Leiolepis (Squamata: Agamidae) farming in southern Vietnam and a new size record in butterfly lizards

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ORIENTAL Asia is famous for its traditional use and consumption of reptiles and amphibians. Besides hunting reptiles and amphibians from the wild as a food resource for millennia, farming of big reptiles for food production increased markedly in the last few years.

In southeast Asia, especially in Thailand and Cambodia, crocodylians (Siamese crocodile *Crocodylus siamensis*; hybrids of *C. siamensis* and the saltwater crocodile *Crocodylus porosus*) are commercially reared for skin and meat production (Magino et al., 2009). To cover the immense food demand of the kept crocodiles in Cambodia millions of homalopsine water snakes are harvested and used as crocodile fodder every year (Handschuh & Müller, 2008).

The second major group of farmed reptiles in southeast Asia is snakes. Farming of snakes is intended for different purposes such as antivenom, skin, meat and snake wine production (Somaweera & Somaweera, 2010). Several hundred snake farms reported from China are producing more than 400,000 specimens of three commonly traded species (*Deinagkistrodon acutus*, *Bungarus multicinctus* and *Ptyas dhumnades*) (Guo et al., 1996). Nguyen & Nguyen (2008) reported on commercial snake farming in Vietnam. The authors indicated that more than 100 tons of snakes (primarily *Naja naja*) were produced annually.

Several terrapin and turtle species are commercially reared for their meat, but most important is the Chinese soft-shelled terrapin (*Pelodiscus sinensis*) which is cultivated throughout Southeast Asia (Silpachai, 2001).

So far trade of butterfly lizards as food-items has been reported from Thailand (Pianka & Vitt, 2003) and from Vietnam (Ziegler, 1999; Grismer & Grismer, 2010), whereas farming of lizards has only been reported from Central and South America. Large iguanid lizards (green iguana *Iguana iguana* and the black iguana *Ctenosaura similis*) are farmed for producing meat for human consumption throughout Central and South America (Eilers et al., 2002). Besides iguanid lizards, farming of large teiid lizards is reported from Argentina where omnivorous tegus (*Tupinambis* spp.) are reared for their skins and meat (NRC, 1991). Herein we present the first documentation of commercial farming of agamid *Leiolepis* spp. lizards for meat production.

Leiolepis Farms in Southern Vietnam

In spring 2009 Peter Geissler conducted an excursion along coastal dune habitats of Binh Thuan Province east of Ho Chi Minh City. These areas reach inland for several kilometres and are covered with a unique dry forest vegetation community adapted to dry and windy conditions (Sterling et al., 2006). Moreover, this area inhabits specialized open-habitat herpetofauna, of which the spotted butterfly lizard (*Leiolepis guttata*) is a prominent member. These diurnal, terrestrial agamid lizards are sand-dwelling and live in burrows (Weitkus, 1999).

Besides observing several *L. guttata* in the wild (front cover), many were also seen in enclosures in small coastal villages where they are farmed. The roofless enclosures (Fig. 1) measure up to half a hectare and are surrounded by a fence made out of corrugated metal sheets that are dug deeply or placed on top of a solid brick fundament. The bleak sandy ground is sporadically planted with cashew trees (*Anacardium occidentale*). The stocking density of lizards in these areas seems to be very high. Up to 40 burrow entrances were counted.

The lizards were fed on a diet of pumpkin

Figure 1. Enclosure at a *Leiolepis* farm near Mui, Ne, Binh Thuan Province, southern Vietnam. Photograph by P. Geissler.

Figure 2. Largest known specimen of *Leiolepis* held by a Bonn student. Photograph by P. Geissler.

slices and green vegetables. Due to the pumpkins' rich content the animals looked very well fed and were surprisingly large.

When for sale the animals are caught in rat traps and sold alive to local restaurants or to middlemen who sell them at local markets all over the area, and even at markets in neighbouring provinces. Local people usually consume the muscular tail. With 300.000 Vietnamese Dong (approximately £9.50)/kg the price of living *Leiolepis* is astonishingly high.

We could not be certain if these traded lizards were bred at the farms or if they were wild caught animals that were fattened at farms. If they are taken from the wild, the trade will consequently have a strong negative impact on populations in the area.

Identification and Size of Farmed Specimens

The biggest farm animal seen (Fig. 2), now stored in the Institute of Ecology and Biological Resources in Hanoi (IEBR A.2010.1920) has an impressive length of 73 cm (SVL: 25 cm). Previously biggest known butterfly lizard was documented by Peters (1971), and had a total length of 55.3 cm (SVL: 18.4 cm; TL: 36.9 cm). This specimen of *L. guttata* was collected in 1936 in Vietnam (without an exact locality) and deposited in the collection of the American Museum of Natural History, New York (AMNH 99295).

Due to the well known heterosis effects in farmed crocodile-hybrids and the occurrence of triploid, parthenogenetic forms of *Leiolepis* (that developed via hybridization) we carefully checked the species of the farmed animals as *L. guttata* to avoid overlooking evidence of hybridization that could create erroneous identification. All the farmed butterfly lizards matched the diagnosis of *L. guttata*. Firstly, the unique colour pattern of alternating black and white transverse bars on the flanks in males identified the farmed animals as *L. guttata*. Also, the presence of more than 16 rows of enlarged scales on each ventral side of the tibia, midway between ankle and the knee, is only known in *L. guttata* (Peters, 1971; Darevsky & Kupriyanova 1993; Schmitz et al., 2001; Grismer & Grismer, 2010). The occurrence of male specimens among the groups at the farm is further evidence against hybridization because all proven cases of hybridization are known only from parthenogenetic lineages.

In conclusion, no indications of hybridisation were found, so perhaps intensive feeding may be responsible for the new size record for *Leiolepis guttata*.

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