Pharmacology Biochemistry & Behavior, Vol. 4, pp. 357–359.

BRIEF COMMUNICATION

Copulation in Noncopulators: Effect of PCPA in Male Rats

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(Received 8 October 1975)

GINTON, A. *Copulation in noncopulators: effect of PCPA in male rats.* PHARMAC. BIOCHEM. BEHAV. 4(3) 357–359, 1976. – Twenty eight virgin male rats who failed to mount spontaneously on four successive mating tests were randomly assigned to two equal groups. One group received four daily injections of PCPA (100 mg/kg-IP), and the other, four vehicle injections. About 24 hr after the last injection all rats were subjected to a mating test. Eight rats of the PCPA group and only two of the vehicle, started to copulate. The difference is significant at the 0.05 level (two-tail). The 18 rats that did not start to copulate, failed to do so also on a repeated test a week later, and were then given four additional daily injections of PCPA. Sixteen of them started to copulate on the following mating test. Most of the rats copulated successfully on additional mating tests that took place three to eight weeks later, in the absence of further PCPA treatment.

Male rats Noncopulators Copulation Sexual behavior PCPA Aphrodisiac

THE APHRODISIAC effect of Para-Chlorophenylalanine (PCPA) on heterosexual mating behavior in the male rat has been found to depend on the baseline sexual activity level of the treated rats. Thus, rats with a high baseline sexual activity are much less affected, if at all, by PCPA, than rats with a low baseline [5, 10, 12, 14, 15, 18]. However, the effect of PCPA on noncopulator males has not yet been clarified. With the exception of one experiment, all others referred to above used experienced copulators. The exceptional experiment [15] that used sexually näive male rats showed that PCPA increases the percentage of rats starting to copulate within a single session of 30 min. Although this result may suggest that some rats which normally would be classified as noncopulators do copulate after PCPA treatment, it is far from being unequivocal. First, a failure to copulate in a single session cannot be regarded as a sufficient criterion for classifying a rat as a noncopulator [13], and secondly, the experimenters did not employ a proper control group with which to compare the PCPA injected rats. Instead, their control condition consisted of untreated rats which did not undergo any handling or placebo injections before the mating session. Hence, in view of the finding concerning the facilitatory effects of painful stimuli upon mating behavior of the male rat and the demonstration that this effect can be transferred to a neutral stimulus by conditioning [1,2], it is impossible to properly evaluate the cause of the percentage increase of copulators in the PCPA injected rats, which undoubtedly undergo an aversive experience upon injection. Thus, the present experiment was conducted especially in order to clarify the aphrodisiac effect of PCPA on noncopulator male rats.

METHOD

One hundred, 80–120 days old, sexually näive Wistar male rats were screened for mating activity 4 times, with a 7-day interval between sessions. Screening took place in 80 cm dia. semi-circular wooden cages, with a Plexiglas front, on the second half of the dark period in the light–dark cycle (dark: 7:00–19:00). Illumination in the mating room was very diffuse and dim. In each session the male was allowed 5 min of adaptation to the mating cage before a receptive female (spayed female treated with 25 μg estradiol benzoate and 400 μg progesterones, 72 hr and 4 hr before the session, respectively) was introduced. Each screening session lasted 30 min. In order to encourage mating activity in males that failed to mate, the following manipulations were performed. The females were changed once in the course of each session, the males were picked up and replaced in the cage; on the second screening session the näive males were accompanied by an experienced copulator for the first 15 min, and on the third session their tails were pinched. These behavioral manipulations were known to be highly effective in eliciting or facilitating copulation [1, 4, 9]. Only the 28 males that did not mount at all during the screening tests were used in the experi-

ment. They were housed 4 to a cage (36 x 29 x 15 cm) and were maintained on an ad lib food and water diet. The rats were randomly assigned to two groups of 14 rats each. One group received four daily IP injections of 100 mg/kg DL-PCPA hydrochloride, which was administered as a suspension (100 mg/ml) in saline plus 2% Tween 80. Simultaneously, the second group which served as a control group received equal volume injections of the vehicle. Twenty-three to 26 hr after the last injection, the rats were given a mating test. The test lasted 20 min and its conditions and procedures were identical to those of the previous screening tests, save the extra mating encouragement manipulations (e.g., tail pinching). Rats from both groups that failed to intromit were given another mating test a week later, and if they failed to intromit again, they were immediately subjected to another 4-daily injections. This time, all animals had PCPA injections (100 mg/kg IP). Seventeen to 20 hr after the fourth injection, another mating test was given. Three additional mating tests for all 28 animals were conducted 3, 4 and 8 weeks after the last injections.

The timing and frequency of mounts, intromissions and ejaculations were recorded on a Monsanto Model 512-A Counterprinter with an attached electronic timer and the considered measures for evaluating the copulatory activity were the standard latency and frequency measures [14].

RESULTS

Eight of the 14 PCPA rats copulated on the test and achieved ejaculation, while only 2 of the 14 vehicle injected rats did so. This difference is significant at the 0.05 level (Fisher exact probability test, two-tailed). Every rat that achieved intromission also ejaculated within the 20 min of the test and no exceptions to this rule could be found on any of the tests that followed. The 18 rats that did not copulate on this test (6 of the PCPA group and 12 of the vehicle group) failed to do so a week later too, and therefore were given four additional daily injections of PCPA. On the following mating test, 16 animals copulated and ejaculated. One of the 2 rats that failed again belonged to the original PCPA group, and the other belonged to the original vehicle group. The latter rat looked very sick during the test and died two days later.

Of the 24 rats that had started to copulate after PCPA treatment, 67% copulated on each one of the three additional tests that took place 3, 4 and 8 weeks after the last injection, 17% failed to do so on one test, 8% did not copulate on two tests and 8% failed to mate on all three of them. In each of the three tests, about 80% of the rats copulated successfully. The 2 rats that had started to copulate after the vehicle treatment, kept doing so on each of the three later tests, while the rat that did not mate even after receiving the two series of PCPA treatments, failed to do so on all subsequent tests. The differences in sexual behavior between the mating that took place under the immediate influence of PCPA and the mating that occurred a few weeks later, were analyzed according to the standard latency and frequency scores (Table 1). Significant differences were found only in the latency to the first mount, and in the latency to the first intromission, which were shorter under the immediate influence of the drug. These significant results are underestimations of the differences since they are based only on tests in which mounts or intromissions actually occurred.

DISCUSSION

Male rats classified as noncopulators have a functionally higher threshold for losing their virginity than normal rats.

TABLE 1

COMPARISON OF MATING ACTIVITY OF 22* SPONTANEOUSLY NON-COPULATOR MALE RATS UNDER THE IMMEDIATE INFLUENCE OF PCPA† AND A FEW WEEKS LATER‡

Measures§	Mean Scores Under the Immediate Influence of PCPA†	Mean Scores a few weeks after PCPA Treatment‡	Level of significance (*t*-test for dependent samples, two tail)
Mount Latency¶ (sec.)	93.5	217.8	$p<0.05$
Intromission Latency (sec.)	98.0	222.8	$p<0.05$
Ejaculation Latency (sec.)	166.8	200.3	n.s.
Post-Ejaculatory—Interval (sec.)	356.3	360.5	n.s.
No. of Mounts	1.83	2.01	n.s.
No. of Intromissions	5.86	6.25	n.s.
Inter-Intromissions—Interval (sec.)	28.4	32.0	n.s.
No. of Ejaculations	2.36	2.16	n.s.

*Since 2 of the 24 rats that had started to copulate after PCPA treatment failed to mate on all later tests they were excluded from the comparison.

†Mating tests were given 17–26 hr after the last injection.

‡The scores are mean scores of three mating tests that took place 3, 4 and 8 weeks after the last injection.

§The measures relate to the first ejaculatory series in each session, except for No. of Ejaculations, which is related to the whole 20 min of the session.

¶Latency to the first mount or intromission, whatever occurred first.

This higher threshold can be overcome in some cases by giving additional testosterone [16,17], or by using highly arousing stimulation such as a peripheral electric shock [1,2]. The results of the present study indicate that PCPA treatment also can lead to initiation of heterosexual mating behavior in noncopulators.

According to Pottier and Baran [13] the noncopulator's failure to mate results from a general syndrome which includes a relatively poor ability to be aroused by external stimulation. Since PCPA is known to increase such ability [11] it is reasonable to explain its effect in the present study by means of improving arousability.

After the initial induction of mating by PCPA, later successful copulations seem to be largely independent of the drug, since the great majority of the treated rats also copulated 3, 4 and 8 weeks after the PCPA treatment. As the increase in general arousability induced by PCPA does not last such a long time, it is necessary to look for another factor to explain the long-lasting effect of the drug treatment on copulations. One possible explanation may be that the new experience of the actual copulation was in itself instrumental in the further maintenance of mating behavior; probably by increasing the salience of the various sexual cues which a female in estrus presents. Such an explanation is compatible with the findings concerning the initiation of mating behavior by peripheral electric shocks and the maintenance of this behavior on later occasions without additional shocks [2,6]. It is also compatible with the absence of any long-lasting effect of PCPA on mating behavior of sexually experienced male rats [12]. This explanation means that the long-lasting effect is not attributable directly to the PCPA treatment, but to the mere losing of virginity. An alternative explanation of course may be that the results were due to some long-lasting effects of the drug itself. However, there are two difficulties in accepting this alternative. The first one is the previously mentioned lack of a long-lasting effect of PCPA on sexual behavior of experienced male rats [12], and the second is that the PCPA induced reduction of brain serotonin, which is regarded as the main reason for the drug aphrodisiac effect [5] does not last more than two weeks [7].

The most reliable effect the drug had on copulation in sexually experienced male rats, was found to be its shortening of the ejaculation latency. In the present study, however, no significant differences in ejaculation latency between the mating that took place under the immediate influence of PCPA and those that occurred a few weeks later, were found. Nevertheless, these results should not question the aphrodisity of the drug. According to findings concerning the effect of experience and age on sexual performance of male rats [3,8] it is expected that ejaculation latency on the first mating session would be longer than the latencies on subsequent sessions. This trend counteracts the effect of the drug in the present study and thus prevents significant differences.

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