Behavior of Sulawesi Black Monkey (*Macaca maura*): a case study of attacking behavior in agricultural plants

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Abstract. Sulawesi Black Monkey (*Macaca maura*) is an endemic species of South Sulawesi that is almost extinct. One of the habitats is in the Tabo-Tabo education and training forest area, Pangkep Regency. The existence of monkeys is a problem because there are human activities in and around the area and they are considered as pests of agricultural crops. To shelter and prevent the Sulawesi Black Monkey (*Macaca maura*) from its extinction, we need to know where to live and evidence about its attacking behavior on agricultural crops. The study was conducted using a survey and observation method in the field which was modified by providing feed in the form of corn, peanut and cassava which were ready for harvest, which was found in a land measuring 10 x 30 m. The results of the *Macaca maura* attack behavioral research revealed: peeping behavior, initial attack behavior, eating behavior and safety behavior. The attack on the agricultural location by *Macaca Maura* because the community's agricultural land is located in the *Macaca maura* home range.

1. Introduction

Sulawesi is a unique island located in the middle of the Wallace region, between two continents, Asia and Australia. Because of its position, it has a high level of endemicity in terms of flora and fauna, and has very clear difference wildlife from Kalimantan which is separated by the Makassar Strait which is not too wide.

The richness of the endemic species of Sulawesi is a matter of pride, but it has a big responsibility to be managed well so that it can still be enjoyed by future generations. The untrustworthy human activities cause the extinction rate of ecology around islands which tends to increase.

Enlarged pressure on wildlife and natural ecosystems is partly due to an escalation in population, uncertainty in land use and management, and economic and development policies. The emergence of pressure on the natural environment is closely related to poverty, population pressure, the use of forest resources and land, and agricultural development.

There are 195 (one hundred and ninety-five) species of primates in the world, 40 (forty) species are found in Indonesia, and 24 of them are endemic animals that only live in Indonesian forests, this high level of endemicity is also found on Sulawesi Island and around it, like *Macaca maura* (Sulawesi Black Monkey / Dare) which is one of the primates, from 8 (eight) endemic Sulawesi primates [1].

The whole classification of *Macaca maura* is [2] Superregnum: Eukaryota; Regnum: Animalia Subregnum: Eumetazoa; Cladus: Bilateria; Cladus: Deuterostomia; Phylum: Chordata; Subphylum: Vertebrata; Infrafylum: Gnathostomata; Superclassis: Tetrapoda; Classis: Mammalia; Subclassis:
Theria; Infraclassis: Placentalia; Ordo: Primates; Subordo: Haplorrhini; Infraordo: Simiiformes; Parvordo: Catarrhini; Superfamilia: Cercopithecoidea; Familia: Cercopithecidae; Subfamilia: Cercopithecinae; Tribus: Papionini; Genus: Macaca; Species: Macaca maura.

The name of the Macaca maura in South Sulawesi region is Dare or Langceng. As the name suggests, the Sulawesi Black Monkey is on Sulawesi Island. The most habitats are in the tropical rain forests of South Sulawesi Province. Local people call it the Dare Black Monkey or Landcare Dare, because its fur is blackish brown.

Macaca maura's body is generally black, or dark brown, and young individual’s paler in color than individuals who have grown up. Macaca maura body length generally ranges from 50–70 cm. All Macaca genera have separate seat pads (ischial callosities), except for Macaca maura which is almost united [3].

Macaca maura's body and limbs are blackish brown to jet black. Macaca maura is not yet mature, on the face, palms and soles are not overgrown with hair and black. The head has a short crest and collapsed, and has a short snout. Ventral body color is younger than the dorsal part. The foot is usually longer than the hand [4].

![Figure 1. Adult male Macaca maura in the Tabo-Tabo forest.](image)

The main threats to wild monkey populations are caused by habitat loss, hunting for consumption, extermination as agricultural pests and maintenance in cages as pets. One of the roles of monkeys in nature is as an agent for spreading the seeds through the food they eat, especially the types of fruits that have seeds. But along with the increasingly narrow forest area, monkeys also experience changes in function, which is no longer as an environmental balance but instead as an enemy for farmers.

Tabo-Tabo’s Forest Area with Special Purpose (FAWSP) in Pangkep Regency, South Sulawesi Province is a protected forest area, which is designated as a special purpose forest area that is functionally managed by the Makassar Environmental and Forestry Education and Training Center Office, with an area of 601.25 ha, which is also one of the natural habitats for Macaca maura. Within the area and around the area, there are agricultural lands and community plantations with commodities that are generally planted are: crops, such as corn, green beans, peanuts, long beans, cassava, sweet potatoes and cocoa. The land is often attacked by Macaca maura.

Protected forest directly adjacent to the Tabo-Tabo’s FAWSP, has experienced deforestation along with an increase in population and increased fulfillment of human welfare, so as to maintain the survival of the Macaca maura wildlife, in certain seasons agricultural land and community plantations, become the main target for foraging with typical behavior [5]. This certainly becomes a nuisance that can cause substantial losses to farmers, so that in order to avoid significant losses, farmers will exterminate them since they are considered pests for their agricultural land or plantation land.

The existence of Macaca maura, which is considered a hassle by farmers, requires wise countermeasures. Therefore, in managing the area, two interests must be considered, namely: the people who manage land in and around the prosperous area, and the life of Macaca maura is also maintained, so that the preservation of its species remains sustainable.
2. Materials and methods
The research was conducted using survey methods and field observations in the Tabo-Tabo Forest, Bungoro District, Pangkep Regency, South Sulawesi. The method is modified by providing feed in the form of corn, peanut and cassava plants that are ready to harvest on agricultural land measuring 10 x 30 m.

The agricultural land that becomes the bait is in the Macaca maura range which is located in the Tabo-Tabo forest area.

3. Results and discussion

3.1. Behavior of attack on agricultural plants
Behavior is a reaction carried out by animals to their natural surroundings which is influenced by internal factors, so that the response of animals to all stimuli in the form of behavior basically comes from a basic impulse that is to stay alive (survive) [6]. Meanwhile, [7] behavior is a strict action of an organism to adapt to environmental conditions in order to pledge its life formed by different components rendering to the type of organism.

Macaca groups that move together often make noise, especially when entering plantations and eating agricultural produce. The male always beeps to control his group members. This sound will be louder if there is danger, so group members quickly enter the forest [8].

Macaca maura has a variety of behaviors and physiological processes to adapt to their environmental conditions and to maintain their life. Macaca maura carry out aggressive activities, compete and collaborate to get food, protection, partners for mating and reproduction [9,10].

The observations at the Tabo-Tabo’s FAWSP show that Macaca maura's daily activities generally live on trees (arboreal), but some are active on the ground, especially during exploration. They move with four limbs, Macaca maura active from morning to evening (diurnal), and finally at night, they sleep in a tree with their group members.

Groups that move together often make a sound, especially when entering residents' plantations and eating agricultural produce. The male always beeps to control his group members. This sound will be louder if there is danger, so group members quickly enter the forest [8,11].

3.1.1. Stalking behavior. Earlier entering and attacking the farm, the behavior of members of the Macaca maura group is lurking or observing around the garden, nevertheless already approaching the garden on their way to the garden, they go hand in hand with the Sulawesi Lizard Bird (Rhampococcyx calyptorhynchus), which flies and chirps ahead of the Macaca maura group, which the number is more than 2 (a pair).

The Sulawesi Kadalan bird, an insect-eating bird that lives in the forests of Sulawesi Island, the people of South Sulawesi (Bugis tribe living in the Tabo-Tabo area) named it "Salesse Lanceng" which means "Monkey Shepherd Birds". Local people call it that because every Sulawesi lizard bird, then at that location there will be a group Macaca maura.

Sulawesi lizard bird song is a signal by farmers that around the source of the bird song, there is a group of Macaca maura, who are conducting surveillance and are ready to enter and attack the plants, if no one stops them.

Already entering the garden, the behavior of Macaca maura, an adult male as a leader in his group, will make a distinctive sound like a whistling sound, amidst the sounds of the Sulawesi Kadalan birds. After several voices, the behavior of Macaca maura will rise to the top of the tree, which is around the garden that is the target of the attack, and observe the garden and stay in the tree for about ± 3 minutes. Then again voiced and was greeted by several other group members, while some of them did not make a sound or were silent without making movements but were alert and concentrated in one place around the garden.

The behavior is in addition to staking out the existence of the garden which was the target of the attack, also to waiting for the other group members to be concentrated and enter to attack...
simultaneously at the same time. Furthermore, the behavior of *Macaca maura*, males who are in the trees, will go down and approach the garden, and rise above the garden fence but do not immediately attack, but paused for about ±2 minutes, but members of his group began to spread around the garden fence. While the Sulawesi lizard bird accompanying *Macaca maura* members, on their way to the garden, continued to sing.

Authors' analysis that between *Macaca maura*, and the Sulawesi lizard bird, there is a relationship of interdependence (symbiosis) between the two, the Sulawesi lizard bird acts as a guide for *Macaca maura* group members, towards the food source, making it easier for group members to obtain food sources which are desired. As for the Sulawesi lizard bird, it benefits from the movement of members of the *Macaca maura* group, both when moving on trees (arboreal) and when moving on bushes and on the ground (terrestrial).

As a result of the movement of *Macaca maura* group members, in each area that is passed through, insects in the trees and bushes, and on the ground, will fly so that the Sulawesi lizard bird can easily catch these insects, to be eaten as source of food he needs in meeting his needs.

3.1.2. Initial assault behavior. After a member of the Macaca maura population spreads around the garden which is the target of the attack, the attack is ready to be carried out, and the first to enter the garden is the *Macaca maura* male as the leader of the group, then followed by the *Macaca maura* male and female adults, and then followed by members the other group. While the last to enter the garden is the juveniles, they enter after all group members are in the garden. The next behavior is that members of the *Macaca maura* group spread towards the target food source, and they are ready to attack and eat the desired food source.

3.1.3. Eating behavior. The selected food sources and the main priority are plants that are easily available or easily accessible. The plant that was first attacked was corn, and all members of the *Macaca maura* group liked the plant. The age group of adult males and adult female’s behavior is very aggressive in taking corn fruit, compared with the age group of young males and young females, while the age group of infants (infant) and the age group of children (juveniles), and have not been able to take themselves the desired corn.

The age group of infants (infant) is still very dependent on the parent, the adult female. An interesting thing happened, it turns out that the adult male age group (adult males) and adult females (adult females) aggressiveness in taking corn fruit, in addition to meeting their own needs, also for the needs of other group members namely for the age group of children (juveniles), and infants (babies) who have not been able to take themselves the corn they want.

*Macaca maura* adult males when giving fruit to the age group of children appeared to be not favoritism, and *Macaca maura* children competed with each other to get corn. While that is still a baby (infant) food is obtained from adult females who carry it.

*Macaca maura*’s behavior in the age group of children, when in the garden, they are only near the fence or not in the middle of the garden as the young and adult age groups, they just wait on the edge of the garden while damaging the corn plant stems. The author's analysis is the existence of this behavior because they have not been able to pick or pick their own corn as desired, as well as in case if there is danger or interference from humans during an attack, the age group will easily run away and leave the garden because their position is in near the garden fence.

While members of the *Macaca maura* group in young male age groups (sub adult males), and young female age groups (sub adult females), in meeting their needs, they are solely responsible for themselves in finding and getting the food they want or are not bound anymore to the *Macaca maura* group adult male and adult female. They freely enter the middle of the garden to find their own corn that is easily obtained and then taken and fed by themselves.

Related to the use of time in the attack and the availability of sufficient food sources, the observations did not see any competition among members of the *Macaca maura* age group in terms of
obtaining food sources, and observers assumed that such eating behavior was an early stage eating behavior.

While the next stage of eating behavior, when members of the *Macaca maura* group began looking for variations in the type of food desired, and in the garden there are several types of plants that are also favored by *Macaca maura* such as: nearly harvested peanuts, three-month-old cassava, sweet potatoes, long beans, and pumpkin.

Some types of plants such as: sweet potatoes, cassava and peanuts according to the author will be very difficult for *Macaca maura* to get these types of food, because the tubers or seeds to be eaten are in the soil. But the writer's guess is wrong because they have their own way or behavior to get the food.

To get the tubers from sweet potatoes or creepers, the sweet potato stems are first removed in order to find out the position of the roots that have the tubers. Once it is known, *Macaca maura* starts digging using hands with sharp nails, after the tubers are obtained, the food is directly eaten, and some given to other group members. The members of the *Macaca maura* group who carried out the excavation were from the adult male age class and adult females who did not carry the infant.

Whereas for peanut type plants, they also obtained it by digging using sharp hands and nails, but in selecting the peanut clumps to be excavated selectively, kissing several peanut clumps first, after determining the target family, it will be immediately excavated and after getting peanut seeds, the seeds will be peeled with sharp teeth and then immediately eaten. Peanut groves that are not dug up will be trampled by the Macaca maura group.

The age group that carried out the excavation consisted of young age classes and adult age classes, both male sex and female gender, while the age classes of children only trampled and damaged plants. When aggressive attacks occur around 10 to 15 minutes, in the 15th minute, it appears that the aggressive behavior of *Macaca maura* in searching for and taking food starts to decrease, this is because most of the group members have begun to get full. While the group of children appears to be playing with some group members from the adult age class, the authors assume that the behavior is a behavior for learning or information transfer media for *Macaca maura* children to what is done by *Macaca maura* adults.

3.1.4. Security behavior. After the deterrence, the *Macaca maura* group who first left the attack site were juveniles, because their presence in the garden was around the garden fence. Meanwhile, the last to leave the garden was the leader of the *Macaca maura* group. Before leaving the location of the attack, the group leader *Macaca maura* paused for a moment and returned to observing the location of the attack while making a sound, but the sound that was issued was louder than the sound when he first entered the location of the attack, and the voice was answered by other group members who have come out of the garden.

The writer analyzes that sound, as a sign to ensure that all group members have left and left the location of the attack. Obstacles continued until the *Macaca maura* group came out and away from the garden, and then went into the forest, but the leader of the last *Macaca maura* group left the garden while running still making a sound, and several times turned then ran and ran away from the location of the attack.

This behavior is the conduct of the group leader *Macaca maura* in an effort to maintain the stability of group members, against the presence of danger or threatening interference. While the presence of the Sulawesi lizard bird, remained faithfully accompanying the *Macaca maura* group members, who fled and entered the forest, the authors suspect that when the *Macaca maura* group members attacked in the garden, the Sulawesi lizard bird who accompanied the trip, waited in the top of the tree around the garden, and when a member of the *Macaca maura* group leaves the garden, the bird also participates with the *Macaca maura* group member leaving the garden and into the forest.

The results of interviews with seven farmers who worked on the land in the Tabo-Tabo’s FAWSP, said that the frequency of *Macaca maura* attacks on their land was more common during the dry season than during the rainy season. This is because during the rainy season the availability of food
sources in the form of fruits in the forest is very abundant, and varies or occurs in the fruit season, or not vary.

Sources of food from the types of fruit that exist in the dry season include types: Ara (Ficus hindsia), Rao (Dracontomelon dao), Forest Mangosteen (Garcinia nervosa), Harp (Sandoricum koetjape), Sempur (Dillenia serratula), Aren (Arenga pinnata) and Guava Forest (Psidium guajava). While the source of feed from the shoot type is Lento-Lento (Gastonia serratifolia).

The attack that occurred on agricultural land was also caused by the home range of Macaca maura in the Tabo-Tabo’s FAWSP, which was not very extensive, and even overlapped with Macaca maura groups living in the Panasai forest, forest area Lapa Durian and Bulu Tarokapae forest area. The home range of members of the Macaca maura group who live in these three forest areas, in which there are farmers ‘arable land, so that each Macaca maura group that passes through the farmers’ arable land, will carry out attacks if not driven away, this is due to the source of food in in the garden is relatively easier to get than the source of food in the form of fruits available in the forest.

Besides that, the location of the farmers’ cultivated lands in the Tabo-Tabo training and education forest area, around which there are various types of fruit trees which are a source of food from Macaca maura. Each fruit season occurs or before the rainy season until the end of the rainy season Macaca maura population members will always come to the region.

4. Conclusion

Macaca maura attacking behavior on agricultural crops in Tabo-Tabo’s FAWSP has a unique pattern, which sequentially that is Staking behavior, lurking behavior is carried out by a dominant adult male (as the leader of his group) by issuing a whistling sound, with the involvement of the ever-singing Sulawesi lizard bird that acts as a guide; The initial attack behavior that is preceded by the entry of dominant adult males into the garden, then followed by members of adult male and female groups, male and young females, and children, but whose children their presence in the garden are only at the edge of the garden or around the fence, while the infant (baby) carried by an adult female; Eating behavior, the adult age group has a very aggressive behavior. The priority feed source is the one that is easy to obtain and reach, namely maize, in addition to its needs Macaca maura male and female adults also share in the age groups of children and infants; Security behavior, dominant adult males when leaving the garden will make a sound. At that time followed by the age group of children, males and young adult females, adult females who carry infants, and males and females, then the last to leave the garden is the dominant adult males, while making a louder sound than when going into the garden to attack plants. The voice was answered by other group members while running away from the garden.

5. Recommendations

Macaca maura has the status of "endangered" and endemic protection in Sulawesi, so that its existence remains sustainable in Tabo-Tabo’s FAWSP, Makassar Environmental and Forestry Education and Training Center as the manager of FAWSP, and the Pangkep Regional Government, must continue to improve coordination and collaboration efforts with the surrounding area in the context of preservation of Macaca maura to remain sustainable and not extinct.

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