

# Interspecies sexual behaviour between a male Japanese macaque and female sika deer

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**Abstract** Interspecies sexual behaviour or ‘reproductive interference’ has been reported across a wide range of animal taxa. However, most of these occurrences were observed in phylogenetically close species and were mainly discussed in terms of their effect on fitness, hybridization and species survival. The few cases of heterospecific mating in distant species occurred between animals that were bred and maintained in captivity. Only one scientific study has reported this phenomenon, describing sexual harassment of king penguins by an Antarctic fur seal. This is the first article to report mating behaviour between a male Japanese macaque (*Macaca fuscata yakui*) and female sika deer (*Cervus nippon yakushimae*) on Yakushima Island, Japan. Although Japanese macaques are known to ride deer, this individual showed clearly sexual behaviour towards several female deer, some of which tried to escape whilst others accepted the mount. This male seems to belong to a group of peripheral males. Although this phenomenon may be

explained as copulation learning, this is highly unlikely. The most realistic hypothesis would be that of mate deprivation, which states that males with limited access to females are more likely to display this behaviour. Whatever the cause for this event may be, the observation of highly unusual animal behaviour may be a key to understanding the evolution of heterospecific mating behaviour in the animal kingdom.

**Keywords** Heterospecific mating · Sexual harassment · Primate · *Macaca fuscata yakui* · Reproductive interference

## Introduction

Interspecific interactions have been widely described and studied in animals. These interactions can be negative for one animal of the two species involved, as illustrated by prey–predation relationships (Freedman and Waltman 1984; Jędrzejewski et al. 1992), or positive for both individuals in examples such as mutualism (Axelrod and Hamilton 1981; Anne and Rasa 1983). Much less literature is available concerning interspecies sexual behaviour compared with other types of relationships, yet this interaction could have a considerable impact on the fitness of both species involved in the interaction (Clutton-Brock and Parker 1995; Gröning and Hochkirch 2008). Heterospecific sexual behaviour has mostly been described in phylogenetically close species and discussed in terms of its effect on fitness, hybridization and species survival (Burdfield-Steel 2012; Kyogoku 2015; Shuker et al. 2015). The few cases of heterospecific mating described between individuals from distant species were reported in animals that were bred and maintained in captivity, or for human–animal sexual interactions (Beetz 2004; Gröning and

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Hochkirch 2008; Beirne 2009). Only one scientific study describes this phenomenon, reporting sexual harassment of king penguins by an Antarctic fur seal (de Bruyn et al. 2008; Haddad et al. 2015). At the end of the mating behaviour, some penguins were killed and eaten. This is the second article describing a case of sexual interaction between distant species, and the first paper describing mating behaviour between a male Japanese macaque (*Macaca fuscata yakui*) and female sika deer (*Cervus Nippon*) on Yakushima Island, South of Japan.

Complex interspecific interactions have been described in many species, ranging from the presence of mixed-species groups to the exchange of services between members of the two species (Clutton-Brock 2002). Mixed-species groups might benefit from proximity with the members of the other species through indirect interactions such as increased vigilance against predation (Pays et al. 2014) or animals dropping fruits on the ground (Tsuji et al. 2007). However, direct interactions can also occur between species, as is the case for Japanese macaques and sika deer on Yakushima Island. Food dropped from trees by macaques is a source of energy for deer (Tsuji et al. 2007), which improve their foraging efficiency by gleaning. This results in strong cohabitation between deer and macaques. Deer also display coprophagia by eating the faeces of Japanese macaques, specifically around macaque sleeping sites (Nishikawa and Mochida 2010). Some macaques have been observed grooming deer and even trying to ride them (without any sexual behaviour, Shimada 2009). Prasad et al. (2013) observed similar behaviour between the rhesus macaque (*Macaca mulatta*) and the sambar (*Rusa unicorn*). Such interaction may favour more complex behaviours between species.

Reproductive interference is defined as an interspecific sexual interaction that has a negative effect on the fitness of one of the species involved in the interaction. This interaction is often described as a consequence of erroneous or incomplete species recognition, but this is most often observed in closely related species. This article seeks to understand why this male displayed this unusual behaviour.

## Observations

Seven of the numerous groups of Japanese macaques on Yakushima are habituated to human presence, and have been monitored for over twenty years (Yamagiwa et al. 1998). Japanese macaques living on Yakushima are a distinct subspecies to those found in the rest of Japan. Their habitat is a mountainous island of approximately 500 km<sup>2</sup>, much of which is protected as a UNESCO World Natural Heritage site and also by the Kagoshima Prefectural government. Japanese macaques live in multi-male, multi-

female groups. They are seasonal breeders, with ovulation occurring at the beginning of November (Takahata et al. 1998).

A.B. was on Yakushima Island from October 10th to November 6th, 2015 to observe different groups of Japanese macaques for a media coverage project concerning cultural behaviours in Japanese macaques. It was during these daily observations that he observed this heterospecific sexual interaction. Indeed, one adult male Japanese macaque was observed attempting to copulate with at least two different female sika deer on November 6th.

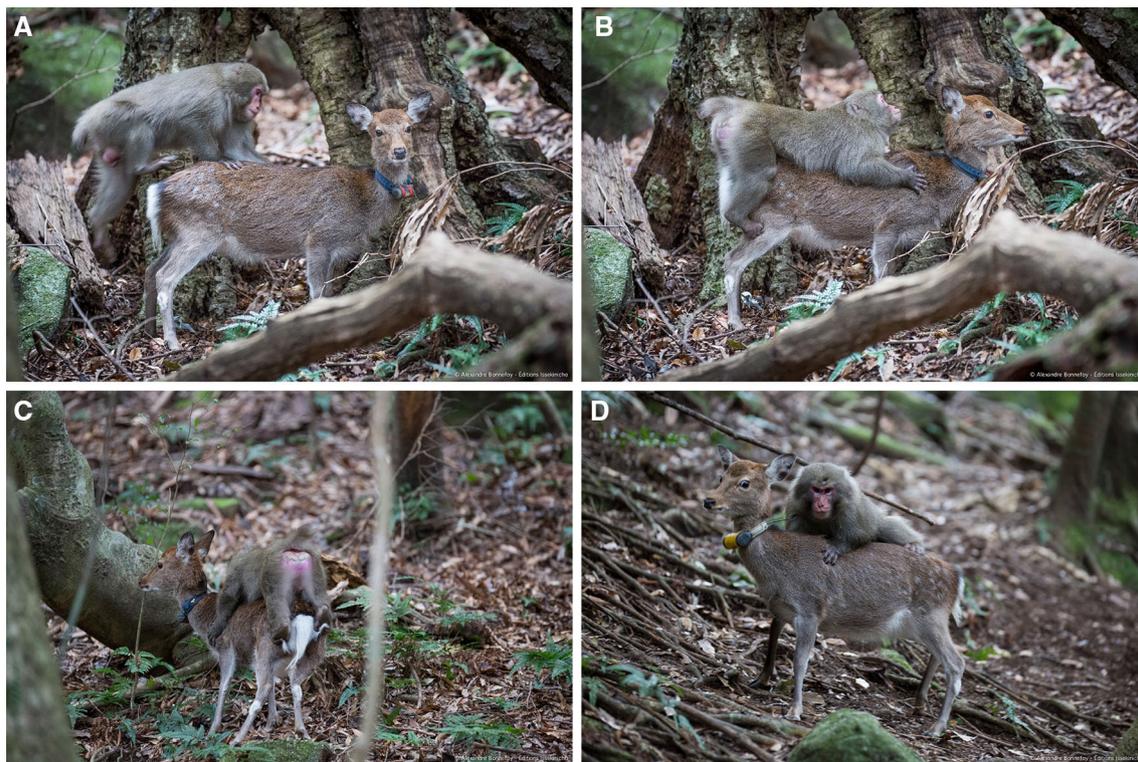
This macaque was a non-troop adult male (Sprague 1991) and was therefore probably either peripheral or belonged to a group of peripheral males, as other males were observed in the vicinity of the deer (see Fig. 1; Supplementary video file). The male displaying sexual mounts on deer was in good health and also displayed a type of mate-guarding behaviour (Matsubara 2003) by chasing other peripheral males when they tried to approach the “guarded” deer (see the video file). The male showing heterospecific sexual behaviour did not show any aggressive behaviour towards any of the deer he followed and rode on.

A first deer seemed to accept to be ridden by the male macaque (Fig. 1a–c). The male mounted the deer and displayed some copulation behaviours (about 15 movements over a period of 10 s) before dismounting. No penetration occurred (the penis of the macaque was not directed at the genital area, but at the back of the sika deer), probably due to differences in morphology/size. However, ejaculation seemed to occur as the deer was seen licking the seminal liquid after the mount. The male then attempted to mount another female deer that did not accept the sexual behaviour as she attempted to escape/remove the macaque by moving, increasing her speed, turning around and displaying threats (Fig. 1d; Video).

The animals were monitored for an hour before they disappeared in the forest. A mount was observed every 4–5 min. Two days before the sexual copulation, the deer were observed without the macaque male. We do not know if the male continued to follow the female deer the day after our observations.

## Discussion

This article describes a heterospecific mating attempt, one of the seven cases of reproductive interference defined by Gröning and Hochkirch (2008). This behaviour involves sexual interaction without penetration. Unlike the case reported for the Antarctic fur seal and king penguins, the sexual behaviour of the male macaque towards the female deer did not seem to be one of sexual harassment or



**Fig. 1** Sexual mount of a Japanese macaque male on two different deer. **a–c** Sequence of a sexual mount on a first deer that accepted being ridden. **d** The macaque tried to mount a second deer, but the latter clearly did not accept the mount

coercion (Clutton-Brock and Parker 1995); on the contrary, the male stayed close to the deer and chased away other male macaques in a behaviour similar to mate guarding. Moreover, the licking behaviour shown by the deer seems to indicate that the sperm could be a good source of protein. The hormonal surge of the Japanese macaques at the breeding season and the close cooperation between these primates and sika deer may have combined to result in this heterospecific copulation behaviour. Particularly, the behaviour may be a sexual manifestation of the play behaviour already described in Japanese macaques when riding deer. Such proximity or cooperation has also been described as a factor favouring copulation between Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins (*Tursiops truncatus*) (Herzing and Elliser 2013).

There are several other possible explanations for this behaviour, such as it being a means to learn how to copulate, but this is highly unlikely. Indeed, Japanese macaques are highly social, and it is probable that, if they have to learn to copulate, they could do so by observing their conspecifics or through social play as juveniles. This reproductive interference may also be caused by incomplete species recognition (Gröning and Hochkirch 2008), but this is generally described in closely related species and is quite improbable in our case since the species are distant in both phylogenetic and morphological terms, yet they

still share the same habitat and interact together. In our case study, the most realistic hypothesis would be the ‘mate deprivation hypothesis’, which states that males with limited access to females are more likely to display this behaviour. Indeed, this heterospecific sexual behaviour is more likely to be observed in species with higher risk of sexual competition (i.e. multi-male, multi-female breeding), as for other sexual behaviour such as masturbation (Thomsen and Soltis 2004) or homosexual behaviour (Gunst et al. 2015) in the Japanese macaque.

Heterospecific sexual interaction between distant species is rarely observed, and this is the second report of such a case. Whatever the reason for this particular event, the observation of highly unusual animal behaviour could be a key element in understanding the evolution of interspecific mating behaviour in the animal kingdom, and specifically in understanding zoophilia in humans (Beetz 2004; Beirne 2009). It is also necessary to determine how this behaviour will impact the fitness of these macaque males. If they can access macaque females over the coming years after this heterospecific interaction, their fitness should not be affected on a long-term scale, but it may be affected on the short term due to the loss of energy, gametes and time (Gröning and Hochkirch 2008). Further studies are necessary across species to identify these types of sexual behaviour in order to understand how they might evolve.

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#### Compliance with ethical standards

**Ethics statement** Authors declare no competing interests and no conflicts of interests. Our approach solely involved observations of non-human animals. Animals were not handled, and no invasive experiments were carried out. This study was conducted with the approval of the Prefecture of Kagoshima (with the help of the Wildlife Research Centre and the Japanese Society for the Promotion of Science) to be in the Yakushima Forest and with the authorisation of our institute (IPHC, CNRS). Animals were already used to human presence on Yakushima.

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