Coconut Feeding of the Babirusa (Babyrousa spp.)

Masaaki ITO1*, Alastair A. MACDONALD2,3, Kristin LEUS4, I Wayan BALIK5, I Wayan Gede Bandem ARIMBAWA6,7, Yamato HASEGAWA7 and I Dewa Gede Agung ATMAJA8

1) Babirusa Foundation Tokyo, Higashi-Oizumi, Nerima, Tokyo 1780063, Japan
2) Royal (Dick) School of Veterinary Studies, The University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, Scotland
3) Royal Zoological Society of Scotland, Edinburgh, EH12 6TS, Scotland
4) Copenhagen Zoo, Roskildevej 38, PO Box 7, 2000 Frederiksberg, Denmark
5) Babirusa Foundation Bali, Br Tengah, Lodtunduh, Ubud, Bali 80571, Indonesia
6) Faculty of Medicine and Health Sciences, Udayana University, Sudirman Campus, Denpasar, Bali 80232, Indonesia
7) Tokyo Tech High School of Science and Technology, Shibaura, Minato, Tokyo 1080023, Japan
8) Bali Zoo, Singapadu, Sukawati, Bali 80582, Indonesia

[Received 12 October 2019; accepted 26 April 2020]

ABSTRACT

The feeding behaviours of the Sulawesi babirusa (Babyrousa celebensis) were investigated in an enclosure imitating the early phase of a commercial coconut palm (Cocos nucifera) grove. Unexpected behaviours, such as the eating of coconut flowers and the picking of young coconut fruits, were observed. Additionally, we conducted experiments in which we fed several different parts of the coconut palm to the animals. We found the following: 1) coconut seedlings and leaflets were not eaten; 2) the babirusas preferred to eat staminate flowers rather than carpellate flowers; 3) the babirusas were able to crush the young coconut fruits with its teeth, but failed to open the mature coconuts; 4) the maxillary and mandibular incisors gripped the coconut, and the tip of the mandibular incisor was then used to penetrate the coconut surface to crack it open; 5) the palatable parts were the kernel and haustorium of the mature coconut. The coconut parts eaten by the babirusas in the experiment were concordant with the pieces of broken kernels and haustorium scattered over coconut groves in copra production. These pieces have no economic value for the farmer. There was insufficient evidence to support the view that babirusas moving through coconut groves constitute vermin for the coconut farmers and copra producers.

Key words: babirusa, coconut, feeding behaviour, human-wildlife relations, incisor teeth

INTRODUCTION

The babirusa (Babyrousa spp.) is a wild pig native to Sulawesi and neighbouring islands in Indonesia. Currently, there are three species: the Sulawesi babirusa (Babyrousa celebensis) from mainland Sulawesi, the Moluccan babirusa (Babyrousa babyrussa) from the Sula Archipelago and Buru Island, and the Togian babirusa (Babyrousa togeanensis) from the Togian Archipelago. They have been protected under Indonesian laws since 1931, but they are facing severe human-caused threats, such as deforestation and habitat destruction [1-4]. In the case of the Togian babirusa, the number of mature animals is estimated to be 1000, and the species is listed as ‘Endangered’ in the International Union for Conservation of Nature (IUCN) Red List [2].

The babirusas are omnivorous [5] and consume a wide range of food items, such as herbs, leaves, roots, fruits and animal material, including small mammals and birds in zoos [6-8]. Recent research has expanded our knowledge of the diet of the wild Moluccan babirusa [3, 9, 10]. It is important to know what potential food resources they eat. This knowledge may contribute to the conservation of a healthy ecosystem for the wild babirusa population.
In the Togian islands, the local people are employed in small-scale fishing and coconut (Cocos nucifera) farming (Fig. 1). The farmers have come into conflict with Togian babirusas because some of the animals’ home ranges overlap with agricultural areas, in particular, vegetable gardens [11-13]. The babirusas have often been seen in coconut groves [12, 14]. Although sightings of babirusas foraging in a coconut grove have been reported [12, 16], in general, the babirusa has not been regarded as a coconut pest. It is believed that it is unable to open intact coconuts and consumes only sprouted coconuts or broken pieces of coconut kernels [7, 14, 15]. It also remains unclear whether the babirusa eats the shoots of young coconut trees and intact fallen fruit [16]. We have recently reported evidence that the coconut fruit is a food resource for Togian babirusas [2, 17].

To examine this topic, we set up a research area in an outdoor enclosure in Indonesia where coconut palms had been planted for Sulawesi babirusas [18, 19]. The objectives of this study were to investigate: 1) which parts of the coconut palm the babirusa eats; 2) how the babirusa opens and eats coconut fruits; 3) whether or not the babirusa should be considered an agricultural pest in coconut groves and copra-producing farms. Copra is the dried meat or kernel of the fruit of the coconut palm.

MATERIALS AND METHODS

Study sites and periods

This study was conducted at Babirusa Park and Bali Zoo, Bali, Indonesia. The former was located in the agricultural area of the Lodtunduh village. The latter is in Singapadu, five km south of Lodtunduh. At Babirusa Park, the study period covered 1936 days from 1 January 2005 until 20 April 2010, with 16 days of interruption. The study at Bali Zoo was intermittently conducted for a total of 38 days between May 2017 and April 2018.

Animals, enclosures and animal husbandry

At the beginning of this study, all Babyrousas, including the Sulawesi babirusa and the Togian babirusa, were scientifically recognised as a single species. Only Sulawesi babirusas have been kept in zoos, therefore, zoo-based Sulawesi babirusas were used in this study (Table 1), and the assumption was made that there is no difference in feeding behaviour between the two types of babirusa. At both study sites, animal handling was kept to a minimum.

Babirusa Park: Two adult pairs of babirusas and their two offspring (Table 1A) were examined in the outdoor enclosure (480 m²). There were nine coconut palm trees (‘Dwarf’ variety), eight clusters of banana plants (Musa acuminata) and cogongrass (Imperata cylindrica). Eight of the nine coconut palm trees were newly planted in August 2002 (28 months before the animals arrived at Babirusa Park). Concrete pens, a water pool and a surrounding swamp area were provided for the babirusas. They were fed twice per day, morning and late afternoon. Each adult animal was given 1.5 kg of sweet potato, 400 g of fresh green leaf fodder, 110 g of banana, 580 g of other fruits and 150 g of commercial swine pellets (Hi-Gro Medicated 551, Charoen Pokphand Indonesia, Surabaya) daily.
Coconut feeding of babirusa

Bali Zoo: After the study at Babirusa Park, the adult animals were transferred to Bali Zoo. Two animals (Female 1 and Female 2) were kept in a 100 m$^2$ enclosure where the ground was covered with hard soil and gravel. Two simple shelters, a mud wallow and a water pool were provided for the babirusas. In the centre of the enclosure, a coconut palm tree and an ylang-ylang tree (Cananga odorata) provided shade. Keepers fed them twice per day, morning and late afternoon, and gave extra tree leaf fodder at mid-day. The total daily amount of feed provided for the two females was 3 kg of sweet potato, 2.5 kg of fresh green fodder, 700 g of banana, 500 g of papaya (Carica papaya), 300 g of rice bran or commercial swine pellets.

Observations at Babirusa Park
At least five observers collected the following information from 05:00 until 22:00: date, animal ID, individual interactions, responses to the coconut palm tree and any materials falling from the palm tree.

Experiments 1–4 at Bali Zoo
Test foods were obtained from a local coconut grove and provided to the babirusa. At the morning feed, the test foods were placed on the ground under the palm tree. The animal behaviours were video-recorded.

Experiment 1: Coconut leaves
Young yellowish and mature dark green leaflets, approximately 120 cm long by 6 cm wide, were prepared as test foods. Fifteen fresh leaflets were provided to each babirusa for two days. The recorded video was 2 min 53 sec long.

Experiment 2: Coconut flowers
The responses to coconut flowers were observed for three days. The test foods were 25–30 cm long coconut spikelets (branches of the inflorescence) bearing both staminate (male) flowers (4 by 9 mm) and carpellate (female) flowers (3 cm in diameter). The recorded video was 6 min 39 sec long.

Experiment 3: Whole coconut fruits
Sixty intact coconut fruits at various stages of growth, ranging from 50-g developing fruits to germinating fruits were prepared as the test food. Of these, 52 fresh surface coconuts weighed 978.8 g on average (SD = 793.6). An additional eight coconuts were fully mature with a dry outer surface and contained coconut water in the seed cavity (Fig. 2). The total number of experiment days was 31. An average of two coconuts per day was provided to the babirusas. The recorded video was 7 hr 7 min 22 sec long.

We analysed video data to determine the duration of the feeding behaviour and to examine the methods they used to open the coconut by means of their maxilla, mandible and forelimbs. In this study, ‘feeding behaviour’ was defined as a sequence of behaviours from the onset of the animal’s contact with the test foods until the termination of eating. Any periods of time spent in some form of interruption, such as carrying the test foods away to another place, was excluded from the
feeding duration. When the babirusa could not open the test food within 70 min from its provision, we judged this case as 'not eaten'. The correlation between the coconut weight and the feeding duration was evaluated by Pearson's correlation coefficient, and the result was noted in the APA style.

Experiment 4: Coconut endosperm, haustorium, young shoots and adventitious roots

Eleven mature and germinating coconuts were used in this experiment. The internal components of the coconuts, including the coconut kernel, embryo and haustorium (Figs. 1A and 2B) [20] were given simultaneously to the babiruses for seven days. The recorded video was 52 min 37 sec long.

RESULTS

Responses to growing coconut palm trees

The babiruses at Babirusa Park were always able to touch the coconut leaves throughout the two years starting in January 2005. However, we observed no remarkable signs of feeding on the leaflets, petioles or stems. The first flowering was observed in April 2006. The study site experienced a record storm at the end of 2006, so that coconut palms were damaged. However, all the coconut palm trees recovered, and grew to bear fruits normally.

Forty-three occasions of coconut plucking were recorded by three animals (Male 2, Male 3 and Female 3) during the three years following August 2006. The peak of this activity was in mid-2008 (Fig. 3). Each of the three animals stood on its hind limbs with its forelimb touching the palm tree stem and plucked a young coconut by holding it in its mouth before returning to a standing posture on all four legs to eat the fruit. For successful coconut plucking, the height of the coconut tree stem at the fruition level was under 150 cm. When the fruition level grew above 150 cm, the babiruses just looked up at the palm trees (Fig. 4). On 14 additional occasions, mainly in 2009, we observed them tackle fallen immature coconuts and eat the inside parts. The babiruses frequently competed for the same coconuts.

The babiruses also tended to walk around under the coconut palm to eat fallen flowers. In July 2007, two animals (Male 2 and Female 3) picked coconut flowers from the tree. Male
flowers, either fallen or on the inflorescence, were eaten on 15 occasions. However, no female flowers were consumed.

**Experiment 1**

We observed that the babirusas examined the palm leaves with their noses, but did not eat them.

**Experiment 2**

The babirusas chewed the coconut spikelets with their cheek teeth (Fig. 5) and spat out the fibrous material. The babirusas ate the male flowers on the spikelet using straight up and down movements (pitch rotation) of their mandibles. Alternatively, they ate fallen male flowers from the spikelet. The female flowers were ignored. Whenever a female flower entered the mouth, the babirusa spat it out.

**Experiment 3**

The babirusas exhibited different actions in relation to the coconut fruits, depending on their growth stage (Fig. 6). Immature fruits weighing less than 200 g were either ignored after being examined with the nose, or the babirusas spat them out. In contrast, the larger fruits were attractive to the babirusas. As shown in Figure 7, to support the coconut fruit, their maxillary incisors pushed down on the top of the coconut, while their mandibular incisors held the side of the coconut. When holding the fruit with both sets of incisors, the tips of their mandibular incisors penetrated the lateral surface of the fruit due to the pitch rotation of the mandible. If the coconut contained kernel, they always ate the kernel first, and then ate the still-soft endocarp and some of the mesocarp layer. They ate neither the seedlings nor the coconut water filling the seed cavity.

With increasing fruit weight (from 240 to 1700 g), the feeding duration increased (from 75 to 654 sec): and the two variables were strongly positively correlated, \( r (32) = .83, \ p < .001 \). Once the whole fruit weight exceeded 1700 g, their responses varied from successful eating to abandonment of the fruit. Twelve coconuts were judged as ‘not eaten’.

**Experiment 4**

When the babirusas were provided with germinating fruits that had been split in half, they preferred to eat the coconut kernel. The haustorium was the second choice. Young shoots and adventitious roots were never eaten. When an exposed kernel was given to the two animals, they competed for it. The winner would run around the enclosure holding the coconut kernel in its mouth, while the other chased it to get access to the pieces.

**DISCUSSION**

No responses to coconut young shoots

Behavioural records from Babirusa Park and Experiments 1,
Fig. 6  Responses of the Sulawesi babirusas to various growth stages of the whole coconut fruits. Symbols ○: Eaten, ●: Not eaten (ignored or spat out) and ◆: Not eaten (abandoned). It is known that the weight of coconut fruits begins to decrease when reaching maturity because of the natural dryness and consumption of the coconut water by the embryo. Therefore, data on the mature coconuts was plotted on the right side of the X axis, and includes an example of abandonment after 10 days. The Y axis is scaled logarithmically to cover a large range of values.

Fig. 7  An adult babirusa (Female 2) eating a whole young coconut fruit. Whole coconut size: 15 cm by 10 cm, 840 g. Babirusa holding the fruit with the maxillary and mandibular incisor teeth. Coconut water spouting out from the crack.

Fig. 8  Yaw rotation of the Sulawesi babirusa mandible during a yawn. A: An adult male babirusa. Surabaya Zoo. B: An adult female babirusa. Bali Zoo.

3 and 4 demonstrated whether the babirusa eats the shoots of young coconut trees [16]. With regard to the shoot itself, the answer is clearly ‘no’. However, there is a small possibility that germinating coconuts or newly planted seedlings may be disturbed by the babirusas foraging with their snouts. This can be attributed to a small amount of coconut kernel remaining in the seed cavity.

Potential reasons why Togian babirusas are often seen in coconut groves

Our findings in Experiment 2 suggest that the likely reasons for babirusa visits to coconut groves include the foraging for fallen coconut male flowers and coconut fruits. This supports a previous finding that Togian babirusas are frequently seen in coconut groves [12, 16]. In this study, we did not investigate
Coconut feeding of babirusa

Coconut feeding of babirusa environments, and its lifespan is shorter (70 years vs. 100 years). Therefore, the earlier-flowering ‘Dwarf’ type coconut was a better choice of plant for this study, which wished to observe coconut loss from direct harvesting by the babiruses. The coconut palms at Babirusa Park began flowering in April 2006. However, a heavy storm at the end of 2006 damaged the plants in the study area [18, 19]. Such an external factor seemed to diminish the reproductive function of the coconut palms in 2007 (Fig. 3).

An adult babirusa (Male 2) established a record height of 150 cm when tossing his snout while standing straight on his hind limbs in August 2009. Despite the almost monthly fruiting of the coconut palm, coconut plucking by the animals was not recorded after mid-2009 (Fig. 3). This was understood to be because the coconut fruits were now beyond the reach of the animals. In the neighbourhood of the study site, we recorded that the height of the first coconut fruit could be as low as approximately 85 cm above the ground. In some varieties of the ‘Dwarf’ coconut palm, the fruits are known to hang close to the ground. The babirusas have the opportunity to take immature coconut fruits from ground level to 150 cm in height, if they are of the ‘Dwarf’ type coconut palm. If the ‘Dwarf’ coconut palm is replaced with the distinctive ‘Tall’ varieties, in conformity with the actual situation in the Togian islands, how does the animal respond to the young ‘Tall’ type of coconut palm tree? In general, the coconut stem elongates 30–50 cm annually [26]. The ‘Dwarf’ type can flower in three years after germination under ideal conditions, whereas the ‘Tall’ type takes several years longer to begin to flower; usually at six to seven years of age [27]. Thus, the ‘Tall’ type of coconut bears its fruits at a higher level on the stem than the ‘Dwarf’ type, suggesting that the height of the first fruition in the ‘Tall’ type will be beyond the range the animals can reach. Clearly, the ‘Tall’ type of coconut palm is the better choice for the next replanting of a coconut grove. The installation of guard fences, 150 cm in height, is also highly recommended.

Food preference of the babiruses

Judging from the food consumption order in Experiment 3 and the food competition between the two animals in Experiment 4, the coconut kernel with its high fat content is the most palatable part of the internal component of the coconut fruit. The second most palatable is the haustorium, that is the spongy tissue with the function of absorbing the
water and nutrients of the kernel to transport them to the growing embryo [20] (Fig. 2). Therefore, it is quite natural that the babirusas were attracted to this part.

**Young coconut cracking**

Babirusa jaws and teeth are strong enough to crack very hard nuts [5, 28]. Examples include canarium (*Canarium indicum*), stone oak (*Lithocarpus*) and chestnut (*chinquapins; Castanopsis*) fruits [7]. Unlike such nuts, coconut fruits store a large quantity of coconut water and grow large and nearly round, which makes it difficult for the babirusas to crack the fruit.

One possible explanation for the variations in the duration of the feeding behaviour with large but still young coconuts (Fig. 6) is the difference in ground condition and surrounding structure. In successful cases with large coconuts, the cracking behaviour was exhibited in typical places, such as adjacent to a fence or the root of a large tree, in the corner of a concrete wall, in a small depression or in a deposit of gravel. Perhaps such conditions gave the coconut greater stability on the ground by supporting it at many contact points in addition to the fundamental points held by the maxillary and mandibular incisor teeth.

**Impact of free-fall from the top of palm trees**

It should be noted that cracks are easily generated on immature coconut fruits because of the impact of freefall from the top of palm trees. Other than the coconut harvest by farmers, opportunities for falling fruit include strong breezes and the activities of wild animals, such as the Tonkean macaque (*Macaca tonkeana*) and rodents on the Malenge Island in the Togian Archipelago (Ito M, personal observation).

In a complementary trial at Bali Zoo, we confirmed that the freefall of young coconut fruits of 1.0 kg from only 3 m above the ground, equivalent to the height of the babirusa enclosure fence, caused a crack in the fruit surface. Thereafter, the babirusas would split open such young fallen coconuts without spending as much time or occlusal force as when a similar but intact test food was placed on the ground in Experiment 3. In addition, from afar, it is not easy to distinguish whether the coconut fruit has a crack or whether the fruit on the ground is a mature fruit with a kernel. For this reason, if a local farmer who has established beliefs regarding the pig species sees a babirusa eating a fallen coconut fruit with a hidden crack, the farmer may fail to recognise the actual occlusal force of the babirusa, and instead feel excessive fear and aversion towards the wild pigs. Interpretations of their feeding behaviour as observed in the wild need to be made with caution in future studies.

**Possible opportunity for Togian babirusas to eat coconuts**

Figure 6 suggests that successful coconut feeding may be explained from a cost-benefit perspective. It is possible that wild babirusas do not spend much time and energy eating the mature coconuts that provide the raw materials for copra. We speculate that in the wild they are able to take the coconut kernels efficiently. Perhaps they delay until they sense the copra harvesting by using their keen auditory and olfactory senses. On the first working day, Togian babirusas may recognise a copra production site by hearing the farmers cracking the coconut shells and by smelling the coconut kernels. They would then visit the site at night to forage [17]. In doing this, they would easily find bite-size pieces of broken coconut kernels and the haustorium (Fig. 1), neither of which have any further economic value for the copra producer. This means that the babirusa consume only a tiny proportion of the potential coconut harvest in traditional copra production. Its visits to the coconut grove would, therefore, be within a permissible range for the farmers, with the conclusion that the babirusas do not constitute vermin for the copra producers. Rather, the animal may play an important role in clearing up the coconut grove at night, eating the pieces of broken coconut that lie scattered around. It could be that the animal makes a valuable contribution to the material cycle of the coconut grove ecosystem.

**ACKNOWLEDGEMENTS**

The authors are grateful to all the staff of the preliminary field researches on Togian islands for their cooperative works, and also the staff of Babirusa Park and Bali Zoo for their assistance. This study was conducted under research permits: No.7527/SU/KS/2004 and No.4191/SU/KS/2007 issued by Indonesian Institute of Sciences, and No.1692/FRP/SM/VII/2008 and No.0166/FRP/SM/VII/2009 issued by Indonesian Ministry of Research and Technology. Our project was financially supported by Babirusa Foundation Tokyo. Additional support was provided by the Balloch Trust, Scotland.
REFERENCES

1. Leus K, Macdonald A, Burton J, Rejeki I. 2016. *Babyrousa celebensis*. The IUCN Red List of Threatened Species 2016: e.T136446A44142964. http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T136446A44142964.en. Downloaded on 26 January 2019.

2. Macdonald A, Leus K, Masaaki I, Burton J. 2016. *Babyrousa togeanensis*. The IUCN Red List of Threatened Species 2016: e.T136472A44143172. http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T136472A44143172.en. Downloaded on 26 January 2019.

3. Macdonald AA, Pattikawa MJ. 2017. Babirusa and other pigs on Buru Island, Maluku, Indonesia – new findings. *Suiform Sound* 16: 5-18.

4. Macdonald AA. 2017. Chapter 6. Sulawesi Babirusa *Babyrousa celebensis* (Deninger, 1909). In *Ecology, Conservation and Management of Wild Pigs and Peccaries* (Melletti M, Meijaard E eds.), pp. 59-69. Cambridge University Press, Cambridge.

5. Macdonald AA. 1993. The Babirusa (*Babyrousa babyrussa*). In *Pigs, Peccaries, and Hippos: Status Survey and Conservation Action Plan* (Oliver WLR ed.), pp. 161-171. IUCN, Gland.

6. Leus YKG. 1994. Foraging behaviour, food selection and diet digestion of *Babyrousa babyrussa* (Suidae, Mammalia). PhD thesis, The University of Edinburgh, Edinburgh.

7. Leus K. 1996. The habitat and diet of the Sulawesi babirusa (*Babyrousa babyrussa celebensis*). In *Population and Habitat Viability Assessment for the Babirusa* (*Babyrousa babyrussa*), (Manansang J, Macdonald AA, Siswomartono D, Miller P, Seal U. eds.), pp.121-143. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley.

8. Leus K, Morgan CA, Dierenfeld ES. 2001. Nutrition. In *Babirusa (Babyrousa babyrussa)* Husbandry Manual (Fischer M. ed.), pp. 11-28. St. Louis Zoo, St. Louis, MO: American Association of Zoos and Aquariums, Silver Spring.

9. Tijiu B, Macdonald AA. 2016. Babirusa (*Babyrousa babyrussa*) on Buru island. *Suiform Sound* 15: 20-26.

10. Macdonald AA, Kailuhu V, Pattikawa MJ. 2018. Babirusa (*Babyrousa spp.*) on Buru and the Sula Islands, Maluku, Indonesia. *Suiform Sound* 17: 22-36.

11. Ito M, Nakata H, Jaga IM, Balik IW. 2005. Status of Togean babirusa (*Babyrousa babyrussa togeanensis*) on Malenge Island, Central Sulawesi. In *Kumpulan Makalah Seminar Sehari Peduli Anoa dan Babirusa Indonesia* (Sugiri N, Mustari AH, Suwelo IS, Djuwita I. eds.), pp. 71-77. IPB, Departemen Kehutanan, LIPI and Pusat Informasi Lingkungan Hidup Indonesia, Bogor.

12. Akbar S, Indrawan M, Yasin MP, Burton J, Ivan J. 2007. Status and conservation of *Babyrousa babyrussa* in the Togean Islands, based on direct observations and questionnaire surveys (intermittently, 1990–2001). *Suiform Sound* 7: 16–25.

13. Ito M, Balik IW, Setiawan L. 2008. Needs of educational activity for conservation of Togean babirusa in Togean Archipelago, Central Sulawesi. In *Proceedings Joint meeting of the 3rd International Meeting on Asian Zoo/ Wildlife Medicine and Conservation & 10th National Veterinary Scientific Conference of Indonesian Veterinary Medical Association*, pp. 234–236, Bogor.

14. Selmon Y. 1983. Bestandsgröße und Verhalten des Hirschebers (*Babyrousa babyrussa*) auf den Togian Inseln. *Bongo* 7: 51-64.

15. Whitten T, Henderson GS, Mustafa M. 2002. *The Ecology of Sulawesi*, pp. 404-415. Periplus Editions, Hong Kong.

16. Meijaard E, d’Huart JP, Oliver WLR. 2011. Family Suidae (pigs). In *Handbook of the Mammals of the World. Volume 2: Hoofed Mammals* (Wilson DE, Mittermeier RA eds.), pp. 248–291, Lynx Edicions, Barcelona.

17. Ito M, Melletti M. 2017. Chapter 8. Togian Babirusa *Babyrousa togeanensis* (Sody, 1949). In *Ecology, Conservation and Management of Wild Pigs and Peccaries* (Melletti M, Meijaard E eds.), pp. 76-84. Cambridge University Press, Cambridge.

18. Ito M, Macdonald AA, Leus K, Balik IW, Arimbawa IWGB. 2019. Nest building behaviour of Sulawesi babirusa (*Babyrousa celebensis*). *Jpn J Zoo Wildl Med* 24: 9-20.

19. Ito M, Macdonald AA, Leus K, Balik IW. Arimbawa IWGB. 2019. Effects of meteorological factors on the expression of nesting behaviour in the Sulawesi babirusa (*Babyrousa celebensis*). *Jpn J Zoo Wildl Med* 24: 73-84.

20. Sugimuma Y, Murakami T. 1990. Structure and function of the haustorium in germinating coconut palm seed. *JARQ: Jpn Agric Res Quart* 24: 1-14.

21. Kitchener DJ, Boeadi, Charlton L, Maharadatunkamsi. 1990. *Wild mammals of Lombok Island: Nusa Tenggara, Indonesia: systematics and natural history*, pp. 82-83. Western Australian Museum, Perth.
バビルサ（Babyrousa spp.）のココヤシ採食行動

伊東政明 1) *, Alastair A. MACDONALD 2, 3) , Kristin LEUS 4) , I Wayan BALIK 5) , I Wayan Gede Bandem ARIMBAWA 5, 6) , 長谷川大和 7) , I Dewa Gede Agung ATMAJA 8)

1) Babirusa Foundation Tokyo 〒 178-0063  東京都練馬区東大泉 7-18
2) Royal (Dick) School of Veterinary Studies, The University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, Scotland
3) Royal Zoological Society of Scotland, Edinburgh, EH12 6TS, Scotland
4) Copenhagen Zoo, Roskildevej 38, PO Box 7, 2000 Frederiksberg, Denmark
5) Babirusa Foundation Bali, Br Tengah, Lodtunduh, Ubud, Bali 80571, Indonesia
6) Faculty of Medicine and Health Sciences, Udayana University, Sudirman Campus, Denpasar, Bali 80232, Indonesia
7) 東京工業大学附属科学技術高等学校  〒 108-0023 東京都港区芝浦 3-3-6
8) Bali Zoo, Singapadu, Sukawati, Bali 80582, Indonesia

【2019年10月12日受領，2020年4月26日採択】

要 約

生育初期のココヤシ（Cocos nucifera）農園を模して造成された飼育施設でスラウェシバビルサ（Babyrousa celebensis）の採食行動を調査したところ、思いがけずココヤシ花の採食やココヤシ未熟果の採取行動が記録された。さらにココヤシの幾つかの部位を用いて給餌実験を行い、次のような所見を得た。1) バビルサはココヤシの芽生えや葉を採食せず、2) 雌花よりも雄花を好んで採食する。3) 未熟果を歯で割ることができるが、成熟果を割ることができない。4) 未熟果を採食する際、上下の切歯で果実を囲んで抑え込み、下顎切歯を果実の壁に突き刺して割り開く。5) 嗜好性の高い部位は、成熟果の胚乳と吸器（haustorium）である。この実験でバビルサが採食したココヤシの部位は、コプラを製造する際にココヤシ農園に散乱する胚乳や吸器の欠片と一致していた。その欠片はココヤシ農園主にとって経済的価値はなく、ココヤシ農園に立ち入るバビルサを害獣とみなす十分な証拠は得られなかった。

キーワード：ココヤシ、採食行動、切歯、バビルサ、人間 - 野生動物関係

* 責任著者：伊東政明（E-mail: masa_partner@hotmail.com）