THE SOCIAL BEHAVIOUR OF BONNET MONKEYS
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Two troupes of bonnet monkeys (Macaca radiata) occupying a garden sector of Bangalore were studied mainly for their social behaviour and it was found that though in their behaviour, the bonnets comply with the general behavioural patterns characteristic of primates, there exist a few features and expressions which are different.

Bonnets live in well organised societies near human habitations and feed on wild and cultivated items of food. The troupe size ranges from 10 to 50 members that include males and females of all age groups. No real solitary bonnet has yet been encountered. They occupy definitely demarcated home ranges which overlap those of the others resulting in occasional fights or aggressive behaviour. They roost in many selected quarters, preferably tall and well spread trees. Though bonnets appear to be mostly ground dwellers, their adaptation to arboreal life provides safety. Adult males drop to the rear during flights in danger and see that the rest of the members are safe on tree-tops. They have a communicative system involving gestures, grimaces and calls.
The main breeding period is during the months of October and November. The period of the highest frequency of copulations in rhesus monkey of North India coincides fairly with that of bonnets, suggesting that the seasonal factors, to a considerable extent, control the onset of mating season and consequently the births. Babies are born mostly during the months of February and March. The gestation period appears to be of about 5 months duration. The mother-infant relation is most intimate and pronounced during the first 2 months of the baby’s life and there is a gradual fall in this aspect as the baby becomes older.

**Introduction**

The literature on the social behaviour of bonnet monkeys (Macaca radiata) is scanty as compared to that of the langur (Sugiyama, 1964; Jay, 1963) and rhesus (Altmann, 1962).

Variability among individuals is of interest in the study of the social behaviour of macaques. Each age class, sex and each member of a troupe has a characteristic poise of behaviour. Such behavioral differences are more than the necessary consequence of morphological differences. Differences between the sexes and between ages within sexes are found not only in those activities closely associated with reproduction but in characteristic patterns of play, aggression and association as well (Thompson, 1969).
Attempts have been made by Holte (1955) and Simonds (1965) to investigate into the social life of bonnet monkeys. The purpose of this study is to present the social behaviour of Macaca radiata during the period 1964-1970.

Bonnet males are larger than the females and have larger canines. An adult male weighs on an average 7.25 kg and a female 5.5 kg. Head and body measure about 18-20 inches but the tail is generally slightly longer being 22-24 inches. The skull is about 5 inches long from the occiput, 3 inches from the foramen and 3 inches across the zygomatic arch. Hair is present all over the body except on the face, forehead, ischial callosites and the area surrounding the volar and plantar surfaces. The hair is sparsely distributed over the ears, chest, belly and extremities of hand and foot, in both sexes. In females which have weaned young, the teats are drawn out. In old individuals the skin on belly droops in folds, the scrotum is practically hair free.

In babies, the chocolate colored hair is sparsely placed and this turns into brownish in juveniles and subsequently brown on the back and whitish brown in the belly region of adults. Old ones have yellowish grey hair. Fur is moderate in length, straight and smooth. Hair of the crown or bonnet are long and radiate from the central part of vortex but stop a little above the forehead and parted in the middle.

The thumb is short, often stumpy, deeply set in; index finger is moderate, middle and ring fingers long (middle being the
The little finger is rather short. Slight webs, best seen when the fingers are stretched apart, extend between fingers and toes. The slender palm is elongated. The toes do not show as much variation as do the thumb and middle finger. The great toe is relatively longer than the thumb; the third and the fourth are long while the second and little toes are moderate in size.

The hand and foot are not specialised for arboreal life to the extent seen in either Cercocebus or Colobus. The cranial capacity as recorded by Flower's method measures about 75-80 cc. The rectal temperature varies from 101-104°F, and the vaginal temperature from 99-103°F.

1. Troupes:

The interesting feature in the study of social organisation is that it sheds light on the origin of the human society. Two groups of animals are of particular importance in such a study. One, the apes and two, those animals that inhabit Savannahs as did the ancestors of human beings.

Bonnets form social units of varying numbers. Certain prosimians like Danbentonia and Cheirogaleus seem to have a non-clumped distribution. But the clustered pattern seems to be of a common occurrence among the primates due to the advantages that such an aggregation offers, i.e., safety against other animals, and ready availability of sexual partners. Certain other animals
form family groups with an adult male and an adult female as the basic unit. But more often the aggregates of primates are larger than the basic family units thus comprising troops of several individuals of both sexes and all age groups, as is reported for rhesus (Southwick et al., 1965), Japanese macaque (Imanishi, 1962), Baboons (DeVore, 1965) and the Bonnet (Simonds, 1965).

Some animals like the howlers (Carpenter, 1965) have large groups of mixed sexes and small groups of one males. Gorillas (Schaller, 1965) have more or less a similar organisation. In Northern India, there are langur groups of both sexes and also all-male groups (Jay, 1965). In South India, among langurs, the similar two types of groupings occur but the mixed groups consist of several females and few adult males and often only one male (Sugiyama and Parthasarathy, 1969).

However, a clumped and random distribution is obviously the rule in higher primates. In all species with a relative orderly pattern of spatial distribution, the arrangement of clusters or clumps seems to show some element of even distribution as is reported by Marler (1968).

Although there is no geographical or physical barrier between the neighboring troupe, it appears that it is their individuality that keeps them isolated in smaller units forming the so called troupe.

Bonnets form social units and live in troupe of 10–50 members of both sexes and all ages. They are to a large extent
ground dwellers as greater part of their time is spent on the ground. Solitary bonnet, in the true sense, is never observed though one may stray away for 2-3 hours. Young adult rhesus males having their groups for several days leading a temporary extra-group existence are common (Southwick, Beg and Siddiqi, 1965). In nature solitary bonnet is a rarity as in case of baboons (Washburn and DeVore, 1968) and such individuals are helpless and are open to attacks, even by crows. An adult male of troupe 1 was left behind on the mango tree near the tank, napping on Sunday, July 18, 1965. The male on finding the troupe gone got terribly upset, jumped from one branch to the other and gave deep throated groan of anguish. On failing to spot the troupe, he descended the tree and headed to those places of daily routine. He would climb the tree top, peer in all directions and groan. He covered the whole home range and finally joined the troupe. He was welcomed by an adult female and a juvenile male that smacked the lips at him, indicating the extent of recognition of familiarity and affection between individuals within a troupe.

2. Hierarchy:

The physical interaction between any two individuals in a group or all individuals as a cohesive unit, being integrated by hierarchy minimises the turmoil, fights and friction. A status hierarchy is characteristic of macaques and baboon troupes, (Chance, 1961) suggests that the occurrence of hierarchy is a general feature of all social primates.
Several investigations conducted in field and laboratory on the social life of primates often demonstrate the occurrence of rank structure but Floog et al. (1968) point out that the rank system is not equivalent to social organisation in squirrel monkey. Hall (1965) suggests that the role structure in primate troupes is more important than status and that the dominance relations may not be readily apparent.

For certain animals there is little evidence about the presence of dominance hierarchy. Bernstein (1966) has observed that certain role functions can be recognised in social groups even while status relationships are not clear.

The concept of dominance was probably first introduced to the student of behavioral sciences by Schjelderup-Ebbe in 1913 who described the peck order in chicken. Later Carpenter (1942) applied this principle to primate studies and he defined it in terms of 'Priorities and Incentives'. Thus far the dominance is defined in several ways by different observers and has been severally measured by methods like counting the number of food pieces taken, observing feeding and drinking orders, number of mating especially with estrous female, counting the lead in fight, scoring escape from noxious stimuli, counting entries into the home cages of selected partners, the direction of aggressive encounters, total aggressive acts and the nature of agonistic behaviour. These measures have further been correlated with grooming against nonsexual mounting, the control of troupe members against intra and inter troupeal disturbance. Thus all these
definitions instead of clearing the situation tend to confuse the issue as is rightly pointed out by Bernstein (1969). Kaufmann (1967) has shown that the high degree of aggression is not equivalent to high rank.

The order of social hierarchy is neither a straight line order of dominance nor a concentric pattern met with in Japanese monkeys (Imanishi, 1957), where the social structure is around the leaders who correspond to the nucleus of a cell, the females, infants and babies forming the central part of the troupe, the subleaders and young males forming the peripheral part (Sugiyama, 1960).

The rank order can be clearly established among adults and subadult males and females. Placing the food between individuals whose relative positions are to be established, results in a dominant one consistently picking up the food but the same individual is not dominant as to his choice in mating partner, troupe safety, etc.

Determination of dominance ranks is further studied by noting down the aggressive and submissive behaviour in dyadic and triadic associations. Careful observation of the social interactions among intra-troupal members was conducted. This brought to light three types of associations that existed among the members within a troupe. Some dominant, some subordinates and some others neutral of the two. The most dominant were invariably males, while certain females also showed this tendency.
Subordinate individuals were the peripheral males and females, while the neutral relation existed between the mothers and their infants and in the associations of juveniles. But sometimes some of the juveniles irrespective of the mother's rank, tended to be more aggressive and hence more dominant, if aggressive nature could be taken as a determinant of dominance, than the others.

Although every bonnet individual had the scope of interacting with any other individual within the troupe, certain factors tended to prevent such social contacts between individuals of various ranks. But as such there is not much competition for sex or shelter but only over food. This proves that shifts in dominance occur among the participating members depending on the situation and activity. (Plate 3, Fig. 3.1 and 3.2).

Warden and Calt (1943) have rightly pointed out, as applicable to bonnet monkey, that the aggressor in a situation is not necessarily the winner and consequently the dominant.

3. Fights:

Different groups restrict their movements within well marked areas. But the overlapping of home ranges occasionally occurs. When two troupes come face to face, aggressive behaviour or fights occur and the larger troupe invariably displaces the smaller one. Often on the approach of the larger troupe the smaller one quietly retreats avoiding unpleasant situations. At times the approach of a single monkey from the larger troupe is enough to scare away the smaller troupe. This indicates that the
bonnets can recognise a stranger among them. Sometimes the sub-adults and juveniles of one troupe on spotting another, would approach it and make screeching noises and back away to alert the members of their troupe.

Adult and old monkeys of both sexes participate in the integrity of their home range. The juveniles and babies rarely participate in fights but act as scared spectators. Inter-troupe fights are rare.

It is characteristic of them that fighting is a last resort. Fight is usually preceded by threat that appears to function in two ways. If the threat is by a more dominant individual it is not ignored by the subordinate who withdraws submissively and thus avoids a fight. Sometimes the threat exchange is being prolonged by the participants if they happen to be of equal status, but and in separation without actual fight. But such prolonged duels among individuals of different troupe have a sad ending. In majority of cases the threat prevents the aggressive tendencies of more especially the subordinates who learn to respect it if directed towards them by more dominant individuals. The threat is thus an important form of aggressive behaviour that is advantageous to the subordinate individuals who submit to the same.

The threat in its simple form is expressed by gestural movement but if ignored, its amplitude may be enhanced by the accompaniment of vocalisation, if still unheeded, it terminates
in an actual attack. Some primates, including bonnets, use their fore and hind limbs in producing additional warning noises, as by branch shaking. Gorillas (Schaller, 1965) beat their chest in resounding manner to express anger.

Among the bonnets there is sometimes a submissive or appeasing gesture, in the form of crouch and lip smack, that prevents the attacks from the dominant ones.

The threat is an expressive movement or a signal given out by a dominant individual to a subordinate one warning the latter to refrain from that particular act in which it is involved. And this will have the desired effect especially on the subordinate ones who immediately become submissive.

The arrival of a rival group is made known by branch shaking or running of an informed member to safety. The gesture alerts the other members and provokes them to stand on their hind limbs, crane their necks, scrutinise and on spotting the strangers run to safety. The fleeing monkeys stop at intervals and look back to make sure they are not being chased.

Intra-troupe fights result generally over food. Warren and Maroney (1958) have observed a correlation of only 0.77 between direction and aggressive interactions and priority of food incentives in monkeys.

Fights over mating partners have not been observed by us. When members within a troupe indulge in disagreeable situations the dominant male intervenes and puts an end to it by branch
shaking or by actually attacking one of the miscreants. The weaker individual backs away screeching and smacking lips out of fear. Mothers prevent their babies from being involved in such situations and always run to rescue them when a turmoil breaks up in the troupe.

4. Feeding:

The nature of the food eaten by bonnets is determined by direct observations in the field rather than by the study of stomach contents. The bonnets tend to be omnivorous and feed upon a variety of leaves, flowers, fruits and seeds. Grass blades, bamboo shoots, mulberry, tamarind and ficus fruits, mango flowers and eggs of birds seem to be the preferred items. A variety of flies, pupae and grass hoppers are eaten. Rarely the gum or juice oozing out of stems is licked. Water consumption is remarkable unlike langurs (Jay, 1965). Water is taken in by direct licking. Bonnets prefer fruits and insects to leaves while the langurs prefer the latter.

The feeding gait varies with the type of food and location (Plates 12-13, Figs. 3.3-3.6). If grains or peanuts are thrown, they squat and hurriedly deposit them in the cheek pouches and run to shelter. At leisure the food is taken out by the sideward movement of tongue or with the aid of hand and eatale. The food is cleaned by rubbing between the palms before it is tucked in. While feeding in open fields, they cover wide areas and search for grass hoppers and other insects by lifting stones and crushing
mud clumps and on spotting one it is caught with a swift downward snap of the hand and is tucked into the mouth. To catch flies that are generally found on the mango trees, they approach cautiously without disturbing the branch and the flies are caught with a quick snap. Pupae found attached to leaves are separated with the tongue and eaten. Caterpillars are never used as food.

The howlers neither cooperate nor compete in obtaining food (Altmann, 1959), whereas the bonnets do not cooperate but compete for food. While eating fruits, they are plucked or the mouth is put to them directly. While on slender branches they assume a bipedal gait to reach the end to pluck fruits. The bonnet monkeys drop half-eaten or unripe fruit by jerking the tongue. Palm trees are invaded, fruits plucked and dropped uneaten. The stem of canna and the like are split open to reach the soft and sweet core. Leaves often cherished by bonnets are extremely bitter to man's taste. Despite the repeated attacks by crows that swarm around it, a monkey seldom retreats from its efforts to reach nest and eat eggs. Dust particles and ecto-parasites found during grooming are eaten. The mouth is put to water directly and licked in the animal fashion (Plate 14, Figs. 3.7 and 3.8). On rainy days wet hands and body are licked dry. The urine excreted by a monkey is often licked by it and others. The evacuated droppings are picked up, smelled and tasted. The semen extruded during copulation is eaten by both the partners. Baby feeds on its mother's breast for about 6 months (Plates 14-15
Figs. 3.9-3.10). One month-old baby is seen to pick up the bits of discarded food by the mother and eat. Even a 3-month-old baby deposits into its pouches the solid food and later consumes it at leisure.

5. Grooming:

There is a considerable variation in the daily rhythm of different troupes and at different seasons of a year. The grooming frequency varies with the season and the time of the day but reaches a peak at noon after hunger is satisfied. Shady places are chosen for the purpose and on no occasion was grooming observed in places exposed to severe sunlight.

The grooming may be of very short duration during group movement or over long periods at noon when the troupes settle down to rest and doze. Sometimes the groomer dozes a while, wakes up and resumes grooming, while the groomee may figet a bit, shift position, walk away or wait for the groomer to wake up. Groomee exposes the desired parts to be groomed or the groomer selects them. The grooming may start from the head and continue upto the tail-tip (Plate 18, Fig. 3.20). The groomer scratches the scar tissue, wounds, parts the hair carefully, picks up the dust particle and the like, and eat or discard them. The foreign matter may be picked up with hand or the mouth is put to it. Both the hands are used with same frequency in grooming. The grooming may occur between any two or more individuals of either sex or it may be self-grooming which is not as frequent as others. The bonnet
male appears to be an active groomer (Table 1). A monkey of superior order may displace a groomee and be groomed. The mother grooms her infant.

Table 1

Frequency of grooming seen in September, October, 1964 and in February, April and May, 1965.

<table>
<thead>
<tr>
<th>Troupe</th>
<th>to</th>
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<th>to</th>
<th>to</th>
<th>B</th>
<th>J</th>
<th>to</th>
<th>J</th>
<th>to</th>
<th>Ad</th>
<th>B</th>
<th>to</th>
<th>others</th>
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<tbody>
<tr>
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<td>201</td>
<td>288</td>
<td>341</td>
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<td>Total</td>
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<tr>
<td>II</td>
<td>249</td>
<td>217</td>
<td>133</td>
<td>287</td>
<td>264</td>
<td>19</td>
<td>71</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>466</td>
<td>634</td>
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</tr>
</tbody>
</table>

Number of males is 3 in each troupe and females 11 and 6 in troupe I and II respectively. B: baby, J: juvenile, Ad: adult.

Different postures are assumed by partners involved in grooming (Plates 16-18, Figs. 3.13-3.22). The desire to be groomed is expressed by an individual approaching and lying down close to another. Sometimes individuals approach each other and groom in turns. The mother stretches the limbs and tail of the clinging baby and grooms. The partners if by chance look at each other, smack their lips. An individual desirous of being groomed if not responded approaches some other individuals.

It is quite apparent that the grooming between members of
the troupe does not reveal any special status of the partners involved. Grooming in bonnets, in addition to being a device to remove the ectoparasites and foreign matter, is an expression of affinity and affection. Such tactile expressions are indubitably important in the maintenance of peace and cohesion of the troupe by being a device to ward off attacks from more aggressive ones.

Grooming in addition to being a friendly performance has an utilitarian action, in that it is usually directed to those parts of the body which cannot be taken care of by the same individual, for example, back of the head, ears, hind quarters and under the chin. These animals have an insatiable lust to groom and be groomed. The bonnets have an extraordinary degree of affection as reflected by the considerable amount of amicable behaviour among the members within a troupe, and have ferocity to the same extent where the strange animals are concerned. This combination of friendly and hostile behaviour holds the key to social cohesion among members within the troupe and to isolated cluster of troupe formation.

Nolte (1958) did not observe any auto or self grooming among the feral subjects. But we observed quite a number of such instances though with low frequency as compared with mutual groomings. Simonds (65) has reported the same.

The grooming may start in sitting position, but more often the groomee takes a reverie position, lying down on chest, back
or side with the limbs stretched out. The bonnets are really relaxed and least tense while being groomed. Wounds are often cleaned and groomed.

Rosenblum, Kaufman and Stynes (Rosenblum et al., 1966) report that it is most significant to note that in both species subjects with wounds have been observed to allow subordinate members to groom the wounds even though this action causes obvious and protracted pain to the recipient. It is difficult to recall any other instance in which a subordinate individual was observed to inflict with impunity such distress, much less pain, on a more dominant subject. Our observations on bonnet show that fresh wounds are rarely groomed by any individual at all, although the subject himself may try to keep it clean of dust, by licking, or preventing the flies from getting into it. Moreover such parts are placed while sleeping in such a position as not to be pressed against other parts and cause pain.

A wounded bonnet relaxes and lets others groom only when the wound is sufficiently old not to inflict pain. Often the scar tissue is removed from the wound by the groomer, using hand or mouth, and scar is eaten. This process should appease rather than pain the wounded animal.

Social grooming lasted several times longer than autogrooming. In social grooming hands and mouth are made use of while in autogrooming either fore or hind limbs are involved, together with the mouth.
The fact that the highest grooming frequency is recorded during those months when the sexual activity is at its highest suggests that grooming may be a prelude to copulation. This pattern of amicable behaviour i.e., grooming, plays an important part in maintaining social cohesion. The stability of a social group does not depend entirely upon the fact that the strangers are chased away, but on the fact that aggressive behaviour is well controlled and is often superimposed by the amicable behaviour.

6. Sleeping:

Bonnets indulge mostly in three daily activities, i.e., feeding, grooming and resting of course not ignoring play by the juveniles and infants and sexual activity by adults. About 50 per cent of their time is spent in sleeping and grooming, about 40 per cent in feeding and 10 per cent in movement.

Bonnet macaques roost in several but selected places like thick and tall trees or roofs of buildings. They leave the feeding grounds by about sunset for the roosting places. They remain in the feeding locality over longer periods if the food is scarce and the trees nearby are made use of for spending the night. On reaching the roosting place they split up into associations of two or more and rest. Zuckerman (1982) observed for Papio comatus that the bands split up into family parties for the night. But the split units of bonnets cannot be relegated to family parties for the night, nBBr can be regarded as subgroups of rhesus (Southwick, Beg and Siddiqi, 1965) as such association.
does not last long. During rains more individuals congregate and sit very close to one another and rest. It is quite common for the bonnet monkeys to spread over two or more trees at night. Dominant ones sit on top branches to sleep as well keep a watch.

Once on a tree, they groom (Plate No. 20, Fig. 3.25) or doze selecting comfortable places like the forks of branches. Wounded and injured parts are safeguarded against being pressed during sleep. One monkey may rest its head on the hunched back of another or on the folded knees. Mother with a young baby embraces another individual to sandwich the baby and prevent it from falling at night (Plate 20, Fig. 3.26). On waking up the members smack their lips looking at one another. Once they settle down for the night's rest they remain there till dawn. There is no semblance of any nocturnal activity after dark.

7. Breeding:

In the bonnet macaque there is to a certain extent sexual dimorphism but no distinguishable differences in the sexual skin of the female as met with in the case of the female rhesus (Kolfor, 1963). On only two occasions a slight reddish tint was seen in the genital region of the females that appeared to experience their first pregnancy. It is very difficult to distinguish the females in heat and those not except by the method of recording the frequency of copulation. Among bonnets, females presenting themselves are extremely rare and are different from rhesus monkeys
(Hinde & Rowell, 1962), Indian langur (Jay, 1965) and the howlers (Carpenter, 1965) which when in heat present themselves for copulation.

A female bonnet in heat stands many chances of being copulated by a dominant male but nevertheless can be mounted by several other males also. Similar observation is made for the rhesus male (Conaway & Koford, 1965) where breeding activity did not decrease with decreasing rank in a regularly predictable manner. On the one occasion it was observed that a female was mounted by three males in succession. On several occasions, a female passing by, attracted the attention of males who invariably showed interest by following her either to groom or copulate (Plate 20, Fig. 3.27).

Of the 308 copulatory mounting recorded during the study, 241 were initiated by males; 294 ended with single mounting, on 243 occasions the females surrendered without resentment; on 31 occasions the females ran away; on 28 occasions dogs and children and on 4 occasions dominant males interrupted it; on 2 occasions the females ran away from subadult males and presented themselves to adult males. It is difficult to assess how many of these copulations were really ejaculatory, but sometimes seeping of the semen deposited during copulation in the vagina of the female would indicate successful mounting. It may take a minimum period of 3 years for the males to gain sexual maturity. A male born during 1963 (about 1 year old when the study was begun) was seen to make copulatory mounting successfully in the middle of June 1967. The same may be true of the females also.
The bonnet male solicits the copulation mostly (Simonds, 1965). The approach of a male to a female varies. He may follow a walking female, whip the tail aside, hold her by the hind quarters and mount or approach her, test and then mount. This may or may not accompany the smacking of lips by one or both the partners. The testing is done by putting the finger inside the vagina, taking out the contents, smelling and or tasting. Though it seems to be a prelude to copulation, in bonnets this is not obligatory process as most copulations have occurred without testing of the female. About 95 per cent of the tested females are mounted, and practically none rejected and if we regard that testing is a real process for judging the receptivity of the female, then those females that were not in heat should be rejected. But this does not happen and hence testing has a secondary significance.

Among bonnets the mounts are very brief. The reasons may be: 1) predator pressure, or 2) anatomical characteristics. Prolonged copulations are dangerous to any animal living in wild and especially the land dwellers, bonnets spend much of their time on land. Furthermore, paired animals, as during copulations, are more vulnerable to such predator dangers. Bonnets thus indulge in briefer mounts than the more arboreal forms. The cheek pouches of these animals further strengthen this hypothesis, in that they aid the animals in the hurried deposit of food which could be leisurely consumed on reaching safety. Only those animals that are free from predation problem indulge in long copulations, for example rhinoceros (Goddard, 1966).
The anatomical specialisation of the penis may also be responsible for these short mounts as the penis structurally highly specialised is correlated with correspondingly brief mounts among a few animals (Sharman, G.B. and Calaby, J.H., 1964).

There was no aggression among males for copulation with an estrous female.

The placenta is swallowed by the female, as it contains lactogenic hormones and may assist in the establishment of lactation. The males are sexually aroused by some tendency not experienced by females, probably a pheromone, discussed later.

Although females never mounted other individuals they spent a part of their time in other interactions with them in being mounted and caring for individuals, forming association with other mothers, etc.

Typical mounts by males involve a voluntary response from the mounted one, most often the female in heat, while atypical mounts are resorted to occur without the consent and cooperation of the partner usually a male, but sometimes unwilling females also.

In our study area, males and females did not show what could be called a consort relationship and differ from howlers (Altmann, 1959), langurs (Jay, 1963), baboons (Hall & DeVore, 1965) and Japanese monkeys (Imanishi, 1957), Simonds (1965) has however reported only one long-term relationship between a
particular male and female that might be called a consort relationship in bonnetas.

Both adult and juvenile males among bonnets resort to masturbation like the howlers (Altmann, 1959) where masturbation was seen in males, females and juveniles. Bonnet females are not observed masturbating. Japanese monkeys of Taishaku-kyo troupe are reported to have no practice of masturbation. Juvenile bonnets mount other juveniles, adults and babies; the babies mount juveniles, adults and other babies.

Considering the frequency of copulation and birth, it is almost certain that the bonnets observe a peak in breeding period. Copulation frequency is at its height during October and November and the birth rate is at its maximum during February and March, and DeVore (1965) observed a baboon female to copulate with 3 males, 93 times in five days. In patas monkey (Erythrocebus patas) the high proportion of clinging infants who were less than one quarter the size of adult females suggests the occurrence of restricted period of birth (Struhsaker et al., 1970). The period of gestation is about 150 days. Hartman (1938) observed for bonnets that in 3 cases the period of gestation was 153, 166 and 169, days.

Southwick, Beg and Siddiqi (1962) observed for the rhesus monkey in North India, a sharp peak of births in March and April. The fact that the period of annual reproductive cycle is fairly uniform in rhesus and bonnets of North and South India, respectively implies that the environmental factors to a certain extent are similar as to control the onset of mating season in these animals.
Table 2: Statistics of the copulation frequencies and the babies born.

<table>
<thead>
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<th>Month</th>
<th>Year</th>
<th>No. of copulations</th>
<th>No. of babies born</th>
<th>Total No. of babies born</th>
</tr>
</thead>
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<td></td>
<td></td>
<td></td>
<td>Troupe I</td>
<td>Troupe II</td>
</tr>
<tr>
<td>Aug.</td>
<td>1964</td>
<td>13</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sep.</td>
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<td>6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Oct.</td>
<td></td>
<td>65</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Nov.</td>
<td></td>
<td>72</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dec.</td>
<td></td>
<td>7</td>
<td>-</td>
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<td>Jan.</td>
<td>1965</td>
<td>4</td>
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<tr>
<td>Total</td>
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+: Months during which copulation is not recorded due to low frequency.
Two cases of twin births were recorded by us (Plate 14, Fig. 3.9).

8. Care of the Young:

Under field and laboratory conditions the nursing of infants by the mothers goes on for about 6 months (Plate 19, Figs. 3.22-3.23). The bonnet babies tend to be close and run to their mothers for safety even after the nursing period. Bonnets resemble the rhesus in that the mother-infant relationship probably lasts about a year and is not disrupted until the next sibling is born (Altmann, 1962). The same observation is made for Japanese macaques (Imanishi, 1957).

Vital nourishment and maintenance of contact with the mother are provided for the primate infant by the mother till such a time proper reflexes are operative. The bonnet mother-baby association is intense during the first 4 to 6 weeks. Bonnet mothers with young babies form their own association and take care of their own babies as well others' (Plates 23-24, Figs. 3.36-3.39). The mother prevents other monkeys from making much contact with the young baby (Plate 25, Figs. 3.40-3.41). After about 4 weeks the juveniles and adults handle and pull the baby from its ventro-ventral position. She prevents the baby from wandering away from her. By the end of second month she is seen to leave the baby in bushes or on the ground while she feeds.

The mother feeds her infant for about 2 months on milk, but gradually the baby starts biting at the solid food and discards
droppings of food by its mother. From the third month onwards the bonnet infant tries to be away from mother for as long as 10 to 15 minutes. The parturitions seem to occur exclusively at night. When the females appeared for feeding, they carried the young ones, clinging to their bellies, that were not seen a day earlier. The baby clings tightly ventro-ventrally to the mother's belly right from the first day of its birth and holds itself in position while the mother jumps or runs but if it slips she supports it. The young baby may ride the mother's back for a short while when she is sitting or walking. Before the mother moves to another place she picks up the baby and the baby clutches at the mother's fur with both the fore- and hind limbs (Plate 19, Fig. 3.23), its tail at times curls around the mother's back or tail acting as an additional grip. On the approach of any danger (Plate 27, Fig. 3.46 the mother's first reaction is to pick up the baby and hurriedly run to safety. If other monkeys harass the baby the mother chases them away (Plate 25, Fig. 3.47). Among langurs it has been observed (Jay, 1965) that as many as 8 females may hold the infant during the first day of its life and it may be carried as far as 50 feet away from its mother. Among bonnets snatching away of the infant is never done although 4 to 5 individuals may gather around and handle a new-born infant. The female resents others' baby trying to cling to her and drastically removes it. As the baby grows the degree of maternal care steadily decreases. The baby is allowed to make more and more contact with others and especially other infants and juveniles (Plate 26, Figs. 3.43-3.45). Such a
grown baby is often prevented from suckling and clinging to its
mother by the mother jerking herself free and staring angrily at
the baby. It is the infant that often breaks its contact with the
mother at which the mother tends to like it and move away from
such individuals thus encouraging them toward self-reliance.
While, on the ground, the baby tries to walk or hop or climb a
tree trunk, the mother always keeps a close watch and follows it.
When a baby walks it generally does so beneath the mother's belly.
The mother expresses affection at the baby by burying her snout
into the baby, by hugging it, by gently patting and by making soft
noises at it. When the baby is upset or fidgety, the mother pats
it gently. At night the young ones of even more than a year old
tend to be close to mothers.

The oft quoted maxim that the female is the deadlier of the
species is indubitably true for bonnet female which becomes highly
ferocious if the baby is threatened. Under conditions of danger,
even a weaned baby is being taken care of by the mother. A dead
baby is carried for several days by its mother (Plate 27, Fig. 3.4')

The baby holds the teat in its mouth either when it is
clutching to its mother or while sitting on the ground. Usually
the teat is taken in hand and then put into the mouth and suckling
with eyes open or close. The baby snaps the jaws fast to suckle
and the thumb is at times sucked at as well the fingers and toes.
Erection of penis is seen in 1-month-old baby. Two-month-old
babies often mount one another (Plates 21-22, Figs. 3.28-3.33).
One baby may mount another and be in turn mounted by a third one. The baby, as grows, starts spending greater part of its time in the company of other babies so as to explore the surroundings and learn it (Plate 28, Figs. 3.49–3.51). The play is a very important medium for the perfection of the future life of an individual to arboreal and terrestrial life as well to exercise its body, experience the social relationships etc. In social species the experience gained in play may have other far reaching effects of a more general character. Scott (1962) working with dogs and Harlow (1962) working with rhesus monkeys found that an animal deprived of contact with its own species during youth, grows into an asocial neurotic or a sort of behavioral cripple, with its social responses to its fellows distorted or missing altogether. In nature social contacts for the developing youngster come from two sources: (1) provided by the mother and (2) made with age group mates in play. The latter, i.e., play with age mates can compensate for deprivation of maternal influence sometimes. The play comprises wrestling, jumping, bouncing, running, chasing, climbing and so on.

Sometimes the bonnet juveniles indulge also in a complex acrobatics of play. This is observed when 2–4 individuals hang down from a slender branch or a rope, some hanging with only one hand gripping the object while the second hand and the legs are suspended free and in this position they bite or try to pull down one another. This assumes a more complex feat when they hang down by only one leg that grips the object. This shows that though a
considerable amount of their time is spent on land the bonnets still have a considerable adaptation to arboreal life. The baby plays with other babies and juveniles but occasionally with adults and old ones. The juveniles are seen to pull the baby by its tail or penis.

One-year-old individual loses almost complete contact with the mother and may be regarded as a juvenile. The most mischievous phase in the life of a monkey is the juvenile phase (Plates 29-30, Figs. 3.52-3.55). It shows a complex of both the infant and adult characters. A juvenile may suckle the thumb and play like babies and yet behave like adults in feeding, mounting, etc. They mount babies, other juveniles and sometimes adults. Highly aggressive juveniles that take priority over other juveniles might become dominant ones at a later stage. They generally groom the adults, embrace one another and often rub the penis and make it erect. The juvenile life probably lasts for about 2 years. The juvenile males are more mischievous than the females. They approach the dominant males in a presenting manner with the tail raised and back into them, at which the latter may mount or in lighter vein pull the penis and release it with a snap. The play by juveniles is a complex of jumping, whirling, somersaulting, etc.
Fig.

3.1. Shifts in dominance occur among the participating members depending on the situation and activity. A juvenile male demonstrates anger at the observer indicating that even among juveniles a certain amount of hierarchial status does occur.

3.2. A dominant male retards the approach of dogs.

3.3. Baby is supported on one of the hind limbs of the mother while the latter keeps her forelimbs engaged in feeding.
3.4. Food cleaning is a habit quite prevalent among bonnets. It is cleaned free of adhering mud and the like. A mother hunches forward to prevent the baby from slipping down while she cleans food.

3.5. A pregnant female cleans food by rubbing it between the palms.

3.6. Another gait of mother cleaning food before conveying it into mouth.
3.7. Unlike langurs, the bonnets consume a considerable amount of water.

3.8. Water is taken in by laping in an animal fashion. One drinks while the other one watches the surroundings.

3.9. A mother suckles her twin borns.
Fig.

3.10. A typical posture of a mother feeding her newborn.

3.11. The extent to which the teat droops indicates the number of litters borne by that female. Note the enormously drawn-out teat.


3.14. Even a dominant male is an active groomer.

3.15. Afternoons are spent by bonnets in grooming while the majority of individuals indulge in this feat.
3.16. A mother stands upright to keep the baby in ventroventral position while being groomed.

3.17. A juvenile male grooms a female with her baby. The neck is groomed.

3.18. The back is being groomed.
3.19. The ears are probed and the nape of the neck is being groomed.

3.20. The grooming extends as far as the tip of the tail.

3.21. The mother grooms her baby.
PLATE 19

Fig.

3.22. The baby plays about while the mother grooms a juvenile.

3.23. The baby can clutch at its mother's fur even with its hind limbs.

3.24. The mother settles down to rest while a dominant male resumes the duty of a sentry before settling down himself.
3.25. Even before settling down for the night rest, the individuals groom one another a bit.

3.26. The baby is usually sandwiched between the mother and another individual of either sex to prevent it from falling down when the mother is asleep.

3.27. The initiation of a typical mount.
3.28. Atypical mount on an unwilling partner.
3.29. Baby-baby mount with a touch of typical mount.
Fig.

3.31. Juvenile-juvenile mount with a hint of typical mount.
3.32. Baby-bay mount, atypical posture.
3.33. Juvenile-juvenile mount, with atypical posture—note the position of the tail.
PLATE 23

Fig.

3.34. A juvenile male masturbates. Females are never seen masturbating.

3.35. An adult male masturbates.

3.36. Association of two mothers with infants.
3.37. Association of three mothers with young babies.

3.38. Congregation of several individuals around mothers and their newborns.

3.39. Humane behavior of two mothers. Note the mother on the left with her own baby clinging to her belly expressing affection towards the baby of the female on the right by sniffing at the baby.
3.40. Mother initially prevents her baby from wandering away from her.

3.41. Mother holds her baby secure while being groomed.

3.42. Mother chases away the individuals that harass the baby. Note the expression on the baby's face, a learning feature.
3.43. As the baby grows older, the mother allows other individuals to handle and play with it.

3.44. She allows the baby to move about freely but closely follows it.

3.45. As the baby grows older and older it is left more and more to itself.
3.46. On the approach of any danger, the mother's first reaction is to scoop or drag the baby to safety.

3.47. Even a dead baby is carried for a number of days by the mother.
Fig.
3.49. A baby in the foreground is left to itself on a tree top while the mother is away feeding.
3.50. The baby learns climbing and playing to explore the surroundings.
3.51. The older babies form their own association and play.
3.52. A juvenile awaits his chance to enter the feeding grounds.

3.53. A juvenile makes a stealthy approach to feed.

3.54. A juvenile is a complex of adult and infant characters.
Fig. 3.55. That again a juvenile.