

Social interaction in male hamadryas baboons (*Papio hamadryas*) with special reference to social structure

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Abstract. Male-male interaction of hamadryas baboons (*Papio hamadryas*) was observed in the colony of Hirakawa Zoo, Kagoshima. The group is consisted of four harems and three free-lance males. Males generally have various types of social interaction. Greeting behavior was focused, because of its variety and frequency. The prime harem leader (PL) and the new harem leader (NL) were the most active males in male-male greeting situations that were studied. The direction of greetings and the role of distribution of male status class, have been analyzed. In comparison with other *Papio* species, the function of greetings and the characteristics of male-male interactions are discussed in the context of their unique social structure.

Keywords : hamadryas baboon, male-male interaction, greeting behavior, patrilineal society, multi-levelled society

Introduction

An ecologically based study of the complex variability in the social structure of the genus *Papio* was discussed by Dunbar (1992). The ecological traits within a species showed variation in diet, group size, social structure and mating system between populations of the same species (Dunbar, 1992 ; Barton, et al.,1996). However, it is important that these factors of variation are tested in relation to the pattern of social interaction itself. Namely, which characteristics of social interaction contribute to the difference of social structure?

Among the genus *Papio*, the hamadryas baboon has been observed to display unique characteristics such as a multi-levelled society and a patrilineal social unit. This has been the primary focus point of research related to *Papio hamadryas*. Many researchers have discussed social structure. Kummer (1968) clarified the multi-levelled society of hamadryas baboons, as a band that is consisted from several clans, in which a clan is consisted of several harems. His discussion focused on the way in which complex interaction between males contributed to the preservation of the social structures. For example, there are intimate relationships between harem leaders, and male-female pair bond is respected by other males and males' sexual behavior is inhibited (Kummer, et al.,1974) . Abbeglen (1986) studied on the socialization of harem males and suggested that males within a band have kin-relations. The possibility of kin-related male bond was discussed by Sigg et al. (1982). In other cases, interaction between harem leaders, in relation to the direction of daily march, is discussed (Sigg & Stolba,1981), and the significance of inter-male greetings are discussed (Pelaez,

1982). In reference to, Colmenares' studies of male-male interaction in a large colony of hamadryas, and yellow baboons and their hybrids, concluded that male-male interaction, especially greetings display the dialectical relationships between male-male interaction and the dynamics of the over all social structure (Colmenares, 1990 ; 1991 ; 1992). The author also observed male-male interaction, especially greetings at a small colony of hamadryas baboons. This study deals with the relationship between the pattern of male-male interaction and the social structure. This paper will clarify the characteristics of male-male social interaction and discuss a genealogy of male-male relationships in baboon species.

Colony of baboons and method

Social behavior among males was observed in a colony of *Papio hamadryas*, Hirakawa zoo, Kagoshima city. This colony keeps 29 baboons and 14 mountain sheep (Fig. 1 & Table 1).



Fig. 1 A group of *Papio hamadryas* in Hirakawa zoo.

Table 1 Members of Hirakawa group

name	sex	status class
ALF	male	PL
BET	male	PL
PEA	male	NL
RPN	male	NL
TRM	male	FW
WAK	male	FW
KAT	male	FW
CHO	male	FW
SOL	male	FW
BOU	male	OL/OF
OJI	male	OL/OF
TBR	male	OL/OF
YNG	male	SA
krm	female	mother of J1
chm	female	mother of J2
dkk	female	
bt1	female	
bt2	female	
bt3	female	
fjk	female	
pef	female	
J1	black infant	
J2	2-3yrs old	

PL: Prime leader, NL: New leader, FW: Follower,
OL/OF: Old leader or follower, SA: Subadult

The study period is from the 25th to the 30th of January, 1993. Total observation time is 2,800 mins. Initially all baboons were identified, then social interactions were observed and recorded. Scanning data from grooming interaction, and proximity was also collected.

Result

(1) Grouping

In Hirakawa zoo, baboons sometimes gather and contact each other to keep warm. Groupings of the colony were clarified according to the baboons' social behavior in relation to interactive roles and proximity (Fig. 2). This group is consisted from 4 harems and three free-lance males.

Five types of male status classes were determined based on the criteria of Colmenares (1990). Prime male (PL), a leader of harem with plural females; new leader (NL), a harem leader who has single female, he will magnify his harem in future; follower (FW), a male that belongs a harem, but does not participate in reproduction; old leader/follower (OL/OF), an old male who was considered to belong to harem as a leader or a follower; subadult (SA), a young male who is not fully matured.

(2) Patterns of male-male interaction

Among males, various types of interactions were observed in addition to grooming and aggression. Social interaction such as presenting/mounting, coordination of grunting, approach and retreat, etc., were defined as greetings here.

Greeting behaviors are listed in Table 2. Greeting behaviors are as follows; penile showing, a male stands upright and presents a penile area in front of the recipient animal, sometimes horizontally rocking; carrying an infant, a male is cuddling an infant or a juvenile and approaches to

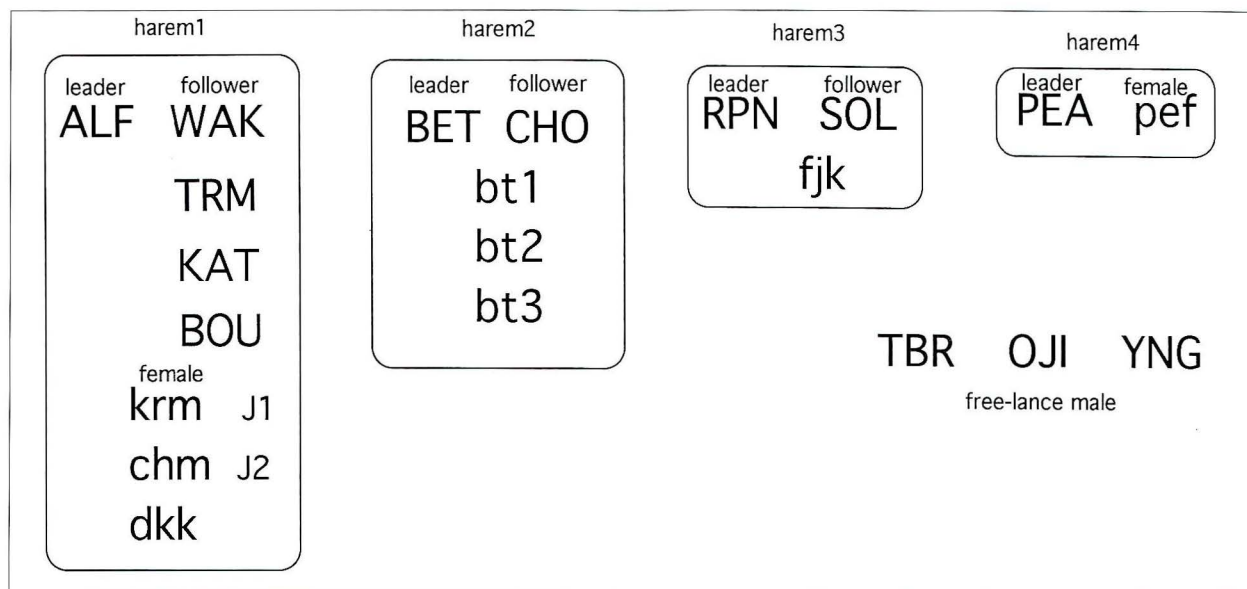


Fig. 2 A schema of the social structure of Hirakawa group. Each animal is shown as an abbreviation letter of its name. The group is consisted from 4 harems and 3 free-lance males.

Table 2 Compared list of greeting behaviors

<i>P. hamadryas</i>	<i>P. anubis</i> (Rowell, 1966)	<i>P. cynocephalus</i> (Hausfater & Tackas, 1987)
grunt	grunt	grunt
grimace	grimace	grimace
lip smacking	lip smacking	lip smacking
present	present	present
penile showing	----	----
carrying an infant	----	carrying an infant
notifying	----	----
penile inspection	nose genitals	perineal inspection
penile pulling	handle genitals	genital manipulation
embrace	embrace	embrace
grasp, touch	touch	grasp
mount	mount	mount

a recipient ; notifying, a male approaches to a recipient very closely and then turns back and retreats ; penile inspection and pulling, responding to an approach, a male sniffs and inspects a penis of the initiator, and sometimes pulls it ; embrace, responding to an approach and present, a male embraces and hugs from the back of the initiator ; grasp/touch, a male touched and grasps the waste of the initiator ; mount, responding to an initiator, a male mount on the initiator.

Total number of greetings that were observed is higher than that of aggression (33 and 26, Fig. 3). Especially penile showing/pulling interaction occurred frequently in this colony.

(3) Male-male relationships based on the greeting

Networks of greeting behavior and aggression were analyzed in relation to male status classes (Fig. 4). The result was as follows ; PL frequently receives greetings and

acts aggression to other males. NL frequently receives and initiates greetings, and also receives aggression frequently. FW initiates greetings frequently but rarely receives, on the other hand, FW rarely joins aggressive interactions. OL/

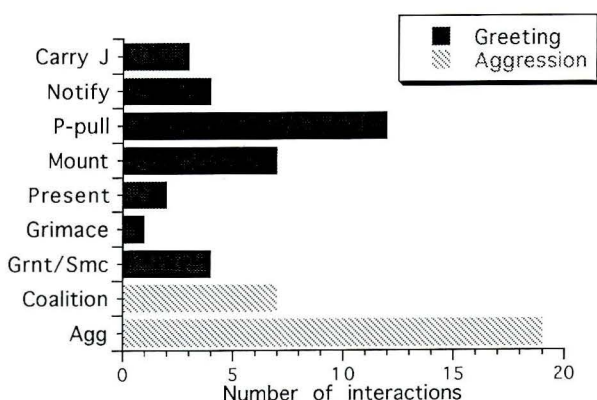


Fig. 3 Number of various behaviors observed in male-male interactions. 7 types of greeting behaviors are compared with coalition and dyadic aggression. Abbreviation of behaviors are as follows. Carry J : carrying an infant, P-pull : penile showing and penile pulling, Grnt/Smc : Grunt and lip smacking.

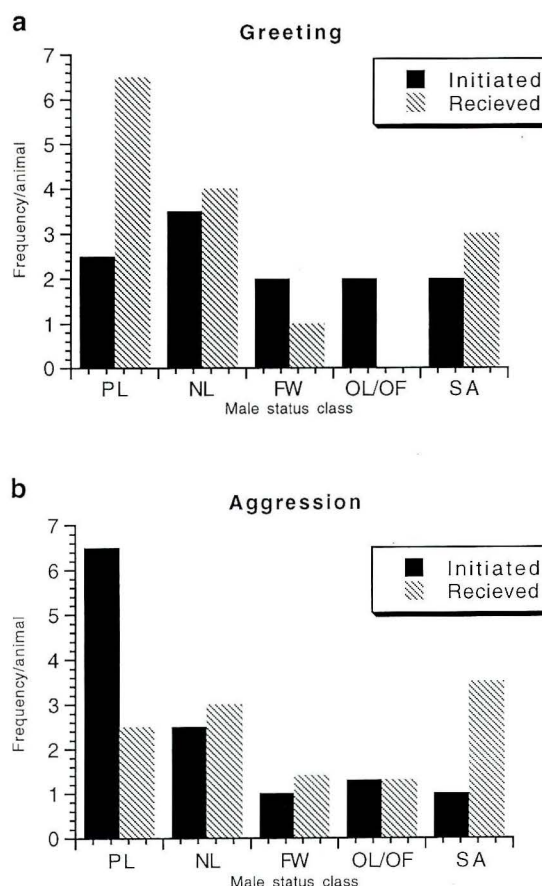


Fig. 4 Direction of greeting behavior within each status class. Direction of (a) greeting and (b) aggression are counted for each status class. PL : Prime leader, NL : New leader, FW : Follower, OL/OF : Old male regarded as a former leader and/or a former follower, SA : Subadult male.

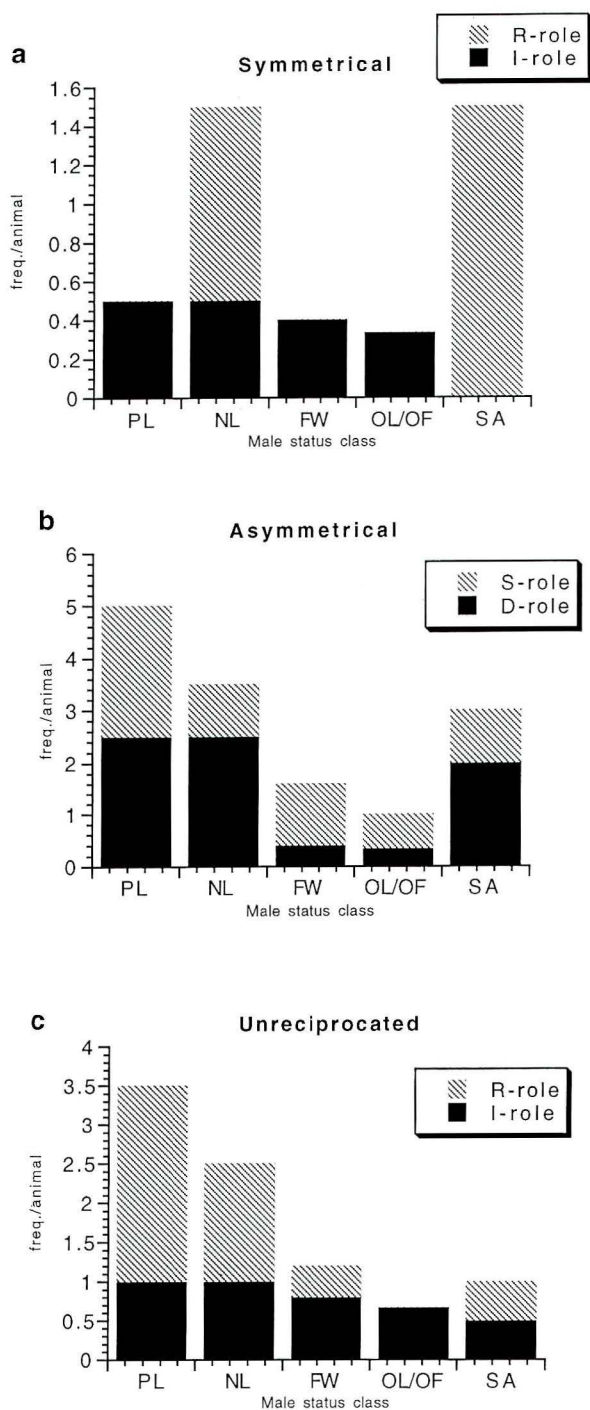


Fig. 5 Distribution of each role type between status classes. How often each type of role was fulfilled by the various status class of males is shown. (a) symmetrical greeting, (b) asymmetrical greeting, (c) unreciprocated greeting. Abbreviation of role types are as follows. R-role : Recipient, I-role : Initiator, S-role : Submissive role, D-role : Dominant role. Male status classes are same as Fig. 4.

OF initiates greetings but never received. SA received both greetings and aggression frequently.

These results are summarized as follows ; both NL and PL interact very actively. Especially PL who frequently receives greetings from various males. PL monopolizes several females, and as the result social interests of other individuals seem to be focused to PL.

(4) Patterns of greetings and male-male interaction

Based on Colmenares' criteria (1990), greetings are classified to 3 types, symmetrical, asymmetrical and unreciprocated greetings. The role of males in each type of greeting are analyzed in relation to their status class (Fig. 5 a, b, and c).

New leader (NL) and subadult (SA) have symmetrical greetings frequently. They fulfill recipient roles (R-role) to the greeting initiators. They play dominant roles (D-role) in asymmetrical greetings.

Prime leader (PL), however, fulfills both dominant and subordinate roles in asymmetrical greetings. PL also received unreciprocated greetings, namely, PL ignored greetings frequently. Observations would strongly suggest that PL always has leadership in greetings.

(5) Comparison with other baboon species

Relative frequency of aggression, grooming and greeting are compared (Fig. 6) between hamadryas baboons and *P.*

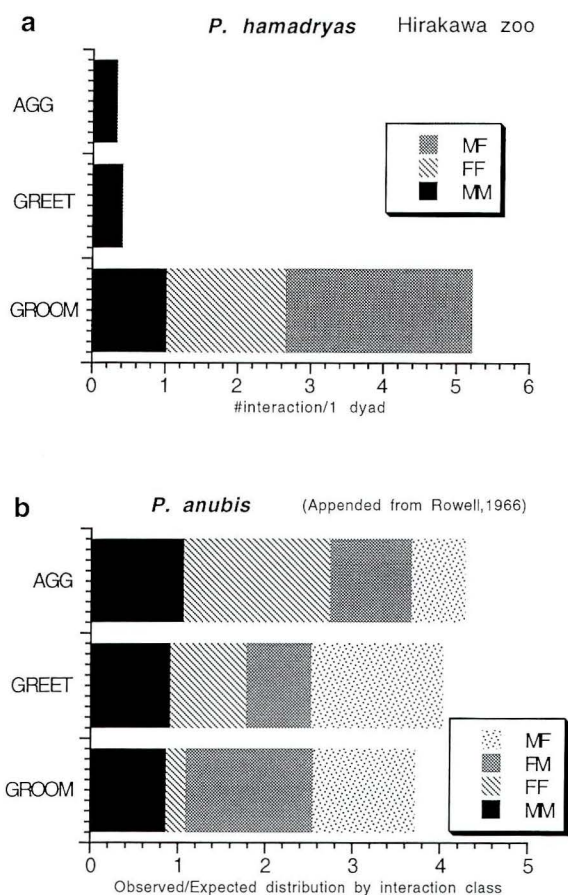


Fig. 6 Inter-specific comparison of relative frequency in social interaction. Relative frequencies of social interaction are shown for (a) *Papio hamadryas* in Hirakawa and (b) captive *P. anubis* group. In hamadryas group, only grooming is shown for all combinations. For anubis group, relative distribution rate (observed rate/expected rate) are recalculated from (Rowell, 1966). MF : from male to female (for hamadryas, between males and females), FF : from females to females, MM : from males to males, FM : from females to males, AGG : aggression, Greet : greeting, Groom : grooming.

anubis (Rowell, 1966). In hamadryas baboons, aggression was not frequent, but grooming was frequently observed, and greeting was only about. In anubis baboon, aggression occurred very frequently compared with expected frequency for number of animals.

Each greeting behavior was compared to each other, between hamadryas and other baboons (Table 2 ; Rowell, 1966 ; Hausfater & Takacs, 1987). Almost all behaviors corresponded each other except notifying and penile showing. Especially, notifying is unique behavior and frequently occurred. In other *Papio* baboons (namely savanna baboons), symmetrical greetings are very rare (Smuts, 1986 reported one case as an exception). In contrast, hamadryas baboons have symmetrical greetings frequently.

For the direction of greetings, presenting is done from subordinate animal to dominant animal and from the immigrant to the resident in savanna baboons. In hamadryas baboons, the direction is not biased by dominance and acquaintanceship.

In sum, male social interaction of hamadryas baboons is more peaceful and more equal than other *Papio* species, and these characteristics seems to be brought by frequent greetings with various directions and nuances.

Discussion

(1) Functions of greetings

In savanna baboons, greeting behavior has been considered to have following functions. 1) Alternatives to aggressions (Hausfater and Takacs, 1987), greetings make defuse aggressiveness ; 2) Assessment strategy, males confronting over females can assess the ability each other and can avoid serious attack (Ransom, 1981 ; Strum, 1982 ; Bercovitch, 1985 ; Smuts, 1985). Actually, it is observed that female possessor frequently do greeting to other males ; 3) Regulation of social relationships, greeting certifies and strengthen a social bond. A newcomer frequently does greetings to residents (Strum, 1982), for example, resident males who do coalition to the newcomer interact by greeting frequently (Smuts, 1985), and unrelated males who keep long-term affiliative relationship

interact by greetings (Hausfater & Takacs, 1987).

For the hamadryas baboon, another function of greeting, the negotiation of social roles (Colmenares, 1990), can be considered. Greetings are used to negotiate the various social roles, for example, in the process of deciding the direction of daily nomadism (Kummer, 1968 ; Sigg & Stolba, 1982), in the context of a female possessor checking towards follower and other harem leaders (Kummer, *ibid.* ; Abbeglen, 1986 ; Colmenares, 1991), and in various context of aggression such as reconciliation, consolution, and aid seeking. Female possessors check rivals by greeting through other means than aggressive elimination, this fact is reflected in the characteristics of male-male relationships in hamadryas baboons.

(2) Uniqueness in social structure and male-male interaction of hamadryas baboons

Table 3 shows types of baboon society containing hamadryas baboons. "Patrilineal" and "multileveled" are key concepts in hamadryas society. Which of the above social systems is the major determinate of male-male interaction ? Male-male interactions were studied in gelada baboons co-existing under a multileveled-matrilineal society and in chimpanzee and Atelins which have patrilineal-single leveled society.

In gelada baboons, intra-harem context, a pattern of male-male interaction is similar to hamadryas. However, inter-harem male-male interaction is very rare, and there is not a clear dominance relationships (Mori, 1979). These results suggest that a basic social unit of gelada baboons is a harem neither a herd nor a band (higher leveled social unit).

Characteristics of male-male relationships of patrilineal society is coded by strict bonding within society and strong aggressiveness towards outside of society. Affiliative interaction between males is exclusively frequent in Atelins (Strier, 1994). In chimpanzee groups male-male interaction called "politics" determines the male bonding (de Waal, 1987).

For this study, intra-band and inter-harem, intra-harem interaction was analyzed. Male-male interactions do not change according to the social unit (harem, clan, and band),

Table 3 Types of social structure in baboon species

	single-leveled	multi-leveled
matrilineal	<i>Papio anubis</i> , <i>P. papio</i> , <i>P. cynocephalus</i> , <i>P. ursinus</i> , social unit: troop	<i>Theropithecus gelada</i> social unit: harem
patrilineal		<i>Papio hamadryas</i> social unit: band

so the basic social unit of hamadryas baboons is a band not a harem. Within these society, patrilineal restrictions of male-male relationships seem to become strong. To fully determine if male-male aggression frequent in Atelins and chimpanzee is similar or not, further study on inter-band interaction is necessary.

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マントヒヒのオス間にみられる
社会的相互交渉と社会構造との関わり
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要約

鹿児島市平川動物園のマントヒヒ (*Papio hamadryas*) のコロニーにおいてオス間の相互交渉を観察した。マントヒヒのグループは、4つのハレムと3頭のフリーランスのオスで構成されていた。オスは、さまざまなタイプの社会的交渉を持つが、特に多様性が高く発現頻度も高かったのは greeting (あいさつ) 行動であった。成熟したハレムリーダー(PL)と新しいハレムリーダー(NL)が、もともと活発に greeting をおこなった。この greeting の方向性や、オスの地位による役割の違いなどを分析した。Papio 属の他種との比較によってマントヒヒの greeting の機能とオス間相互交渉の特徴を明らかにして、ユニークな社会構造と関連づけて考察する。

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