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## CHANGES IN THE NORTHERN BORDER OF THE HOME RANGE OF THE DICE SNAKE, *NATRIX TESSELLATA* (REPTILIA, COLUBRIDAE), IN THE DNIPRO BASIN (UKRAINE)

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**Changes in the Northern Border of the Home Range of the Dice Snake, *Natrix tessellata* (Reptilia, Colubridae), in the Dnipro Basin (Ukraine).** Nekrasova O. D., Gavris G. G., Kuybida V. V. — A new distribution boundary of the dice snake, *Natrix tessellata* (Laurenti, 1768), in Ukraine has been established. The northern edge currently lies within the valley of the middle course of the Dnipro River: Trakhtemyriv Peninsula, Cherkasy Region on the right side (49°59' N, 31°25' E); on the left side in Kyiv Region within Pereyaslov-Khmelnytsky District: at a fishermen's station (50°02' N, 31°17' E), yacht club (Kurinoe Estuary 50°02' N, 31°29' E); Lubny, Poltava Region (49°58' N, 33°01' E). These points are located 70–80 km northwards from the previous boundary of the species home range. The level of *Natrix tessellata* population polymorphism in the North of Cherkasy Region is high; more than 40 % of specimens are dark-colored.

**Key words:** reptiles, *Natrix tessellata*, dice snake, home range, Ukraine.

**К изменению северной границы ареала водяного ужа, *Natrix tessellata* (Reptilia, Colubridae), в бассейне Днепра (Украина).** Некрасова О. Д., Гаврис Г. Г., Куйбида В. В. — Установлены новые пределы распространения водяного ужа, *Natrix tessellata* (Laurenti, 1768), в Украине, относящиеся к долине Среднего Днепра: правобережье — Трахтемировский п-ов Черкасской обл. (49°59' N, 31°25' E), левобережье — Переяславо-Хмельницкий р-н Киевской области: рыбстан (50°02' N, 31°17' E) и яхтклуб (Куриное гирло 50°02' N, 31°29' E), г. Лубны, Полтавской обл. (49°58' N, 33°01' E). Данные пункты находятся на расстоянии около 70–80 км севернее от предыдущей границы ареала вида. Группировка ужей на севере Черкасской обл. отличается большим полиморфизмом и наличием более 40 % тёмных особей.

**Ключевые слова:** пресмыкающиеся, *Natrix tessellata*, водяной уж, ареал, Украина.

### Introduction

The dice snake *Natrix tessellata* (Laurenti, 1768) is one of the two *Natrix* species in Ukraine. This species is on the list of the specially protected animals (Appendix II) of the Bern Convention (1998). *N. tessellata* belongs to the southern steppe hydrophilic and thermophilic species of Mediterranean origin by its biotopic and climatic preferences. The northern boundary of *N. tessellata* distribution is not studied enough for Ukraine. Thus, in 1950–1980 it was information that this species spread only on south and west of Ukraine, in Transcarpathian, Dnipropetrovsk, Luhansk, Odessa, Zaporizhzhya, Mykolaiv, Kherson Regions and almost everywhere on the coasts of the Black Sea and Sea of Azov and Crimean Peninsula (Tarashchuk, 1959; Shcherbak, 1966; Shcherbak, Shcherban, 1980). In 1960s Ukrainian areal of this species reached Pellaheivka vil. (Mykolaiv Region, 47°44' N) and Lubimovka (Dnipropetrovsk Region, 48°22' N); Russian areal reached 53–54° N: Uljanovsk Region (Tarashchuk, 1959; Bakiev et al., 2009). “Identification manual...” (Kurilenko, Verves, 1999) presents information that this species occurs in Cherkasy, Mykolaiv, Kyrovohrad (Sumy and Zhytomyr Regions misgiven), south of Kharkiv, Zaporizhzhya, arpathian Regions, in and Crimea. According to modern data, the northern boundary of *N. tessellata* distribution on the Left Bank Ukraine reaches the southern parts of Poltava, Kharkiv and Luhansk Regions, parallel or corresponding to July isotherm (21 °C) and north of — 49°41' N (Zinenko, 2008; Kotenko et al., 2011; Marosi et al., 2012). In the Right bank of Ukraine distribution of *N. tessellata* reaches southern part of Cherkasy, Zhytomyr (data needing verification), and Dnipropetrovsk, Poltava, Kirovohrad, Vinnytsa, Khmelnytsky, Ternopil, Ivano-Frankivsk and Zakarpattia Regions (Tarashchuk, 1999; Bulakhov, 2007; Nekrasova, 2010; Sobolenko, Tarashchuk, 2008).

## Material and methods

During 2003–2013 groupings of *Natrix tessellata* were found in Poltava Region near Kobeliaky (Kobeliakskiy District, Vorskla River, 49°09' N, 34°14' E), nearby Lubny (Lubny District, Sula River, 49°58' N, 33°01' E, fig. 1: 1, 2) and Cherkasy Region; Kyiv Region, Pereyaslav-Khmelnysky District (yacht club — 50°02' N, 31°29' E spring 2012, 2013; fishermen's station — 50°02' N, 31°17' E, coll. Saulko R. 01/05/2013). Standard morphological parameters were analyzed (2 morphometric and 10 features of pholidosis) for 11 dice snakes (5 females, 4 males, 2 juvenile) from Trakhtemyriv Peninsula (Cherkasy Region, Kaniv District): Buchak village (lake, 49°52' N, 31°25' E, fig. 1: 3; 2004–2005, 2007–2010, 2012), Hryhorivka village (Dnipro, 49°57' N, 31°25' E, fig. 1: 4; summer 2012–2013), Batura and Zarubency natural boundary (Dnipro, 49°59' N, 31°25' E, fig. 1: 5; summer 2012–2013), Monastirok natural boundary (Dnipro, 49°59' N, 31°23' E, fig. 1: 6; summer 2013); Trakhtemyriv Village (Dnipro, 49°59' N, 31°20' E, fig. 1: 7; 05/05/2013). Coloration and pattern was studied in vivo. Digital collection of photo was taken with Olympus SP570UZ camera; some specimens stored in collection of Schmalhausen Institute of Zoology NAS of Ukraine and Grigoriy Skovoroda National Pedagogical University of Pereyaslav-Khmelnysky. Statistical treatment was made with Statistica for Windows v. 8.0. Cartographic support was made with OziExplorer v. 3.95.4m and DIVA GIS (<http://www.diva-gis.org>) (cartographic modeling).

## Results and discussion

In 2003 a small aggregation of *N. tessellata* was found in the Leftbank Ukraine in the Vorskla River near village Kobeliaky. Same year a large aggregation of adults and juvenile specimens was observed south of Lubny along the right bank of Sula River (Poltava Region, July 2003). The specimens were of different age and coloration. Aggregations of



Fig. 1. Map of Ukraine with *Natrix tessellata* areal changes for the last 50 years.

Distributional ranges of *N. tessellata*: I — literature data for 1950–1970 (Sherbak, 1966; Tarashchuk, 1959); II — literature data (Bannikov et al., 1977; Ananjeva et al., 2004) and III — modern literature data (Kotenko et al., 2011); IV — latitude (50° N); new records in Poltava Region: 1 — Kobeliaky Village (Vorskla River), 2 — near Lubny (Sula River); Cherkasy Region: 3 — Buchak Lake (Dnipro, Kaniv Reservoir); 4 — Hryhorivka Village; 5 — Batura and Zarubency natural boundaries; 6 — Monastirok natural boundary; 7 — Trakhtemyriv Village; Kyiv Region, Pereyaslav-Khmelnysky District: 8 — yacht club; 9 — fishermen's station; Zhytomyr Region: «?» — Ruzhyn (lit. dat., Shcherbak, 1967).

Рис. 1. Карта Украины с указанием изменения ареала *Natrix tessellata* за последние 50 лет.

Границы распространения *N. tessellata* по литературным данным: I — литературные данные 1960–1970-е гг. (Шербак, 1966; Тарашчук, 1959); II — литературные данные (Банников и др., 1977; Ананьева и др., 2004); III — литературные данные (Котенко et al., 2011); IV — широта (50° с. ш.); точки новых находок в Полтавской обл.: 1 — окр. пгт Кобеляки (р. Ворскла), 2 — окр. г. Лубны (р. Сула); в Черкасской обл.: 3 — оз. Бучак (окр. с. Бучак, р. Днепр, Каневское водохранилище); 4 — пос. Григоровка; 5 — ур. Монастырек и ур. Батура (напротив пос. Луковицы); 6 — ур. Монастырек; 7 — пос. Трахтемиров и Киевская обл. Переяславо-Хмельницкий р-н: 8 — яхтклуб; 9 — рыбстан в Житомирской обл.: «?» — г. Ружин (лит. дан. Шербак, 1967).

dice snakes reached up to ten specimens per 1 km near steep slopes on the right bank of the Sula. On the 4th of July 1978 one dead snake was found by T. I. Kotenko (Kotenko et al., 2011). Later, this find was not confirmed by these authors.

In the summers of 2004, 2005 and 2007–2010 isolated specimens of *N. tessellata* were observed on the right bank of Dnipro, near Buchak Village. Dice snakes stayed in the deep artificial lake with running water. The lake of 7 ha was formed in 1980s in the excavation site of a hydro power pumping station. The lake is filled with spring water and connected with the Kaniv Reservoir. In 2012 a large group of dice snakes was found in the creeks of Dnipro from Hryhorivka to Lukovitsya villages, 4–12 km north of the lake. In 2013 snakes were observed north of — Cherkasy Region, Kaniv District: Monastirok natural boundary; Trakhtemyriv Village; Kyiv Region, Pereyaslav-Khmelnysky District: yacht club and fishermen's station (see materials and methods).

Young specimens of Trakhtemyriv Peninsula hatched in the beginning of the summer 2012, were 200–215 mm of body length (L.), and 35–40 mm of caudal length (L. cd.) in July; one female laid eggs in the beginning of July.

Body length of adults (L.) —  $648 \pm 36$  mm, tail (L. cd.) —  $147 \pm 36$  mm (total length: males (m) — 585–905 mm; females (f) — 700–950 mm); L./L. cd. =  $4.4 \pm 0.2$  (m —  $4.3 \pm 0.3$ ; f —  $4.5 \pm 0.2$ ). Head scales: upper labral (Lab.) — 7–9, lower labial (Sub. lab.) — 8–10, preorbital (Pr.) — 2–3, postorbital (Post.) — 3–4, temporal (Temp.) — 1(3). Neb sharpened, suture between rostral and first upper labral more than two times larger than rostral and internasal suture, posterior chin shields scute longer than anterior and separated by scales. Squamae around middle of body (Sq.) — 19–21 (m —  $19.3 \pm 0.3$ ; f —  $19.8 \pm 0.4$ ). Scutes on ventral part of body (Ventr.) — 161–190 (m —  $183.3 \pm 3$ ; f —  $179.6 \pm 5$ ), under tail (S. cd.) — 56–70 (m —  $58.8 \pm 3$ ; f —  $61.0 \pm 5$ ), anal scute (A.) separate. Squamae on back and dorsal part of tail is with well-developed edges. Juvenile snakes (n = 2 specimens) had light grey-brown coloration with 4 rows of black spots on dorsal (Werner, Shapira, 2011), and yellow-orange ventral part with black spots. All black spots were in staggered order. 60 % of adult specimens were grey or brown, dorsal side with 4–6 rows of black spots, which are merging sometimes and form dotted stripes (squamae edges could be yellow-orange), ventral part of body yellow (34 %) or orange (66 % of the light forms) with black spots in staggered order. Black spots are usually merged near anal scute. 40 % of adult specimens with dark or black dorsal part of body (“partial melanist” — sometimes with light motleys), the labral and labial scutes are partially white, ventral part is black and white, caudal scales are black, the iris black.

Most of the melanistic forms (more than 5 %) occurred in the South of Ukraine on Kerch Peninsula. Apart from the dark color of dorsal and ventral part of the body, specimens had difference in pholidosis features (Karmishev, 2002; Pisanets et al., 2005). At the northern boundary of distribution of *N. tessellata* in Russia (north-western part of Samara Region,  $53^{\circ}30' N$ ), most of snake specimens had dark color dorsal surface and black or yellow-red ventral body part with dark spots (Bakiev et al., 2009).

*N. tessellata* is the thermophilic species and on the northern boundary of areal it needs special landscape and microclimatic conditions to survive, for example stony denudations. In Russia, at the northern boundary of *N. tessellata* areal (Samara Region) this species occurs near rocky cliffs of rivers (Volga, Usa). Mass hibernation of *N. tessellata* was confined exactly to the stony denudations (Bakiev et al., 2009). Maximum amount of dice snakes in Ukraine was observed near granite denudations and steeps (or near) in the Mykolaiv and Zaporizhzhya Regions. The association found in Cherkasy Region kept near southern and south-eastern side of Dnipro right bank steeps. The highest bank altitudes are located in this part of Trakhtemyriv Peninsula (Hryhorivka village, 242 m a. s. l.). This species has not been found near slope banks and on the northern and north-west steeps near Khodoriv Vil. (Kyiv Region). *N. tessellata* has been observed in

the Poltava Region (south of Lubny) near steeps and hills of one of the highest parts of Sula river (c. 140–143 m a. s. l.). This species has not been found nearby on slope zones.

Near Hryhorivka Village (Cherkasy Region), the dice snakes were represented by different age groups. In total, 20 specimens of this species were observed. Their population was about 9 specimens per 1 km. Length of adult females was up to 950 mm (data above). 3 subad. and 2 juv. specimens of *N. tessellata* were recorded. Recorded rates show that the age of this association is not more than 6–10 years. This information was confirmed by local fishers. In the beginning of July 2012 the highest activity of *N. tessellata* was recorded not only in the morning but also in the evening hours. As the heat declines (after 17 : 00 PM) mass hunt of dice snakes for bullhead fish was observed; they hunted on neaps 100–200 m from the shore.

The artificial lake near Buchak village also has steep banks, but only separate specimens of *N. tessellata* were observed there. We have captured one female 730 mm long in 2004. We suggest that specimens get into the Buchak's lake from Hryhorivka Village randomly. The specimens of snake possibly appeared in the begging of 2000s as the result of expansion upstream the Dnipro cascade or as the result of fish seeding.

Shcherbak (1967) noted that V. I. Brukhovsky collected *N. tessellata* in the south of Zhytomyr Region, near Ruzhyn (49°42' N, fig. 1: «?») in 1958. Nowadays this specimen is stored in the collection of Zhytomyr Museum of Local History. There were no records of this species from Zhytomyr Region later.

Thus, the northern boundary of *N. tessellata* distribution reaches: south of Lubny (Poltava Region, Sula River, 49°58' N, fig. 1: 2); Kyiv Region, Pereyaslav-Khmelnytsky District (50°02' N, fig. 1: 8, 9) for the left bank; Trakhtemyriv Village and Monastirok natural boundary (Trakhtemyriv Peninsula, Cherkasy Region, Kaniv District, Dnipro, 49°59' N, fig. 1: 6, 7) for the right bank. Dice snakes of Trakhtemyriv water area have about 40 % of snakes of the dark form, which represented by melanists and “incomplete melanists” with black and white ventral part of body (n = 11 specimens). This is the quite a large association represented by different age groups. The dice snakes were observed on the peninsula since 2004, but in the last two years the growth of population was recorded. This localities are 80 km to the north of the previous areal boundary, and more than 200 km northwards of the areal boundary 50 years ago (Shcherbak, 1967). The climatic changes are one of the reasons of dice snake areal changing. These changes are confirmed by several facts. In 1981–2004 temperature of air surface layer in the Dnipro basin has grown for 0.5 °C (Strutinska, 2007). Along with temperature growth of the air, late freezing time for the Dnipro can be explained by insertion of chilling processes for such great volume of water in reservoirs. Also, the temperature of water, in Kyiv for April and May become higher than even in Kherson, after the Dnipro cascade was created (Vyshnevsky, 2011). It allowed penetration of previously unknown animal species to Kyiv (Nekrasova, Tytar, 2009). It is also worth note the appearance and increase in the diversity of the prey-gobies and some other fish species. Thus, the recording of the *N. tessellata* associations at 50° N show that this thermophilic species moves northwards, and such monitoring studies should be continued.

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