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Copulatory behavior of *Calomys callosus*

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A quantitative description of copulatory behavior in *Calomys callosus* (laucha de campo) was obtained under laboratory conditions. The copulatory pattern is characterized by intravaginal thrusting and multiple intromissions preceding ejaculation. Copulatory locks were rare. Copulatory behavior typically ceased upon attainment of the first ejaculation. Their small number of ejaculations per test resembles some other South American cricetines.

The present report is one of a series of descriptive analyses of the copulatory patterns of muroid rodents, the objective of which is to develop a substantial catalogue of such descriptions for a variety of muroid species (see Dewsbury, 1975). Such a catalogue is essential in providing an empirical basis for inferences regarding evolution and adaptive significance. Although the copulatory patterns of 38 muroid species have been studied in this laboratory, the catalogue is particularly weak with respect to the South American cricetines (Hooper & Musser, 1964), from which only *Oryzomys palustris* (Dewsbury, 1970) and *Sigmodon hispidus* (Dewsbury, 1972a) have been studied.

Calomys callosus (laucha de campo) is a small rodent that lives in forest edges and grasslands in South America (Hershkovitz, 1962). Several laboratory colonies have been established and information is available regarding such characteristics as stomach morphology (Carleton, 1973), organ weights (Dietrich, Morrison, & Preston, 1973), breeding, and growth and development (Morrison, Dietrich, & Preston, 1977; Justines & Johnson, 1970; Petter, Kamiri, & DeAlmeida, 1967). In unpublished work in this laboratory, *C. callosus* have been found to be primarily nocturnal in activity patterns and sexually dimorphic, with males weighing more than females. *C. callosus* have a 6-day estrous cycle, a postpartum estrus, and a gestation period of 19-22 days (Justines & Johnson, 1970; Petter et al., 1967). Although Sales (1972) observed mounting and its accompanying ultrasonic calls, only Justines and Johnson (1970) report observed copulations. They observed just one pair of animals in two copulations, which were separated by an interval of 5 min. The present account of copulatory behavior in *C. callosus* is based on observations of 38 animals, including a total of 613 copulations.

METHOD

A total of 27 male and 26 female *C. callosus* were tested. All animals were laboratory born from stock originally captured in San Joaquin, Bolivia (see Justines & Johnson, 1970), and were at least 90 days of age at the beginning of testing.

Animals were housed in clear plastic cages, 48 x 27 x 13 cm for males and 29 x 19 x 13 cm for females. San-i-cel (ground corn cobs) served as substrate. Purina laboratory animal chow and water were continuously available. The colony was maintained on a reversed 16 h light, 8 h dark photoperiod, with white fluorescent light onset at 1730 h. Dim red light shone continuously.

Tests were conducted during the dark phase of the diurnal cycle, with at least 2 weeks separating successive tests for individuals. Females were brought into behavioral estrus with intramuscular injections of .05 mg estradiol benzoate 48 h before testing and .5 mg progesterone 4-6 h before testing. This regimen appeared optimal for eliciting behavioral estrus and served as an effective contraceptive. Tests were initiated by placing an injected female into a male's home cage. Tests in which no copulation occurred within 30 min were discontinued and scored as negative. If copulation was initiated, tests were continued until attainment of the standard satiety criterion of 30 min with no copulations. Behavioral observations were recorded on an event recorder by a single observer.

RESULTS

Both animals typically were inactive immediately following introduction of the female. Social interaction typically began with the female approaching the male and sniffing him in the head region. The male would then reciprocate and follow the female as she walked about the cage. The female would often run from the male, but when caught, would adopt a lordotic posture typical of many muroid rodents. The head and perineal region were elevated producing a concave upward arching of the back.

The copulatory pattern is composed of three classes of events, which are readily discriminable by an experienced observer on the basis of behavioral criteria. On mounts, the male mounts the female from the rear and displays shallow pelvic thrusting, but fails to gain vaginal insertion. Intromissions are characterized by vaginal penetration and repetitive pelvic thrusting, which is deeper and occurs at a slower rate than during the shallow preinsertion thrusting. The ejaculatory pattern was easily discriminated from mounts and intromissions, as the male not only mounted and gained vaginal insertion, but maintained insertion for a longer period, during which pronounced shuddering and spasmodic twitching

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occurred. Typically, both male and female fell on their sides after ejaculation in a pattern similar to that described for *Mus musculus* (McGill, 1962). Occasionally, a male and female would appear to become locked, resulting from an apparent mechanical tie between penis and vagina. The female would often move as if attempting to free herself from the male and, as a result, drag the male around the cage in a manner similar to that of dogs (Hart, 1967). As such locks were rare and of no obvious functional significance, they appear more as instances in which the mice simply become "stuck," rather than as true functional locks, such as those that characterize some other rodent species (see Dewsbury, 1974).

A total of 125 tests were conducted. Copulation occurred in 47 of these tests (38%). Eighteen males and 20 females copulated. Copulations were observed on 47% of the tests of the latter animals. Of these animals, only 15 male-female pairs copulated on at least two tests; only their data are included in the quantitative summary to follow.

The mean latency from introduction of the female to the first intromission was 510 sec (range = 149-1,449). The mean number of intromissions preceding ejaculation was 14.6 (range = 3-36). There was a mean of 3.3 (range = 1.0-16.3) thrusts per intromission. A mean of 2.9 (range = 0-15) mounts without intromission preceded the first ejaculation. The mean ejaculation latency (time from the first intromission to ejaculation) was 1,172.6 sec (range = 117-4,589). The mean interval separating successive intromissions, including the ejaculation, was 145.8 sec (range = 18.8-1,433.6). Locking patterns did not occur on any of the intromissions and were observed on only 5% of the ejaculations (2 of 42). Although copulation was initiated following ejaculation on three occasions, only once did a second ejaculation occur. The three postejaculatory intervals were 649, 480, and 214 sec.

DISCUSSION

It has been proposed that mammalian copulatory patterns can be classified into 2^4 or 16 categories on the basis of four attributes: whether or not there is a lock, whether intravaginal thrusting occurs, whether multiple intromissions are prerequisite to ejaculation, and whether multiple ejaculations occur (Dewsbury, 1972b). *C. callosus* clearly display both intravaginal thrusting and multiple intromissions prior to ejaculation. However, in a manner identical to that of cactus mice, *Peromyscus eremicus* (Dewsbury, 1974), they are difficult to classify with respect to the remaining attributes. As locks are rare and appear to be of no functional significance, *C. callosus* might best be classified as a nonlocking species. Although multiple ejaculations are rare, occurring just once in 47 tests under the present set of testing conditions, they can occur. It is the possibility of occurrence that has been used in classification (Dewsbury, 1972b). Thus, *C. callosus* can be tentatively classified as displaying Pattern 9 of Dewsbury (1972b) (no lock, intravaginal thrusting, multiple intromissions, multiple ejaculations). However, the factors complicating such classification should be stressed.

The glans penis of *C. callosus* has been described as particularly "stubby" with rather prominant penile spines. As has been suggested for grasshopper mice, *Onychomys torridus* (Dewsbury & Jansen, 1972; Horner & Taylor, 1968), these spines may be functional in creating the penile-vaginal locks.

The South American cricetines appear to attain relatively few ejaculations per test (means of 1.0 in *C. callosus*, 2.1 in *Sigmodon hispidus*, and 2.3 in *Oryzomys palustris*) (Dewsbury, 1970, 1972a). Data on additional species will be required to determine whether this is a general characteristic of this group and what, if any, the significance might be. Whereas *S. hispidus* and *O. palustris* ejaculate after relatively few, single-thrust intromissions, *C. callosus* display a larger number of intromissions with intravaginal thrusts. Thus, *C callosus* require some 5-11 times the number of thrusts before ejaculating as the other two species.

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