

Mating propensity of interstrain hybrids in *Drosophila bipectinata*

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ABSTRACT

In *Drosophila bipectinata*, seven wild stocks were crossed reciprocally with each other to obtain F₁ hybrids. Mating success of hybrids was studied by direct observation in an Elens-Wattiaux mating chamber. The number of matings varied in the different crosses. Analysis of variance was carried out on the data of hybrids and strains to detect the effect of male and female strains as well as interaction between sexes. Variation was highly significant for males, females and males x females interaction. Thus both sexes contribute to the variance of the next generation. The overall mean number of matings of F₁ hybrids was close to that of the original strains, which shows polygenic control of mating propensity, and a substantial amount of additive genetic variation in natural populations of *D. bipectinata*, which is reported for the first time in this species. These findings suggest that mating propensity is under genetic control and that there is sexual selection in *D. bipectinata*.

INTRODUCTION

A number of investigations have been carried out on mating propensity in various species of *Drosophila* (for references see Spiess, 1970; Parsons, 1973; Spieth and Ringo, 1983). It is evident from the result of these studies that efficiency of mating varies for different genotypes. This provides evidence for sexual selection. Experimental evidence includes the work done on wild strains, mutant strains, inversion karyotypes, allozyme polymorphism and artificial selection for high and low mating propensity in various species of *Drosophila* (Spiess, 1970; Parsons, 1973; Gilbert and Richmond, 1982; Spieth and Ringo, 1983). The contribution of males to the variation in mating propensity is greater than that of females and thus males are inherently more subject to intrasexual selection (Maynard Swith, 1956; Parsons, 1964, 1965; Markow, 1986; Singh and Chatterjee, 1987). However,

Kessler (1968) reported that females contribute more to the variation of mating speed than males of *D. pseudoobscura*. While studying the mating propensity of wild stocks and the hybrids it has been shown that it is under the control of polygenes, with additive, heterotic and reciprocal effects (Parsons, 1964, 1965; Fulker, 1966; Singh and Chatterjee, 1987).

Drosophila bipectinata, which is common in India, belongs to the *bipectinata* species complex of the *ananassae* subgroup of the *melanogaster* species group. This species shows incomplete sexual isolation with other members of the *bipectinata* complex (Singh *et al.*, 1981). We studied mating propensity of wild stocks of *D. bipectinata* derived from different geographic localities and found significant variation in mating propensity which is due to genetic heterogeneity among the stocks tested (Singh and Sisodia, 1995). On the basis of diallel analysis it was also shown that variation in the activity among the strains is due to differences in sexual activity of both sexes. The present paper describes the results of our investigations on mating propensity of

interstrain hybrids which were obtained by making reciprocal crosses among seven wild stocks of *D. bipunctinata* originating from ecogeographically different localities in India, which is being reported for the first time in this species.

MATERIAL AND METHODS

Seven mass culture stocks of *D. bipunctinata* established from flies collected from different localities in India were employed. The details of these stocks are given in Table I. All these stocks were reciprocally crossed with each other to produce F₁ hybrids. Virgin females and males were collected from F₁ and aged in small batches in food vials for seven days. All the experiments were conducted by direct observation for 60 min in an Elens-Wattiaux mating chamber kept in a room maintained at approximately 24°C under normal laboratory light condition. All the experiments were carried out between 7.00 to 11.00 a.m. In each trial 15 females and 15 males were used and females were introduced first into the mating chamber. Five trials were run in each cross. When a pair commenced mating it was aspirated out with an aspirator and the time of mating was also recorded. Females and males from the same strain were also tested for mating success.

RESULTS

Variation in the number of matings between strains was significant (Table II). It is apparent that variation is due to both female and male strains. The analysis of variance (Table III) shows highly significant variation due to males. The F value for females also shows highly significant variation. There was also significant interaction between sexes. Thus male strains as well as female strains contribute to the variance of the

Table I - Strains of *Drosophila bipunctinata* used in mating propensity test.

Abbreviation	Place of origin	Year of collection
BHU	Banaras Hindu University Varanasi, U.P.	1987
KER	Ernakulam, Kerala	1990
KOT	Kottayam, Kerala	1993
MY	Mysore, Karnataka	1988
UL	Unchawa Lodge Near U.P. College, Varanasi, U.P.	1987
AD	Alipur Dwar, West Bengal	1993
NL	Nilgiris, Tamil Nadu	1993

next generation with respect to mating propensity in *D. bipunctinata*.

The mean number of matings out of 75 pairs tested in 60 min for F₁ hybrids between the strains is given in Table IV. The overall mean of F₁ hybrids is close to that of strains. There was more variation for the strains, compared to the hybrids. Hybrids are superior

Table II - Number of matings in 60 min in Elens-Wattiaux mating chamber containing 15 flies of each sex (15 males x 15 females - total 5 replicates) for F₁ hybrids produced by making reciprocal crosses between strains of *Drosophila bipunctinata*.

Strain of female parent	Strain of male parent						
	KER	BHU	KOT	MY	UL	AD	NL
KER	53	50	40	46	42	56	44
BHU	43	53	43	47	44	43	44
KOT	52	41	49	38	36	49	48
MY	48	40	44	47	45	45	43
UL	44	46	42	42	42	44	44
AD	53	43	40	44	28	36	38
NL	41	45	43	40	40	44	25

For abbreviations, see Table I.

Table III - Analysis of variance for F₁ hybrids.

Source	df	S.S.	M.S.	F	P
Males	6	66.16	11.027	6.517	P < 0.001*
Females	6	62.62	10.437	6.168	P < 0.001*
Males x Females interaction	36	176.75	4.91	2.902	P < 0.001*
Error	196	331.60	1.692		
Total	244	637.13			

*Significant.

Table IV - Number of matings in 60 min in Elens-Wattiaux mating chamber containing 15 flies of each sex (15 females x 15 males - total 5 replicates) in different strains (number is based on 5 replicates) and for F₁ hybrids (mean number out of 75 pairs calculated by combining the data of different crosses) in *Drosophila bipunctinata*.

Strains	a	b	c
KER	46.33	46.83	53
BHU	44.00	44.16	53
KOT	44.00	42.00	49
MY	44.16	39.16	47
UL	43.66	42.83	42
AD	41.00	43.50	36
NL	42.16	46.83	25
Overall mean	43.61	43.61	43.57

a) Means for hybrids with the strains as female parent, crossed with males of the six other strains.

b) Means for hybrids with the strains as male parent, crossed with females of the six other strains.

c) Number for strains, male and female from the same strain.

For abbreviations, see Table I.

to those strains which show lower mating frequency (such as NL and AD strains) but inferior to the strains with higher sexual activity (KER and BHU). Thus F₁ hybrids show intermediate mating frequency when compared with the strains of high and low mating frequency.

DISCUSSION

It is known that male activity and female receptivity are the main factors responsible for successful mating in *Drosophila* (Bastock, 1956). Significant variation in mating propensity was found while comparing the mating frequency of wild stocks of *D. bipectinata* derived from different localities in India (Naseerulla and Hegde, 1993; Singh and Sisodia, 1995). In the present study interstrain hybrids showed intermediate mating activity when compared with the strains of high and low activity. This demonstrates that sexual activity in *D. bipectinata* is under the control of polygenes with additive effect. Furthermore, both sexes contribute to the variance of next generation. Thus both sexes are subject to intrasexual selection.

Thus *D. bipectinata* stands out distinct from other species such as *D. melanogaster*, *D. subobscura* and *D. ananassae* in which it has been found that contribution of males to variation in mating propensity is greater than that of females and males are inherently more subject to intrasexual selection than females.

RESUMO

Sete estoques selvagens de *Drosophila bipectinata* foram cruzados entre si para obtenção de híbridos F₁. O sucesso do acasalamento dos híbridos foi estudado por observação direta em câmaras de acasalamento Elens-Wattiaux. O número de acasalamento variou em diferentes cruzamentos. Baseado nos dados de híbridos e linhagens, a análise de variância foi realizada para detectar o efeito das linhagens machos e fêmeas e a interação entre os sexos. A variância foi altamente significativa para machos, fêmeas e interação machos versus fêmeas. O número médio total de acasalamentos de híbridos F₁ era próximo daquele das linhagens originais, o que mostrou controle poligênico da tendência de acasalamento e uma quantidade substancial de variação genética aditiva em populações naturais de *D. bipectinata*, que está sendo relatada pela primeira vez nesta espécie. Assim estes achados sugerem que a tendência de acasalamento está sob controle genético e que há seleção sexual em *D. bipectinata*.

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