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The floristic composition of the habitat of *Malacochersus tornieri* at a hill in Tarangire National Park, Tanzania

Reginald T. Mwaya

Abstract. During the wet season, April 2006, vegetation sampling was performed at a hill in Tarangire National Park, Tanzania, the habitat of *Malacochersus tornieri*. A total of 68 plant species were identified to occur in the area. The family Poaceae was most species-rich represented with 21 (30.9%) different species. The second, third and fourth highest species representation were found in Papillionoideae (7 species = 10.3%), Compositae (6 species = 8.8%) and Labiatae (4 species = 5.9%). The herbaceous species composition at a hill is potentially higher considering the xeric nature of this Maasai heartland area.

Key words. Chelonia, Testudinidae, *Malacochersus tornieri,* floristic composition, habitat.

Despite the previous allowance by the government of Tanzania to collect and trade pancake tortoises, *Malacochersus tornieri* (Siebenrock 1903), for international markets, our understanding of the species' ecology has been very meager and in most cases superficial. Specifically, for instance, the vegetation composition of the species' microhabitat remains inadequately known despite the fact that the species interacts with its immediate environment, the herbaceous layer serving as its food source, as well as being an inevitable transitory shelter and hideout from predators when venturing outside the safety of their crevices.

The pancake tortoise is the only testudinid endemic to the Somali Maasai and Zambesian 'miombo' woodland phytochoria in east Africa (Broadley 1989, Klemens & Moll 1995, Wood & MacKay 1997, Spawls et al. 2002). Klemens & Moll (1995) pointed out that the species' major conservation threat in Tanzania emanates from wild collection by humans for the international live animal trade. Wood & MacKay (1997) argued that in Kenya habitat destruction, due to bad agricultural practices, might be one of the dimensions linked to the species' vulnerability.

There is scanty literature on the species' natural ecology, which might be important for charting out a long-term strategy for management of the species. The few notable recent fieldwork publications include those of Klemens & Moll (1995) and Moll & Klemens (1996) in Tanzania and Wood & MacKay (1997) as well as Malonza (2003), both from Kenya. The study in Tanzania concentrated on the species' population distribution and status along the prominent 'trade' routes where excessive exploitation for live trade had been reported by Klemens & Moll (1995). Moll & Klemens (1996) highlighted the tortoises' microhabitat affinities of the rocky crevices. Although this literature mentions the few grasses eaten by the species, no detailed analysis of the herbaceous layer was made. On the other hand, the Kenyan literature largely focused on the population distribution dynamics and likewise, there has been no in-depth determination of the vegetation analysis. Other recent field ecological study includes that of Chansa & Wagner (2006) who elucidated on the range extension of the species into northern Zambia. Mwaya (2006) reported on the tortoises' patterns of diurnal activity and spatial

behavior in Tarangire National Park, Tanzania. The most recent ecological study in Tanzania evaluated the effect of the exploitation moratorium on pancake tortoise population recovery in habitats whose populations were thought to have been severely affected (own unpubl. data).

This note seeks to contribute to the understanding of the pancake tortoise habitats' floristic composition at a hill in Tarangire National Park. This hill is one of the sites within the Park where a pancake tortoise population has been identified (Klemens & Moll 1995, Mwaya 2006). The thorough understanding of the herbaceous vegetation is important because plants are the primary food source of the tortoises (Kabigumila 2001), but it also provides a hideout from potential predators when tortoises are outside their crevices.

Tarangire National Park lies between latitudes 3°40' and 5°35' south and longitudes 35°45' and 37° east, at an elevation between 1200 and 1600 m a.s.l. Within the Park, the study was conducted at a hill located in the northeast area of the park. The specific study site covers approximately 23,000 m^2. The site was divided into square blocks of 30 × 30 m and each block was given numerical grid reference. The study site is situated at the foot of the hill and is characterized by scattered broken rocks, sandy soils, and wooded grassland. This site was chosen because the respective population was readily accessible for study.

During the wet season, April 2006, vegetation sampling was performed. Ten quadrats of 1 × 1 m were randomly placed in each of the 30 × 30 m blocks. All plants falling within each of the quadrats were identified *in situ* except for those which could not be identified in the field; samples were collected and kept for later identification at herbaria facilities at Mweka Wildlife College, and in some cases at Tanzania Pesticide Research Institute in Arusha and the Department of Botany, University of Dar-Es-Salaam, Tanzania.

A total of 68 plant species of 26 families were identified (Table 1). The six most important families, in terms of species representation, were Poaceae (21 species = 30.9%), Papillionoideae (7 species = 10.3%), Compositae (6 species = 8.8%), Labiatae (4 species = 5.9%), Cyperaceae (3 species = 4.4%) and Acanthaceae (3 species = 4.4%). The herbaceous species richness at the hill is potentially higher considering the xeric nature of the study site and surrounding Maasai heartland area. As expected, Poaceae included a greater species diversity than other plant families. However, herbs in general, which apart from Poaceae provide forage for the species, are relatively richer in the study site. Moll & Klemens (1996) carried out faecal analysis of pancake tortoise scats in Tanzania and found fragments of grasses (Poaceae) including *Cynodon* spp., *Sporobolus* spp., *Themeda triandra*, *Panicum* spp. and leaves of *Achyranthes aspera* (Amaranthaceae). All Poaceae species observed by Moll & Klemens (1996) consumed by the tortoises were also found at the Hill. However, *Achyranthes aspera* was absent from the sampled study area. The presence of diverse vegetable matter is consistent with the report of Poelchau & Mistry (2006) who found higher forb diversity in the kopjes of Serengeti National Park, Tanzania. Furthermore, as the result of habitat heterogeneity, these rocky outcrops contain higher species diversity relative to the surrounding areas (Timbuka & Kabigumila 2003). This suggests that the diverse herbs may meet adequate forage choices for the species' nutritional requirements.

It therefore appears that any factor leading to the removal of the herbaceous layer, either through natural or anthropogenic activities such as slash-and-burn cultivation and frequent late burning, characteristic of tropical savannah habitats, is predicted to have significant negative impact on the species fitness (Wood & MacKay 2007). This might be mediated through forage reduction, increased risks of hyperthermia and amplified predation pressure. In the face of increased human population and subsequent encroachment (Gamassa 1989) to the species' prime habitat, detailed research is recommended.

Tab. 1. Identified plant species in a habitat of the pancake tortoise at a hill in Tarangire National Park, Tanzania.

Family	Species
Poaceae	*Aristida adoensis* Hochst.
	Cynodon plectostachyus (K.Schum.) Pilg.
	Dactyloctenium aegyptium (L.) Willd.
	Dichanthium annulatum (Forssk.) Stapf
	Digitaria milanjiana (Reendle) Stapf
	Eragrostis aspera (Jacq.) Nees
	Eragrostis caespitosa Chiov.
	Eragrostis superba Peyr.
	Harpachne schimperi A. Rich.
	Heteropogon contortus (L.) Roem. & Schult.
	Hyperrhenia filipendula (Hochst.) Stapf
	Hyperrhenia rufa (Nees) Stapf
	Isachne mauritiana Kunth.
	Microchloa kunthii Desv.
	Panicum coloratum L.
	Panicum maximum Jacq.
	Rhyncheltrum repens (Willd.) C.E. Hubbard
	Setaria sphacelata (Schumach.) Moss.
	Sorghum arundinaceum (Desv.) Stapf
	Sporobolus pyramidalis P. Beauv.
	Themeda triandra Forrsk.
Caesalpiniodeae	*Cassia mimosoidea* L.
Capparidaceae	*Cadaba faricosa* Forssk.
Malvaceae	*Sida ovata* Forssk.
Papillionoideae	*Crotolaria massaiensis* Taub.
	Dalbegia melanoxylon Guill. & Perr.
	Erythrina abyssinica DC.
	Indigofera arrecta A. Rich.
	Indigofera schimperi Jaub. & Spach.
	Tephrosia pumila (Lam.) Pers
	Vigna vexilata (L.) A. Rich.
Mimosoideae	*Dichrostachyus cinerea* (L.) Wight & Arn.
Labiatae	*Leonotis mollissima* Gurke
	Ocimum suave Willd.
	P. caninus (Roth.) Vatke
	Plectranthus prostatus Gurke
Rubiaceae	*Psychotria* sp. L.
	Richardia brasiliensis Gomes
Compositae	*Aspilia mossambiensis* (Oliv.) Wild.
	Bidens pilosa L.
	Helichrusum glumeceum DC.
	Microglosa oblongifolia O. Hoffm.
	Senecio sp.
	Vernonia galamensis (Cass.) Less.
Capparidaceae	*Cadaba farinosa* Forssk.
	Cleome monophylla L.
Polygalaceae	*Polygala fischeri* Gurke
Cyperaceae	*Cyperus laevigatus* L.
	Cyperus rotundus L.
	Kyllinga arrecta Schumach.
Acanthaceae	*Asystasia schimperi* T. Anderson
	Blepharis hildebrandtii Lindau
	Justicia flava Vahl
Euphorbiaceae	*Euphobia hirta* L.
Cucurbitaceae	*Cucurmis dipsaceus* Spach
	Momordica foetida Schumach.
Rutaceae	*Clausena aniseta* (Willd.) Benth.
Simaroubaceae	*Harrisonia abyssinica* Oliv.
Piperaceae	*Piper capense* L.f.
Adiantaceae	*Pteris dentata* Forssk.
Scrophulariaceae	*Craterostigma plantagineum* Hochst.
Commelinaceae	*Commelina petersii* Hassk.
	C. benghalensis Wall.
Anacardiaceae	*Lannea alata* (Engl.) Engl.
Convolvulaceae	*Ipomoea spathulata* Hallf.
Thymelacaeceae	*Gnidia involucrata* A. Rich.
Orchidaceae	*Aerangis confusa* J. Stewart
Vitaceae	*Cyphostemma cryphopetalum* (Fresen.) Wild.
Total number of species: 68	

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Author's address: Reginald T. Mwaya, 100 Western Avenue, Elmwood Apt., J3, Kalamazoo, MI 49008, USA, E-Mail: rmwaya@yahoo.com; reginald.mwaya@wmich.edu.