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AN APPARENT LUNAR PERIODICITY IN THE SEXUAL CYCLE OF CERTAIN PROSIMIANS

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During the course of other work by two of us, on a considerable group of lemurs and lorisoids in captivity in New Haven, Connecticut, certain types of cyclical behavior have become apparent. Since it has been necessary to reconstruct the living quarters of some of these animals, the disturbance of which precludes further observations in the immediate future, the more remarkable aspects of this cyclical behavior are reported at the present time, largely in the hope of stimulating other workers who may have access to prosimians to watch for comparable phenomena.

The animals observed consisted of a group of four (2♂♂, 2♀♀) *Lemur fulvus* E. Geoffroy, a pair of *Lemur albifrons* E. Geoffroy, 3♀♀ and 1♂ *Galago senigalensis* E. Geoffroy, one ♂ and one immature ♀ *G. crassicaudatus* E. Geoffroy, and three pairs *Perodicticus potto* (P. L. S. Müller). These animals lived from three to twelve months, up to December 1, 1961, in a room at the top (fifth floor) of a low tower with windows on all walls. The most important animals, 2♂♂ of *Lemur fulvus rufus* Audebert, one ♀ of *L. f. rufus* ("Calo"), and one of *L. f. fulvus* ("Sal") occupied a large section of the room, could reach windows looking north and east, could easily see out from windows looking south and less easily from one small window facing west. A pair of pottos and both *G. crassicaudatus* occupied a similar section; the *L. albifrons* and the *G. senegalensis* lived in smaller but naturally illuminated cages, the other two pairs of pottos in darker cages. These animals are referred to collectively as group 1.

A pair of *Lemur fulvus rufus* kept in the kitchen of a dwelling house with a window facing west-north-west and with little view of the night sky has served as a control. These animals are designated as group 2.

All these animals are reported to breed seasonally. The lorisoids breed biannually, producing young about April and October.[1–3] Gestation lasts between 3 and 4 months for *G. senegalensis*[2–4] to 6 months for *Loris*.[1] Lemurs have a single annual breeding period. Mating occurs in the southern hemisphere during April, May, and June and parturition from September through January.[5] In the northern hemisphere the seasons become reversed with birth occurring about April and May.[1, 5] Pregnancy lasts about 4 months.[1, 5]

Oestrous cycles of 4 to 6 weeks are well documented in *G. senegalensis*,[4, 6] in *Loris*,[1] and in the lemuriforms *Microcebus* and *Cheirogaleus*.[5, 8] However, there is no record of a 4- to 6-week oestral cycle in *Lemur*, although periods of swelling and

coloring of the external genitalia are visible at least in *L. fulvus fulvus* and *L. fulvus rufus*.

The majority of observations of mating behavior were made in dim white light. Some, especially during the summer and autumn months, were made without any artificial illumination. All the animals tend to make particular sounds prior to or during mating, so that if any sexual behavior occurred while an observer was present it would be recorded. While mating ordinarily was observed in the early hours of the night in the tower room, *L. fulvus* at the height of sexual activity may mate by daylight. The control group usually mated in the afternoon, and slept at least for the early part of the night, perhaps because less light entered the room in which they were kept. Observations are lacking for the later part of the night. Needless to say, it is almost impossible for one or even several people to be present continuously with the animals and therefore it is believed that many occurrences of mating, especially in the very early morning, went unrecorded even in the tower room. No records of possible oestrus were made for *G. senegalensis* or *P. potto*. However, complete records were kept of oestrus in *L. fulvus*. In the case of *L. albifrons* the pigmentation of the animal is so dark, that it is almost impossible to see any color change of the female genitalia.

In group 1, eight periods of oestrus have been observed in Calo and two in Sal. Pregnancy probably reduced the incidence of oestrus in the latter female. Calo was observed to mate after three periods of oestrus, in all on six or seven days, Sal after two periods of oestrus and on two groups of dates apparently without oestrus, in all on seven or eight days. These dates are indicated in Table 1 along with the incidence of mating in *L. albifrons*, *P. potto*, and *G. senegalensis*.

The initial long oestrus in both Sal and Calo after the animals had recently been established in their quarters is presumably abnormal. It should be remembered that these animals arrived from Madagascar just before the beginning of the observation period; their breeding cycle may yet not have fully adjusted to the northern hemisphere. In general, females of *Lemur* come into oestrus for a period of 5 to 6 days, accompanied by increased aggressiveness, general activity, and anal marking. Different females probably differ in the intensity with which these changes are shown: thus the control female showed increase in anal marking but no change in aggressiveness. There appears to be a lag in the responsiveness of males, which extends for a few days beyond the period of oestrus. After the middle of January and until June 1961, Calo showed oestrus tending to end just before alternate full moons, and this behavior was repeated with a little irregularity (Nov. 7–8), after three months of anoestrus in the late summer, during the period from September to November. Sal apparently exhibited initial irregular behavior though at about the same time as Calo; in the autumm of 1961 she was essentially synchronous with Calo. The actual disposition of all matings relative to the full moon is shown in Figure 1.

The control pair of *L. fulvus rufus*, of group 2, mated irregularly in February and March 1961 and exhibited no lunar periodicity. There also appears to be no clear lunar periodicity in *P. potto* in group 1. There is however a suggestion of lunar periodicity in the mating of *G. senegalensis* and perhaps in the behavior of *G. crassicaudatus* in group 1.

It appears that mating can occur in *Lemur* during pregnancy and at times when

TABLE 1

MATING BEHAVIOR OF GROUP 1

Date of full moon	Period of oestrus of *L. fulvus*	Dates of mating of *L. fulvus*	Other animals mating
Dec. 2	Dec. 16–26 Calo Dec. 20–28 Sal	Dec. 24 Calo	*P. potto* Dec. 26, 28
Jan. 1	Jan. 6–10 Calo	Jan. 7 Sal	*P. potto* Jan. 2, 3
Jan. 31		Feb. 1 Sal	
Mar. 2	Feb. 25–March 2 Calo		
April 1	(April 16, Sal produced young ♀)		
April 30	Apr. 28–29 Calo (probably pseudoestrus in pregnancy)		
May 29	(c. June 8, Calo produced premature young)		
June 28	June 22–30 Calo		
July 27			
Aug. 25			*P. potto* Aug. 27, 28
Sept. 24	Sept. 19–25 Calo		
	Sept. 19–25 Sal	Sept. 20 Calo or Sal*	*L. albifrons* Sept. 20
		22 Calo, Sal	*P. potto* Sept. 20, 22, 24 Oct. 1,10
		27 Calo, Sal	*G. senegalensis* Sept. 20, Oct. 2
			G. crassicaudatus Sept. 24, 26 apparent sexual activity
Oct. 23			
	Nov. 7–8 Calo		*G. senegalensis* Oct. 18
Nov. 22	Nov. 17–22 Calo	Nov. 20 Calo, Sal	
		21 Calo, Sal	*P. potto* Nov. 3, 7, 20
		22 Calo, Sal	

* Observer uncertain of identity of ♀ involved.

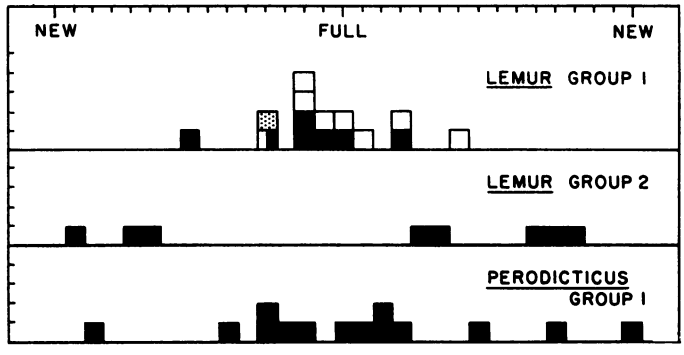

FIG. 1.—Relation of matings to days before and after full moon. Top panel, black squares, days when Calo mated; white squares, days when Sal mated; one *L. fulvus* mating when the female involved was uncertain given as half black, half white; stippled, *L. albifrons* mating. Middle panel mating *L. f. rufus* of control group 2. Lower panel mating of pottos of group 1.

the females are not visibly in oestrus. It may be noted parenthetically that male pottos in mating mounted the female in the ordinary mammalian manner, male ventral to female dorsal, contrary to what has been alleged by some authors.

Part of the synchronization in group 1 may have been due to social facilitation, particularly on September 20 when individuals of *L. fulvus*, *L. albifrons*, *G. senegalen-*

sis, and *P. potto* were all mating and the ♂ of *G. crassicaudatus* was apparently attempting mating on the same evening. It is noteworthy that this was the only time when the *L. albifrons* have shown any clear indication of sexual activity. On several occasions, the dominant male of the *L. fulvus* group has advanced to both females in turn and has been accepted by each of them within a few minutes.

While the obvious contagious nature of the incidence of mating and the possible unknown effects of social facilitation due to olfactory or other behavioral interactions render any rigid statistical treatment impossible, the data appear to suggest a *prima facie* case for a correlation between peaks of sexual activity and the lunar cycle in *Lemur* spp. and possibly in *Galago* spp., when the animals are exposed to appreciable illumination, due to changes in the amount of moonlight It is clear that the full significance of this can only be assessed on the basis of field observations. Possibly lemurs are active at night chiefly when a good deal of light is available; certainly both in eye structure[9] and observed behavior they are strongly diurnal, unlike the *Lorisoidea*. However it may be noted parenthetically that much of the display movements of lemurs and lorisoids appear to the human observer to be enhanced by moonlight. The long sparse shiny hairs of the lemur tail, the white tail of at least some forms of *G. crassicaudatus*, and even the silver tipped hairs of many pottos reflect dim light very effectively.

Harrison[10] has obtained evidence of lunar periodicity in the breeding of several species of *Rattus* in Selangor, and the phenomenon may well be more frequent than has been expected in tropical polyoestrous mammals.

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