

Specimens examined: India, Karnataka State, Turuvekere taluk, M. Bevinahalli village, R. R. Rao 4501, 11-10-2012 (specimen deposited in Herbarium, Botanical Garden, University of Agricultural Sciences, GKVK, Bengaluru).

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Grooming of sambar (*Rusa unicolor*) by rhesus macaque (*Macaca mulatta*) in Sariska Tiger Reserve, Rajasthan, India

Instances of interspecific cooperation and associations between non-human primates and other mammals, especially ungulates, are not uncommon, although certain cases have been extensively studied in many parts of Asia and Africa¹. In South Asia, the most common association is found between Hanuman langur (*Semnopithecus* spp.) and chital (*Axis axis*)^{1–4}, whereby the langur, while selecting edible parts for feeding, drops large quantities of buds, flowers and fruits from trees which are then foraged upon by chital (gleaning). Such associations further result in a more effective warning system against common predators, where the olfactory sensibility of chital is pooled with the visual acuity of langurs, thus providing an efficient vigilance system^{1–4}. Such primate–ungulate associations have also been reported between Hanuman langur and other ungulates such as nilgai (*Boselaphus tragocamelus*)³, sambar (*Rusa unicolor*)³ and hangul (*Cervus elaphus*)⁵ in Asia. In Africa the most common reported associations

are between baboon *Papio* spp. and impala (*Aepyceros melampus*), and baboon and bushbuck (*Tragelaphus scriptus*)^{6,7}. Such alliances may further go beyond just mere acceptance and association and may result in frequent physical contacts and active grooming of other mammals by the primates⁸. Here we report one such association between rhesus macaques (*Macaca mulatta*) and a sambar, which interestingly also involves grooming and riding of the sambar by the rhesus macaque (Figure 1a), observed during the large mammal survey conducted in Sariska Tiger Reserve (76°17'–76°34'E and 27°5'–27°33'N), Rajasthan, western India.

On 15 December 2010, at about 11:04 am, we came across an adult female sambar standing at a distance of about 10–12 m from the roadside near the Bandipool temple in Sariska Tiger Reserve. Close to the sambar, a troop of multimale bisexual rhesus macaques was busy in its routine activities such as basking, playing, grooming, etc. The

sambar stared at us for a few seconds and then walked towards the monkey group, made its way through and stopped at about 5 m from the troop. Meanwhile a juvenile rhesus macaque (JM1) approached the sambar and sat at a distance of about 1 m. After about 30 sec JM1 stood upright and raised itself as much as possible and started grooming the lower region of the right flank of the sambar. The sambar seemed indifferent to the moves by the macaque. After intermittent grooming for about a minute the macaque stopped for a while and then climbed upon the sambar, sat on the rear back, raised the tail of the sambar with its hands and started grooming it; soon, the macaque moved on to groom the neck and ears of the sambar. The sambar was calm and demonstrated no sign of distress. Most of the adult male troop members seemed to be least concerned with the whole happening; however, 5–6 juveniles and a few adult females were keenly observing the grooming of the sambar by JM1. When this grooming of

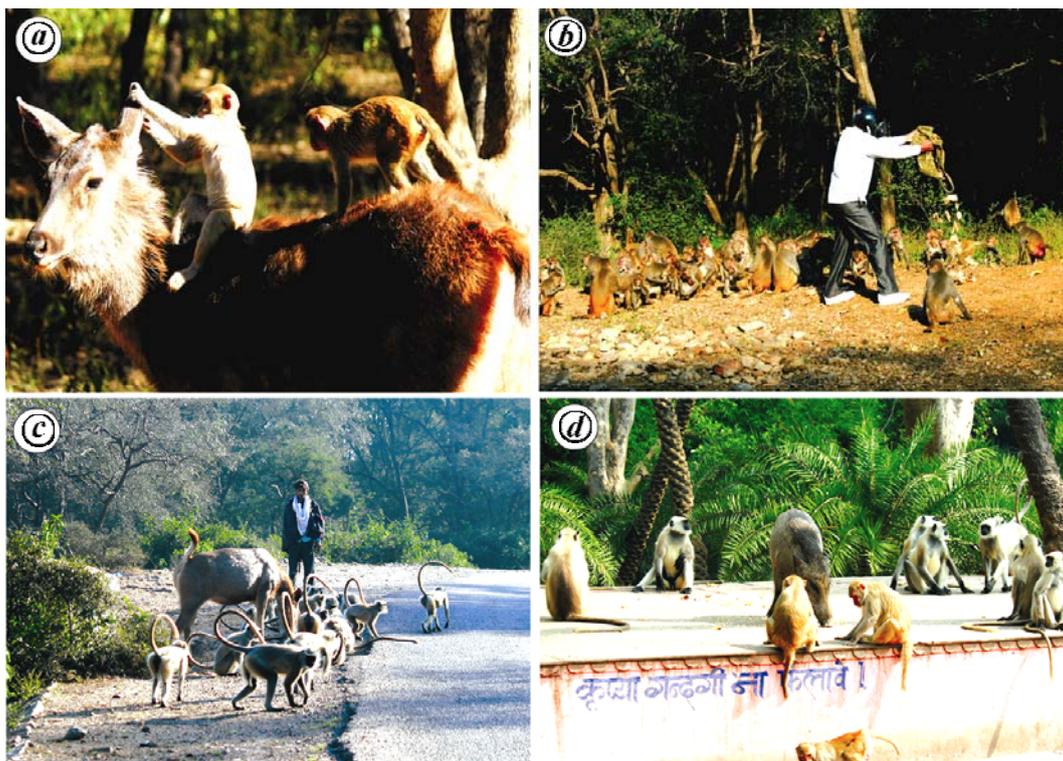


Figure 1. *a*, Rhesus macaques grooming sambar. *b*, Food provisioning at Bandipool temple. *c*, Hanuman langur and sambar feeding together near Bandipool temple. *d*, Mixed species feeding associations involving langurs, macaques and wild pigs at Pandupole temple (Photographs: A.G.V.).

the sambar was going on, another juvenile rhesus macaque (JM2) also climbed on the sambar, sat behind JM1, groomed JM1's back for about a minute, stopped after some time and sat watching JM1 grooming the ear of the sambar. After some time JM1 stopped grooming the ear, turned towards JM2 and then both macaques started grooming the front back of the sambar. A few seconds later a third juvenile macaque (JM3) climbed on the sambar's back and sat keenly watching the other two macaques indulged in grooming. The sambar still seemed unperturbed by the activities and was standing peacefully, simply staring around. Suddenly the sambar looked back which might have startled JM3, which hurriedly jumped down. Now the sambar started walking away from the troop at a fast pace due to which both macaques also got startled and stopped grooming, but both of them kept riding, while sticking themselves tightly on the sambar's back, for around 30 sec. Then JM2 hurriedly jumped from the back of the sambar, while JM1 kept riding for about 45 sec more, after which it also got down and joined the rest of the troop. The sambar kept moving slowly away from troop and vanished into the forest.

This whole interaction between the sambar and the macaques lasted for around 7–8 min.

This macaque troop resides around Bandipool temple, mostly near the road passing nearby and regularly feeds on vegetables, fruits and other food items provided by the devotees who come to the temple (Figure 1 *b*). The macaques portray a far more terrestrial life, possibly depending heavily on the provisioned food (A. Vasava, pers. obs.). The sambar is also mostly seen around the same area, often sharing the same food. Members from the resident troop of langurs also regularly participate in mixed species feeding associations along with the sambar and the macaques. During these feeding associations, these species foraged together both on the road and on the forest floor. Though feeding associations between the macaques and the sambar were observed seven times at Bandipool during our stay (two and a half months) at Sariska, grooming and riding behaviours were never observed again. Hanuman langurs were also never seen indulging in grooming the sambar. Furthermore, wild pigs (*Sus scrofa*), which also frequently come to feed, were never observed to be groomed by the macaques

or langurs. Instead on many occasions, wild pigs were received with aggression, mostly from adult male macaques. Surprisingly, no such interspecific aggression was observed while the sambar and macaques or langurs utilized a common resource at the same place at the same time. During all observed occasions of feeding associations, the sambar showed no signs of visible distress by the presence of both the primate species and was also unruffled by the human presence and vehicles passing by on the road (Figure 1 *c*). These primates–sambar associations around Bandipool temple have also been observed by other researchers studying large carnivores in Sariska Tiger Reserve (K. Mondol and S. Bhat-tacharjee, pers. commun.). Although many such interspecific feeding associations were also observed at Bharathari and Pandupole temples (Figure 1 *d*), situated in Sariska Tiger Reserve, interspecific grooming was never observed except for one incident, whereby a juvenile rhesus macaque was trying to groom an adult Hanuman langur at Pandupole, to which the langur responded by moving away.

Interspecific grooming has been extensively documented between birds and mammals, especially ungulates^{9–11}. There

are a few examples of groomers and cleaners among non-primate mammals as well; for example, white-nosed coatis (*Nasua narica*) and banded mongoose (*Mungos mungo*) have been recorded to pick ticks from medium-sized to large ungulates^{12,13}. There are many documented incidents where different primate species groom each other¹⁴⁻¹⁷. Interspecific grooming between primates and non-primate species is also not uncommon. However, due to lack of published reports, little information exists on such interactions between primates and other mammals. Sharma⁸ reported Hanuman langurs grooming domestic dogs (*Canis lupus familiaris*), which developed under the influence of human activities similar to what we observed in this area. A Hanuman langur was seen grooming a chital in Kanha Tiger Reserve, Madhya Pradesh, India¹⁸. Newton¹⁹ observed a langur occasionally slapping a chital's buttock when both species foraged together on ground. Rhesus macaques were also observed trying to ride chitals in Sundarbans, West Bengal, India²⁰. Interestingly, researchers have observed lion-tailed macaque (*Macaca silenus*) grooming Indian giant squirrel (*Ratufa indica*) in Annamalai hills (H. N. Kumara and Mewa Singh, pers. commun.), conversely which is a prey species for the macaque²¹. Such observations are not restricted to natural ecosystems, and are observed in captivity as well. Japanese macaques (*Macaca fuscata*) and Gelada baboons (*Theropithecus gelada*) have been observed grooming the Barbary sheep (*Ammotragus lervia*) in a mixed species exhibit in German Zoological Gardens¹⁷. However, records of feeding associations and grooming behaviour involving sambar and macaques have not been recorded earlier.

If we put the grooming behaviour aside, this feeding association between the macaque and sambar could possibly be interpreted as asymmetrical mutualism, as suggested in the chital-langur association and other such associations observed in parts of India and Africa^{1,6,7}. The widely accepted ultimate cause of such interspecific associations is primarily safety from predation^{1,22,23}. It seems that the observed associations involving both primate species and sambar are possibly largely connected to foraging, vigi-

lance playing little role, which may have been induced by availability of easy provisioned food, thereby forcing these animals to exploit a common food resource. However, aspects of potential foraging and predation advantages have not been assessed for these interactions and therefore, would not be conclusive enough to comment on this observation. Although it is well accepted that grooming amongst primates has a social as well as utilitarian (parasite removal) function²⁴, the purpose of primates grooming other species remains unclear. We do not know to what extent this grooming interaction between these species exists throughout the year or exists in other populations. Presumably, the grooming behaviour must be beneficial for such an investment of time and energy to be worthwhile. However, only if all possible costs and benefits are investigated will it be possible to identify the underlying motive, function and ultimate cause of such interactions¹. However, this apparently rare occurrence of grooming and riding behaviours, emerging as a result of interspecific associations, depicts an intriguing part of community ecology that remains relatively unexplored. Such interspecific behaviour seems to be more widespread than is appreciated, which needs to be discovered and quantified appropriately.

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