additive gene effects were observed for the expression of days to 50% flowering. Opium and husk yield were predominantly under the control of dominance and dominance x dominance gene action. Dominance gene effects were operative for seed yield. Additive gene action were also observed for opium and plant height in few crosses. Duplicate type epistasis were noticed for all the characters.

Key words: Generation mean analysis, gene effects, opium poppy.

Opium poppy (*Papaver somniferum* L.), an important medicinal crop, is wildly grown for opium and seed yield. The information on gene effects for various characters is meagre, which is needed for formulating an efficient breeding programme to achieve desired genetic improvement in this crop. The present investigation has been conducted to analyse the gene effects in 10 crosses of opium poppy.

MATERIALS AND METHODS

The experimental material comprised of parents, F_1, F_2 and F_3 generations of 10 crosses (MOP 507 x NOP 4, MOP 507 x NBPGR 1, MOP 507 x MOP 539, IC 128 x UO 185, MOP 539 x NOP 4, IC 42 x MOP 319, IC 42 x MOP 506, IC 42 x IC 7, IC 42 x IC 88 and IC 42 x IC 95). The trial was laid out in compact family block design with four replications at Mandsaur in All India Coordinated Research Project on Medicinal and Aromatic Plants, in rabi 1990-91. Parents and F_1s in two rows and F_2 and F_3 in four rows of 3 m length were sown in each replication. Spacing was 30 cm between rows and 8-10 cm between plant. Data on five

competitive plant from each plot of parents, F_1s and all plants from F_2, F_3 generations were recorded on eight characters (Tables 1, 2). Crosses showing significant variation among generations in compact family block design were subjected to generation mean analysis for five parameters according to Hayaman [1]. C-scaling test was used to detect the presence of epistasis [2].

RESULTS AND DISCUSSION

Gene effects in five-parameter model revealed that mean values were highly significant for all the characters in all the significant crosses (Tables 1 and 2). The cross MOP 507 x NOP 4 showed significant additive gene effects (d) for number of effective lancings per capsule, husk and seed yield. The crosses IC 42 x MOP 506 for plant height, IC 42 x MOP 319 for plant height and capsule size, IC 42 x IC 95 for number of capsules per plant and husk yield, and IC 128 x UO 185 and MOP 539 x NOP 4 for opium yield showed significant additive gene effects (d), indicating that additive gene action was operative for the control of these traits in respective crosses.

Table 1. Gene effects and type of epistasis for husk, seed and opium yield in opium poppy

Cross	Gene effects					Type of epistasis
	m	d	h	i	l	
			Husk yield per plant			
MOP 507 x NOP 4	3.76**	0.53**	2.7**	-2.00	-6.31**	Duplicate
MOP 507 x NBPGR 1	4.09**	0.18	3.83**	1.25	-9.26**	Duplicate
IC 42 x MOP 506	3.53**	0.26	4.44**	1.75	-6.72**	Duplicate
IC 42 x IC 95	2.29**	0.36**	0.61	0.10	3.44	Complementary
			Seed yield per plant			
MOP 507 x NOP 4	3.90**	5.76*	3.02*	0.25	-5.71	Duplicate
MOP 507 x NBPGR 1	4.00**	0.21	1.80**	-0.50	-2.00	Duplicate
IC 42 x MOP 506	2.86**	0.19	2.89*	-0.66	4.53	Complementary
IC 42 x IC 7	3.10**	0.15	2.64**	-0.61	3.23	Complementary
			Opium yield per plant			
MOP 507 x NOP 4	0.096**	0.008	0.092**	0.065	-0.100	Duplicate
MOP 507 x NBPGR 1	0.152**	0.001	0.140**	0.134	-0.431**	Duplicate
MOP 507 x MOP 539	0.076**	0.003	-0.004	-0.007	0.090**	Duplicate
IC 128 x UO 185	0.092**	0.015**	0.017	0.001	0.022	Complementary
MOP 539 x NOP 4	0.090**	0.015*	0.024	0.107	-0.046	Duplicate
IC 42 x MOP 319	0.084**	0.008	0.024	0.066*	0.264	Complementary
IC 42 x MOP 506	0.102**	0.009	0.134**	0.017	0.067	Complementary
IC 42 x IC 95	0.086**	0.014	0.014	-0.008	0.247*	Complementary

*$P \leq 0.05$, **$P \leq 0.01$.

Table 2. Gene effects and type of epistasis for days to 50% flowering, plant height, capsule size and capsule number per plant in opium poppy

Cross	Gene effects					Type of epistasis
	m	d	h	i	l	
			Days to 50% flowering			
MOP 507 x NOP 4	95.75**	0.00	5.50*	5.65*	- 6.00	Duplicate
MOP 507 x MOP 539	96.55**	1.25	2.17	6.08*	- 3.33	Duplicate
MOP 539 x NOP 4	96.50**	0.37	5.67*	6.06*	- 5.33	Duplicate
IC 42 x MOP 506	96.75**	0.12	3.32	6.19*	- 6.67	Duplicate
			Plant height			
IC 42 x MOP 319	82.35**	4.75**	3.99	9.68	24.87	Complementary
IC 42 x MOP 506	82.73**	2.94**	8.37	1.18	3.07	Complementary
IC 42 x IC 7	92.10**	1.52	20.87**	2.65	- 12.53	Duplicate
			Capsule size			
MOP 507 x MOP 539	14.69**	1.11*	1.19	2.56	- 5.08	Duplicate
IC 42 x MOP 319	14.10**	1.24*	0.02	-3.24*	0.47	Complementary
			No. of capsule per plant			
IC 42 x MOP 319	1.08**	0.12	- 0.61	0.35**	1.41	Duplicate
IC 42 x IC 95	1.17**	0.15*	0.08	0.26	0.56	Complementary
			No. of effective lancings per capsule			
MOP 507 x NOP 4	1.53**	0.22*	0.35	0.95*	- 1.95	Duplicate
MOP 507 x MOP 539	1.48**	0.07	- 0.14	0.13**	0.24	Duplicate
MOP 539 x NOP 4	1.58**	0.04	0.47	0.45*	- 1.39	Complementary

*$P \leq 0.05$ and **$P \leq 0.01$.

Dominance gene action (h) was significantly operative in the cross MOP 507 x NOP 4 for days to 50% flowering, husk, seed and opium yield; in MOP 539 x NOP 4 for days to 50% flowering; in IC 42 x IC 7 for plant height and seed yield; and in MOP 507 x NBPGR 1 and IC 42 x MOP 506 for husk, seed and opium yield. The relative magnitude of additive (d) and dominance (h) gene effects indicated that husk and seed yield were predominantly under the control of dominance and additive gene action, respectively, in the cross MOP 507 x NOP 4.

Among the nonallelic gene interaction components, additive x additive (i) type of gene action was significantly operative for days to 50% flowering and number of effective lancing per plant in all crosses. The cross IC 42 x MOP 319 for capsule size and number of capsule per plant and opium yield showed additive x additive (i) type of gene action. Dominance x dominance (l) type of gene action were operative for husk and opium yield in the cross MOP

507 x NBPGR 1 and for husk yield in MOP 507 x NOP 4 and IC 42 x MOP 506. Duplicate type epistasis was involved in the development of all the characters in majority of the crosses.

The present results revealed that additive type of gene action was prevalent for capsule size, capsule number per plant, number of effective lancings per capsule and plant height. This is in agreement with earlier reports [3–5]. Nonadditive gene action was present for husk and seed yield. Opium yield was under the control of either additive or nonadditive gene effects in different crosses whereas days to 50% flowering was predominantly under the control of both additive and nonadditive gene action. Similar results were also reported earlier for husk yield [6], days to 50% flowering and other characters [5] in opium poppy. Crosses showing significant gene effects for yield characters also showed significant gene effects for one or more component characters.

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