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Mating activity, sexual isolation and temperature in the "yellow", "white" and wild type strains of D. gaucha.

The object of the present work was to study the effect of temperature on mating activity and sexual isolation in two mutant strains of D. gaucha, "white" and "yellow" in relation to a heterogeneous wild type stock from which the mutants arose spontaneously a few years ago (Iturra, P.D.I.S. 45, 1970).

Sexual activity and isolation was analyzed by direct observation for a period of two hours in mating chambers designed by Ellens and Wattiaux (DIS 39: 118, 1964). 15 wild type pairs were placed in one chamber with 15 males and 15 females of either the "yellow" or the "white" strains. The experiments were performed under uniform illumination, at 16°C and 25°C.

The results from the study of 40 observations of each type (600 pairs) are summarized in the Table. It shows the number of matings, and the statistical significance of the differences in mating of different types at both temperatures.

In general, the wild type males are the most active at both temperatures, as they inseminate more females than any of the mutant males. "White" males are very little active at 16°C and 25°C, both in relation to their own, as well as to the wild type females. On the other hand, "white" females are highly receptive at both temperatures. The receptivity of "yellow" and wild type females is increased significantly at higher temperatures.

	Temperature				
	16°C		25°C		16/25°C
Type of cross	Total no. of matings	χ^2	Total no. of matings	χ^2	χ^2
♂ n x ♀ n	57	12.668^{+}	104	0.367	17.962^{+}
♂ n x ♀ w	96		96		0.007
♂ w x ♀ n	4	0.671	4	0.126	0.126
♂ w x ♀ w	2		4		0.168
♂ n x ♀ n	52	0.877	101	0.000	20.209^{+}
♂ n x ♀ y	62		102		12.786^{+}
♂ y x ♀ n	30	0.157	52	0.047	2.705
♂ y x ♀ y	34		49		6.229^{++}

n = wild type w = white y = yellow + = 0.001 ++ = 0.02-0.01

As has been described for other species, the activity of males and the receptivity of females are in inverse relationship, a fact that is specially noteworthy in the low activity of the "white" males and great receptivity of the "white" females. These differences must be attributed mainly to the mutation, as the genetic background in the three strains is the same.

The behavioral changes of the "white" and "yellow" mutations in D. gaucha follow a similar pattern to those described for other phylogenetically quite distant species, such as D. melanogaster (Bastook, M., 1956 Evolution 10: 421-439).

The mechanisms by which these mutations modify sexual behavior and discrimination in relation to temperature, must be analyzed in the future.

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How much crossing-over occurs within heterozygous inversions?

This has been tested by Sturtevant and Beadle 1936 and by Novitski and Braver 1954, and using X chromosome inversions these authors find a general decrease of crossing-over within the loop (especially near breakpoints). On the other hand, heterozygous inversions can enhance recombination, not only in heterologous bivalents but also often in the inversion chromosome outside the inversion. We wondered whether under particularly suitable conditions, this Schultz-Redfield effect might even act in the middle of an inversion loop. Observation of such intra-inversion effects would have a bearing on hypotheses about the cause of the Schultz-Redfield effect. Such suitable conditions might be expected with In(2LR)Gla, a reasonably symmetric pericentric inversion, superimposed on an

In(2L)Cy lacking the Cy gene. This inversion has a considerable Schultz-Redfield effect on X, and the centromere region, usually the most sensitive part of a chromosome in this sense, lies in the middle of it. Indeed Alexander (Univ. Texas Publ. 5204: 219) has already checked the amount of double crossing-over within In(2LR)Gla, and found none among 2125 offspring. However, at the time of her experiment it was not known that Gla overlaps In(2L)Cy. Instead, it was regarded as a two-break arrangement, and thus she used an unsuitable marker stock.

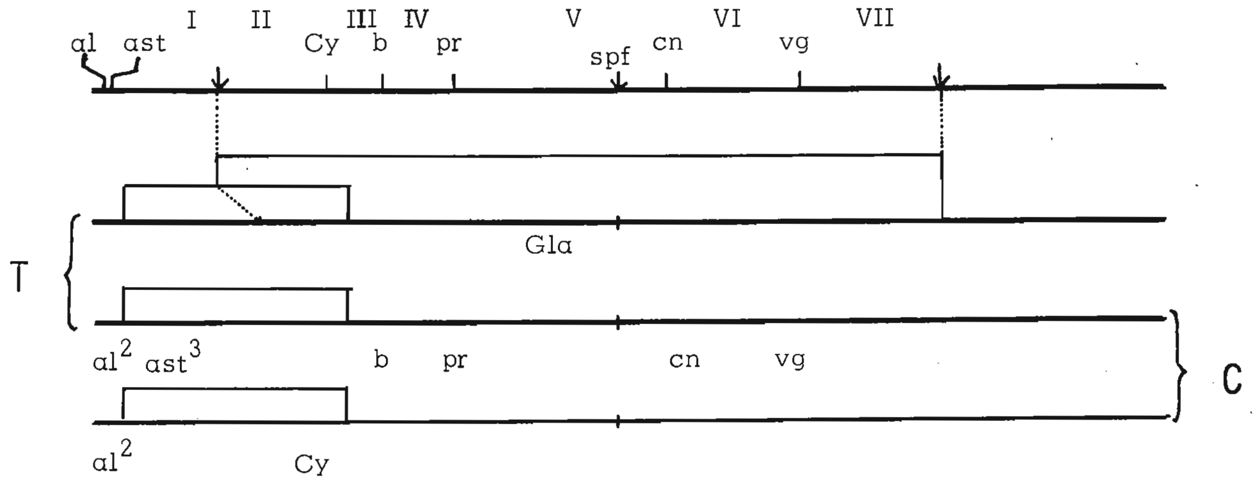

Fig. 1. Approximate salivary distribution of markers and rearrangements, markers spaced as in In(2L)Cy chromosome. T = test female chromosomes, C = control female chromosomes. I - VII = regions where crossing-over was scored.

% recombination in structurally homozygous regions

	I	II	III	IV	V	VI	N counted
Control series	30.0		14.6	7.0	0.6	7.6	1488
Gla series	1.4	-	-	-	-	-	1390

Double recombinants (triples excluded)

	I-II,III	I-II,IV	I-II,VI	III,IV	III,V	III,VI	IV, V	IV,VI	V,VI	
Control series	15	16	27	15	1	14	1	9	1	
Gla series				1				1		6
				II-III,IV				IV,VI		VI,VII

We therefore felt it was worth while to repeat her interesting experiment, but our marker stock contained In(2L)Cy - which was thus rendered homozygous, so that a large single loop could be formed in meiotic prophase. The tested females carried In(2LR)Gla/In(2L)Cy, al^2 ast^3 b pr cn vg, and the control consisted of full sibs to these, carrying In(2L)Cy, al^2 Cy/In (2L)Cy, al^2 ast^3 b pr cn vg, as shown in Fig. 1. Note that in the Gla series, intervals II + III are scored as one region; in the control series I + II are similarly lumped.

The result, as shown in the table, was felt unsuitable for treatment by common statistical methods, but it is evident at sight that no recombination enhancement of the kind envisaged above occurs. The number of VI, VII doubles in the Gla series is high considering the small physical size of region VII, but since all 6 animals appeared in one brood from one vial, they may be the result of a gonial event. Being negative, the result does not entirely rule out the possibility of intra-inversion Schultz-Redfield effects, but it seems probable that the general depression of crossing-over observed by older authors is indeed universal with heterozygous inversions.