



## On the genus *Babyrousa*: biology, ecology, conservation

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**Abstract.** The babirusas, also called deer-pigs, are a genus, *Babyrousa*, in the swine family found in Eastern Indonesian, on the island of Sulawesi, Togian Islands, Buru, and the Sula Islands of Sehu, Taliabu and Mangole. The notable archaic look of these animals is mainly owing to the prominent upwards incurving canine tusks of the males, which actually pierce the flesh in the snout. Our work is a collection of general information about species of the genus *Babyrousa*. It includes information on their biology, taxonomy, conservation, ecology and the babirusa's relationship with humans.

**Key Words:** *Babyrousa celebensis*, *Babyrousa togeanensis*, *Babyrousa babyrussa*.

**Introduction.** Among the oddities of the animal world, we also have members of the swine group. The babirusas, also called deer-pigs (in Indonesian language: babi rusa, Skeat 1901), are a genus, *Babyrousa*, in the swine family found in Eastern Indonesian, on the island of Sulawesi (Macdonald 2018), Togian Islands (Ito & Melleti 2018), Buru (Macdonald & Pattikawa 2017) and the Sula Islands of Sehu, Taliabu and Mangole (Grubb 2005; Macdonald et al 2018). The notable archaic look of these animals is mainly owing to the prominent upwards incurving canine tusks of the males, which actually pierce the flesh in the snout (Animal Diversity Web 2015).

Our work is a collection of general information about species of the genus *Babyrousa*.

**Taxonomy.** The genus is monotypic within the subfamily Babyrousinae, or alternatively considered to form a tribe, Babyrousini, of the subfamily Suinae (wikipedia.org). So far, only one fossil skull has been found to suggest a larger ancestor (Metcalf 2001).

Within these ungulates, taxonomy has undergone some changes due to the dominant trend of splitter taxonomists. All members of the genus were considered part of a single species until 2002, the babirusa, *Babyrousa babyrussa*, but later the genus was split into several species (wikipedia.org). This scientific name, *B. babyrussa*, is now restricted to the Moluccan babirusa, whereas the best-known species, the Sulawesi babirusa, is named *B. celebensis* (Meijaard & Groves 2002). The split, which uses the phylogenetic species concept (see a general view of the concept in Nixon & Wheeler 1990), is based on differences in size, amount of hair on body and tail-tuft, and measurements of the skull and teeth (Meijaard & Groves 2002). The maxillary and mandibular dentition are somewhat relevant in taxonomy, but the cheek teeth and their wear cannot in all cases be used to determine the age of the animal, but rather to identify the type of food frequently consumed (Macdonald 2019) (Figures 1-2).

In a classification consistent with current taxonomy (Ito et al 2019), the genus *Babyrousa* comprises three living species: Sulawesi babirusa – *Babyrousa celebensis*

(Deninger 1909) (Figure 3), Togian babirusa – *Babyrousa togeanensis* (Sody 1949) (Figure 4), and Moluccan babirusa – *Babyrousa babyrussa* (Linnaeus 1758) (Figure 5).

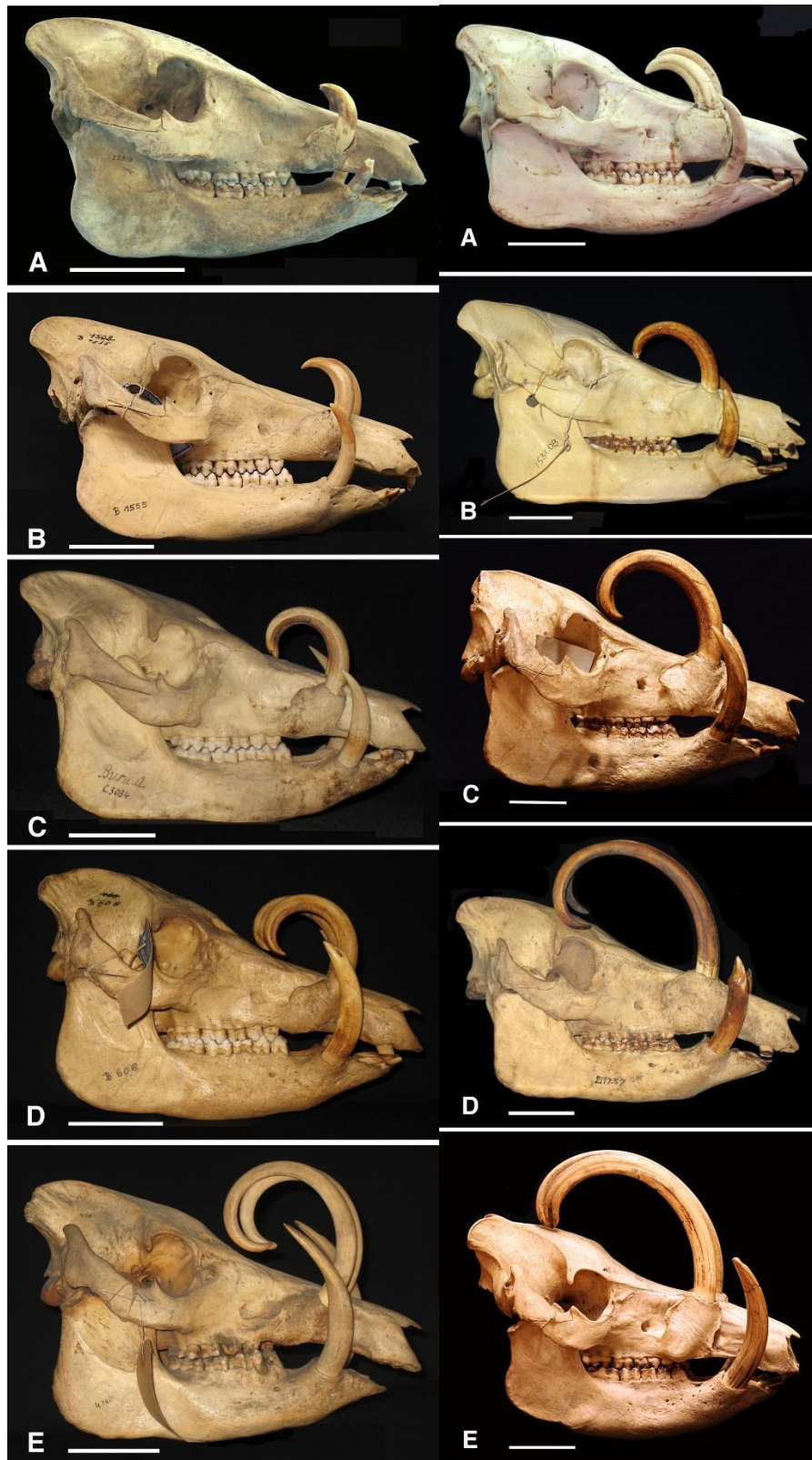


Figure 1. Skulls of *Babyrousa babyrussa* (left) and *Babyrousa celebensis* (right) by age classes (A-E) (Macdonald 2019).

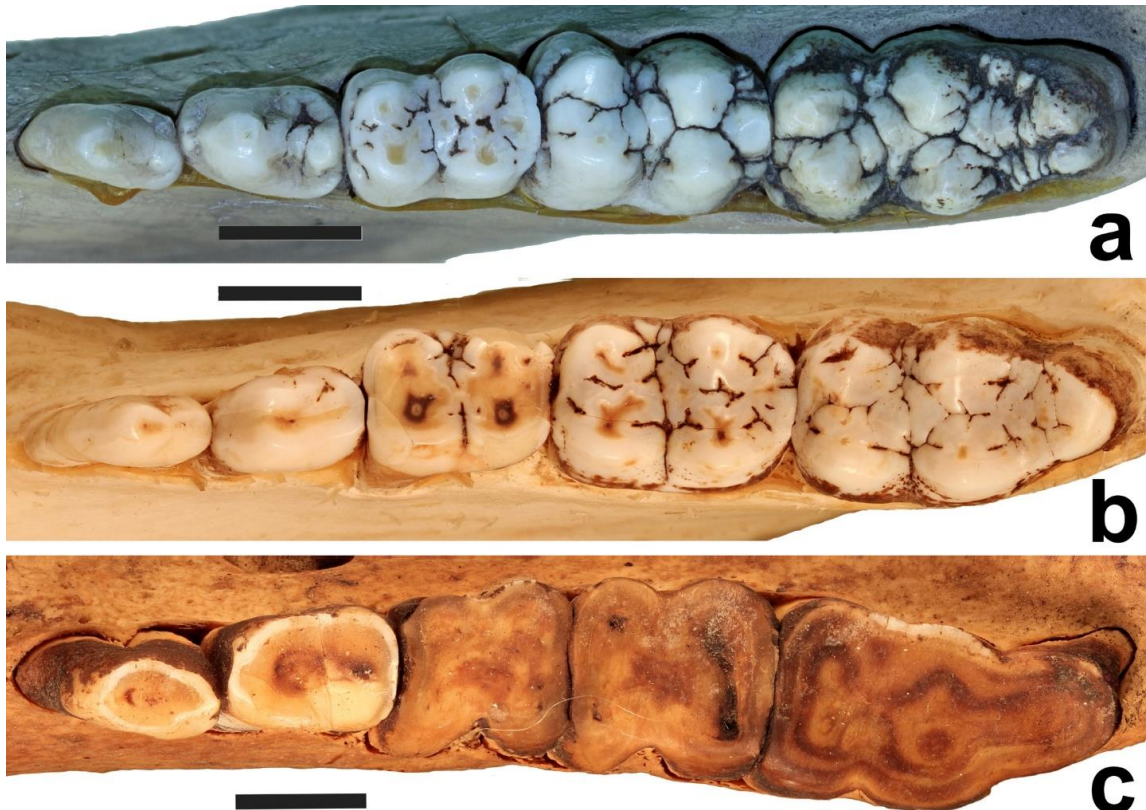


Figure 2. Cheek tooth wear patterns of babirusa at different ages (A-C): (a) the right mandible from Buru illustrating maxillary canine tooth age (A); (b) the right mandible from Sulawesi illustrating maxillary canine tooth age (B); (c) the right mandible from Sulawesi illustrating maxillary canine tooth age (C) (scale = 10 mm) (Macdonald et al 2019).



Figure 3. Sulawesi babirusa – *Babyrousa celebensis* (Deninger 1909) (photo: Masteraah at German Wikipedia).



Figure 4. Togian babirusa – *Babyrousa togeanensis* (Sody 1949) (photo: Mangkau Zulkifli, wikipedia.org).



Figure 5. Moluccan babirusa – *Babyrousa babyrussa* (Linnaeus 1758) (photo by Suzanne Phillips).

**Conservation and relation with humans.** All extant species of babirusa are listed as threatened (endangered or vulnerable) by the International Union for Conservation of Nature (IUCN 2010). Babirusas are protected in Indonesia and killing them is interdicted in most cases. However, poaching remains a serious threat to the babirusa (wikipedia.org). Moreover, commercial logging operations threaten the babirusa by habitat loss, and also reduce its spread, making the babirusa more susceptible to poaching (wikipedia.org; Rosyidy & Wibowo 2020).

The future of these species of mammals does not look too bright. The babirusa never lived in large numbers, because the habitat was limited to only a few islands. But today they are definitely threatened with extinction. Even though the babirusa does not damage farmland or bother farmers, it is a favorite target of poachers. The few patches of forest they inhabit are rapidly disappearing due to deforestation. Currently, it is estimated that there are still around 4,000 individuals of the genus *Babirusa* (zooland.ro).

In the past, specimens of the babirusa were owned by the rulers of Sulawesi and given as gifts to high-ranking guests. Masks representing the demons of these islands were modeled after the face of a babirusa (zooland.ro).

The Balinese Hindu-era Court of Justice pavilion and the "floating pavilion" of Klungkung palace ruins are well known for painted babirusas raksasa (grotesques) on the ceilings (Albarella et al 2007).

Prehistoric paintings of babirusas discovered in caves on the island of Sulawesi (Indonesia) have been dated back at least 35,400 years (to the ice age Pleistocene epoch) (wikipedia.org). Adam Brumm, one of the researchers who investigated the paintings, said that "The paintings of the wild animals are most fascinating because it is clear they were of particular interest to the artists themselves" (wikipedia.org).

The babirusa has sparked dispute among Jewish and/or Muslim scientists and animal researchers about whether it is considered kosher/halal or, in other words, allowable to be eaten by Jews/Muslims, as stated by Jewish/Muslim culinary and cultural laws.

As concerns the Jews, the debate centers around whether the animal chews its cud, which is a condition according to the Old Testament for an animal to be considered kosher. Several specialists, such as J. David Bleich, which is a professor of Jewish legislation and ethics at Yeshiva University, say that the babirusa doesn't meet the physical conditions to be accepted as kosher, pretending that the babirusa does not chew its cud. J. David Bleich cites a research article published in 1940 that found that true rumination couldn't take place in the babirusa's stomach (wikipedia.org). However, the expert also mentions the fact that Jews can consume any food that is not explicitly forbidden and that "the babirusa's resemblance to a pig in appearance and taste is not sufficient grounds for banning its consumption as kosher meat" (wikipedia.org). Other experts, like Fuller Blazer, an animal husbandry professor at Florida University, consider that the animal is kosher because it has cloven hoof and chews its cud (wikipedia.org). However, the discussion is far from being clarified. It has been noted that babirusas are endangered taxa and that most Muslims, who face similar dietary limitations, would avoid eating the meat of any animal whose status in religious/cultural law is debatable (Dart 1985; wikipedia.org).

**Description, biology, ecology.** Although the Babirus are present on both Sulawesi and Sula islands, they are not found on the large islands between them, i.e. the Banggai Archipelago. Specialists believe that the unexpected distribution of babirusa is due to the spread of babirusa by humans in the form of gifts given by native royalty (Albarella et al 2007).

In size, the babirusa is smaller than domestic pigs. They have a length that varies between 85 and 110 cm, and the height at the shoulder is between 65 and 80 cm. The tail measures between 20 and 30 cm and is not twisted, as in domestic pigs. The weight of the babirusa is between 40 and 100 kg (zooland.ro).

These curled-tusked pig species have rounded, almost hairless bodies and wrinkled skin. The skin is gray or brown in color and has lighter shades on the belly. The limbs of the body are slender and longer than those of domestic pigs. The adult babirusa has strongly folded skin on the neck and belly (zooland.ro).

All species of babirusa reach sexual maturity at the age of 1-2 years (zooland.ro). The menstrual cycle in these species lasts between 28 and 42 days, and estrus lasts 2-3 days (Macdonald 1993). After mating, the gestation period lasts about 150-157 days (zooland.ro; Krueger et al 2019). Females give birth to 1-3 piglets, unlike other pigs that give birth to up to nine piglets. When nursing, the female lies down. Although piglets

begin to feed themselves at around one week of age, they are generally not weaned until they reach the age of 6-8 months (zooland.ro). The lifespan of the babirusa in captivity is about 24 years, but in the wild they do not live more than 10-12 years (zooland.ro), due to competition, habitat reduction, predation and parasitism.

The specific habitat of the babirusa is the tropical forest, along the banks of the rivers (Macdonald 1993). It appears that they have been confined to the higher grounds in the interior despite occurring in lowland areas near coasts in the past (Macdonald 1993). They are also active during the daytime (wikipedia.org). Like all pig species, babirusa have an omnivorous diet with an intestinal tract similar to that of the domestic pig (Langer 1988). The stomach diverticulum of a babirusa is enlarged which may indicate that it is a ruminant but evidence shows otherwise (Macdonald 1993). Because it does not have a rostral bone in the nose, a babirusa does not dig with its snout like other pigs do except in mud and swampy grounds (wikipedia.org). The diet of the babirusa includes leaves, roots, fruits and animal material. Apparently, the strong jaws of a babirusa are capable of easily cracking hard nuts (Ito et al 2021; Macdonald 1993; Macdonald 2019).

Males are solitary and females live in small family groups consisting of mothers and their young (Patry et al 1995). These groups can number up to 84 individuals and almost never include any adult males. Males spend time alone and very rarely form groups of 2-3 adult individuals (Patry et al 1995). Juveniles predominate in family groups and very rarely include more than 3 adult females (Patry et al 1995). The developed tusks appear only in males and are used in fighting with other males of the same species. The upper tusks are used for defense, while the lower tusks are for attack (MacKinnon 1981). If a male babirusa does not grind his tusks (achievable through regular activity), they can eventually keep growing so as to penetrate the individual's own skull (wikipedia.org) (Figure 2).

Babirusa is a diurnal animal and tends to feed mainly in the morning. It feeds on fruits, nuts, mangoes, mushrooms, leaves and insects found in rotting wood (Ito et al 2020; zooland.ro). Unlike other pig species, the babirusa does not dig in the ground with its snout to procure its food, but digs with the help of its hooves (zooland.ro). The sense of smell is very well developed in this animal. Babirusa is a good runner and swimmer. This animal has been observed swimming to nearby islands. It is the fastest animal in the pig family and can reach the speed of a deer (zooland.ro). The Babirusa grunts and moans, and when irritated it chatters its teeth. Like other pigs, they like to bathe in mud, and on this occasion they also get rid of parasites (zooland.ro).

**Conflict of interest.** The authors declare no conflict of interest.

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