

The Macaques: Studies in Ecology, Behavior and Evolution, D.G. Lindburg, ed. Van Nostrand Reinhold Company, New York. pp. xii + 384 (1980).

“The Macaques” is an attempt at updating what is known about the genus *Macaca* – the most widely distributed genus of Asian cercopithecines. The editor states that the original goal was to include reports from all the recent field studies on those species that are not well-known, but for practical reasons this did not prove possible.

The preface points out that macaques occupy a geographical distribution second only to the genus *Homo*. They extend from northern Africa right up to Japan, and are found in practically every habitat from semi-desert to rainforest, from the plains to 3000 metres elevation in the snow. Several species have also adapted remarkably well to urban habitats.

Chapters 1-4 attempt to identify the various species of macaques, their current distributions, and the reasons for these distributions. The approaches vary – Fooden summarises taxonomy, Delson explores the fossil evidence, Cronin et al. look at the distribution of some blood proteins, and Eudey examines distribution as affected by climatic changes. Some interesting topics are inadequately explored, which could well provide opportunities for research in the future. One of these is the possible effect of interspecific interactions on distribution. *Macaca radiata* and *M. mulatta* are allopatric in India, and Delson suggests that *M. mulatta* displaced the *sinica*-like forms (*M. radiata*, *M. sinica*) from India (p. 27). How then, can it co-exist with *M. assamensis* and *M. thibetana*, also *sinica*-like forms, in Burma, Thailand and China? Was *M. silenus* really forced into the rainforest because of strong competition with *M. radiata*, or was this a consequence of its prior adaptation to a rainforest existence? (*M. nemes-trina* and *M. assamensis*, closely related to the previous two, coexist in Thailand.)

Chapter 4 is of particular interest to readers in Thailand. In it, Eudey discusses the results of her study in the Huay Kha Khaeng Wildlife Sanctuary. This is part of the Dawna Range refugium, one of the three known Pleistocene refugia from continental Asia, sites that have played a significant role in primate evolution. Five macaque species are found in this large area. While her data are relatively few, knowledgeable local persons point out the difficulties of working in this area: the macaque groups are

extremely shy, and some dangers exist from hill tribes, opium smugglers, poachers, etc., not to speak of tigers and wild elephants. Where macaque species have been found in proximity, they do not appear to be ecologically segregated in this very patchy environment with its diverse forest types. Much more effort will be required before we will be able to sort out the complex ecological and evolutionary relations among the species in this very important area.

Groves, in Chapter 5, discusses the issue of how genuine the species differences postulated for Sulawesi macaques are. By studying the evidence for hybridisation at the species boundaries, he concludes that there are only four species instead of the seven proposed by Fooden earlier in the book. It would be interesting, however, to have quantitative data of the extent of positive assortative mating in the hybrid zones before these conclusions are taken as final. Groves also discusses the conservation problems facing the Sulawesi group of macaques. For implementation of any conservation proposals, however, a detailed socio-economic study of Sulawesi is necessary, something that conservationists tend to shy away from.

Bernstein and Gordon then discuss macaque systematics from the point of view of which species can hybridise and which cannot, in captivity. Unfortunately they have neglected to point out which species combinations occur together in the wild and which do not. For instance, 19 of the 32 hybrids that are listed on page 128 are impossible in the wild, and it is intriguing that there are more live hybrids with the 'impossible' combinations than with the 'possible' ones.

The relevance of this kind of research to macaque systematics may be questioned. The authors would have learnt far more of biological significance by studying actual contact zones between species. They make little attempt to relate their findings to actual field situations and specific taxonomic problems. And isn't it obvious that where geographical separation does not isolate species, then, by definition, behavioural differences of some sort must?

The next part of the book moves away from the evolutionary aspects and examines ecology. Crockett and Wilson begin by examining the comparative ecology of crab-eating and pig-tailed macaques in Sumatra. They conclude that sympatry is possible because of the ecological separation between these two species. The crab-eating macaque is an animal of the riverside, beach, forest fringe and secondary forest, while the pigtail is found mainly in primary forest. Their foraging strategies are also different, with the pig-tail being more selective in its choice of food.

Lindburg and Fittinghoff then discuss the causes of riverine refuging in crab-eating macaques. These animals return to the same riverine tree each night for sleeping, and the authors speculate that this type of foraging strategy gives them a competitive advantage over other primate species. It also helps them monitor the movements of other groups of crab-eating macaques, enabling them to maintain an exclusive home range. Query: could the fact that the animals tend to split up into foraging subgroups at times have something to do with the fact that they return to the same sleeping tree each night, to maintain group contact? In the next chapter, Wheatley discusses the ranging and feeding behaviour of the same species at the same site, and concludes that the lack of competition and the availability of abundant food resources explain this species' heavy use of the riverine habitat. Another query: is this any less true for other species?

Teas et al. follow by reporting an investigation on the population structure and behaviour of rhesus macaques in Nepal. They conclude that populations there remain stable due to the lower natality and the higher adult mortality rates, compared to lower density study populations in India. Males show an increase of aggression in the fall, and this may be linked to the higher adult mortality.

Next, Dittus summarizes his remarkable 10-year long study on toque macaques in Sri Lanka, and compares them with other monkey species. He argues that sex ratios are maintained by the differentially greater agonism shown by the adult males towards the female infants. This explanation has a hint of group selection in it (males are being altruistic towards the infant males by not attacking them), and while the data are ironclad, the theoretical framework of analysis could perhaps bear re-examination.

Taub then analyses mating strategies in the Barbary macaque, and demonstrates how female behaviour actually minimises male variance in reproductive success. The female confuses the paternity of each offspring, and thus most males invest energy in looking after the offspring. It is perhaps of interest to note that similar strategies exist in the bonnet macaque also, where there is also some evidence of inbreeding and male parental care (pers. observation).

Finally, Glick analyses various factors affecting the mating activities of bonnet macaques. The age and rank of both the male and the female are important indicators of whether they mate with one another or not. Testosterone levels are correlated with various indices of mating success only among the subadult males, and not among the adults—a finding now becoming common among primates.

The chapters in this book are variable in quality, and there is, probably unavoidably, too much emphasis on a few species. Nevertheless, it contains some valuable new information. It does bring us up to date on the state of the art in several different areas of research on this extremely successful group of primates. For this reason, it is a useful reference work for all those interested in primates.

Rauf Ali

Faculty of Science
Mahidol University
Rama VI Rd.
Bangkok 10400