

**Thermal Biology and Dayly Activity of Central Asian Tortoise
(*Agrionemys horsfieldii*) (Testudinidae, Reptilia)**

Dmitry A. Bondarenko¹ and Evgeny A. Peregontsev²

¹ *Head Center of Hygiene and Epidemiology, Federal Medical and Biological Agency
6 1st Pekhotny Pereulok, Moscow 123182, Russia*

² *«Davbioonazarat», State Committee of Nature Protection
21a Chashtepa St., Tashkent 100149, Uzbekistan
E-mail: dmbonda@list.ru*

Received 4 March 2019, revised 17 April 2019, accepted 27 April 2019

The data on the thermal biology and daily activity of the Central Asian tortoise *Agrionemys horsfieldii* have been generalized on the basis of our own research and literature information. A description of the daily activity cycles with the body and environmental temperatures characterized is proposed. There are 8 periods of the daily activity and thermoregulatory behavior. According to our measurement data of the tortoise's cloacal temperature, their egress from their burrows takes place under a minimum body temperature of 9.4°C and a minimum substrate one of 11.8°C. A significant correlation is traced between the body and environmental temperatures in the periods of egress and heating. It is equally high for both air temperature ($r = 0.86-0.67$) and ground surface one ($r = 0.88-0.75$). In the morning, the spontaneous body temperature of *Agrionemys horsfieldii* was varying within 22.1–38.0°C at the mean value of 30.5±0.3°C. The mean values were statistically insignificant in females, males and immature individuals. 76% of active individuals had their body temperature within the range of 28.0–35.9°C. In this period of activity the body temperature keeps a high correlation with the substrate temperature only ($r = 0.72$). The evening (afternoon) activity depended on the ground temperature weaker than on the air temperature. During the cooling down the relation between the body and substrate temperatures rose again ($r = 0.68$), as during the morning heating, although it didn't reach such a power. During the bimodal activity cycle, fewer tortoises were observed in their evening peak than in the morning one. That is why we should ignore evening counts to correctly estimate the population density. From the middle of May the substrate temperature rapidly rises above 40°C in the morning and protractedly remaining till the evening. Such a temperature regime leads to an "acute" time deficit for feed activity. Even in the presence of food the high environmental temperature doesn't allow the Central Asian tortoise to eat it. The absence of forage reserve and high temperature make the continuation of its activity impossible in the summer period.

Key words: *Agrionemys horsfieldii*, tortoises, daily activity, thermal biology.

DOI: <https://doi.org/10.18500/1814-6090-2019-19-1-2-17-30>

REFERENCES

- Andreev I. F. On the ecology of reptiles of Kyzyl-Orda region. *Proc. Chernivtsi University, Ser. Biol. Sciences*, 1948, vol. 1, iss. 1, pp. 94–106 (in Russian).
- Ataev Ch. Materials on the Ecology of the Central Asian tortoise of Kopetdag Region. In: *Environmental Protection of Turkmenistan*. Ashkhabad, Ylym Publ., 1979, pp. 161–167 (in Russian).
- Ataev Ch. *Reptiles of Turkmenistan*. Ashkhabad, Ylym Publ., 1985. 344 p. (in Russian).
- Bogdanov O. P. *The Fauna of the Uzbek SSR. Vol. 1. Amphibians and Reptiles*. Tashkent, Izdatel'stvo AN UzSSR, 1960. 260 p. (in Russian).
- Bogdanov O. P. *Reptiles of Turkmenistan*. Ashkhabad, Izdatel'stvo AN TSSR, 1962. 236 p. (in Russian).
- Bondarenko D. A., Duysebayeva T. N. Central Asian tortoise, *Agrionemys horsfieldii* (Gray, 1844), in Kazakhstan (distribution, habitat division, population density). *Current Studies of Herpetology*, 2012, vol. 12, iss. 1–2, pp. 3–26 (in Russian).
- Bondarenko D. A., Peregontsev E. A. Distribution of the Central Asian tortoise *Agrionemys horsfieldii* (Gray, 1844) in Uzbekistan (range, regional and landscape distribution, population density). *Current Studies of Herpetology*, 2017, vol. 17, iss. 3–4, pp. 124–146 (in Russian).
- Brushko Z. K., Kubykin R. A. Activity and movement of the Central Asian tortoise in southern Kazakhstan. *News of the Academy of Sciences of the Kazakh SSR, Biol. Ser.*, 1982, no. 6, pp. 35–39 (in Russian).
- Voznesensky V. L. *Pervichnaia obrabotka eksperimental'nykh dannykh. (Prakticheskie priemy i primery)* [Primary processing of experimental data. (Practical techniques and examples)]. Leningrad, Nauka Publ., 1969. 84 p. (in Russian).
- Zaitsev G. N. *Matematicheskaya statistika v eksperimental'noi botanike* [Mathematical statistics in the

experimental botany]. Moscow, Nauka Publ., 1984. 424 p. (in Russian).

Zakhidov T. Z. Biology of reptiles of the Southern Kyzyl-Kum and Nura-Tau ridge. *Proc. of Central Asia State University, Ser. VIII a, Zoology*, 1938, iss. 54, pp. 1–52 (in Russian).

Isabekova S. B. *Thermobiology of Reptiles*. Almaty, Galym Publ., 1990. 143 p. (in Russian).

Paraskiv K. P. *The Reptiles of Kazakhstan*. Almaty, Izdatel'stvo AN KazSSR, 1956. 228 p. (in Russian).

Polyakov V. A. On the biology of the steppe tortoise *Testudo horsfieldi* Gray. In: *Proc. of the Bukhara State Pedagogical and Teaching Institute, Chemistry and Biology*. Bukhara, Izdatel'stvo Buharskogo gosudarstvennogo pedagogicheskogo instituta, 1946, pp. 32–42 (in Russian).

Rustamov A. K. On the fauna of amphibians and reptiles of Southeastern Turkmenistan. *Proc. of the Turkmen Agricultural Institute named after Mikhail Kalinin*, 1956, vol. 8, pp. 293–306 (in Russian).

Sokolov V. E., Sukhov V. P. Radio-telemetric study of the motor activity and temperatures of the steppe tortoise. *The Problems of Herpetology: Abstracts of Fourth Herpetological Conference*. Leningrad, Nauka Publ., 1977, pp. 193–194 (in Russian).

Sokolov V. E., Sukhov V. P., Stepanov A. V. The use of magnetical reed switches for registration the motor activity of some reptiles. *Zoologicheskii zhurnal*, 1975, vol. 54, no. 3, pp. 438–440 (in Russian).

Cherlin V. A. *Thermobiology of reptiles. General information and research methods (manual)*. St. Petersburg, Izdatel'stvo Russko-Baltiyskogo informacionnogo centra "Blitz", 2010. 124 p. (in Russian).

Cherlin V. *Reptiles: Temperature and Ecology*. Saarbrücken, LAP LAMBERT Academic Publ., 2014. 442 p. (in Russian).

Shammakov S. *Reptiles of the Plane of Turkmenistan*. Ashkhabad, Ylym Publ., 1981. 312 p. (in Russian).

Bondarenko D. A., Peregontsev E. A., Neronov V. V. Ecological and geographical feeding Peculiarities of the Central Asian Tortoise (*Agrionemys horsfieldii* Gray, 1844) in desert landscapes. *Russian J. Herpetology*, 2011, vol. 18, no. 3, pp. 175–184.

Brattstrom B.H. Body Temperatures in Reptiles. *American Midland Naturalist*, 1965, vol. 73, no. 2, pp. 376–422.

Brushko Z. K., Kubykin R. A. Horsfield's tortoise (*Agrionemys horsfieldi* Gray, 1844) and the ways of its rational utilization in Kazakhstan. *Vertebrata Hungarica*, 1982, vol. 21, pp. 55–61.

Cheylan M. *Testudo hermanni* Gmelin, 1789 – Griechische Landschildkröete. *Handbuch der Reptilien und Amphibien Europas*. Bd. 3/III A. Schildkröten (Testudines) I. Wiebelsheim, Aula Verlag, 2001. S. 179–289.

Hai-tao S., She-ke X., Zhi-xiao L., Chen-xi J., Zhi-tong L. Activity rhythm of *Testudo horsfieldi*. *Chinese J. of Zoology*, 1995, vol. 30, no. 4, pp. 40–45 (in Chai-nian).

Hailey A., Coulson I. M. Temperature and the tropical tortoise *Kinixys spekii*: constraints on activity level and body temperature. *J. Zoology*. London, 1996, vol. 240, iss. 3, pp. 523–536.

Hutchison V. H., Vinegar A., Kosh R. J. Critical thermal maxima in turtles. *Herpetologica*, 1966, vol. 22, no. 1, pp. 32–41.

Lagarde F., Bonnet X., Nagy K., Henen B., Corbin J., Naulleau G. A short spring before a long jump: the ecological challenge to the steppe tortoise (*Testudo horsfieldi*). *Canadian J. of Zoology*, 2002, vol. 80, no. 3, P. 493–502.

Meek R. Thermoregulatory behavior in a population of Hermann's tortoise (*Testudo hermanni*) in southern Yugoslavia. *British J. Herpetology*, 1984, vol. 6, pp. 387–391.

Meek R., Inscreep R. Aspects of the field biology of a population of Hermann's tortoise (*Testudo hermanni*) in southern Yugoslavia. *British J. Herpetology*. 1981, vol. 6, pp. 159–164.

Meek R., Jayes A. S. Body temperatures and activity patterns of *Testudo graeca* in North West Africa. *British J. Herpetology*, 1982, vol. 6, pp. 194–197.

Rozyłowicz L., Popescu V. D. Habitat selection and movement ecology of eastern Hermann's tortoises in a rural Romanian landscape. *European J. of Wildlife Research*, 2013, vol. 59, iss. 1, pp. 47–55.

Wright J., Steer E., Hailey A. Habitat separation in tortoises and the consequences for activity and thermoregulation. *Canadian J. of Zoology*, 1988, vol. 66, no. 7, pp. 1537–1544.

Cite this article as:

Bondarenko D. A., Peregontsev E. A. Thermal Biology and Dayly Activity of Central Asian Tortoise (*Agrionemys horsfieldii*) (Testudinidae, Reptilia). *Current Studies in Herpetology*, 2019, vol. 19, iss. 1–2, pp. 17–30 (in Russian). DOI: <https://doi.org/10.18500/1814-6090-2019-19-1-2-17-30>
