Zoodiversity, **57**(3): 215–222, 2023
DOI 10.15407/zoo2023.03.215

UDC 598.115.31(477.44)

CONFIRMATION OF THE PRESENCE OF THE *DOLICHOPHIS CASPIUS* (SERPENTES, COLUBRIDAE) IN VINNYTSIA REGION — THE WESTERNMOST LOCALITY OF THE SPECIES IN UKRAINE NEAR ITS NORTHERN SPECIES RANGE

N. A. Smirnov[1]*, O. I. Zinenko[2] & D. A. Smirnov[3]

[1]*Chernivtsi Regional Museum, vul. O. Kobylianskoi, 28, Chernivtsi, 58002 Ukraine*
[2]*The Museum of Nature and School of Biology, V. N. Karazin Kharkiv National University, Svobody Sq., 4, Kharkiv, 61022 Ukraine*
[3]*The Armed Forces of Ukraine*
**Corresponging author*
E-mail: nazsmirnov@gmail.com

N. A. Smirnov (https://orcid.org/0000-0001-9731-6404)
O. I. Zinenko (https://orcid.org/0000-0001-5228-9940)

urn:lsid:zoobank.org:pub:EA9CF604-9D9B-4D23-A7A2-257E594E6BDD

Confirmation of the Presence of the *Dolichophis caspius* (Serpentes, Colubridae) in Vinnytsia Region — the Westernmost Locality of the Species in Ukraine Near its Northern Species Range. Smirnov, N. A., Zinenko, O. I. & Smirnov, D. A. — For the ongoing range shifts under climate change, it is essential to have reference information on the current presence of the species. In recent years, there has been an increase in observations of thermophilic reptiles outside their historical range in Ukraine. The distribution of the Caspian whipsnake, a common snake in southern Ukraine, appeared to be poorly documented at the northern edge of its range due to low density under sub-optimal conditions at the edge of the range. Here we provide verified observations of the Caspian whipsnake from the Mohyliv-Podilsky (formerly Yampil) District of the Vinnytsia Region. These data considerably extend and specify the north-western limit of the range and, together with accompanying data on the frequency of species observations, support the hypothesis of a northward shift in the range of the species and/or a strong recent increase in the abundance of the species.

Key words: Caspian whipsnake, Reptilia, distribution records, road mortality, Podillia, Eastern Europe.

Introduction

The Caspian whipsnake, *Dolichophis caspius* (Gmelin, 1789), is one of the largest snakes in Europe (Arnold & Ovenden, 2004). Its range extends from Hungary and the Balkans in the west to the Caucasus and northwestern Kazakhstan in the east, and from Anatolia in the south to central Ukraine and the southern Russian Federation in the north (Arnold & Ovenden, 2004; Bellaagh et al., 2008; Sahlean et al., 2014). In Ukraine, the vast majority of observations come from Crimea and the southern steppe zone of Ukraine in the Donetsk, Dnipropetrovsk, Kherson, Kirovohrad, Luhansk, Mykolaiv, Odesa, Poltava and Zaporizhzhya regions (Akimov, 2009; Tytar & Nekrasova, 2016; Nekrasova et al., 2019). Meanwhile, in the recent regional herpetological monograph by V. Reminny and O. Matviichuk (2018), *D. caspius* was listed in the fauna of the Vinnytsia Region. This statement was based on a photo from a social network and was not subsequently verified by observations or collections. Therefore, the presence of *D. caspius* and its population status should be confirmed given the remote location of the find from the known localities of the species in Ukraine.

Material and Methods

Field surveys were conducted in September 2021 and June 2022 in the vicinities of Yampil town, Bila, Velyka Kisnytsia, Porohy, and Rusava villages in Mohyliv-Podilsky (former Yampil) District of Vinnytsia Region, Ukraine. In addition to own surveys, the observations of *D. caspius* in the Vinnytsia Region by local amateurs from personal communications and the social network Facebook (group "Frogs, lizards and snakes" (https://www.facebook.com/groups/1449554118682265/)) were used.

The following morphological characteristics of snakes were recorded: Ventr — the number of ventral scales; S.q. — the number of scales around the midbody, S.cd. — number of pairs of subcaudal scales, Lab — number of supralabials (left/right), Temp — number of temporal scales in the first + second rows (left/right), A — anal scale (1/1 — divided, 1 — entire). The length of the body (L.) and tail (L.cd.) of snakes was measured using a tape measure (the accuracy 1 mm), the mass was measured using digital scale (the accuracy 1 g).

The air temperature was measured using the PeakMeter PM6252B multifunctional device (Peakmeter Instruments Co., Ltd), the substrate temperature was measured using a Benetech GM320 pyrometer (Shenzhen Jumaoyuan Science and Technology Co., Ltd), and the geographic location was determined using a Garmin eTrex 10 portable GPS navigator (Garmin Ltd.).

Maps were prepared in the Google Earth Pro 7.3.4.8248 and QGIS 3.4.10 software. For the maps we used *D. caspius* records from the literature source (Dotsenko, 2003; Dotsenko & Radchenko, 2005; Biliakov & Taraschuk, 2008; Roman et al., 2008; Nekrasova, 2013; Oskyrko & Jablonski, 2021) and the national platforms of citizen science UkrBIN (2017) as well as GBIF (https://www.gbif.org; Kharchenko et al., 2021; Vasyliuk et al., 2022).

Results

Since the first report about the possible occurrence of *D. caspius* in southern Vinnytsia Region in 2018 (Reminnyi & Matviichuk, 2018) the authors received several reports from local residents about very big snakes near Yampil town. In some cases, correspondents reported the dead animals on the suburban roads, in other cases they observed large snakes on the Dniester slopes. However, no solid evidences (pictures, video, specimens) were provided proving that it was not locally common the grass snake, *Natrix natrix* (Linnaeus, 1758), or the dice snake, *N. tessellata* (Laurenti, 1768).

A dead snake with a total length apparently exceeding 1.5 m was found 08.09.2021 on the eastern outskirts of Yampil town (48.2446 N, 28.3033 E, Zibrovsky O. V., personal communication) and was identified as the Caspian whipsnake. According to observed injuries, the snake was killed by a human. The specimen had been preserved (fig. 1, *a*) and initial identification was later confirmed. It was an adult male Caspian whipsnake with a total length exceeding 166 cm (end of the tail missing, body damaged). In one week, 15.09.2021, D. Smirnov had found nearby, on the motorway P08 (48.25045 N, 28.29298 E), fresh body of one more subadult male Caspian whipsnake. This specimen was also preserved (fig. 1, *b*). All specimens are temporarily stored in the working collection of the Department of Nature of the Chernivtsi Regional Museum.

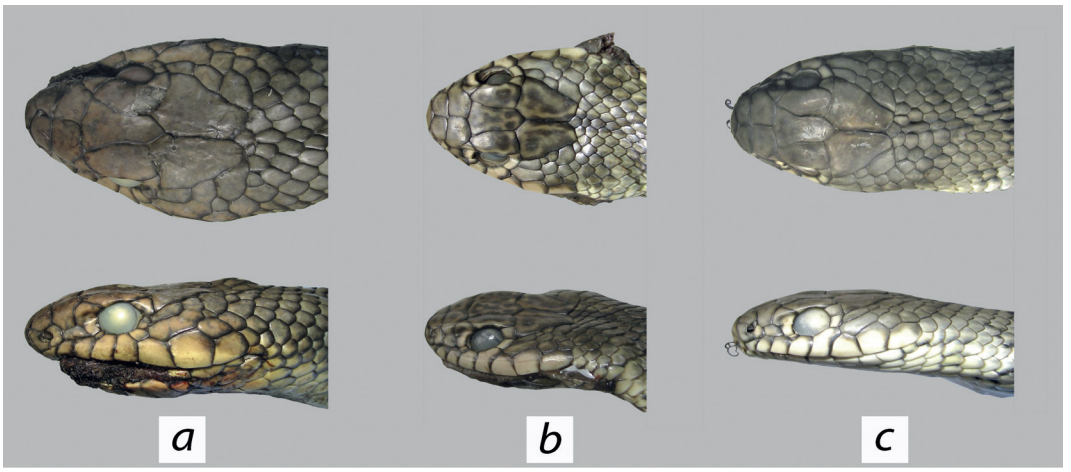

Fig. 1. Head scalation the specimens of the Caspian whipsnake in the vicinities of Yampil: *a* — adult male, 08.09.2021; *b* — subadult male, 15.09.2021; *c* — subadult female, 26.09.2021.

Consequently, we made several excursions to the Yampil vicinities between 26 and 28 September 2021: large abandoned quarry in the eastern part of the town, adjacent territories, old and new cemeteries, jewish cemetery between Yampil and Porohy, steppe slopes, pits, roads and small streets in industrial districts were searched. Special attention was paid to roads, because it is well known that the Caspian whipsnakes are common victims of traffic (Covaciu-Marcov et al., 2012; Ile et al., 2020). During these surveys we had registered the green lizard, *Lacerta viridis* (Laurenti, 1768), the grass snake, *N. natrix,* and the dice snake, *N. tessellata*. Even though we did not observe any active Caspian whipsnakes, 26.09.2021 at 15.30 (local time) while searching motorway T0202 we had found dead subadult female *D. caspius* (fig. 2). It was overridden probably a few hours before she was found (fig. 1, *c*). The animal was laying on the side of a road near the town cemetery (48.24809 N, 28.29924 E). Air temperature this day had reached +21 – +23 °C in the midday, while substrate had heated on sunny spots of a road up to +19 – +24 °C. Main body measurements and pholidosis traits for all three specimens are given in the table 1.

New observations of the Caspian whipsnake from the South of Vinnytsia Region were reported in social network Facebook in the first half of 2022. The snake was observed 8.05.2022 near the Porohy village about 2 km east of our findings by L. Moroz (48.24 N, 28.32 E; personal communication, confirmed by photo). One more snake was observed while climbing branches of a small tree 11.06.2022 near Velyka Kisnytsia village, 15–

Fig. 2. Road killed subadult female of Caspian whipsnake (*a*) and road section (motorway T0202) near Yampil's cemetery (*b*) where this snake was found on 26.09.2021.

Table 1. Morphological parameters of *D. caspius* from Yampil

Parameter	Specimens (date of collections)		
	# 1 (8.09.2021)	# 2 (15.09.2021)	# 3 (26.09.2021)
Sex	male	male	female
L., mm	1310	602	553
L.cd., mm	> 354*	216	197
L./L.cd.	–	2.79	2.81
Ventr	195	192	200
S.cd.	> 71*	99	99
S.q.	19	19	18
Temp, left/rigth	2 + 3/2 + 3	2 + 3/2 + 2	2 + 3/2 + 3
Lab, left/rigth	8/8	8/8	8/8
A	1/1	1/1	1/1
Mass, g	> 762	77	61

*The end of the tail is missing.

20 km to the S-E from our findings near Yampil (~ 48.1 N, 28.1 E; photo observation by N. Khomytovska; https://www.facebook.com/photo/?fbid=1920290614847684&set=gm.2823267647977565&idorvanity=1449554118682265). Considering these observations, we have tried to complement them and did a survey in suitable habitats and along roads in Yampil, Bila, Velyka Kisnytsia, Porohy and Rusava vicinities, but failed to add any records.

Discussion

Thus, the presence of the Caspian whipsnake in the southern part of Vinnytsia Region is now a confirmed fact. The population conditions including density and area of habitats in Yampil vicinities however could not be estimated, but the presence of specimens of different size and age prove that the population there is viable and seems stable. Reports of local people about the regular encounters of large (above 1.5 m long) snakes in and around the quarry could be the indirect evidence of this. All observations in this area (fig. 3, *a*) were situated within 1 km from the sandstone quarry and were near town cemetery, where the snake was initially reported by V. Reminnyi and O. Matviichuk (2018) (V. Reminny, personal communication). Reports of observations of very large snakes also come from the nearest vicinities of these localities within administrative borders of Yampil and Porohy. So, we assume that the core of the population is situated in the quarry and cemetery territories. Available habitats with the overall area 25–30 ha there are represented by typical to the whipsnake slopes, covered by steppe vegetation and bushes (fig. 3, *b*), stone outcrops in partially exploited quarries (fig. 3, *c*), abandoned graves and buildings, etc. The territory is full of cavities, piles of rubbish, which, in turn, evidently enrich the habitat and provides snakes with shelters and food objects (small mammals, birds and reptiles) simultaneously having low human pressure.

First finding of the Caspian whipsnake in Vinnytsia Region 08.06.2018 near Porohy village, former Yampil District was published by V. Reminny and O. Matviichuk (2018). But for the neighboring territories of the Republic of Moldova this species had been listed earlier. Thus, records of this species were reported by M. Lozan and colleagues (1998) for "Stynka" Reserve near Cosăuţi village, Soroka District, on the opposite bank of the Dniester River from Yampil. The Red Data Book of Moldova the presence of the species is indicated on a map along the Dniester River to the North approximately up to the Rîbnyţa town

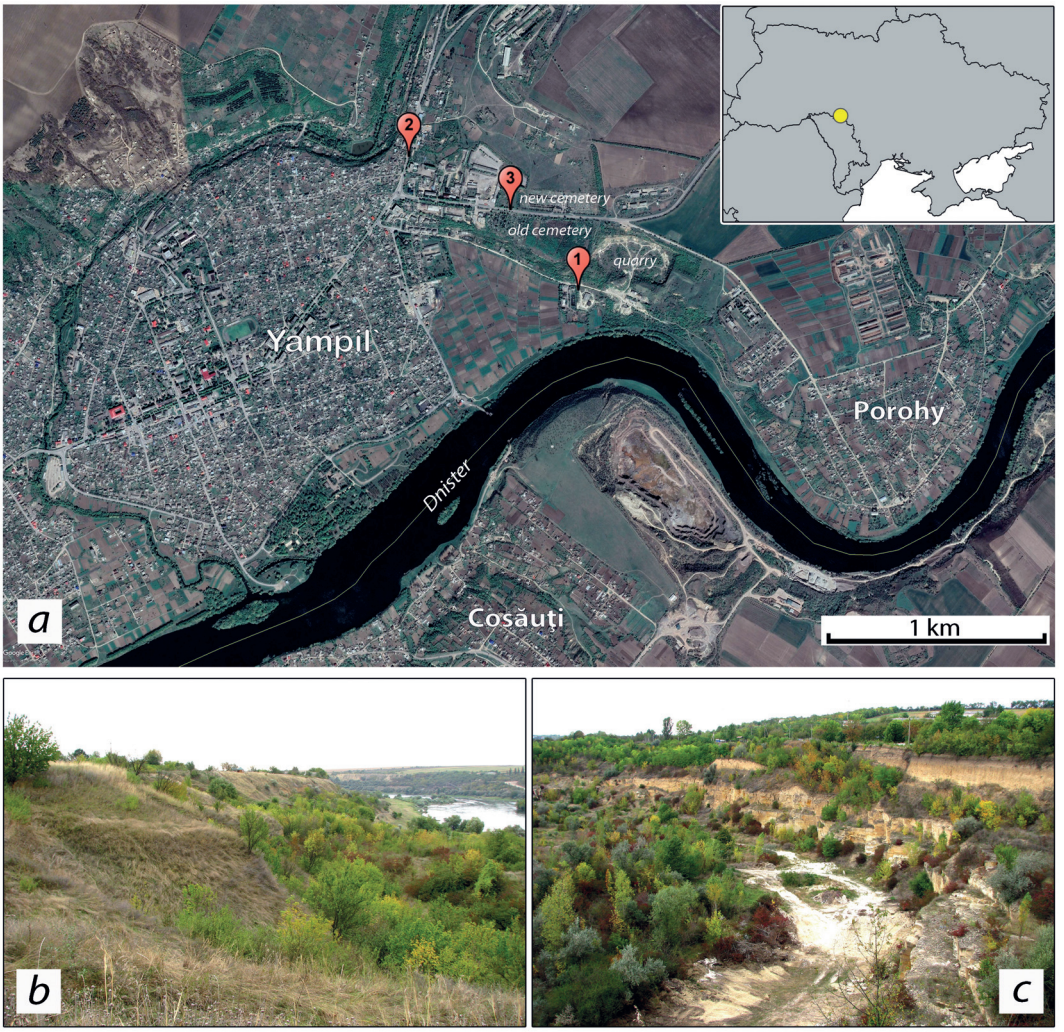

Fig. 3. Places of registrations of *D. caspius* near Yampil, Vinnytsia Region (*a*: 1 — adult male, 08.09.2021; 2 — subadult male, 15.09.2021; 3 — subadult female, 26.09.2021) and habitats (*b* — slopes of the Dniester River; *c* — quarry).

near Moldova–Ukraine state border (Cartea Roșie…, 2015). Also there is an indication of this species presence in the Yagorlyk River valley near Doibani village (Bezman-Moseyko, 2008). Literature data from Ukraine however contains only nearest localities in Odesa Region, where this species was observed by O. Brauner in 1910 near Podilsk town (former Kotovsk and Birzula) (Dotsenko, 2003; Dotsenko & Radchenko, 2005), while most of current localities of the species are from the Black Sea shore or come from the Southern Buh River valley (fig. 4). Our surveys of Podilsk in September 2021 and May–June 2022 did not bring any observations of the whipsnake.

At the same time, recent observations of large snakes became more frequent along the northern border of the Whipsnake range, specifically along the Oril River in the Southern Kharkiv Region (G. D. Turaziani, personal communication).

Thus, Yampil is the westernmost known locality of *D. caspius* range in Ukraine (approximately 110 km to the north-west from nearest locality in Podilsk, 200 km to the west and north-west from localities in Odesa and Mykolaiv regions) and is one of the northern-

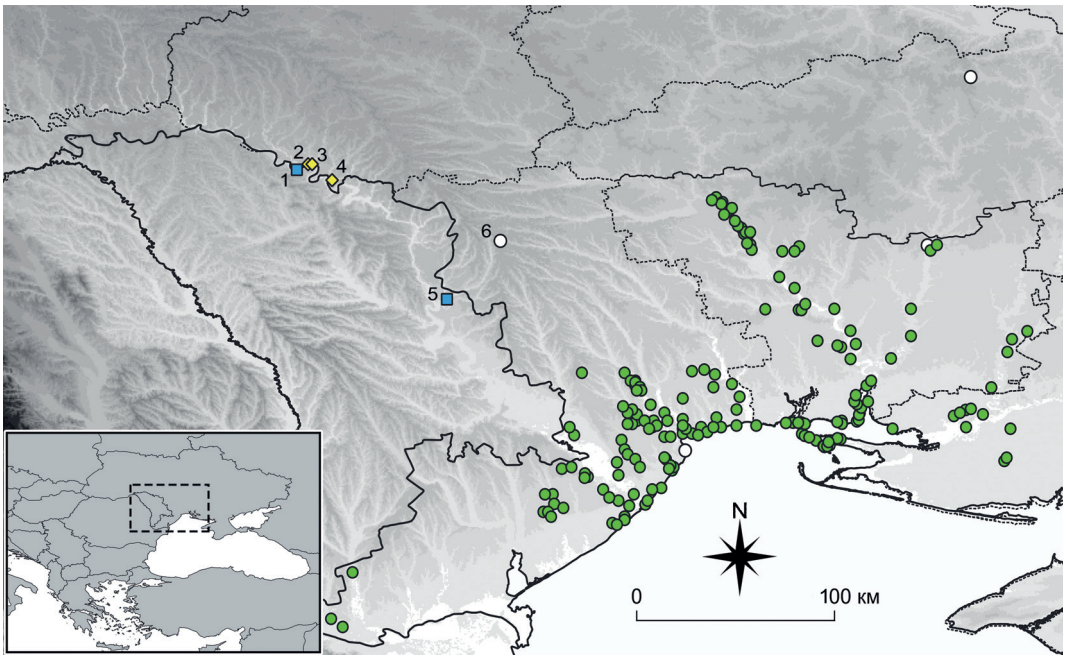

Fig. 4. The distribution of *D. caspius* in south-west of Ukraine (white circles — observations before 1922, green circles — observations after 1922, yellow diamonds — observations in Vinnytsia Region, blue quadrats — northernmost localities in Moldova). Numbered north-west border localities in Ukraine and Moldova: 1 — Cosăuţi, 2 — Yampil, 3 — Porohy, 4 — Velyka Kisnytsia, 5 — Doibani, 6 — Podilsk (after: Lozan et al.,1998; Dotsenko, 2003; Dotsenko & Radchenko, 2005; Bezman-Moseyko, 2008; Biliakov & Taraschuk, 2008; Roman et al., 2008; Nekrasova, 2013; Reminnyi & Matviichuk, 2018; Kharchenko et al., 2021; Oskyrko & Jablonski, 2021; Vasyliuk et al., 2022; UkrBIN, 2017; L. Moroz and N. Khomytovska observations; our data).

most localities in western part of Ukraine (fig. 4). This locality, however, is only 10 km away from Cosăuţi in Moldova which could be viewed as a possible source population.

Two authors of this note, N. Smirnov and D. Smirnov, have been monitoring herpetofauna of the former Yampil region for 25 years. The quarry in Yampil was surveyed multiple times in the end of 1990th–2000th, but no whipsnakes had been found. We did not hear any personal communications about very large snakes in the vicinity of Yampil until 2018. Perhaps this results from the extremely low number of whipsnake in the region in previous decades. And now we are observing an increase in the population due to changes in living conditions, particularly warming due to the climate change. Relatively recent resettlement due to the expansion of the range of the species in the northeastern direction along the Dniester River could be an alternative explanation. We also do not exclude that the Caspian whipsnake could colonise the region from Moldova by crossing the Dniester. It is known that the Caspian whipsnake is not a frequent but good swimmer (Oskyrko & Jablonski, 2020). The water level in the section of the Dniester became low in recent years with rocks and small islets in the river which could facilitate migration. But this is only our assumption which needs a check in future. Also, the modern distribution of the whipsnake in the north of the Odesa Region of Ukraine and in the northeast of Moldova must be studied. It will help to understand the ways the probable expansion of *D. caspius* in this part of the species range.

The reptile fauna in Ukraine has range borders of many species (all racers and rat snakes, the Dice snake, the Steppe viper, *Vipera renardi* (Christoph, 1861), the Steppe runner, *Eremias arguta* (Pallas, 1773)), with several invasive species introduced in recent

years (Matvyeyev et al., 2013; Kukushkin & Jablonski, 2016; Krasylenko & Kukushkin, 2017; Nekrasova et al., 2022), and even sea turtles' encounters became more frequent in Black Sea in the recent decade (Zinenko et al., 2021). Some thermophilic reptile species like *Zamenis longissimus* (Laurenti, 1768) became more abundant judging on number of registration which contrasts with its recent status "Endangered" in the Red Data Book of Ukraine (Akimov, 2009). It is difficult to disentangle here such factors as intensification of field researches, development of citizen science, availability of smartphones and exposure of information about species in social networks, but the number of rediscovered populations seems also connected with changes of population densities (Vikyrchak & Smirnov, 2014; Hrynchyshyn et al., 2020; Smirnov, 2022). Therefore, we believe that ongoing climate changes are also reshaping the distribution of southern reptile species in Ukraine, and this hypothesis needs to be verified and such processes need to be monitored in future research.

Acknowledgements

Authors are grateful to O. Zibrovsky, V. Reminny, L. Moroz and N. Khomytovska for information about records of Caspian whipsnake in Vinnytsia Region, A. Tupikov and N. Suriadna for valuable consultations.

Some equipment for field survey was donated to N. Smirnov by IDEA WILD organization in 2018. Field investigations in North of Odesa region in 2021 were financed by Societas Europaea Herpetologica Grant in Herpetology "Landscape ecology approach to understand local extinctions of the steppe viper".

We thank all the defenders of Ukraine who made this publication possible.

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Received 23 February 2023
Accepted 26 April 2023