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EFFECT OF NICOTINE ON SEXUAL BEHAVIOUR OF MUTANT STRAIN (CURLED) OF *DROSOPHILLA MELANOGASTER*

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ABSTRACT

In the present study, an attempt was made to study the effect of plant extract on Sexual behaviour of Mutant Strain (Curled) of *Drosophila melanogaster*. The LC_{50} has been estimated with 1% of the food media. The virgin females and males were isolated and fed with normal food media for three days. Then sub-lethal concentrations of 0.625 µl / 100 ml food, 1.2 µl /100 ml food, 2.5µl /100 / food of nicotine were mixed in food medium and allowed in flies to feed for two days. Then appropriate combination of untreated / treated males and females were introduced into the mating chamber. Courtship latency, mating latency and copulation duration were studied. After observation of the behaviour, mated flies were allowed to produce progeny. The sexual behaviour of bachelor male and virgin female obtained in the progeny was also studied. The pooled data were analyzed by student t-test and the result indicates p-value significant at 0.05 levels. The courtship latency was affected by in treatment but it is neither dose dependent nor sex dependent.

Figure : 00 References : 09 Tables : 03

KEY WORDS : Curled, *Drosophila melanogaster*, Nicotine, Sexual behaviour.

Introduction

The common vinegar fly, *Drosophila melanogaster* is one of the most studied organisms in biological research. It is a convenient model organism in laboratories because it is easy to culture, inexpensive, available with a high homogenous genetic background and has high reproductive capacity and a short life span. It even provides a genetic model for study of human neurodegenerative disease.

D. melanogaster exhibits an interesting sexual behaviour which includes a series of courtship elements consisting of various behavioural displays followed by an interchange of different sensory stimuli (visual, acoustic, olfactory and tactile). The sexual behaviour of *Drosophila* is a sequential strereotyped stepwise process and a change in any step would reveal in effect of change in the stimuli. The 2-3 mm sized vinegar fly (*D. melanogaster)* is able to mimic neuropathological mechanisms that are operative in certain human neurodegenerative disorders[8]. The effect of chemical on sexual function in human cannot be studied directly but it cannot be well studied in the simple genetic system like *Drosophila*. In this background the effect of a plant extract (Nicotine) on Sexual behaviour of Mutant Strain (Curled) of *Drosophila* has been made.

Materials and Methods

In the present study, in Mutant Strain (Curled) of *Drosophila melanogaster* maintained on standard food medium consistency of corn flour, agar-agar, sugar, yeast, nepagin (antifungal) and propionic acid (antibacterial) which was prepared[2] at 25 ± 5^0C. Virgin females and unmated males were separated every 5-6 hrs. after eclosion and aged for two days on normal food media. After two days these virgin females and unmated males were separately transferred into the vials containing fresh food media supplemented with sub –lethal concentration of 0.625 µl / 100 ml food, 1.25 µl/100ml food and 2.5 µl / 100ml food of nicotine. These flies were allowed to feed this food supplemented with the drug for two days. In order to determine the effect of test compound, the flies were,etherized for separation of males and females in ratio of 1:1 and were then placed in a Elens-wattiaux mating chamber and allowed to undergo mating. The sexual components such as courtship latency, copulation duration and mating latency were studied[5]. While making observation of sexual behaviour different cross combination (i) Female treated X male treated, (ii) female untreated X male treated, (iii) Female treated X male untreated were formed and examined against the control set. The three replicates studied in each cross combination and 30 pairs were studied. After completion of mating each pair was separately transferred to normal food media. The virgin females and unmated males from each pair were separated, aged for five days and sexual behaviour was also studied. The collected data were subjected to t-test to know the effect of test compound

TABLE -1 : Showing mean, standard error and student t-test for courtship latency of nicotine treated and untreated groups of parents and progeny of mutant (Curled) *D. melanogaster*

Crosses	Treatment	Parent Means ± SE	T- Values			F1 means ± SE	t-values		
			0.625 µl	1.25 µl	2.5 µl		0.625 µl	1.25 µl	2.5 µl
Female treated	0.625 µl/100ml food	6.70 ± 0.75	×	1.10	2.60*	2.10 ± 0.30	×	5.72*	1.38*
×	1.25 µl/100ml food	5.66 ± 0.20	×	×	3.80*	2.62 ± 0.70	×	×	3.86*
Male treated	2.5 µl / 100ml food	11.12 ± 0.82	×	×	×	2.11 ± 0.09	×	×	×
	Control	3.25 ± 0.01	1.03	2.21*	7.50*	1.10 ± 0.20	1.09	1.61*	1.75*
Female untreated	0.625 µl /100ml food	2.22 ± 0.35	×	3.62*	2.91	3.05 ± 0.03	×	10.01*	10.06*
x	1.25 µl /100ml food	3.37 ± 0.65	×	×	3.82	3.58 ± 0.25	×	×	5.55*
Male treated	2.5 µl / 100ml food	8.15 ± 1.02	×	×	×	3.09 ± 0.32	×	×	×
	Control	3.52 ± 0.34	1.79*	1.25*	3.09*	3.28 ± 0.50	4.01*	9.48*	4.66*
Female treated	0.625 µl /100ml food	1.50 ± 0.22	×	2.95*	0.05	4.65 ± 0.80	×	1.75	9.45*
x	1.25 µl /100ml food	3.20 ± 0.33	×	×	0.90	4.25 ±0.40	×	×	10.89*
Male untreated	2.5 µl /100ml food	8.01 ± 0.15	×	×	×	2.11 ±0.38	×	×	×
	Control	6.10±1.22	6.80*	9.10*	2.80*	5.13±0.40	7.11*	7.65*	3.25*

*Indicates P- value significant at 0.05 Level

TABLE - 2 : Showing mean, standard error and student t-test for mating latency of nicotine treated and untreated groups of parents and progeny of mutant (curled) *D. melanogaster*

Crosses	Treatment	Parent Means ± SE	T- Values			F1 means ± SE	t-values		
			0.625 µl	1.25 µl	2.5 µl		0.625 µl	1.25 µl	2.5 µl
Female treated	0.625 µl /100ml food	12.76±0.55	×	2.01	3.08*	3.98±1.02	×	0.77	0.28
x	1.25 µl /100ml food	7.40 ± 1.09	×	×	7.00*	3.89±0.55	×	×	4.26*
Male treated	2.5 µl /100ml food	13.22±1.15	×	×	×	3.27±0.90	×	×	×
	Cotrol	8.73±0.50	3.43*	3.01*	5.98*	3.02±0.30	2.00	2.99*	1.52
Female untreated	0.625 µl /100ml food	7.12±0.89	×	1.72	0.22	5.40±0.41	×	2.20	2.42*
x	1.25 µl/100ml food	11.20±0.40	×	×	0.29	7.41±1.32	×	×	1.18
Male treated	2.5 µl /100ml food	9.06±0.43	×	×	×	3.00±0.90	×	×	×
	Cotrol	5.32±0.66	0.33	0.56	0.30	7.40±0.41	0.60	2.98*	1.08*
Female treated	0.625 µl /100ml food	3.70±0.50	×	0.05	1.22*	1.31±0.55	×	0.50	1.74*
x	1.25 µl /100ml food	12.07±1.55	×	×	0.04	8.32±0.70	×	×	0.64
Male untreated	2.5 µl /100ml food	10.22±1.01	×	×	×	4.72±1.51	×	×	×
	Control	13.82±0.55	0.50	0.28	0.32	4.65±0.31	0.50	0.60	1.74*

*Indicates P- value significant at 0.05 Level

TABLE - 3: Showing mean, standard error and student t-test for Copulation duration of nicotine treated and untreated groups of parents and progeny of mutant (curled) *D. melanogaster*

Crosses	Treatment	Parent Means ± SE	T- Values			F1 means ± SE	t-values		
			0.625 µl	1.25 µl	2.5 µl		0.625 µl	1.25 µl	2.5 µl
Female treated	0.625 µl /100ml food	20.00±1.79	×	7.02*	5.20*	21.02±2.65	×	1.72	6.40*
x	1.25 µl /100ml food	18.00±2.02	×	×	2.62*	19.23±3.65	×	×	5.89*
Male treated	2.5 µl /100ml food	20.35±1.22	×	×	×	19.30±2.98	×	×	×
	Control	21.01±2.52	0.15	1.02	3.18*	21±02±1.75	1.08	1.15	3.02*
Female untreated	0.625 µl /100ml food	19.00±1.22	×	2.76*	1.92	19.22±1.39	×	3.65	3.70
x	1.25ul/100ml food	20.01±2.22	×	×	6.10	21.05±1.55	×	×	3.82
Male treated	2.5 µl /100ml food	17.32±1.06	×	×	×	22.05±2.70	×	×	×
	Control	23.20±2.92	3.18*	0.22*	9.77*	19.20±2.77	3.33	5.38*	2.01*
Female treated	0.625 µl /100ml food	20.50±2.11	×	2.77	4.53*	18.21±0.09	×	7.72*	8.01*
x	1.25 µl /100ml food	25.7±1.55	×	×	4.31*	22.39±1.33	×	×	7.71*
Male untreated	2.5 µl /100ml food	21.05±2.81	×	×	×	19.15±1.43	×	×	×
	Control	20.50±2.10	5.45*	1.78	3.01*	20.38±0.01	1.77	1.24	2.98*

*Indicates P- value significant at 0.05 Level

on the above behavioral trait.

Results and Discussion

The observations show (Table-1)the courtship latency of the treated flies with the plant extract (Nicotine). The mean courtship latency of flies increased in all the concentrations of group I where both females and males were treated. Courtship latency is one of the parameter used to access the vigor of male towards mating[4].Long courtship latency indicates less urge to sexual activity of the flies. The result therefore indicates that treatment of nicotine decrease in Sexual activity of mutant *Drosophila*. The increase in courtship latency was proportionate with the concentration. The comparison of the mean values of courtship latency by student t-test showed significant difference between control and different concentration except 0.625 µl / 100ml food. In group II and III the courtship latency of flies treated with 0.625 µl/100ml food concentration was less than the control, while it was more in 2.5 µl/100 ml food concentrations. The effect was found irrespective of the sex of the treated individuals. Thus, in the present study, the effect of nicotine is neither dose, nor sex dependent. Further more, the test compound at low doses enhance the sexual activity, while high concentration suppresses it. These findings agree with that[7]who have demonstrated such dose/sex independent effect of fluoxetine on courtship latency of *D. melanogaster*. A few earlier studies have demonstrated sex and close dependent action of drug on the sexual behaviour of *D.* melanogaster[3]where they have tested in effect of 3, 4 methylenediooxyaphetamine, a drug affected in *Drosophila* behaviour when fed throughout their development period.

Table-2 shows the effect of nicotine on mating latency of mutant strain (curled) of *D. melanogaster*. In group I where both males and females were treated, nicotine has significantly affected all concentrations and the t-values are significant at 0.05 level (except 0.625 µl/ 100ml food and 1.25 µl/ 100ml food). In group III (male untreated and female treated) also the mating latency increased in treated pairs when compared to control. In contrast to this in group II the effect of nicotine is significant in all the concentrations. In group I and II males are the ones which received the treatment.This means the treatment of nicotine effects male's sexual activity. As mating latency is a measure of females receptivity and males courtships efficiency and intensity[9]. It could be argued that the increased mating latency could also be due to the decreased receptivity of females. However in group III the females being treated should also have had higher mating latency if in effect is on the female's receptivity. Thus it could be concluded that the treatment of nicotine to males reduces the vigor and thus increases in mating latency[7]. Thus study of effect of fluoxetine on sexual behaviour of *Drosophila* have reported shorter mating latency. Although the difference in the mating latency of control and different concentration were significant in their study in differences among different concentrations were insignificant. Present study also shows that the effect is carried to next generation because some treatments exhibited significant increase in mating latency in the F1 generation.

Table-3 shows the mean copulation duration of mutant strain of *D. melanogaster* treated with sub-lethal concentrations of nicotine. The copulation duration was decreased, but in effect was not dose dependent. Longer the duration of copulation higher is the number of sperm transferred. But in the present study copulation duration was decreased and thus shows the effect of drug on sperm transfer. The student t-test showed that the mean values of copulation duration between control and different concentrations were significant, but between different concentrations were insignificant. The effect was also carried to next generation. The Dopamine effects reduce in female receptivity in *Drosophila*, without changing male and female courtship behaviour[6].Their findings provide an insight into the relationship between the dopamine levels and the courtship behaviour of *Drosophila[1]*showed that overexpression of dopamine vesicular monoamine transporters decrease fly's behaviour by decrease in fertility, prolongation of courtship behaviour and decrease in successful mating. The present study thus shows that nicotine affects the sexual behavior of mutant *Drosophila* by enhancing the courtship and mating latency and by reducing the copulation duration.

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