

Phylogenetic relationships of the vulnerable wild cattle, Malayan gaur (*Bos gaurus hubbacki*), and its hybrid, the selembu, based on maternal markers

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Abstract: The gaur (*Bos gaurus*) is one of the two extant wild cattle species that can be found in several Asian countries. This species is threatened by extinction due to declining wild populations. Selembu is the name of the Malayan gaur × domestic cattle hybrid. We planned this study to determine the position of the Malayan gaur and its hybrid, the selembu, in the phylogenetics of the genus *Bos* (*Bos gaurus*, *Bos javanicus*, *Bos indicus*, and *Bos taurus*). The mitochondrial 12S rRNA gene and the control region (D-loop) were sequenced in 29 *Bos* samples. Sequences from one water buffalo (*Bubalus*) were used as an outgroup. Phylogenetic trees were reconstructed using neighbor-joining and maximum parsimony in PAUP 4.0b10 and Bayesian inference in MrBayes 3.1. All tree topologies indicated that the Malayan gaur belongs to its own monophyletic clade that is distinct from other species of the genus *Bos*. Selembu samples were grouped in zebu and/or taurine cattle clades. The results also indicated that there are significant embranchment differences in the tree topologies between wild (Malayan gaur and banteng/Bali cattle) and domestic (taurine cattle, zebu cattle, and selembu) cattle. The results showed the complete maternal inheritance situation among the studied samples of all cattle species.

Key words: *Bos gaurus hubbacki*, gaur, seladang, selembu, wild cattle, hybrid

1. Introduction

Cattle species in the genus *Bos* can be subdivided into wild and domestic types. Wild cattle comprise *Bos gaurus* (gaur) and *Bos javanicus* (banteng), while domestic cattle comprise *Bos indicus* (zebu cattle) and *Bos taurus* (taurine cattle) (Syed-Shabthar et al., 2013). In Malaysia, all four species can be found throughout the Malay Peninsula and Borneo. Wild Malayan gaurs (*Bos gaurus hubbacki*) can only be found in Peninsular Malaysia and wild banteng (*Bos javanicus lowi*) can only be found in Sabah, a part of Borneo (Medway, 1983; Wilson and Reeder, 2005). Both species of domestic cattle can be found in the Malay Peninsula and Borneo. The selembu is a hybrid cattle bred in Malaysia by crossbreeding wild Malayan gaur with domestic cattle (zebu and/or taurine) (Mamat-Hamidi et al., 2009). In other countries, gaur has been domesticated and produces fertile offspring called gayal (*Bos frontalis*). The Bali cattle is a domestic form of wild banteng originally bred on Bali Island, Indonesia (Mohamad et al., 2012).

Three subspecies of gaurs are generally recognized: *Bos gaurus gaurus*, found in India, southern Nepal, and Bhutan; *Bos gaurus laosiensis*, distributed in Myanmar, Laos, Vietnam, Thailand, and Cambodia; and *Bos gaurus hubbacki*, which exists only in Peninsular Malaysia and southern Thailand (Duckworth et al., 2008). The Malayan gaur, locally known as 'seladang', can be found in several states, including Pahang, Kelantan, Kedah, Perak, and Terengganu (Yusof, 1981). According to Sahir (2001), there are about 500 remaining individuals in Malaysia. Wild populations of gaur have declined significantly in this country (Conry, 1989). It has been declared as a "Totally Protected" animal under Wildlife Protection Act 76/72, Schedule I (Wild Animals) by the Malaysian government. Since 1982, in situ conservation efforts for the Malayan gaur by the Department of Wildlife and National Parks have included steps to prevent its extinction in response to the growing concern that survival in the wild may be threatened by severe habitat reduction (Sahir, 2001).

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