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Use of genital inspection and female urine tests to detect oestrus in captive Asian elephants

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ABSTRACT

Captive Asian elephant (*Elephas maximus*) populations are decreasing due to low birth rates compared to wild elephants. Improving oestrous detection in female elephants is required to ensure successful mating in captive and semi-captive herds. Responsive behaviours of eight semi-captive bull elephants to the uro-genital area (genital inspection test) or urinary pheromones (urine test) of 14 female elephants throughout the oestrous cycle were evaluated. Weekly blood samples were collected for 27 consecutive months (14 months for the genital inspection test and 13 months for the urine test) from female elephants to characterize the patterns of circulating progestagen. Responsive behaviours of bulls were compared between females in the follicular versus the luteal phase of the cycle. The sensitivity and specificity of the genital inspection test were 65% and 68%, while those of the urine test were 52% and 61%, respectively. The bulls showed significantly higher "genital inspection", "flehmen from genital area" and "trunk on back" behaviours during the genital inspection test, and "flehmen" behaviours during the urine test in oestrous than in non-oestrous females. In sum,

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this study showed that monitoring sexual behaviours of Asian elephant bulls towards females or their urine can be used to detect the oestrous period. Although the sensitivity and specificity of both tests were not as high as expected, still, these methods appear to be more efficient at detecting oestrous than traditional methods based on mahout estimations of female receptivity. The use of genital inspection and urine tests may lead to more successful matings and thus to creating self-sustaining populations of captive elephants in range countries.

1. Introduction

The number of Asian elephants (*Elephas maximus*) continues to decline; hence, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has categorized this as an Appendix 1 endangered species. Because capturing of wild elephants is no longer permitted in most Asian countries, it is necessary to breed elephants in captivity to sustain populations used for work or tourism industry. Unfortunately, captive breeding programmes worldwide have met with limited success and few *ex situ* elephant populations are self-sustaining.

In several locations in southern India and Sri Lanka, captive elephants are seldom bred or are even prohibited from breeding because of work obligations, cultural beliefs or religious reasons (Lair, 1997). In western zoos, the captive elephant population has declined in part because of the low number of breeding bulls and the aging population (Wiese, 2000; Hildebrandt et al., 2006). At the Pinnawala Elephant Orphanage in Sri Lanka, bulls and cows are allowed to freely interact during daily outings to a river for bathing. As a result, matings occur regularly, and the population is more than self-sustaining (Rajapaksa, 2007). By contrast, in Asian elephant tourist camps, bulls and cows are separated most of the day because of the need for both to work. Traditionally, the mahout observes the elephant in a very subjective way. Sometimes they just "feel" that the cow is in oestrus. They also observe the bull's behaviour towards a cow and if he shows increased interest, the mahout decides that she is in oestrus. Sometimes the body temperature is considered, but not measured with a thermometer. If the bull shows interest, the mahout will allow them to copulate. If not, both elephants return to work. These are very subjective ways of oestrous detection and results in a low number of calves born each year. There are no consistent records of elephant mating frequency in Thailand during the previous 20–30 years, only the number of calves born has been noted.

One question related to the use of this strategy is how correct the mahouts are in assessing the reproductive status of the female and, more precisely, oestrus. This method has resulted in a birth rate of 1.9% (National Elephant Institute) of the mature females per year during the last 15 years in this large, well-managed elephant breeding/work camp (personal observation). With this low birth rate less than 2% each year in the captive Thai elephant population (Lair, 1997), and approximately 150 elephants that die prematurely each year (e.g. accidents, diseases), the population is declining at a yearly rate of about 3.5% (Mahasawangkul, 2001; Thitaram et al., 2004). These low birth rates reflect the poor breeding management. Since most of the elephants in camps have not been born in captivity, they can be compared with their wild relatives. In wild populations, young and juvenile calves were observed to be around 40% of the 300 elephants population in Huay Kha Kaeng wildlife sanctuary, Thailand (Sookmasuang, 2007) illustrating a birth rate significantly higher than 4% per year. These data indeed indicate that the low level of captive elephant fertility is based on management. Therefore, a reliable and easy to perform oestrous detection method is needed.

Female Asian elephants have a reproductive cycle of 14–18 weeks. The non-pregnant luteal phase is characterized by high concentrations of circulating progestagen for 10–14 weeks, with an interluteal phase (or follicular phase) that lasts between 3 and 6 weeks, and a receptive period of 2–10 days (see reviews: Hodges, 1998; Brown, 2000; Vidya and Sukumar, 2005; Hildebrandt et al., 2006). The oestrous cow exhibits subtle changes in the external genital area, such as a swollen and descended vulva during urination, and a thick, white discontinuous discharge from the vulva. She is also more