

Indotestudo travancorica (Boulenger 1907) – Travancore Tortoise

V. DEEPAK¹, MADHURI RAMESH², S. BHUPATHY³, AND KARTHIKEYAN VASUDEVAN¹

¹Wildlife Institute of India, P.O. Box 18, Dehradun 248001 India [deepaksalea@gmail.com, karthik@wii.gov.in];

²Ashoka Trust for Research in Ecology and the Environment, Royal Enclave, Srirampura,
Jakkur Post, Bangalore 560064, India [madhurir@hotmail.com];

³Sálim Ali Centre for Ornithology and Natural History, Anaikatty P.O.,
Coimbatore 641108 India [bhupathy.s@gmail.com]

SUMMARY. – The Travancore Tortoise, *Indotestudo travancorica* (Family Testudinidae) is a medium-sized tortoise (straight carapace length [SCL] up to 331 mm) endemic to the mountain ranges of the Western Ghats in southwestern India. The taxonomy of the genus *Indotestudo* has recently been revised, and *I. travancorica* is considered a distinct species. It is found in semi-evergreen, evergreen, moist deciduous, and bamboo forests, as well as in rubber and teak plantations, occurring mostly near streams and marshes, with a home range of 5.2–34 ha. Travancore Tortoises are omnivorous; their diet encompasses grasses to mollusks and they occasionally scavenge on dead animals. They breed from November to March in captivity, have a clutch size of 1–5 eggs, and hatchlings measure 55–60 mm SCL. The major threats to this species are hunting and habitat loss. Conservation measures should focus on protection, identification of crucial tortoise habitats, and increasing awareness among local communities.

DISTRIBUTION. – India. Endemic to the Western Ghats, across the states of Kerala, Karnataka, and Tamil Nadu of southwestern India.

SYNONYMY. – *Testudo travancorica* Boulenger 1907, *Testudo (Indotestudo) travancorica*, *Geochelone travancorica*, *Geochelone (Indotestudo) travancorica*, *Indotestudo travancorica*.

SUBSPECIES. – None recognized.

STATUS. – IUCN 2011 Red List: Vulnerable (VU A1cd) (assessed 2000); CITES: Appendix II, as Testudinidae spp.; Indian Wildlife (Protection) Act (1972): Schedule IV.

Taxonomy. – *Indotestudo travancorica* was first described by Boulenger (1907) as *Testudo travancorica* based on specimens collected by Ferguson, who believed it to be common in the Travancore hills of Kerala, southwestern

India. Boulenger noted that it bore resemblance to both *Testudo elongata*, from the northern and eastern parts of the Indian subcontinent, and *T. forsteni* [sic] from Celebes (now Sulawesi, Indonesia) and the neighboring Gilolo Is-



Figure 1. Female *Indotestudo travancorica* from the Anamalai hills, southern Western Ghats, India. Photo by V. Deepak.



Figure 2. Ventral view of an adult female *Indotestudo travancorica*. Photo by V. Deepak.

land (now Halmahera, Maluku, Indonesia). Smith (1931) also considered *T. travancorica* as very closely allied to *T. elongata*. Lindholm (1929) first recognized *T. elongata* as a distinct species and assigned it to the subgenus *Indotestudo* (under *Testudo*) (Fritz and Havas 2007). While Lindholm did not mention the placement of the other two valid names, Williams (1952) included *travancorica* and *forstenii* in this subgenus. Subsequently, Williams (*in* Loveridge and Williams 1957) partitioned the all-encompassing tortoise genus *Testudo*, by placing three tortoise species in the subgenus *Indotestudo*, which in turn was placed under the genus *Geochelone*. Bour (1980) elevated *Indotestudo* to a



Figure 3. Close-up of the head of an adult male *Indotestudo travancorica*. Photo by V. Deepak.

distinct genus; this was supported by cladistic analyses by Crumly (1982, 1984).

Pritchard (1979) suspected that tortoises from India could have been introduced into Indonesia, giving rise to disjunctive populations. When Hoogmoed and Crumly (1984) examined specimens of the three species of *Indotestudo*, they were unable to distinguish *I. forstenii* from *I. travancorica*. Therefore, *I. travancorica* was synonymized with *I. forstenii*, with the latter name taking priority. Since then, the species name *I. forstenii* has been associated with many reports of *I. travancorica* (e.g., Frazier 1989; Das 1991, 1995; Sharath 1990; Bhupathy and Choudhury 1995; Radhakrishnan 1998). After examining specimens of *Indotestudo* from different regions, Pritchard (2000) suggested that *I. travancorica* be resurrected as a separate species because it was morphologically distinct from *I. forstenii* and *I. elongata*. Phylogenetic evidence supported the recognition of three distinct species, and also revealed that *I. travancorica* was more closely related to *I. elongata* than to *I. forstenii* (Iverson et al. 2001; Le et al. 2006).

Description. — Adult *I. travancorica* have elongated shells, usually flattened at the vertebral region with margins that may be reverted and mildly serrated at the anterior and posterior ends. The carapace and plastron are brown to chocolate brown and may have blackish blotches; blotches on the vertebrals are usually surrounded by a central brown blotch that may fade into the marginals (Figs. 1–2). The head is cream or yellowish-brown with pinkish-red coloration around the orbital skin and nares. The iris is dark brown; the upper mandible is slightly hooked and tricuspid (Fig. 3). Large, uneven, imbricate scales cover the anterior part of the forelimbs. The tail ends in a claw-like spur (Boulenger 1907; Das 1991; Pritchard 2000). Absence of the nuchal (cervical) scute (or if present, wedge-shaped), and the interhumeral seam that is 1–1.4 times the length of the interpectoral seam, differentiate it from its congeners *I. elongata* and *I. forstenii* (Pritchard 2000).

A sexually dimorphic species, the abdominal region of the plastron is concave in males and flat in females, while the tail claw is longer and hooked in males, and small and conical in females (Auffenberg 1964b; Vijaya 1983; Das



Figure 4. Yearling of *Indotestudo travancorica* from the Anamalai hills, Western Ghats. Photo by V. Deepak.

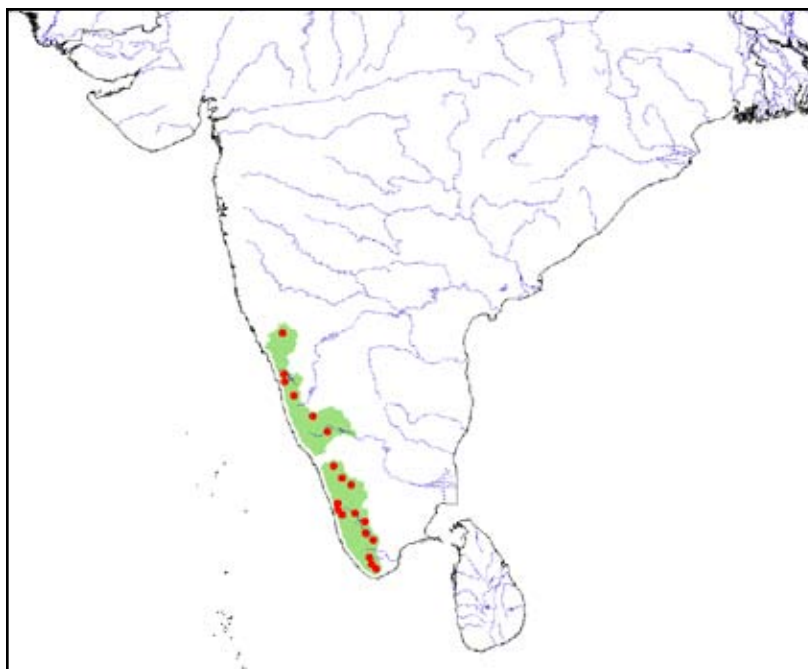


Figure 5. Distribution of *Indotestudo travancorica* in the Western Ghats of southwestern Peninsular India; the discontinuity in the range is the Palghat Gap. Red dots = museum and literature occurrence records of native populations based on Iverson (1992) plus more recent and authors' data; green shading = projected distribution based on GIS-defined hydrologic unit compartments (HUCs) constructed around verified localities and then adding HUCs that connect known point localities in the same watershed or physiographic region, and similar habitats and elevations as verified HUCs (Buhlmann et al. 2009), and adjusted based on authors' data.

1991). There is no significant size difference between the sexes (Ramesh 2008a). Their straight carapace length (SCL) ranges from 55–330 mm, and mass from 35–4010 g (Sane and Sane 1988; Appukuttan 1991; Das 1995; Bhupathy and Choudhury 1995; Ramesh 2008a; Vasudevan et al. 2010).

Hatchlings are usually uniformly brown, though in a few, the carapace or plastron may be mottled with darker spots (Fig. 4). The shell is rubbery to touch, especially the plastron. The carapace appears rounded and the anterior and posterior marginals have sharp transparent edges. In newly-hatched tortoises, both the caruncle at the tip of the snout and the umbilical scar on the plastron are discernible (Ramesh, pers. obs.). Age or size at sexual maturity is unknown, but a male having 160 mm SCL had a distinctly concave plastron and hooked tail claw (Ramesh 2008b) indicating probable size of male sexual maturity.

Distribution. — Endemic to the Western Ghats of southwestern peninsular India, *I. travancorica* has been reported from states both south (Kerala, Tamil Nadu) and north (Karnataka) of the Palghat Gap from 100–1000 m above sea level (Boulenger 1907; Smith 1931; Vijaya 1983; Das 1991; Bhupathy and Choudhury 1995; Vasudevan et al. 2010).

Habitat and Ecology. — Travancore Tortoises are found in the evergreen, moist deciduous, bamboo forests, and rubber and teak plantations of the Western Ghats. They frequent marshlands, dry grass openings in the forest, and rocky biotopes close to streams (Vijaya 1983; Bhupathy and Choudhury 1995; Ramesh 2008b; Vasudevan et al. 2010). While inactive, they use leaf litter, ground-level cavities in trees, rocks, fallen logs and occasionally, pangolin burrows

for shelter (Vijaya 1983; Bhupathy and Choudhury 1995; Vasudevan et al. 2010).

In a recent study in the Anamalai hills of the Western Ghats (Vasudevan et al. 2010), of 50 individuals recorded, 24 were found near streams and grassy marshes, 15 in forest interiors, and 11 in *Lantana camara* bush and rocky microhabitats. In 728 tracking days between February 2008 and March 2010, four tortoises with attached radiotransmitters (2 males and 2 females) spent about 37% of the time inactive under leaf litter, 21% inside *Lantana camara* scrub, 12% inside bamboo thicket, 7% under fallen logs or liana, 6% in rock cavities and 6% in ground-level tree hollows, 5% under grass, 4% inside pangolin or termite burrows and 2% in the open. *Indotestudo travancorica* is crepuscular (Vijaya 1983) and 70% of 23 tortoises were encountered between 1700 and 1830 hrs (Ramesh 2008b) in the Anamalai hills.

The estimated home range of *I. travancorica* based on 728 days of radiotracking of four tortoises was 5.2–34 ha and tortoises were active even during midday (Vasudevan et al. 2010). The minimum and maximum distances moved in a day were 0.8 m and 665 m, respectively. Three radiotracked individuals moved 440 m on average (range 350–586 m) in one year. Radiotagged tortoises spent nearly equal proportions being active and inactive during rainy and non-rainy days ($n = 493$ tracking days). However, some individuals buried themselves under leaf litter during the dry season (February–May) and became inactive. There was no evidence of long-distance movement in this study. However, a report by Ramesh (2004), suggested that a tortoise had traveled about 50 km in 20 years.

Tortoises feed on mushrooms, tender bamboo shoots, fallen fruits of *Artocarpus* spp., *Dillenia pentagyna*, *Ficus virens*, and the leaves of herbaceous plants such as *Synedrella nodiflora*, *Desmodium repandum*, *Senecio scandens*, *Mimosa pudica*, and *Veronica buabaumii* (Vijaya 1983; Ramesh and Parthasarathy 2006; Vasudevan et al. 2010), apart from animals such as frogs, insects, and millipedes (Das 1991, 1995). Feces collected from 32 tortoises contained at least one identifiable diet item: 91% had grass/bamboo blades, 94% other plant matter (leaves and stems), 75% insect remains, 63% sand, 38% seeds (*Grewia tilaefolia* and *Dillenia pentagyna*), 22% vertebrate remains (identified as skink scale, mammal hair, and vertebral bone), 19% mollusks, 9% scorpion and crab remains, and 3% millipedes. They also scavenged on carcasses of mammals such as sambar, *Cervus unicolor* (Vasudevan et al. 2010).

Travancore Tortoises are known to produce chorus calls at night in captivity; the purpose of the call is unknown (Campbell and Evans, 1972). The vocalizations are probably produced by a posteriodorsal movement of the mandible against the alveolar surface of the upper jaw (Auffenberg's observations in Campbell and Evans, 1972). The calls of tortoises belonging to genus *Indotestudo* sound like whimpers or bellows and are highly stereotyped for each individual (Galeotti et al. 2005).

Courtship consists of the following stages: 1) sex recognition by olfaction, 2) immobilization of the female by shell-ramming, and 3) mounting and copulation (Auffenberg 1964b). Male combat, consisting of shell-ramming and biting, also occurs (Das 1991; Ramesh 2008a). In adult male *I. travancorica*, the pink coloration around the eyes and nares intensifies during the breeding season, which is from November to January (Auffenberg 1964a). But there are reports of breeding in other months of the year; a gravid free-ranging female was found in October (Moll 1989) and in February–March, in captivity (Das 1991).

Nesting has not been observed *in situ*. In captivity, the species excavated small chambers near the roots of trees or shrubs for egg-laying, and the entire process took about 50 minutes. Eggs were 47 x 38 mm and had a mass of 41 g (Ramesh 2007). In captivity, clutch size varied from 1–5 eggs but was often 3 (Vijaya 1983; Sane and Sane 1988; Das 1991, Ramesh 2007); eggs have also been found on the floor of the enclosure (Sane and Sane 1988) or in leaf litter (Das 1991), likely due to a lack of suitable nesting substrates. The incubation period varied from 141–149 days in captivity and a hatchling measured 55 mm (SCL) and had a mass of 35 g (Sane and Sane 1988; Das 1995).

Indotestudo travancorica is occasionally consumed or gnawed upon by large carnivores. A large (280 mm SCL), intact shell of the species (carapace and plastron) from the Parambikulam Wildlife Sanctuary, Kerala, had a deep puncture on a costal and scratch marks on the scutes. Similarly, another live tortoise (172 mm SCL) had extensive scratch marks and was missing a few marginals; this was probably caused by some large carnivore, such as tiger (*Panthera*

tigris), leopard (*P. pardus*), or dhole wild dog (*Cuon alpinus*) found in the area.

Population Status. — *Indotestudo travancorica* was historically reported to be a common species in the forests of the Western Ghats (Boulenger 1907; Henderson 1912; Vijaya 1982) but no current population estimates are available. Encounters of the species during active searches in forests ranged from 6.7 hrs/tortoise in Parambikulam Wildlife Sanctuary (for 20 man-hours) to 8.0 hrs/tortoise in Indira Gandhi and Peechi-Vazhani Wildlife Sanctuaries (for 16 man-hours each) (Bhupathy and Choudhury 1995). The species might be more abundant in relatively undisturbed habitats. For instance, in a survey conducted in 2002–03, 57 tortoises were captured with a mean search effort of 3.4 hrs/tortoise (Ramesh 2008a). Intensive sampling in a large forested landscape carried out during 2006–08 in the same area yielded one tortoise in 17.5 hrs in monsoon (for 508 man-hours), and one in 22.3 hours in summer, winter and post-monsoon (for 401 man-hours), suggesting poor detection of the species by the observers or sparse distribution, or both (V. Deepak, unpubl. data).

Threats to Survival. — Across most of its range, the species is hunted and consumed. Tribes of the Western Ghats such as the Kadar, Malai Pandaram, Kani, Malasar, and Malaimalasar hunt these tortoises using dogs or by following their tracks (Vijaya 1983; Frazier 1989; Moll 1989; Choudhury and Bhupathy 1993; Vasudevan et al. 2010). Sometimes, tortoises are also reared as pets till they attain a size suitable for consumption. Kani tribals also use charred shell mixed with oil as a cure for external injuries and skin rashes (Bhupathy and Choudhury 1995). So far, this species has not been reported in regional trade (Choudhury and Bhupathy 1993). However, subsistence hunting of the species could reduce their populations (Vijaya 1983; Frazier 1989; Moll 1989; Bhupathy and Choudhury 1995).

Habitat alteration and fragmentation of forest due to hydroelectric reservoirs is known from almost all areas where the tortoise occurs (Bhupathy and Choudhury 1995). There are 24 operational and 12 proposed hydroelectric projects in the state of Kerala alone, which would severely impact the biodiversity of this region (Sreekumar and Balakrishnan 1998; Nikhil Raj et al. 2009). These projects also bring in settlers, who pose a threat to the species since they might intensify habitat disturbance and hunting.

Conservation Measures Taken. — *Indotestudo travancorica* has been listed as Vulnerable on the IUCN Red List since 2000 (www.iucnredlist.org). It is included in Appendix II of CITES under Testudinidae spp. In India, it is protected under Schedule IV of the Indian Wildlife (Protection) Act (1972).

This species has been reported from 12 Wildlife Sanctuaries, three Tiger Reserves, one National Park and seven Reserved Forests in the Western Ghats (Bhupathy and Choudhury 1995). The Western Ghats is a global biodiversity hotspot (Mittermeier et al. 2005) and the conservation of biological diversity has been a priority for India. As a result,

53 Protected Areas (PA) have been gazetted covering 17% of the entire biogeographic region; India's PA covers 4.9% of the total land area. The high proportion of PA cover for the Western Ghats is a reflection of national-level policies aimed at strengthening protection in regions with high biological diversity and endemism. There are currently 53 protected areas in the Western Ghats Mountains (source: PA network, Wildlife Institute of India) covering an area of 11,222.47 km² and these PAs are of great significance to Travancore Tortoise populations. However, they ensure protection for only 17% of the entire biogeographic unit that has potential habitat for the species. The reserves in this province have a mean area of 198 km² with 43% of them < 100 km². These limitations expose several populations to exploitation and insularization of remnant habitats of the species.

Conservation Measures Proposed. — We propose that the current IUCN Red List status of Vulnerable be retained for *I. travancorica* because it is an endemic species experiencing unabated pressure from subsistence hunting. More significantly, recurrent attempts to establish new hydroelectric projects in this region will result in rapid, extensive, and irreversible habitat loss. Conservation efforts focusing on increasing the PA cover and improving connectivity within the existing PAs will be one of the priorities for the survival of the species. Creating awareness among forest protection staff will help in enhancing protection for the species. Removal of domestic dogs from PAs will also considerably reduce the threat of exploitation of the species. Crucial habitats such as the swamps in woodland openings (locally known as 'vayal') also require area-specific protection and management since *vayals* provide an important foraging area for tortoises during the dry season and probably serve as refuge during forest ground fires.

Captive Husbandry. — The Centre for Herpetology, Madras Crocodile Bank Trust has the only captive breeding group of this species in the country. At present, the population consists of 4 males, 12 females, 5 juveniles and 5 hatchlings (MCBT Taxon report 2011, Nikhil Whitaker, pers comm.). Some observations on this captive group have been published over the years (Vijaya 1983; Das 1991, Ramesh 2007).

Current Research. — It is expected that the recently completed research project on the ecology of *I. travancorica* in the Anamalai hills by Wildlife Institute of India will provide much-needed information on the ecology of the species from the wild. Ongoing monitoring of the captive tortoises at the Centre for Herpetology, Madras Crocodile Bank Trust would provide further insights on husbandry and developmental biology of the species.

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