

OBSERVATIONS ON THE REPRODUCTIVE BEHAVIOUR OF THE TIGER, *PANTHERA TIGRIS TIGRIS* LINN. IN CAPTIVITY¹

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(With a chart)

INTRODUCTION

In view of the importance of tiger as one of the major endangered species in India a study of its reproductive behaviour is worth noting. This study was undertaken to provide information (i) on the reproductive behaviour of tiger, (ii) to ascertain the duration of oestrus, (iii) breeding season, (iv) gestation period, (v) percentage of pregnancies, (vi) litter size, (vii) sex ratio and (viii) the ratio of white and coloured cubs produced through crossing among coloured hybrids and between coloured hybrids and pure white tigers. This paper is based on data collected at the Calcutta Zoological Garden from 1965 to 1977.

MATERIALS AND METHODS

The Calcutta Zoological Garden has a good record of breeding of tigers in captivity. The first birth of tiger cubs at this Zoo took place in May, 1880 when three cubs were born. Two cubs were born in May, 1886 and two more cubs in April, 1889 (Sanyal 1892). Since then many tiger cubs have been born in this Zoo during the last several decades. Moreover, the acquisition of 3 white tigers (two pure white males from Maharaja of Rewa and one coloured female carrying gene for white, from Delhi Zoological Park) of the

same litter in 1963, has improved much of its breeding potential. The tigers at Calcutta Zoo are kept in spacious enclosures and cages having sufficient space for exercise. Each cage or enclosure has a small den at the back where the tiger is shut in at night.

Tigers at Calcutta Zoo are fed six days in a week on beef and on Thursday no food is given. On average an adult tiger is given 12 kg of raw beef with and without bones daily. The ration of beef given to tigers ranges from 7 to 15 kg depending on the age, size, sex and general condition of the animals.

For the purpose of this study, data have been collected from my own observations from 1968 onward, supported by the records maintained at Calcutta Zoo in the form of daily report, birth and mortality registers etc. Mating behaviour of tigers have been recorded by me with assistance from some of my staff.

BREEDING SEASON

The tiger in India breeds all the year round and the cubs are born in any month of the year (Asdell 1946, Crandall 1964, Prater 1964, Schaller 1967, Ewer 1973).

At Calcutta Zoo the tigresses came in oestrus during all the months of the year. From 1965 to 1977, 48 oestruses or heat periods of seven tigresses had been recorded, and the females produced 61 cubs in 22 litters. This data is presented in Table 1.

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TABLE 1
BREEDING SEASON OF TIGER, *Panthera tigris tigris*
IN CAPTIVITY

Months	Number of oestrus	Percent- age	Number of litters born	Percent- age
January	5	10.4	1 (2)	4.5
February	5	10.4	—	—
March	7	14.5	3 (9)	13.6
April	4	8.3	3 (9)	13.6
May	3	6.4	4 (12)	18.1
June	5	10.4	3 (8)	13.6
July	4	8.3	3 (10)	13.6
August	3	6.4	—	—
September	2	4.1	3 (8)	13.6
October	5	10.4	1 (1)	4.5
November	2	4.1	1 (2)	4.5
December	3	6.4	—	—
	48	100	22 (61)	100

The figures in the bracket indicate number of cubs.

TABLE 2
BREEDING RECORDS OF TIGER, *Panthera tigris tigris* IN CALCUTTA ZOO

Specimens	Number of oestrus periods	Range of oestrus periods (days)	Average oestrus periods (days)	Average of last day of oestrus to birth (days) Gestation period.	Average number of cubs Litter
Malini	16	4—7	5.1	103	2 (7)
Chandni	14	3—7	5	104	3.2 (7)
Shashi	7	4—6	4.8	103	3.8 (5)
Sona	4	4—7	5.3	—	—
Rupa	3	6—9	7.3	—	—
Bharati	3	6—9	7.2	102	1.5 (2)
Moti	1	5	7	103	2 (5)
	48				

The figures in the bracket indicate number of litter.

Duration of oestrus:

The tigress in oestrus becomes restless and moves about very frequently and sometimes does not feed. Schaller (1967) reports that the tigress in oestrus squirts scent, sniffs, moans and roars in a low voice. The duration of oestrus was calculated on the basis of the total number of days for which the above men-

tioned behaviours of a tigress were recorded and when she permitted mounting and copulation by the male.

The data of oestrus periods as recorded in 7 tigresses in Calcutta Zoological Garden are shown in Table 2. The minimum interval between two consecutive oestruses was 26 days. Last oestrus phase was observed upto the age of 16 years in a tigress (Malini).

Sexual maturity:

Crandall (1964) reports that a tigress in New York Zoo reached maturity at 3 yrs. 8 months. Sankhala (1967) reports that tiger cubs attain maturity at an age between 3½ and 6 years. In captivity female lions become cyclic at 36 months of age (Crandall 1964). According to Stracey (1968) tigresses start

to breed at the age of about three years. Tigresses in the wild reach sexual maturity at about four years of age, but in the abnormal conditions of captivity copulation has been observed as early as two and a half years (Mountfort 1973). Sexual maturity and birth of 1st litter in the case of six tigresses are shown in Table 3.

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TABLE 3

OBSERVATION OF SEXUAL MATURITY OF TIGER, *Panthera tigris tigris*, AT CALCUTTA ZOO

Specimens	Date of birth	Date of first oestrus	Age at onset of oestrus	Date of birth of first litter	Age when first litter born
Malini	18.6.60	25. 2.65	4 yrs. 8 months	12. 6.65	4 yrs. 11 months
Chandni	12.6.65	2. 3.69	3 " 8 "	14. 7.69	4 " 1 "
Shashi	8.9.67	21. 7.72	4 " 10 "	24.11.72	5 " 2 "
Rupa	25.9.70	12. 3.75	4 " 5 "	—	—
Sona	25.9.70	22. 3.74	3 " 11 "	—	—
Bharati	10.6.66	10.10.70	3 " 6 "	24. 1.71	4 " 10 "

Mating behaviour:

Tigers and tigresses which are kept together, except at night, from very early age, breed freely in captivity but attempts to introduce new specimens to each other are not without risk of injury.

When a tigress comes in oestrus at Calcutta Zoo, a male tiger is put in the adjacent cage from where the two can see each other. At the advent of oestrus the tigress becomes restless, walks and sits frequently. While walking it moans and roars in low voice and squirts scent from its anal gland. She sits repeatedly in front of the wire-netted door of the adjacent cage where the male is confined. She sniffs at different places of the floor and wall and on seeing the male in the adjacent cage she produces a purring sound.

Courtship:

When the door of the adjacent cage is opened, the tigress hurriedly rushes into the adjacent cage and proceeds to the male very cautiously, sniffs the male producing puffing sound. If the male is in mood for mating he responds with a purring noise. If the male is not in a mood for mating a fight may occur and the couple have to be separated. It is seen that after fighting on the first day of oestrus, the male may accept the female the next day.

When mutual confidence is established, the female approaches the male, purrs, rolls on her back on the ground in front of the male and pats at him playfully. The male sniffs the genitalia of the female, purrs and squirts scent frequently. He follows the female when she walks with lashing tail and starts playing with her. Mountfort (1973) states that the prelude to mating is accompanied by periods of play and harmless sparring which help to reduce the normal antagonism between sexes.

Copulation:

The tigress sometimes comes very close to the male and rubs her head, body and mouth to the head, body and mouth of the male. She sometimes lies on her belly stretching her forelimbs fully on the ground and her hind limbs remaining half bent. The male approaches from behind the female and arches his back, bringing his penis in contact with the genital region of the female. At this time the female begins to tread by pushing against the floor with her hind legs and when vaginal contact is made she bends her tail sharply to one side exposing her genital region and at the same time she turns her hind end in the direction of the stimulus. The male then holding the scruff of the neck of female by his teeth begins a series of vigorous pelvic thrusts at the female's

urinogenital sinus. Intromission of penis is signalled by a loud copulatory cry from the female and a tremendous roar is produced by the male as he presses his genital region tightly against that of female. Ejaculation occurs during this interval. The actual time of coition varies from 7 to 10 seconds. The female then pulls forward, turns abruptly on the male, hisses and paws him and throws him off her back. Sometimes fighting takes place between the sexes inflicting scratch wounds. There may be unsuccessful attempts at mounting prior to successful mating.

Post copulatory behaviours:

After each copulation the male moves away from the female and walks about in the enclosure or usually lies on the ground. Sometimes he passes stool and urine and in some cases drinks water. The female tigress after copulation rolls on the ground and sometimes goes to the water for bathing. It is seen that the female goes to water at 3 to 5 times a day during her heat period.

After a short interval, the female again approaches the male and the whole process of courtship and copulation is repeated. With repeated copulations, initiative and eagerness of mating are seen more in the female than the male. The tigress proceeds to the male, rubs her head, body with the male and makes purring sound and sits in front of the male in the mating posture inviting him to mount. The entire process of copulation lasts for 1 to 3 minutes.

In Calcutta Zoo tigers are allowed to mate from 7 a.m. to 10-30 a.m. in the morning and again at 2.30 p.m. to 5 p.m. in the afternoon, i.e. for 6 hours per day. The duration of mating period as observed during 48 heat periods was from 3 to 9 days and average heat period was 5-9 days. The range of mating was from 2 to 52 times per day and the averages per day was 22.2 times. The minimum interval between two consecutive matings was 1 minute and maximum was 90 minutes and the average interval was 7.1 minutes. The highest number

TABLE 4
OBSERVATION OF MATINGS OF TIGER, *Panthera tigris tigris* AT CALCUTTA ZOO

Matings between	Number of heat period	Duration of heat period (days)	Average heat period (days)	Range of matings per day (in 6 hrs)	Average matings per day in 6 hours	Average interval between two consecutive matings (in minutes)	Highest number of matings in a single heat period	Lowest number of matings in a single heat period
Malini × Neeladri	16	4-7	5.1	5-52	25.1	7.3	235	66
Chandni × Himadri	12	3-6	4.9	2-45	20.4	4.9	171	20
Chandni × Bhanu	2	4-7	5.5	4-44	23.9	5.3	174	89
Rupa × Barun*	2	7-9	8	3-25	17.1	12.9	152	122
Shashi × Rabi	7	4-6	5	7-49	25.8	6.9	167	27
Rupa × Arun*	1	6	6	12-26	19.5	6.9	117	—
Sona × Bhanu*	4	6-8	6.4	10-48	25.1	7.8	206	126
Bharati × Johny*	3	6-9	7.3	10-47	26	5.6	247	170
Moti × Bhanu	1	5	5	9-35	18.4	6.7	92	—

* Indicates the pair of tigers which lived together except at night.

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of matings observed in a single heat period was 235 times and the lowest was 20 times (Table 4).

Gestation period:

The gestation period of tiger is given as 105 to 109 days by Asdell (1946). Crandall (1964) records the gestation period as 100 to 108 days. Stracey (1968) records the gestation period as 15 to 16 weeks. Schaller (1967) reports the gestation period of tiger as 95 to 107 days. Ewer (1973) shows the gestation period of Indian tiger as 95 to 109 days. It

Percentage of pregnancies:

The tigress does not become pregnant after matings in each heat period. In Calcutta Zoo, 7 tigresses mated with the males in 48 heat periods from 1965 to 1977. Out of 48 mating or heat periods pregnancy occurred in 22 cases and did not occur in 26 cases. The percentage of pregnancy is therefore 45.8% only and non-pregnancy is 54.2%. (Table 5). It was observed that the number of heat periods and percentage of pregnancy were less when both sexes lived together except at night.

TABLE 5
RECORDS OF THE PERCENTAGE OF PREGNANCY AND NON-PREGNANCY OF TIGER, *Panthera tigris tigris*. IN CALCUTTA ZOO

Mating between (specimens)	Number of mating or heat period.	Number of pregnancy	Percentage	Number of non-pregnancy	Percentage
Malini × Neeladri	16	7	43.7	9	56.3
Chandni × Himadri	12	6	50	6	50
Chandni × Bhanu	2	1	50	1	50
Shashi × Rabi	7	5	71.4	2	28.6
Bharati × Johnny*	3	2	66.6	1	33.4
Moti × Bhanu	1	1	100	—	—
Rupa × Arun*	1	—	—	1	100
Rupa × Barun*	2	—	—	2	100
Sona × Bhanu*	4	—	—	4	100
	48	22	—	26	—

* Indicates the pair of tigers which lived together except at night.

is difficult to compare the above data, as in most cases the date of conception is defined differently. Crandall (1964) shows the gestation period of a tigress from the last observed mating as 100 to 108 days.

The duration of gestation period in the present observation has been estimated as the period from last day of mating to birth and the mean period was 103 days and the maximum and minimum were 107 and 101 days respectively.

Litter size:

Asdell (1946) records that the size of the litters varies from one to six but usually two to three cubs are produced. Schaller (1967) shows that the size of the litters varies from 1 to 7. Ewer (1973) reports that range of litter size is from 1 to 4 but 2 to 3 cubs are usually produced. Schaller (1967) shows the average size of 79 litters of tiger cubs born in Zoos as 2.8.

Data of 22 litters of tiger cubs at Calcutta

Zoo indicate that one cub per litter was on three occasions, two on nine occasions, four on eight occasions, three on one occasion and five cubs were born on one occasion. Average number of cubs per litter was 2.6 and the range of cubs per litter was 1 to 5 (Table 6 and Genealogical chart of white tigers).

Sex ratio:

Thirty two tiger cubs were born in eleven litters to one tigress from 1948 to 1959 at New York Zoological Park, the divisions of sexes being nineteen males and thirteen females (Crandall 1964). According to Schaller (1967) the sex ratio of 196 tiger cubs at birth in various Zoological Gardens was 100 males and 100 females. Acharjyo and Mohapatra (1977) reported that 18 tiger cubs were born from 1960 to 1975 in Nandan Kanan Biological Park, Orissa of which 6 were males and 12 were females with a sex ratio of 50 : 100.

TABLE 6

LITTER SIZE AND SEX RATIO OF TIGER, *Panthera tigris tigris*, IN CALCUTTA ZOO

Specimens	Litter Size		Sex Ratio		
	Total number of litters	Number of cubs in litter	Average number of cubs in litter	Male	Female
Malini	7	1-4	2.0	8	6
Chandni	7	2-4	3.2	8	15
Shashi	5	2-5	3.2	7	12
Bharati	2	1-2	1.5	1	2
Moti	1	2	2	1	1
	22			25	36

In Calcutta Zoo five tigresses gave birth to 61 cubs from 1965 to 1977 in 22 litters, the divisions of sexes being 25 males and 36 females. The ratio of male and female cubs was 100 : 144 (Table 6).

Ratio of white and coloured cubs:

In Calcutta Zoo 56 cubs were born out of crossing between pure white tigers with coloured hybrids, among pure whites, among coloured hybrids and between pure white and pure coloured tigers. Fourteen cubs were born

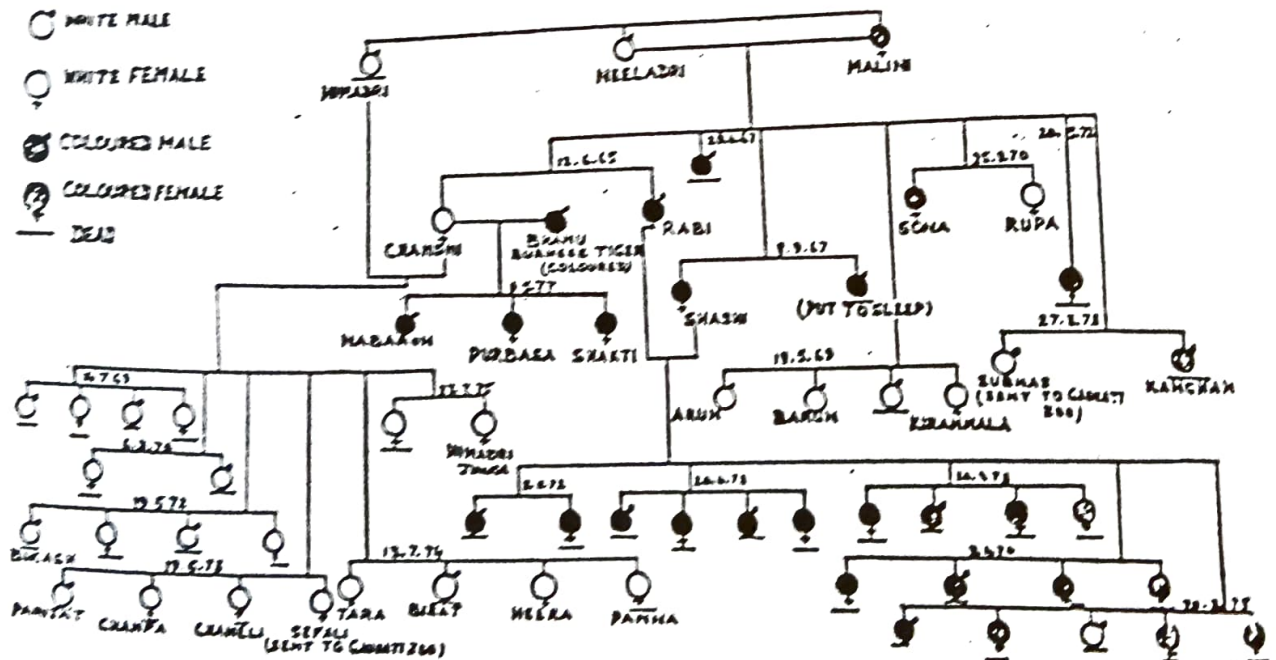


Chart. Genealogy of white tiger *Panthera tigris tigris*, at Calcutta zoo.

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to Malini (coloured hybrid female) being crossed with Neeladri (pure white male). The ratio of white and coloured cubs was 7 : 7. Twenty cubs were born to Chandni (pure white female) being crossed with Himadri (pure white male). All cubs were white. But Chandni when crossed with Bhanu (pure coloured Burmese male tiger) produced 3 coloured cubs. Nineteen cubs were born to Shashi (coloured hybrid female) being crossed with Rabi (coloured hybrid male). The ratio of white and coloured cubs was 1 : 18 (Genealogical chart of white tiger).

DISCUSSION AND CONCLUSION

Tigers mate throughout the year and cubs are produced during all seasons in captivity although there are peak periods of matings and births. High percentage of mating took place in the month of January, February, March, April, June and October and mating percentage is low in other months of the year. High percentage of birth occurred in March, April, May, June, July and September. These correspond to the high breeding activities in the month of January, February, March, April, June and October. In the month of February, August and December not a single cub was born. These correspond with low breeding activities in the month of November, September and May.

The variations in the peak period of birth and mating may be due to climatic condition and other conditions in captivity.

All Felidae appear to be polyoestrus in tropics (Asdell 1946, Crandall 1964, Prater 1964). Crandall (1964) shows that the receptivity of tigress lasts about 5 days on average. Sankhala (1967) states that the mating period of the tiger ranges from 3 to 23 days. Schaller (1967) reports the average length of

receptivity of 14 oestrus periods as 7.1 days. At Calcutta Zoo the duration of 48 oestrus periods of 7 tigresses ranged from 3 to 9 days and the average length of oestrus was 5.9 days. The variations in oestrus periods may be due to age, physical condition and frequency of copulation. Last oestrus phase was observed in a tigress (Malini) upto the age of 16 yrs. This suggests that menopause starts in a tigress after 16 years. It needs further verification.

There is much individual variations in the age at which the tigresses become sexually mature. It appears that tigresses attain sexual maturity at ages between 3½ to 5 years. But no clear conclusion can be drawn from these small examples.

The compatible pair of tigers mate freely in captivity but there is a chance of serious injury in first meeting. It can be seen from the Table 4 that the range of mating period is greater in case of tigresses which live together with the males in captivity. It may be due to the fact that the females are with the males at the very beginning of oestrus or heat period. The average heat period of tigress in captivity is 5.9 days and the average matings per day is 22.2 times.

The range of gestation period of four tigresses in 22 litters was from 101 to 107 days with an average of 103 days. These data compare well with the gestation period given by other authors (Asdell 1946, Crandall 1964 and Ewer 1973).

The tigress does not become pregnant after matings in each heat period in captivity. The data of pregnancy show that out of matings in 48 heat periods, pregnancy occurred in 22 cases and did not occur in 26 cases. The percentage of pregnancy was 45.8% and non-pregnancy was 54.2%. It is not known whether the age, physical condition, range of mat-

ing period and number of matings in each heat period of a tigress have any role in pregnancy.

Crandall (1964) reported that the average number at birth of tiger cubs at London Zoo in 17 litters was 2.3 per litter. In Calcutta Zoo, the range of tiger cubs per litter was from 1 to 5 with an average of 2.6 cubs per litter. Usually 2 or 4 cubs were born in Calcutta Zoo. It seems probable that condition of health, availability of food, and stress and strain in Zoo condition have some role in litter size of a tigress.

The sex ratio of tiger cubs at birth varies widely. The ratio of male and female cubs born in Calcutta Zoo from 1965 to 1977 was 100: 144.

Genealogical chart of white tigers shows that the ratio of white and coloured cubs produced in a crossing between pure white male with coloured hybrid female is 7 : 7. The pure

white female when crossed with pure white male produces all white cubs and pure white female when crossed with pure coloured male produces all coloured cubs. All these data are in conformity with the laws of inheritance. The data of crossing between coloured hybrid female with coloured hybrid male are yet to be observed.

The tigers' adaptability, wide range in choice of habitat and above all its remarkably short gestation period suggest that under favourable condition it can survive well.

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Longevity record of Indian tiger, *Panthera tigris tigris*, Linn. in captivity

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'Malini', a coloured tigress (*Panthera tigris tigris*, Linn.) of White Tiger family of Alipore Zoological Garden died on 18th September, 1980. The cause of death was senility. She was born on 18th June, 1960, at Govindagarh palace of Maharaja of Rewa as a result of cross between 'Mohan', the male white tiger, caught by Maharaja of Rewa and "Radha" a coloured tigress carrying gene for white (Roychoudhury & Sankhala, 1979). 'Malini' was acquired by the Delhi Zoological Park (National Zoological Park) from Maharaja of Rewa and was given to the Alipore Zoological Garden in 1963, on exchange basis. In Alipore Zoo, 'Malini' had been mated with "Neeladri" a white tiger of this Zoo and she produced 14 cubs in 7 litters. Out of 14 cubs, 7 were white and 7 were coloured and their sexes were 8 males and 6 females (Das, 1980).

"Malini" enjoyed a longevity of 20 years 3 months which is the highest longevity of tiger ever recorded in captivity. Crandall (1964) reported that a tigress (Bengal) at Staten Island Zoo, New York, died at the age of 19 years 7 months 23 days. Schaller (1967) reported that maximum longevity of tigers under Zoo conditions is about 20 years, an age which is probably not exceeded in the wild.

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