Editha Krüger

Moist Root Shelters for Hatchlings

When raising juveniles of certain tortoise species, one sometimes unfortunately observes the development of deformations of the bony shell, especially in the region of the back. Discussions about potential causes of this so-called "pyramiding" commonly revolve around factors such as unnaturally accelerated growth due to a diet that is excessive in both quantity and protein (Highfield 2008), insufficient intake of calcium (Frye 1991, Gerlach 2006), or excessive intake of calcium (Stancel *et al.* 1998). In recent years, a latent dehydration has also been implicated (Wiesner & Iben 2003). It is possible that the formation of a humped shell results from a combination of the above-mentioned factors, since it appears to involve a dehydration of the animals that, for currently unknown reasons, is not compensated by the oral intake of water (pers. obs.).

To remedy this problem, some breeders recommend that juveniles be bathed on a regular basis, as this enables them to absorb additional moisture via the skin (Harless & Morlock 1989). Most keepers have furthermore changed to housing their *Testudo* juveniles in a relatively moist environment, especially at night. This measure may appear to be counter-intuitive at first, since one would expect the natural habitats of these animals to be for the most part very dry. However, the reasons why hatchlings in the wild do not experience a comparable dehydration presumably lies, next to their naturally slower growth rate, in their much more covert lifestyle. During their first few years of life, juvenile *Testudo* spend almost their entire time under the thick undergrowth of the Mediterranean maquis and garrigue.

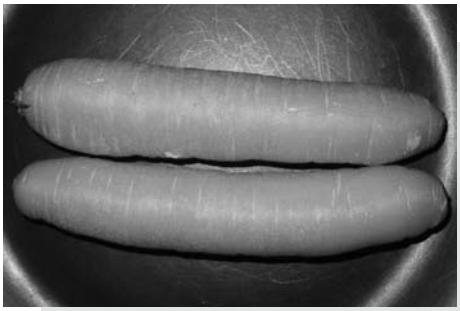

Fig. 1. Test of evaporation rates using two fresh carrots.

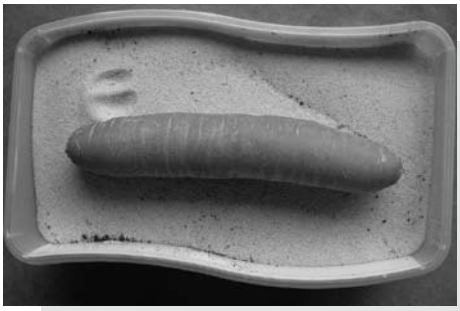

Fig. 2. One carrot was stored on dry quartz sand, while the other was buried in it.

Fig. 3. After only one week at 21 °C and ca. 50 % relative humidity, the carrot lying in the open has shrivelled up completely, even though it was thicker originally, while the carrot buried in the sand is still moist and crunchy...

In periods of inactivity, they frequently bury themselves in the ground, typically in the fully shaded root areas of bushes and shrubs. Here, evaporation from the vegetation creates a higher level of relative humidity than an overall impression of the landscape suggests and the climatological charts indicate, the latter data usually being gathered at a point two meters above the ground. Moreover, even when the plants and soil are completely dehydrated, they still reduce the air volume surrounding the small animals and thus decrease the loss of fluids through evaporation, much in the same manner as dry cling wrap counteracts the dehydration of groceries. The extent to which being buried in dry sand reduces evaporation is illustrated here by an example from the plant kingdom (Figs. 1-3). In contrast, juvenile *Testudo* in human care soon lose their initial shyness towards their keepers and potential predators and as a consequence retreat into their shelters less frequently. Furthermore, our lower air temperatures necessitate longer and more dehydrating basking sessions, since the ambient temperature almost always ranges below the preferred body temperature of these animals. In my experience, this increased dehydration can be more effectively compensated by providing soil- or root-based dens at night (Fig. 4) than by raising the level of humidity in solid shelter huts. The larger air volume in these huts caused my juveniles to dehydrate more even at increased humidity levels than if their shell was in close contact with a moist substrate. My initial concern that spending the night in a damp environment might lead to respiratory tract infections or cause skin or shell diseases proved unfounded in the Testudo graeca soussensis in my care, even though this species is considered to be sensitive towards moisture. Nevertheless, it will be left to every tortoise keeper to take into consideration the specific needs of the species and individuals in his or her care.

I had the idea of creating underground dens when my first baby Testudo graeca soussensis ceased to bury themselves in the ground shortly after they had hatched. They sat on

Fig. 4. Entrance to a shelter in the moist section of a terrarium.

Fig. 5. Various layers of the plant brick.

the moist moss lining their wooden shelter hut rather than burying themselves under it as I had intended. My older juveniles have not turned out particularly humped, but unfortunately also not as smooth as most specimens living in the wild. The hatchlings that emerged from a clutch that had been incubated in a naturalistic manner in a greenhouse (KRÜGER 2007) therefore received neither a solid wooden hut nor the commonly used shelter beneath a piece of cork bark in their hotbed. As in the wild, the only cover available to them consisted of soil and plants, mainly lavender, moss and ground ivy. Within a short period of time, the animals had established a system of tunnels between the roots of the plants that barely exceeded the height of their shells. This was where the small tortoises spent their time whenever they were inactive. In order to provide such a natural shelter even after they were transferred to their autumn quarters, I built an artificial structure according to the plan outlined below.

Fig. 6. Growth after four weeks.

Using moist soil dens rather than a solid shelter hut has by now been proving beneficial in my nursery enclosures since 2006. All animals have so far grown without developing any recognizable humps in their shells. Because hotbeds tend to heat up substantially in full sun and thus have low levels of relative humidity, the presence of the plants ensures that they are watered on a regular basis, since thirsty plants are far more obvious than low humidity levels. At the same time, the young tortoises thus find reliable protection from both overheating and dehydration throughout the year.

Owing to principal considerations, I water the plants exclusively in the evening. This ensures that there is sufficient moisture at night, while excess water has dissipated into deeper soil levels by the next morning. This permits the surface to dry quickly during the day, much in the same manner as morning dew.

Another advantage of this low soil shelter over a wooden hut is that it does not subtract from the available ground space of the terrarium or hotbed, which is usually in short supply. On the contrary, the low hillock above the root den

Fig. 7. The root system provides stability.

forms a favourite basking spot with natural plant protection. Heating the underground tunnels at night is no problem either. A heating cable of low wattage can be integrated in the plant bricks from the beginning, or a thermostat-controlled infrared spotlight can be installed afterwards to gently heat the roof of the shelter from above.

My by now one and a half year old juveniles accepted their root shelter readily after being transferred to their transition quarters, spending the first night there without hesitation. Over time, the newly set-up shelter integrated progressively into its environment.

It even increased in stability, since the plants will grow and intertwine with the surrounding vegetation if the environmental conditions are favourable. This renders the root shelter portrayed here – besides its function as a source of moisture – a valuable bioindicator for harmful temperature peaks in hotbeds and for adequate lighting conditions in terraria.

A short manual for constructing a root shelter

You will need:

A planting tray of adequate size, a firm but pliable piece of fine wire mesh (e.g., snail fence, 5 mm mesh), germination soil, grass seed, 10-15 baby plants with small rootballs, e.g., ground ivy, hawkbit, creeping Jenny, wild strawberry.

This is how it is done:

- Cut the wire mesh to fit into the planting tray; be sure to file down all sharp edges. This mesh will later provide the necessary stability to the arched shelter.
- Loosen the rootballs of the plants, shake out the soil, and trim the roots to stimulate new growth.
- Fill the tray 3 cm deep with germination soil and cover it with the wire mesh.
- Add another layer of soil, insert plants, and spread grass seeds.

Fig. 8. The preformed shelter.

- Leave for 4-6 weeks, then check for rooting and if satisfactory, remove plant brick from tray.
- Bend the plant brick carefully along its longitudinal axis to form a semi-tube.

References

Frye, F. L. (1991): Reptile care – an atlas of diseases and treatments Vo. 1. – Neptune City (T.F.H. Publications), 323 pp.

Gerlach, J. (2006): Captive Seychelles-Aldabra giant tortoises: reproduction, growth and dietary distortion. – pp. 518-528. In: Artner, H., B. Farkas & V. Loehr (eds.): Turtles. Proceedings: International Turtle & Tortoise Symposium Vienna 2002. – Frankfurt/Main (Edition Chimaira), 618 pp.

Harless, M. & H. Morlock (1989): Turtles: Perspectives and Research. – Reprint, Melbourne (Krieger Publishing), 695 pp.

Highfield, A. (2008): www.tortoisetrust.org/care/faq.html#pyramiding (Downloaded on 01.01.2008)

Krüger, E. (2007): Near-natural Incubation of *Testudo graeca soussensis* Pieh, 2000, Eggs. – Radiata (english edition), Lingenfeld, **16** (3): 42-48.

Stancel, C. F., E. S. Dierenfeld & P. A. Schoknecht (1998): Calcium and phosphorus supplementation decreases growth, but does not induce pyramiding, in young red-eared sliders, *Trachemys scripta elegans*. – Zoo Biol., Chicago, **17** (1): 17-24.

Wiesner , C. S. & C. Iben (2003): Influence of environmental humidity and dietary protein on pyramidal growth of carapaces in African spurred tortoises (*Geochelene sulcata*). – J. Anim. Phys. Anim. Nutr., Berlin, **87** (1-2): 66-74.

Author and photographs
Editha Krüger
(Address known to publishers)
E-Mail: webmaster@emys-home.de

Swinhoe's soft-shell turtle (*Rafetus swinhoei*), Part II

However, after nearly three years of searching lakes and wetlands along the Red River in northern Vietnam, researchers settled upon a lake just west of Hanoi where local people claimed that a gigantic soft-shell turtle was still occasionally seen. In 2007, field biologist Nguyen Xuan Thuan managed to capture a digital photograph of turtle as it basked on the surface, allowing scientists to positively confirm the discovery. Until recently the location and presence of the turtle was kept secret until senior government officials could be briefed and local protection measures could be put in place at the site.

The species historically occurred in the Red River basin of northern Vietnam, and extended north into southern China, and along the Yangtze River of eastern China. However over the past few decades, the species has all but disappeared from the wild, caught and consumed as food or used to make traditional medicine from its bones. The disappearance of Swinhoe's turtle may also be influenced by other factors such as loss of nesting habitat along major rivers where the species once resided, pollution, and incidental drowning or injury from fishing nets or boat propellers.

The discovery of Swinhoe's turtle in the wild in Vietnam is an important development in efforts to conserve the species, however without evidence of reproduction, the future of the legendary Hoan Kiem turtle and its three surviving cohorts looks bleak. Hopes are set on finding other turtles that have somehow been overlooked by local hunters or preserved in lakes and wetlands scattered along the Red River and its tributaries while similar efforts continue in China. More importantly, efforts to bring together the male and female adult soft-shell turtles in two Chinese zoos may offer the best chance for the species survival.

Continued on page 27