

1. INTRODUCTION

Wildlife heritage is a divine gift to a country. According to Govt. of India (1983) wildlife in India at present comprises, of : 350 species of mammals, 200 species of birds, 900 species of reptiles (Mukherjee, 1982) and a large number of other animals. It is a man dominated world as such human beings have a great chance to enjoy at the same time bear a tremendous liability to preserve, utilize and pass on the treasure to generations to come. The task is particularly difficult in India in the face of growing demands from more than 1 billion people and 500 million farm animals. It may be mentioned that 80% of Indians live in rural areas and are almost completely dependent on the living natural resources for their sustenance. Per capita forest area in India is barely 0.12 hectre, while the world average of the same is 1.0 hectre. In the course of 32 years from 1951 to 1983, India lost about 43, 420 square kilometres of forest area. At present 22.7% of the country spread over 3 million square kilometres is officially claimed as forest area, but this includes unproductive areas with little or no forest covers. Out of this 22.7%, national parks and wildlife sanctuaries cover 8.6% which represents only 0.5% of the total geographical area of the country (Singh, 1980). Per capita forest area is negligibly small to maintain a sustainable base for the living natural resources of the country and to act as an effective buffer against increasing threat of ecological and environmental degradation.

The Vedas, the Brahmanas, the Aranyakas and the Purans throw some lights on the inhabitants of forest and forestry in India during those periods. Traditionally the Aryan and the Non-Aryan inhabitants of India were respectful to both forest and wildlife. They followed the principle of living along with nature as is evident from the Vedas particularly Rig Veda and Atharva Veda. To quote one hymn from the latter "what of thee I dig out, let that quickly grow over, let me not hit thy vitals, or thy heart". In mythological period wildlife in India enjoyed a privileged position of protection through religious doctrines, taboos and sentiments. Valmiki's Ramayana contains an interesting story of Indra turning himself into a peacock to escape the wrath of Ravana. Risi Valmiki cursed the hunter who killed a pair of birds in the mating and thereby uttered the first 'Sloka'. The ideas of Reserve forest and

forest sanctuary was first thought out by Emperor Asoka (B.C. 269 - B.C. 227) as mentioned by Kautilya in 'Arthashastra'. Specific forest and game laws were in vogue during Emperor Asoka. Emperor Asoka prohibited animal killing in forests on 72 specific days of the lunar year. In his "Fifth Pillar Edict" we find first laws to protect fish, game and forests. The forest protection strengthened further during the Gupta period. The Mughals were great hunters. They had aesthetic and utilitarian approach to plants and wildlife, but without any comprehensive idea about forest and wildlife conservation. During the British rule wildlife were slaughtered indiscriminately with high powered fire-arms. It is mentioned that an officer shot 80 lions in Kathiawar, another British sportsman hunted 227 tigers in Hyderabad, Maharajah of Rewa killed 616 tigers in his life and Maharajah Nipendranarayan of Coochbehar (a district of North Bengal) killed 370 tigers, 208 rhinos, 430 buffaloes and 324 barasingha deer in addition to other animals (Stracey, 1963). The tradition of hunting continued even after independence. It may be mentioned that the Duke of Edinburgh, Phillips during his visit to India in the early 1950's hunted several lions in the 'Gir' sanctuary. There were 40,000 tigers at the end of 19th century (Gee, 1966), but the number is now reduced to only 3740 in 1993 (Govt. of India, 1994). The present elephant population in India also shows a great decline and is estimated to be around 6000-7000 (Nair and Gadgil, 1980). The first Indian Forest Protection Act was passed in 1927, as a consequent of drastic reduction of forest area and wildlife.

Linnaeus (1758) named the group of animals to which we ourselves belong as primates, an important order of the class mammalia. The primates in general inhabit a variety of habitat types from tropical wet evergreen forest to moist dry temperate forest. As such reduction of forest areas due to developmental activities affect their populations. Today, there are far fewer types of primates than there were at certain times in the past. The living primates are large and diversified groups of mammals encompassing more than 50 living genera in which atleast 200 species are well defined. Many modern primate genera are at present restricted in distribution as well as number in comparison to the past. In general, the more arboreal the species the greater is the tendency for it to be restricted in geographical distribution.

Only field study in a natural environment can reflect the full range of behavioural patterns in most species. The early guidelines of primate behaviour were based on laboratory works and those were erroneously considered to be normal enough for the purpose of research. For proper comprehension of primate behaviour both field and laboratory studies must complement each other. Field studies are essential to sort out problems of : relationships of behavioural patterns to population pressures, to the ecological or climatic changes, to the presence of predators or to the formation of a social group. It also helps to determine the social structure and group dynamics. Laboratory or captive colony, however, are required for studying some aspects of ontogeny and the factors that affect perception.

In the late 1920's and 1930's a three-months, field study was considered respectively long, and very few species were observed including newworld monkeys, old world monkeys and apes. C.R. Carpenter actually pioneered primate field studies in middle and South America and in East India during the 1930's and performed a series of excellent monographs. During the Second World War, field studies were set aside but started once again during mid 1950's. C.R. Carpenter (1934), had established a rhesus colony on Cayo Santiago, off the coast of Puerto Rico with monkeys imported from India. The 'Japanese Monkey Centre' was established in 1956. Recently it has been established that behaviour or groups of some species living in different habitats vary. It would be interesting to find out the quantum of variability in adaptive responses to prevailing social and ecological factors and the way various social and ecological components interact.

After independence the leaders of our country framed policies for all round development within a schedule period particularly in agriculture and industry. Consequently massive dams, numerous irrigation canals, National Highways and giant industrial complexes started coming up one after another. At the same time due to improved medical facilities, health and sanitary conditions human population experienced an unprecedented explosive growth rate. Naturally more and more forest areas were taken up under cultivation to materialize the 'Grow more food' campaign. The results were disastrous in general on the forests, the biological support system and on the wildlife in particular. The debacle evidenced by wild

life is evidenced from the fact that the mammalian fauna declined from more than 500 species as early as 1963 (Tracey, 1963) to a mere 350 in 1983 out of which 66 has been declared as endangered (Negi and Bahuguna, 1983). Several species of primates are categorised as endangered, vulnerable, rare, threatened, out of danger and indeterminate (see chapter 13) in India (Tikader, 1983). In this situation a new more rigid law, i.e., 'The Indian Wildlife (Protection) Act. 1972' was passed and 19 national parks (Area = 6471.22 sq. kms) and 202 wildlife sanctuaries (Area = 69292.01 sq. kms.) were established to save the existing wildlives from becoming extinct. Moreover, several places were selected to serve as biosphere reserve (insulated from all forms of interference) and marine parks along with a massive programme of afforestations involving the common people for establishing village and community forests on land not required for other purposes.

Most of our scientific endeavour revolves around human benefit, for example each and every medicine was to be tested through a series of animals before it is applied to man. As human beings is also a primate and have many physiological and immunological systems similar to those found in other lesser primates, a large number of primates such as rhesus monkeys and chimpanzees were used in biomedical researches throughout the world. During the last 25 years so far, the behaviour of primates has been considered increasingly in the context of their ecosystems (Crook, 1970).

1.2. EXCELLENCE AND IMPORTANCE OF RHESUS

Rhesus macaques are one of the most common monkeys in South and South-east Asia. Of the old world monkeys belonging to the family Cercopithecidae, macaques alone occur both in Asia and Africa. A small population of macaques probably originating from North Africa, survives on the rock of Gibraltar. Seven species of macaques occur in India of which *Macaca mulatta* or rhesus macaque as it is popularly called is the most important not only because of its wider range of distribution and dominance in number but also because of its importance in biomedical research. This animal was used extensively in the production of vaccines and in other laboratory research. It may be mentioned here that

previously large number of juveniles of this species were exported to western countries mainly for use as test animal in Medical Research (Southwick and Siddiqi, 1975). Its importance in biomedical research is due to the fact that its disease spectrum is very similar to that of human beings. Thus detailed study of this species both in wild state and in captivity is of more than ordinary interest, and it is not surprising that *M. mulatta* received more attention than any other non-human primates.

It is also one of the most attractive species among the macaques. It lives in wide variety of habitats, including cities, villages, farms, forests and even mountains upto 2660 m. (Southwick, Ghosh and Lauch, 1964; Neville, 1968). Rhesus macaques can easily be tamed and taught various tricks, especially when young, but is never fully domesticated. In India, a small human community make their living by showing various tricks performed by their trained monkeys. This species is also popular as pets in some parts of our country.

1.3. SYSTEMATIC POSITION :

The Systematic position of rhesus macaques according to J.Z. Young (1962) is as follows :

Class	:	Mammalia
Sub-Class	:	Theria
Infra-class	:	Eutheria (Placentalia)
Order	:	Primates
Sub-order	:	Anthropoidea
Super-family	:	Cercopithecoidea
Family	:	Cercopithecidae
Genus	:	<i>Macaca</i>
Species	:	<i>mulatta</i>

1.3.1. Close Relatives :

The genus *Macaca* include several species other than *mulatta* which are shown in Table-1.1. with their present distribution.

This animal has four sub-species recognised by Ellerman and Morrison-Scott (1951), Napier and Napier (1967), all found in South Asia (Table-1.2). Fodden (1964) stated that *M.fascicularis* is a sub-species of *M. mulatta*. Hill (1972), however, has shown that *M. fascicularis* is an independent species.

1.4. PHYLOGENETIC CONSIDERATION :

Primates probably originated in early cenozoic time, but most of their evolutionary development has been confined to oligocene and subsequent ages (Simpson 1945). It seems highly probable that tree-shrews living in early cenozoic time were at once the descendants of true insectivores and the ancestors of higher primates. The eocene prosimian forms resembled monkeys in dentition and skull structure. At any rate it is clear that cenozoic prosimians were the ancestors of higher primates. The earliest members of the family cercopithecidae arose and evolved from eocene prosimians during oligocene epoch (60 million years). The earliest members of oldworld monkeys and apes may have originated from the ancestral stock, '*Parapithecus*', found in Egypt during oligocene period (Gregory, 1916 and Colbert, 1969). The evolutionary history of macaque was recorded in the middle pleistocene epoch (about 1 million to 2,50,000 years ago), but outside the Asian mainland. The distribution pattern of macaque conforms with a pattern of evolution out from the Asian mainland (centered on Burma and Thailand), rather than one having several foci on the 'Sundashelf' (Medway, 1970). *M. fascicularis*, a kin of the species *mulatta*, however, has represented the earliest stage of macaque evolution from the middle pleistocene.

1.5. PRESENT DISTRIBUTION :

The family Cercopithecidae comprises of the oldworld monkeys found in Africa and Asia and is divided into thirteen genera, of which *Macaca* alone is common to both regions. Of the remaining twelve, six are Asian (*Cynopithecus*, *Nasalis*, *Presbytis*, *Pygathrix*, *Rhinopithecus* and *Simias*) and six African (*Cercocebus*, *Cercopithecus*, *Colobus*, *Erythrocebus*, *Papio* [including *Mandrillus*] and *Theropithecus*). Only three genera are found in South Asia : *Macaca*, *Presbytis* and *Rhinopithecus*. Of some 200 known species of recent primates 25 are found in South Asia.

The genus *Macaca* is found in North Africa and South and South-east Asia from eastern Afghanistan through Tibet to China, Japan and Formosa; south to India and Ceylon; east to Indonesia (Sumatra, Java and Borneo), Celebes, Philippines and several neighbouring islands. It is found at altitudes upto 3,140 metre. *M. mulatta* is found in North-eastern Afghanistan, south to the Godavari river in India, Burma (but not in the extreme south, Tenasserim; Fry 1928), Laos, Combodia, Vietnam; Tibet (small pockets), and china.

Present distribution of rhesus monkey in India is shown in Figure-1.1. In several areas of northern India its distribution is curiously discontinuous (Krishnan 1972). Annekov, Mirvis and Kotrikadze (1972) suggested that there are two groups of populations, a Chinese - Vietnamese and an Indian. Figure 1.2 also shows sites of recent observations of rhesus in India. At present several wild groups (Pal and Bhattacharjee 1982 and Pal and Guin 1981) are known to exist in protected forest reserves of North Bengal (Table - 1.3).

1.6. OBJECTIVES OF THE PRESENT STUDY :

The general objectives of this research work was to study the ecology and behaviour of rhesus at Baikunthapur Forest Division and the adjoining village areas of North Bengal. The specific objectives were to study :

- (i) the population dynamics of rhesus monkey with special reference to size, composition, density, natality and mortality.
- (ii) the social organization with special emphasis on group type, and interaction with other species.
- (iii) the social behaviour pattern of the species.
- (iv) the food species of rhesus with special reference to feeding pattern, food selection technique and drinking behaviour.
- (v) dominance behaviour pattern of the species.
- (vi) reproductive behaviour pattern of the species with special reference to breeding season, mating pattern and reproductive success.
- (vii) parental behaviour with emphasis on mother-infant relationship, non-mother infant relationship and other associated behaviour.
- (viii) the problems of conservation and management of rhesus and its natural habitats.

Table - 1.1 : List of species under the genus *Macaca* with present distribution

Name of the species	Local name	*F/D	Distribution	Authority
1. <i>M. arctoides</i> I. Geoffroy, 1831	Stumptail macaque	F / D	China, India, Burma, Laos, Thailand, Cambodia, Vietnam, Malay; Sea level upto 2400 m* altitude.	Medway (1969, 1970) Southwick and Siddiqi (1970)
2. <i>M. assamensis</i> McClelland, 1840	Assamese macaque	F	India, Nepal, Bhutan, Burma, Thailand, Laos, Combdia, Vietnam, Yunnan, 610-1, 330m altitude.	Roonwal (1950); Napier & Napier (1967); Hill & Bernstein (1969); Khajuria & Ghose (1970); Fodden (1971).
3. <i>M. fascicularis</i> Raffles, 1821	Long-tail macaque	F/D	India, Burma, Malay Thailand, Vietnam, Indonesia and Philli- pines upto 2000m. altitude.	Furuya (1962); (1965); Medway (1969, 1970); Fodden (1971); South- wick and Cadigan (1972).
4. <i>M. nemestrina</i> Linnaeus, 1766	Pig-tail macaque	F/D	India, Malay, Indonesia upto 900m. altitude	Fodden (1969) Medway (1970)
5. <i>M. radiata</i> E. Geoffroy, 1812	Bonnet macaque	F/D	India, upto 2100m. altitude	McCann (1933); Simonds (1965); Krishnan (1972);
6. <i>M. silenus</i> Linnaeus, 1758	Lion-tail macaque	F	Peninsular, India upto 610 to 1300m. altitude	Sugiyama (1968); Southwick & Siddiqi (1970); Krishnan (1972)
7. <i>M. sinica</i> Linnaeus, 1717	Toque macaque	F	Ceylon, altitude-?	Phillips (1935); Pocock (1939); Napier and Napier (1967).

* F = Forest; D = Domestic; m = Metre.

Table-1.2 : List of four sub-species of *M. mulatta* with present distribution.

Serial No.	Name of the Species	Distribution	Authority
1.	<i>M. m. mcmaehoni</i>	North-Eastern Afghanistan and Pakistan, about 1,100 *m. of altitude.	Pocock, 1932
2.	<i>M. m. mulatta</i>	Nepal, Bhutan, India, Thailand Laos, Combodia, Vietnam and Southern China.	Zimmermann, 1780
3.	<i>M. m. vestita</i>	Tibet	Milne - Edwards, 1876.
4.	<i>M. m. villosa</i>	Northern India (Southern Kashmir, upper Punjab and Kumaun Hills)	True, 1894

* m = metre.

Table - 1.3 : Showing forest reserves in North Bengal where Rhesus monkeys occur at present.

Province	Forest Reserve	Altitude (m.)	Authority
West Bengal	1. Senchal Wildlife Sanctuary, 1915	1500 - 2600	Southwick, Ghosh and Louch (1964), Louch, 1964, Present Author
	2. Jorepokhri Wild life sanctuary, 1985		Southwick, Ghosh and Louch (1964), Present Author
	3. Mahananda Wild life sanctuary, 1949	150 ± 1200	Southwick, Ghosh & Louch(1964) Neville (1968), Pal & Guin (1981) & Present Author.
	4. Gorumara National Park, 1995	Above 120	Neville (1968), Pal and Guin (1981), Present Author.
	5. Chapramari Wildlife sancutary, 1940	Above 100	Neville (1968), Pal and Guin (1981), Present Author.
	6. Jaldapara Wildlife sancutary, 1941	Above 150	Neville (1968), Pal & Bhattacharjee (1980), Present Author.
	7. Buxa Reserve (Tiger) 1982-83	150-1500	Neville (1968), Present Author.

* m = metre.

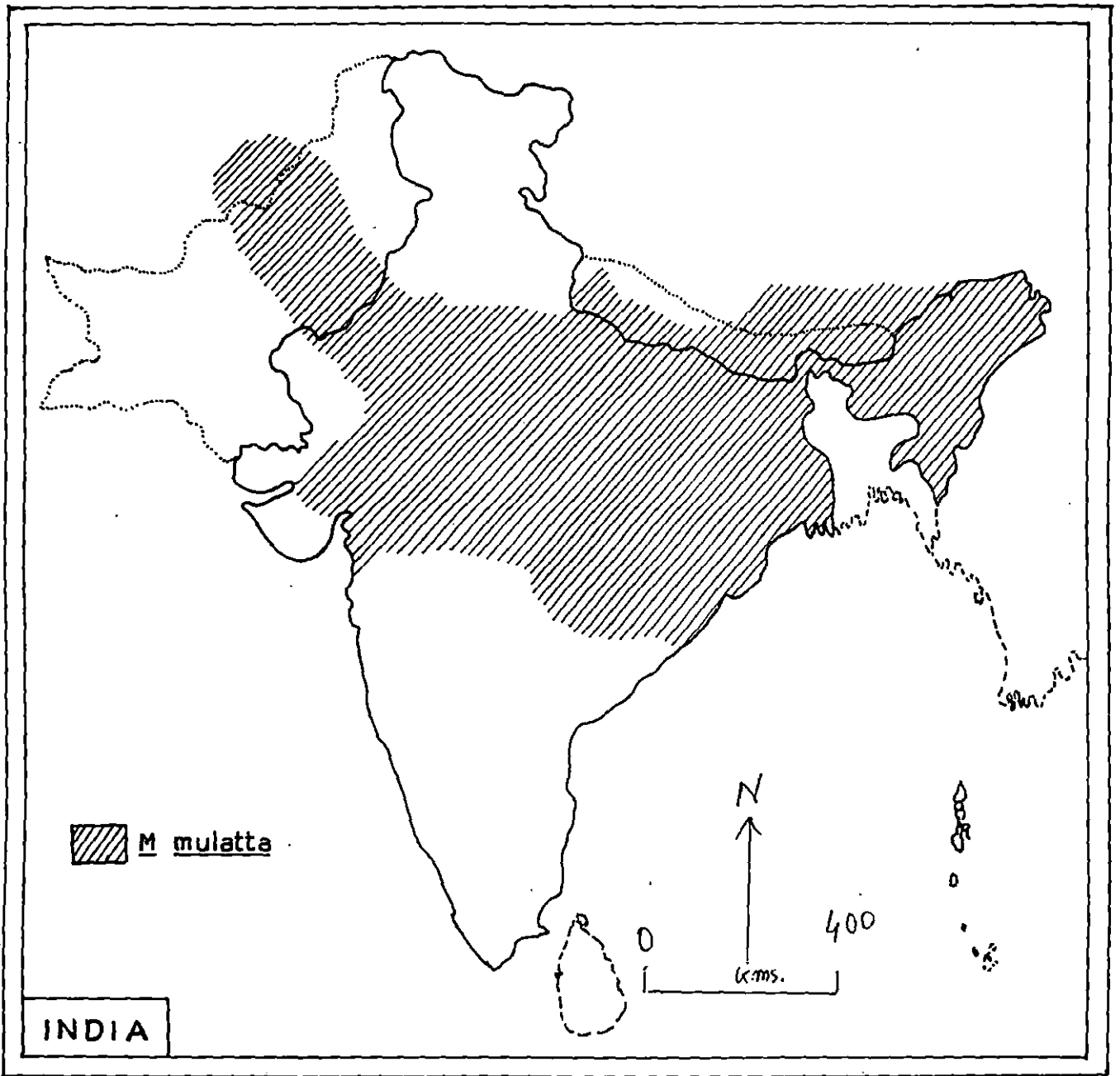


Fig. 1-1. Approximate geographical distribution of Macaca mulatta

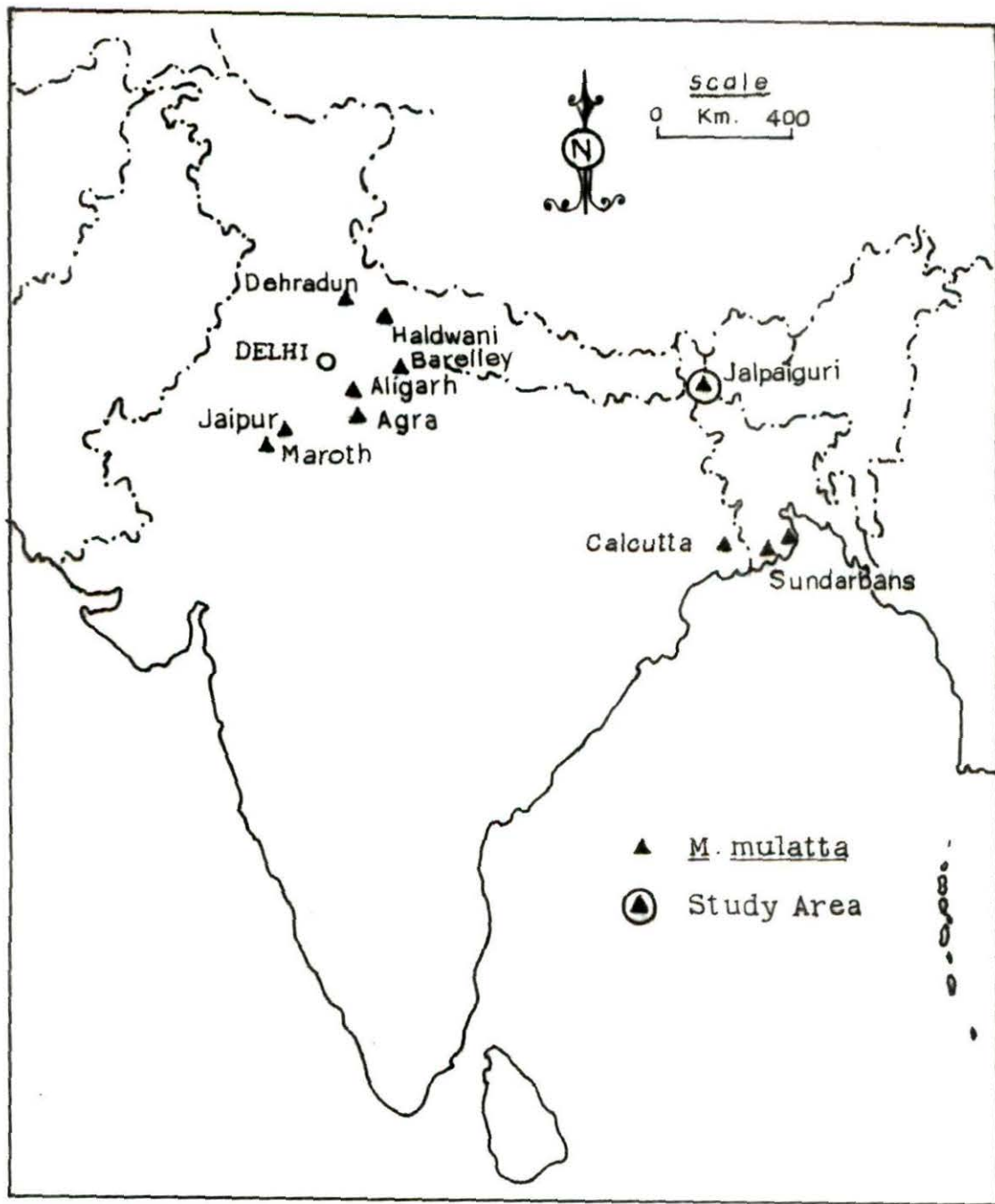


Fig. 1.2: Sites of recent field observation of rhesus monkey in India.