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Sexual Behavior of Javan Langur (*Trachypithecus auratus*) in Taman Safari Indonesia Ex-situ Conservation Facility

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Abstract

Trachypithecus auratus is one of the vulnerable primate species that is declining in number due to illegal hunting and forest degradation. The efforts to increase population can be through ex-situ conservation program that are specific to reproduction. Information and data about reproduction in this species is still very limited, particularly in the aspect of sexual behavior. The aim of this research was to analyze the sexual behavior of *T. auratus* at the Taman Safari Indonesia ex-situ conservation facility. This research was conducted on five adult individuals from a group of consisting of one male and four females. The group of *T. auratus* were observed for five months from September 2018 until January 2019. The method was used focal animal sampling with BORIS (Behavioral Observation Research Interactive Software). The results showed that the females performed pre-copulation (courtship) behavior such as head shaking (28.90%), hindquarter present (17.33%), raising a forelimb (11.66%), and the male performed pre-copulation (courtship) behavior such as genital inspection (68.46%). Copulation lasts for 60 seconds, starting with male mounting and thrusting as many as 40 seconds and ejaculation which is thought to occur for 20 seconds. At the end of the copulation sequence, a pair of *T. auratus* showed grooming and foraging together. The conclusion of this research was *T. auratus* has parameters of sexual behavior with copulation that lasts for 60 seconds and head shaking was sexual behavior that can be used as a signal for mating. This research are expected to be used as basic reproductive biology data to support the breeding and conservation program of *T. auratus* species.

Key words: Copulation, reproduction, sexual behavior, *Trachypithecus auratus*

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Introduction

Javan langur (*Trachypithecus auratus*) is an endemic primate species of Indonesia that can be found on the islands of Java, Bali and Lombok. These primate is one of species that continue to experience threats such as hunting, forest degradation and wildlife trade in traditional and modern markets. The population of Javan langur which continued to be pressed due to this threat became very worried. This is related to the increasing scarcity of Javan langur species in

the habitat. The Javan langur conservation status was declared vulnerable by IUCN (International Union for Conservation of Nature), which means it is vulnerable to the risk of extinction in habitat. The ex-situ conservation efforts are urgently needed. These efforts can be made through the breeding program. It has been done by Taman Safari Indonesia with providing cage facilities that also aim to educate the public. However, efforts for breeding program require reproductive biology information that is still very limited. Animal reproductive biology can be studied on behavior, the mechanism of endocrine, anatomy, morphology, and physiology.

Primates have a strategy to reproduce one of them by showing sexual behavior through a stage to mating. Reproductive strategies are much influenced by sexual behavior which is a reflection of reproduction that is influenced by hormones (Nelson, 2011). Generally, sexual behavior of primate starts from courtship to the stage of mating (Saltzman *et al.*, 2010). Sexual behavior and animal reproduction strategies are ecological behaviors that can be determined depending on the species, the environmental conditions in which the species lives, and the category of sexual behavior. This affects the understanding of reproduction stage of primate that can be interpreted differently for each researcher. However, primate such as Javan langur which are included in the *Cercopithecidae* will show a reproductive strategy that is not much different from one and the other species. But, some species show sexual behavior with different indicators.

Studies of sexual behavior in several genera of *Trachypithecus* have been reported in *Trachypithecus cristatus* (Harding, 2010) and *Trachypithecus pileatus* (Solanki, 2007). However, sexual behavior has not been reported in *Trachypithecus auratus*. This study was conducted with the aim of analyzing the sexual behavior of *Trachypithecus auratus*. The result of the study are expected to provide basic information and data that can be used to determine the strategy of the reproductive system to support the ex-situ and in-situ breeding program.

Materials and Methods

The subjects used were one group of *Trachypithecus auratus* which consisted of one adult male and four adult females. This study was approved by ethics commission Research Primate Center, IPB University with license number ACUC No. IPB RPC – 18 – C005.

The observation of sexual behavior using the focal animal sampling method. Observation begins with determining the parameters that refer to *Macaca fascicularis* sexual behavior (Iskandar and Kyes, 2016) and *Trachypithecus cristatus* (Harding, 2010; Solanki, 2007) (Tabel 2). Determination of behavioral parameters for *T. auratus* was done by habituation for one month. Sexual behavior in this study was observed when male and female courtship (pre-copulation) to copulation.

The group were observed for five months from September 2018 until January 2019. Time of observation was started 10.00 – 16.00 WIB (every Monday – Friday). This observation used BORIS Software (Behavioral Observation Research Interactive Software) (Fiard and Gamba, 2012). The duration of observation is 10 minutes for each individual the continued with the next individual with the same duration. The duration recorded when the first second the male/female show behavior until the second of behavior is end. The total time observed for sexual behavior that has been done 224.5 hours.

Tabel 2. Indicator of sexual behavior

Behavior Stage	Individu			
	Male		Female	
	Behavior	Definition	Behavior	Definition
Courtship (Pre-copulation)	Genital inspection ^a	Male inspects the female genital area by approaching the female and grooming	Head shaking ^b	Female moves the head side to side
			Hindquarter present ^a	Female show anogenital area as signals for male
			Raising a forelimb ^b	Female stands upright with two hind legs and raises the two front legs
Rejection	Agonistic action	Male attack female by pushing and grimace face	Agonistic action	Female pushes and bites the male
	Jump	Male jumps away from female	Jump	Female jumps away from male
Copulation	Mounting ^a	Male climbs female body with dorso-ventral position	Raising a tail ^c	Female raises the tail up
	Thrusting ^a	Push and pull the penis in the female genital	Copulatory vocalization ^c	Female voice when copulation
	Ejaculation ^a	The discharge of sperm from penis		

^aSource by Iskandar and Kyes (2016)

^bSource by Solanki (2007)

^cSource by Harding (2010)

Sexual behavior data were analyzed descriptive and quantitative in the form of percentages, tables, and graphs. Sexual behavior frequency data is calculate by,

$$P = (A/B) \times 100\%$$

P = frequency of activity,

A = average of each activity during observation, and

B = total average of all activities during observation.

Results and Discussions

Primate genus *Trachypithecus* forms a group with a harem system consisting of one adult male with several female and child (one male – multi females) (Bennet and Davies, 1994; Supriatna *et al.*, 1986). Taman Safari Indonesia has one group of Javan langur which are treated for the purpose of conservation and education (Tabel 1).

Reproductive activity has a stage that starts from courtship (pre-copulation), rejection and copulation. Parameters of *T. auratus* behavior in TSI Cisarua Bogor were observed to females showed courtship behavior such as head shaking, showing anogenital area to male (hindquarter present), standing with the body upright (raising a forelimb), and male showed courtship behavior such as genital inspection to female. During the courtship stage, rejection occurs when male and female try to copulate. The rejection behavior was indicated by agonistic action, and jumping. Behavior of copulation was indicated by the male climbing to female body (mounting), and the male movement by pushing and pulling into the female genital (thrusting).

Tabel 1 The size and composition of the javan langurs (*Trachypithecus auratus*) in Taman Safari Indonesia Cisarua, Bogor

Individu	Composition	Sex	Age (years)	Weight (kg)
Tono	Adult	Male	15	12
Anjeli	Adult	Female	6	10
Ambar	Adult	Female	6	8
Tini	Adult	Female	8	10
Tesa	Adult	Female	8	10
Tito	Infant	Male	0.5	N/A

Note : N/A (not available)

The mean duration and frequency of courtship behavior of *T. auratus* is presented in Figure 1. Head shaking was indicated by moving the head side to side for 4-6 times with a frequency of 28.90%. Head shaking was showed together with hindquarter present. Hindquarter present was showed by the frequency of 17.33%. Female also show courtship behavior to male by standing upright with both hind legs (raising a forelimb) by 11.66% with an average duration of 2.40 ± 1.72 seconds. The value of head shaking frequency and hindquarter present of *T. auratus* female was observed to be higher than raising a forelimb. According to Dixson (2012), langurs is a primate has not sexual signs as well as *Macaca* which shows sexual swelling to be used as an indicator of females in a estrus phase. *Macaca* will show redness in anogenital area which will attract to male for reproductive activities. In *T. auratus* the sign is shown as a signal that aims to attract male attention. Head shaking and hindquarter present is a signal that can be seen clearly to be used as an indicator of the start of mating activities. The signal was received by males to showing behavior approaching females by genital inspection.

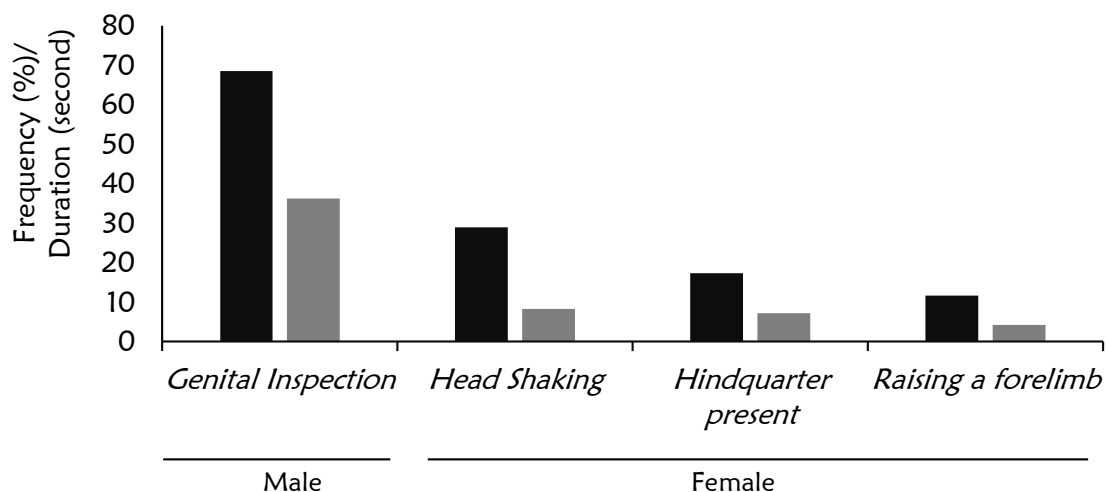


Figure 1 Frequency (■) and mean duration (■) of courtship (pre-copulation) behavior of male and female *Trachypithecus auratus*.

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Male showed genital inspection frequency of 68.46% with an average duration of 30.69 ± 5.52 seconds. This activities is carried out by smell and grooming around the female anogenital. This shows that reproduction of female *T. auratus* is known to have genital secretions in the form of chemical liquids that can be detected by males. This can be observed in primates of the Cercopithecidae and some Prosimians (Dixson, 1977). Genital inspection was observed a few days before and after copulation. This occurs because there is a possibility that males can mate with the same female.

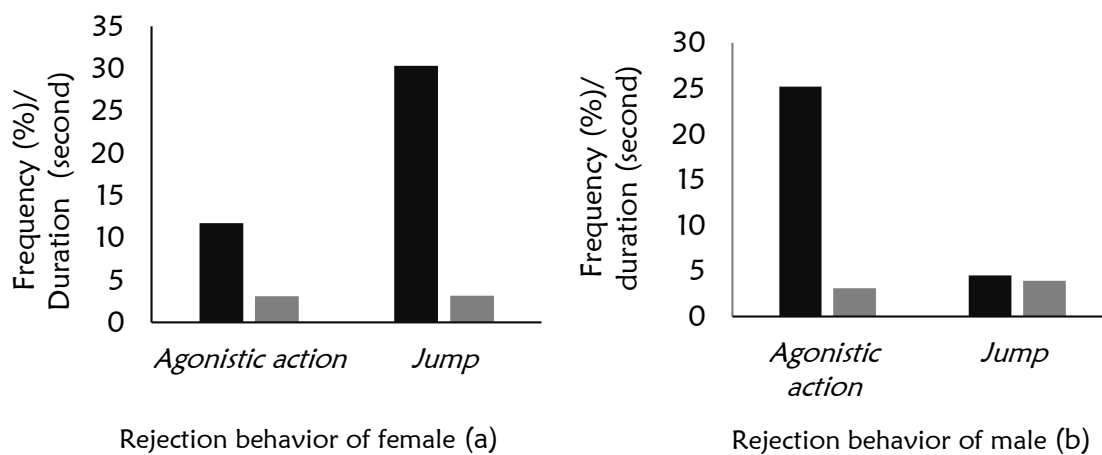


Figure 2. Frequency (■) and mean duration (■) of rejection behavior *Trachypithecus auratus*

When male showed genital inspection, females sometimes show a rejection with an agonistic action or jump to avoid male. Females showed agonistic action such as push and grimace face to male. This activities showed 11.76% with an average duration of 2.62 ± 0.58 seconds (Figure 2a). In addition, females that showed resistance by jumping to avoid male were shown to be 30.32% with a duration of 2.53 ± 0.58 seconds (Figure 2b). The value of frequency of female rejection is high because there are female who are not active for reproduction, and there are female who are identified as subordinate (low-ranking) based on observing by pre-copulation stage for 8-20 times, but continued rejection at the time before copulation occurred. Females that are not ready for copulation will resist male (Wright *et al.*, 1986b).

In *T. auratus* rejection can also be shown by males by doing the same behavior as females. Agonistic action behavior is shown by male with a frequency of 25.22% with an average duration of 2.46 ± 0.80 seconds, and avoiding females as indicated by a frequency of 4.50%

with a duration of 3.40 ± 0.55 seconds. This rejection behavior does not always appear simultaneously. In general, one of them will appear, for example, just jump away, or do an agonistic action with threatening face. This rejection occurred more than before the copulation, but it was also shown at the time after copulation.



Figure 3. Copulation of *Trachypithecus auratus* with dorso-ventral position

The behavior of copulation observed in *T. auratus* consists of mounting, thrusting and ejaculation. Male will climb to female body (mounting), pushing and pulling his penis into the female genital (thrusting). The behavior of copulation is shown once in the male *T. auratus*. Copulation occurs with the dorsal-ventral position (Figure 3). The male climbs female body to the dorsal position. This position of copulation is common in the famili *Cercopithecidae* (Dixon, 1977).

The mounting duration observed in *T. auratus* occurred for 40 seconds. During mounting, the male tried to stabilize his position to begin thrusting for 28 seconds. After thrusting, they were observed to be silent with a position of copulation. This lasts for 20 seconds until the male starts to descend from the female body. This situation is thought to be a process of ejaculation. Male descend from female at the end of copulation. They were observed grooming activities and foraging together. This activity is common in Colobine and *Trachypithecus* species after copulation (Solanki, 2007). The mean duration and frequency of behavior of *T. auratus* copulation is shown in Figure 4.

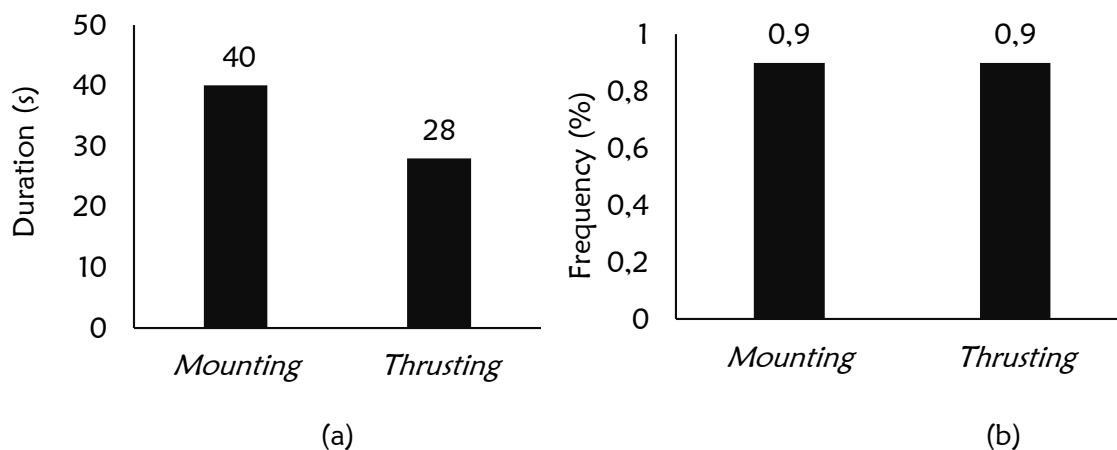


Figure 4. Mean duration (a) and frequency (b) copulation behavior of *Trachypithecus auratus*

Copulation is a stage of female acceptance of male during the estrus phase (Beach, 1976). The stage of acceptance of females occurs during certain periods because sexual behavior is strongly influenced by sexual hormone (Dixson, 2012). *T. auratus* copulation occurs for 60 seconds. When the copulation of *T. auratus* is a longer duration than *Trachypithecus pileatus*. According to Solanki (2007), *T. pileatus* copulation was successful at an average maximum duration of 31.20 ± 8.07 seconds. Based on this observation, copulation only occurred once in Desember. The time of *T. auratus* copulation occurs at 14.00 WIB with temperature reaching 20°C. Copulation occurs in the rainy season. This was stated by Solanki (2007) that the mating activity of the *Trachypithecus* species can occur in the rainy season, and the success rate occurs in November – Desember (Standford, 1991). The Success of copulation is also supported by the quality of individual reproduction. In *T. auratus* identified males experience a decrease in quality that can be seen from physical conditions. Decreasing reproduction quality of langur can be influenced by age, diets, and habitat condition factors. Reproduction quality of langur can decrease at the age of 20 – 25 years (Harley 1990). However, the male *T. auratus* is still in the age who can reproduce well. This is concern that can be done further research related to health and environment.

The behavior of copulation that cannot be observed in this group is the sound of female copulation called copulatory vocalization. According to Harding (2010), *Trachypithecus* can vocalization during copulation. However, the sound cannot be heard during observation because the exhibit's condition is made of glass so that it is resistant to sound. Females in some primate such as *Macaca fascicularis*, *Pan paniscus*, *Papio cynocephalus*, and *Hoolock hoolock* make a sound during copulation (Maestriperi and Roney, 2004). The copulation call function includes showing social standing, reducing competition, showing conditions close to ovulation, showing the reproductive status of females and mating outcomes (Clay *et al.*, 2011; Nikitopoulos *et al.*, 2004). The call heard during or immediately after copulation may show physiological responses associated with orgasm (Dixson, 2012).

Conclusion

The sexual behavior of *T. auratus* to get mating is divided into 3 stages, which is courtship (pre-copulation), rejection and copulation. Head shaking behavior during the copulation stage can be used as a female signal to initiate reproductive activity. Every females was showed the same stage of sexual behavior, but this study only one pair of male and female individuals were observed to do these stages up to the copulation stage. This study needs health screening and nutritional in this group. Exchange of male individual should be planned immediately. This aims to avoid late mating activities due to the age factor of male who are too old for female in this group.

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