

Comment

In a recent issue of the journal *Nature* (438: 1097-1098; December 22-29, 2005), David R. Greenwood, Dan Comeskey, Martin B. Hunt & L. Elizabeth L. Rasmussen have published a paper that deals with the impact of the pheromones associated with the phenomenon of musth on reproductive behaviour of Asian elephants. The word 'musth' means 'intoxicated' in Urdu, and the phenomenon has been known to elephant handlers and keepers for many centuries in India and Sri Lanka. But it is only now, thanks to the studies of Dr. Bets Rasmussen and her colleagues (both in the USA and New Zealand) we seem to understand the role played by the pheromones involved in musth. During musth, Asian bull elephants go through a heightened period of sexual and aggressive activity. The hormone testosterone controls such sexual and aggressive behaviour in bull elephants. In Africa, a musth bull walks with an assertive, purposeful stride and holds the head higher than the shoulders most of the time (Poole, 1987). Kahl & Armstrong (2002) refer to such musth walk as the "John Wayne walk" 'because of its self-confident, take-charge swagger'.

Musth is exhibited only by mature males, usually over 24 years of age (Poole, 1987) and the behaviour of the bulls in musth is the same in both Asian and African elephants (Kahl & Armstrong, 2002). Musth in Asian elephants is an annual phenomenon, and its duration varies from individual to individual depending on age, physical condition and social status. It may last from a few weeks to even months. In captive situation, bulls in musth are always separated from conspecifics and cared for until the musth period is over. When elephants get out of musth, they tend to become more social, amicable and manageable. Although non-musth bull elephants can mate successfully, musth improves the competitive ability of the bulls in their efforts to have access to estrus females. In Asia, older bulls in musth seem to have a significant reproductive advantage over younger bulls. In the captive elephant facility known as the Elephant Orphanage at Pinnawala, Sri Lanka, almost all the young ones that were born were sired by just a few old bulls.

During musth, Asian bull elephants secrete a powerful, pungent smelling fluid from the temporal glands situated on the face. A previous study carried out by Rasmussen *et al.* (2002) on musth in Asian elephants has shown that young socially immature bulls release honey-like odours to avoid conflict with mature bulls, while older bulls in musth broadcast foul-smelling odours to deter young bulls. This was a significant finding that confirmed what the ancient Hindu poetry refers to the phenomenon of bees being attracted by the secretions of the temporal glands in young musth elephants.

As Greenwood *et al.* (2005) point out, musth among Asian elephants is mediated by the release of a pheromone called

frontalin, which exists in two chiral forms or molecular mirror images or enantiomers. They are referred to as + and - enantiomers. The researchers have found that these enantiomers of frontalin are released in specific ratio that depends on the animal's state of musth and age. Depending on the ratio of the enantiomers released, other bulls and cows in a population may react and respond in different manners.

Asian bull elephants reach sexual maturity when they are between 12-15 years old, but until they become socially mature, they have very little reproductive success in the wild. Social maturity may take another 5-8 years. The study also shows that frontalin is released in young bulls in late teens and the secretion increases 15-fold in 25 year age span - the time when the bulls become socially mature. As young bulls become sexually mature, they secrete more of the + variety of frontalin than the - variety but as they become socially mature, the proportions of the two enantiomers become equal (1:1 ratio). It is this ratio that enables other elephants (both bulls and cows) to distinguish both the maturity of the bull concerned as well as its phase of musth and respond appropriately.

Other studies have shown that the length of musth increases as bull elephants mature, with the fittest demonstrating a long mid-phase. The Greenwood *et al.* (2005), studies demonstrated that during mid-musth these older males release 'an optimal ratio of frontalin enantiomers'. Estrous females respond positively to such mid-phase release of pheromones, especially during the time of ovulation, and the musth bulls concerned are therefore able to send a precise message to females in estrus, perhaps helping their reproductive success over other less mature bulls. Since female elephants are in estrus only for about 4 days every 4-5 years in the wild, it is important that bulls find them and mate with them. As Kahl & Armstrong point out, musth helps a mature bull in finding and impregnating a receptive female.

The findings of Greenwood *et al.* (2005) and Rasmussen *et al.* (2002) have important relevance in the dealing with crop-raiding wild elephants in Asia where most of them are bulls and quite a number of them are in musth. An understanding of musth and behaviour of musth bulls would help formulate more effective deterrent measures to mitigate the perennial human-elephant conflict in Asia.

While the misfortunes of the African elephant are due to its tusks for which it is being slaughtered in large numbers irrespective of sex, in Asia given that females do not have tusks and not all males carry them either, elephant poaching may be a minor problem and so poaching cannot be the terminal threat it is in Africa. Nevertheless,

elephants in Asia are being killed as they interfere with agriculture. The long-term future of elephants, outside the protected areas in Asia is inextricably linked to the tolerance of man.

The human-elephant conflict in Sri Lanka is real, and it is leading in just one direction: the destruction and eventual elimination of elephants, males in particular, from agricultural areas, unless innovative measures are adopted to address the legitimate concerns of the farmers. The management of human-elephant conflict has to be integrated into a proper land-use policy and also must recognize the elephant as an economic asset to the community. Unless people value living with elephants, the slaughter will go on. If the local people could perceive the elephant as an economic asset instead of as an agricultural pest, they will tolerate it on their land. One way that local people can benefit from the

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elephant in their midst is from revenues it generates, whether through small-scale ecotourism or from projects that help manufacture paper from dung, produce biogas from dung, or promote organic farming using dung.

The human-elephant conflict has replaced poaching as the biggest threat to the elephant in Asia. While the international conservation organizations are concerned over the trade in ivory, non-tuskers or *makhnas* continue to be slaughtered in large numbers. The debate over elephants is an emotional one, between the preservationists and the pragmatists. The problem with wildlife is that the people who wish to preserve it, are rarely those who have to bear the cost. Given that the human-elephant conflict is already bad today, it may become worse tomorrow. Even if we cannot eliminate the conflict altogether, we need to reduce it to tolerable levels. This is the biggest challenge facing the AsESG.

References

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Photo: Dr. H. I. E. Katugaha