Zoodiversity, **56**(6): 489–494, 2022
DOI 10.15407/zoo2022.06.489

UDC 597.6(477.85)

THE CASES OF ABNORMAL AMPLEXUS IN ANURA ON THE TERRITORY OF THE CHERNIVTSI REGION, UKRAINE

N. A. Smirnov

Chernivtsi Regional Museum,
vul. Olha Kobylianska, 28, Chernivtsi, 58002 Ukraine
E-mail: nazarsm@ukr.net

https://orcid.org/0000-0001-9731-6404

urn:lsid:zoobank.org:pub:0D20DC00-A170-4D75-B030-75B487743B1B

The Cases of Abnormal Amplexus in Anura on the Territory of the Chernivtsi Region, Ukraine. Smirnov, N. A. — The paper contains information about 21 cases of abnormal amplexus among anurans (Amphibia) detected on the territory of the Chernivtsi Region, Ukraine. Multiple amplexus, consisting of one female and two or more males, was registered in three species: *Bombina variegata*, *Bufo bufo*, *Rana temporaria*. The author described interspecific amplexus in six cases. Five of them were among anurans (*Bufo bufo* male × *Pelophylax lessonae* male, *Rana dalmatina* males × *Rana temporaria* female or males, *Rana temporaria* male × *Pelophylax ridibundus* female) and one case — among Anura and Caudata (*Bombina variegata* male × *Lissotriton montandoni* female).
Key words: Amphibia, abnormal spawning, mating behaviour, *Lissotriton montandoni* .

Introduction

Amplexus is a form of mating behaviour known in most species of anurans (Duellman & Trueb, 1994). Normally amplexus is a part of mating behaviour when a male wraps its forelegs around a female and fertilizes the eggs that are being laid. Such behaviour enables partners to synchronize allocating reproductive products and increase the chances of successful external fertilization due to the closest approaches of male's and female's cloacas. Currently, seven types of amplexus are known among anurans, the most common of which are axillary and inguinal types (Duellman & Trueb, 1994; Willaert et al., 2016).

As a rule, amplexus is an interaction of one male with one female of the same species, however different deviations also can take place. For example, there have been cases of multiple amplexus with interaction among one female and several males, among males of the same species or with amphibians of different species, with non-living individuals of its or other species or inanimate objects of the surrounding nature (Mollov et al., 2010; Kuzmin, 2012).

Abnormal amplexus is a result of a breakdown in mating behaviour. Such a phenomenon is relatively rare because it leads to unreasonable spending of resources – energy and time (Simović et al., 2014). As an exception, there is a multiple amplexus common to species with "explosive" reproduction and which were documented, for example, for *Bombina variegata* (Linnaeus, 1758), *Bufo bufo* (Linnaeus, 1758), *Rana temporaria* Linnaeus, 1758, *Rana iberica* Boulenger, 1878 and others (Hartel et al., 2007; Ayres, 2008; Kuzmin, 2012; Đorđević & Simović, 2014). Fewer interspecific amplexus was found (among beings of different species) (Gherghel et al., 2008 a; Strugariu & Gherghel, 2008; Simović et al., 2014; Rocha et al., 2015; Gül et al., 2018; Mačát & Jablonski, 2018; Mačát et al., 2019; Vásquez-Cruz et al., 2019; Decemson et al., 2020; Amin et al., 2021; Koynova & Natchev, 2021; Pupins et al., 2022), between males and dead females (Pintanel et al., 2021; Pupins et al., 2022), with other males (Mollov et al., 2010) or with inanimate objects (Mollov et al., 2010; Đorđević & Simović, 2014; Pupins et al., 2022) and even the cases with females act like a male (Malashichev, 1999).

The information about abnormal amplexus for the territory of Ukraine is rather scarce. There are reports on copulation of *Pelophylax ridibundus* (Pallas, 1771) with *Bufotes viridis* (Laurenti, 1768) in Crimea (Shcherbak, 1966), *Pelobates fuscus* (Laurenti, 1768) with *Epidalea calamita* (Laurenti, 1768) in Volyn (Zabroda and Ilyenko, 1981), *Rana dalmatina* Fitzinger in Bonaparte, 1839 with *R. temporaria* in Chernivtsi Region (Smirnov, 2013), multiple amplexus of *B. bufo* and attempt of *R. temporaria* to interact with other species (Pysanets, 2014). In the Carpathians (Shcherbak & Shcherban, 1980) abnormal amplexus was registered for *B. bufo* (multiple amplexus, couples with other species, interacting with dead females or a piece of wood), *B. viridis* (multiple and interspecific amplexus), *Pelophylax lessonae* (Camerano, 1882) (interspecific amplexus), *R. temporaria* (multiple amplexus). Different types of abnormal amplexus were notified in Kharkiv Region (multiple amplexus in *B. bufo*, interspecific amplexus between *Rana arvalis* Nilsson, 1842 and *P. fuscus*, *R. arvalis* and *B. bufo*, *B. bufo* and *P. ridibundus*, *P. fuscus* and *Triturus cristatus* (Laurenti, 1768)) (Shabanov, 2011).

The purpose of this work is to characterize the cases of abnormal amplexus detected in the Chernivtsi Region of Ukraine.

Material and methods

The paper is based on the results of field studies conducted by the author during March–June 2008–2021. We studied the reproductive biology of amphibians during surveys of various types of water bodies in Chernivtsi Region in the breeding season. The cases of abnormal amplexus were registered by photos or videos where possible. Coordinates were determined by using the package of Google Earth or GPS navigators Garmin eTrex 10 and eTrex 30. We measured the temperature of air (Ta) or water (Tw) by a mercury-in-glass thermometer (resolution 0.1 °C).

Results and discussion

During the research we collected information about 21 cases of abnormal amplexus (table 1) from the following types: multiple amplexus (fig. 1, *a, b*), interspecific amplexus (fig. 1, *c–e*), amplexus with a dead specimen, incorrect embrace, amplexus between a male and inanimate object (fig. 1, *f*). In some cases, we observed a combination of several types of amplexus, e. g. amplexus among two males of *R. dalmatina* and dead male *R. temporaria*, incorrect embrace (from the abdominal side) of a dead *R. temporaria* female by a male of the same species, multiple amplexus and embrace of *R. temporaria* female from the abdominal side (fig. 1, *b*).

More than half of the noted cases (11 or 52.3 %) were multiple amplexus among one female and two or more males. Such behaviour was observed in three species of amphibians — *B. variegata*, *B. bufo* and *R. temporaria*. Moreover, in most cases registered in *B. variegata* and *R. temporaria* (3 and 6 accordingly), it was a combination of multiple amplexus and incorrect embrace (a part of males grasped female from the abdominal side). The cases of multiple amplexus for this species were known from a number of publications (Shcherbak and Shcherban, 1980; Hartel et al., 2007; Gherghel et al., 2008 b; Mollov et al., 2010; Kuzmin, 2012; Đorđević and Simović, 2014; Pysanets, 2014; Pupins et al., 2022). The disparity in the ratio of sex during reproduction may be a possible explanation of this phenomenon. Males of these species outnumber females in a breeding site, thus, females are a valuable resource for males (Hartel et al., 2007; Mollov et al., 2010).

Interspecific amplexus is the second type by the frequency of detection (6 cases or 28.6 %). Males of *R. dalmatina* tended to make mistakes, trying to make amplexus with other species, more often (three cases). One mistake registered in *B. bufo*, *B. variegata* and

Table 1. Cases of abnormal amplexus in anurans in the Chernivtsi Region

Type of aberration	Species	Date, Locality, Coordinates	Notes
Multiple amplexus	*Bombina variegata*	13.06.2010, Stebnyk tract, Berehomet urban vill., Vyzhnytsia Distr. (48.145 N, 25.278 E)	Two cases: 1 ♀, 5 ♂; 1 ♀, 2 ♂
	Bombina variegata	2.06.2011, Krasnoilsk urban vill., Vyzhnytsia Distr. (48.021 N, 25.506 E)	1 ♀, 5 ♂
	Rana temporaria	27.03.2012, Stebnyk tract, Berehomet urban vill., Vyzhnytsia Distr. (48.145 N, 25.266 E)	1 ♀, 3 ♂ (Tw 3.5 °C)
	Bombina variegata	22.05.2012, Stebnyk tract, Berehomet urban vill., Vyzhnytsia Distr. (48.143 N, 25.259 E)	1 ♀, 7 ♂
	Rana temporaria	5–6.04.2016, Perkalab forest plot, Vyzhnytsia distr. (47.80 N, 24.95 E)	Five cases: 1 ♀, 2 ♂
	Bufo bufo	22.03.2017, "Hariachyi Urban" forest park, Chernivtsi (48.296 N, 25.988 E)	1 ♀, 2 ♂ (Ta 16.0 °C; Tw 10.5 °C)
Interspecific amplexus	*Bufo bufo* × *Pelophylax lessonae*	31.03.2009, Shypyntsi vill., Chernivtsi Distr. (48.369 N, 25.734 E)	A ♂ *B. bufo* has embraced a ♂ *P. lessonae* (dead animals on the road)
	Bombina variegata × *Lissotriton montandoni*	13.05.2010, Stebnyk tract, Berehomet urban vill., Vyzhnytsia Distr. (48.145 N, 25.280 E)	A ♂ *B. variegata* has embraced a ♀ *L. montandoni* (Tw 18.9 °C)
	Rana dalmatina × *Rana temporaria*	20.03.2012, "Hariachyi Urban" forest park, Chernivtsi (48.293 N, 25.990 E)	A ♂ *R. dalmatina* has embraced a ♀ *R. temporaria* (on the bank of a pond; Ta 11.0 °C)
	Rana dalmatina × *Rana temporaria*	21.03.2012, "Tsetsyno" reserve, Chernivtsi (48.305 N, 25.837 E)	Two ♂ of *R. dalmatina* has embraced a dead ♂ *R. temporaria* (Tw 9.0 °C)
	Rana dalmatina × *Rana temporaria*	2.04.2013, "Hariachyi Urban" forest park, Chernivtsi (48.293 N, 25.990 E)	A ♂ *R. dalmatina* has embraced a ♂ *R. temporaria* (Ta 10.0 °C)
	Rana temporaria × *Pelophylax ridibundus*	29.03.2016, Kitsman` town, Chernivtsi Distr. (48.454 N, 25.738 E)	A ♂ *R. temporaria* has embraced a ♀ *P. ridibundus* (on the bank of a pond; Ta 14.5 °C)
Incorrect embrace and amplexus between alive male and dead female	*Rana temporaria*	25.03.2010, "Hariachyi Urban" forest park, Chernivtsi (48.293 N, 25.989 E)	A ♂ *R. temporaria* has embraced a dead ♀ *R. temporaria* from the abdominal side (Tw 12.2 °C)
Incorrect embrace	*Rana dalmatina*	12.03.2014, "Hariachyi Urban" forest park, Chernivtsi (48.293 N, 25.990 E)	A ♂ *R. dalmatina* has embraced a ♀ *R. dalmatina* from the abdominal side (Tw 7.5°C)
	Rana dalmatina	26.03.2021, near Valia Kuzmina vill., Chernivtsi Distr. (48.164 N, 26.047 E)	A ♂ *R. dalmatina* has embraced a ♀ upside down in the axillar area (Tw 7.5 °C)
Amplexus between the male and inanimate object	*Bufo bufo*	3.04.2016, "Krugle Boloto" Lake, Shypyntsi vill., Chernivtsi Distr. (48.367 N, 25.732 E)	A ♂ *B. bufo* has embraced a piece of candock's root (*Nuphar lutea* (L.) Smith 1809), floating on the surface of the water

R. temporaria. Victims of this type of amplexus were *R. temporaria* (three cases), *P. lessonae* and *P. ridibundus*. Amplexus between individuals from different orders, not only between different species, genera or families, is especially interesting. That was observed in interacting between a *B. variegata* male and a *Lissotriton montandoni* (Boulenger, 1880) female (fig. 1, *e*). The cases of amplexus between anurans and urodelans were described in scien-

Fig. 1. The examples of abnormal amplexus: *a* — multiple amplexus in *Bombina variegata* (one female, seven males), May 22, 2012, Stebnyk tract, Berehomet, Vyzhnytsia District; *b* — multiple amplexus in *Rana temporaria* (one female, two males), April 6, 2016, Perkalab, Vyzhnytsia District; *c* — interspecific amplexus (♂ *R. temporaria* × ♀ *P. ridibundus*), March 29, 2016, Kitsman, Chernivtsi District; *d* — interspecific amplexus (♂ *R. dalmatina* × ♀ *R. temporaria*), March 20, 2012, "Hariachyi Urban" Forest Park, Chernivtsi; *e* — interspecific amplexus (♂ *B. variegata* × ♀ *L. montandoni*), May 13, 2010, Stebnyk tract, Berehomet, Vyzhnytsia District; *f* — amplexus between a male and inanimate object (♂ *Bufo bufo* and the root of *Nuphar lutea* (L.) Smith 1809), April 3, 2016, Lake "Krugle boloto", Shypyntsi, Chernivtsi District.

tific literature, though they are extremely rare (Shabanov, 2011; Simović et al., 2014; Mačát et al., 2019; Koynova and Natchev, 2021). Moreover, no information on similar cases with the participation of *L. montandoni* in published sources has been found.

In three cases there were incorrect grasping of females by the males. In one of them, the *R. temporaria* male captured a dead female of the same species from the abdominal side. That is a combination of some types of abnormality — incorrect embrace and amplexus with a dead female. In another case, a *R. dalmatina* male interacted by inguinal amplexus with a female of the same species but mates' heads were turned in diametrically opposite directions. One case of a male *R. dalmatina* interaction with female of the same species from the abdominal side was observed.

Also, we observed amplexus between the male *B. bufo* and the piece of candock's root (*N. lutea*) (fig. 1, *f*). Interacting of males of this species with inanimate objects are also known. For example, some investigators described amplexus of *B. bufo* with a piece of wood (Shcherbak and Shcherban, 1980), a lump of silt (Đorđević and Simović, 2014) and, even, plastic cup (Mollov et al., 2010) and plastic bottle (Pupins et al., 2022). Seemingly, that is the result of a lack of females in breeding sites.

In general, our research confirms that such abnormal behaviour is rather rare. Thus, throughout the studies during 14 field seasons (2008–2021) we observed thousands of cases of amplexus in many species of anurans. But given data represent only a small percentage of the total observations. Available mechanisms (vocal, tactile, chemical) permit amphibians to avoid such cases effectively or correct the situation rather quickly, therefore minimizing the wasting of time and energy.

The author is grateful to IDEA WILD organization for providing some equipment for this research, to Tetiana Nykyrsa for English translation and Oleksii Marushchak for additional language corrections.

References

Amin, H., Kevin, R. Messenger, K.R., Borzée, A. 2021. First record of heterospecific amplexus behaviour between *Pelophylax plancyi* (Lataste, 1880) and *P. nigromaculatus* (Hallowell, 1861) from Nanjing, China. *Herpetology Notes*, 14, 773–774.

Ayres, C. 2008. Multiple amplexus in the Iberian Brown Frog *Rana iberica*. *North-Western Journal of Zoology*, **4** (2), 327–330.

Decemson, Ht., Biakzuala, L., Lalremsanga, H. T. 2020. Interspecific amplexus between two sympatric species, *Amnirana nicobariensis* (Stoliczka, 1870) and *Microhyla berdmorei* (Blyth, 1856) at Tuitun stream, Mizoram, India. *Herpetology Notes*, 13, 433–434.

Đorđević, S., Simović, A. 2014. Strange affection: male *Bufo bufo* (Anura: Bufonidae) passionately embracing a bulge of mud. *Ecologica Montenegrina*, **1** (1), 15–17.

Duellman, W. E., Trueb, L. 1994. *Biology of Amphibians*. The Johns Hopkins University Press, Baltimore–London, 1–670.

Gherghel, I., Strugariu, A., Ghiurcă, D., Cicort-Lucaciu, A.-Ş. 2008 a. The herpetofauna from the Bistriţa river basin (Romania): geographical distribution. *North-Western Journal of Zoology*, 4 (supp. 1), 71–103.

Gherghel, I., Strugariu, A., Pricop, E., Zamfirescu, S. 2008 b. The Northern Goşmani Mountains (Romania): an important herpetofaunal area requiring urgent protection. *Herpetologica Romanica*, 2, 51–54.

Gül, S., Özdemir, N., Dursun, C. 2018. First record of interspecific amplexus behaviour between *Bufotes variabilis* (Pallas, 1769) and *Pelophylax ridibundus* (Pallas, 1771) with *Bufo bufo* (Linnaeus, 1758) (Anura: Bufonidae) from Turkey. *Herpetology Notes*, 11, 153–155.

Hartel, T., Sas, I., Pernetta, A. P., Geltsch, I. C. 2007. The reproductive dynamics of temperate amphibians: a review. *North-Western Journal of Zoology*, **3** (2), 127–145.

Koynova, T. V., Natchev, N. D. 2021. Interspecific amplexus between *Rana dalmatina* (Fitzinger in Bonaparte, 1838) and *Salamandra salamandra* (Linnaeus, 1758) in "Shumensko Plato" Nature Park, Bulgaria. *Herpetology Notes*, 14, 653–655.

Kuzmin, S. L. 2012. *The Amphibians of the Former Soviet Union*. KMK, Moscow, 1–370. ISBN 978-5-87317-871-1 [In Russian].

Mačát, Z., Jablonski, D. 2018. *Pelobates fuscus* (LaurentI, 1768), amplexing male *Bufo bufo* (Linnaeus, 1758). Herpetozoa, 30 (3/4), 222–223.

Mačát, Z., Rindoš, M., Mihalca, D., Jablonski, D. 2019. Amplexus between two different orders of amphibians recorded in Romania. *North-Western Journal of Zoology*, **15** (1), 112–113.

Malashichev, Ye. B. 1999. Female amplexus in a Yellow-Bellied Toad, *Bombina variegata*. *Russian Journal of Herpetology*, **6** (2), 143–146.

Mollov, I. A., Popgeorgiev, G. S., Naumov, B. Y., Tzankov, N. D., Stoyanov, A. Y. 2010. Cases of abnormal amplexus in anurans (Amphibia: Anura) from Bulgaria and Greece. *Biharean Biologist*, **4** (2), 121–125.

Pintanel, P., Gabriela Obando-Moreno, G., Merino-Viteri, A. 2021. Necrophiliac behaviour in the recently described species *Scinax tsachila* (Anura: Hylidae), with a review of necrophilia in amphibians. *Neotropical Biodiversity*, **7** (1), 53–56.

Pupins, M., Telnov, D., Matrozis, R., Čeirāns, A. 2022. First report of amplexus in Anura (Amphibia) fron Latvia. *Biharean Biologist*, **16** (1), 47–50.

Pysanets, Ye. 2014. *Amphibians of Eastern Europe. Part II. Order Ecaudata*. Zoological Museum NNPM NAS Ukraine, Kyiv, 1–192.

Rocha, S. M., Santana, D. O., Soares da Silva, I. S., Faria, R. G. 2015. Interspecific amplexus between *Hypsiboas albomarginatus* (Spix, 1824) and *Hypsiboas raniceps* Cope, 1862 (Anura: Hylidae) in northeastern Brazil. *Herpetology Notes*, 8, 213–215.

Shabanov, D. A. 2011. Common toads, Green frogs: love and death in cool water. *Priroda*, 4, 56–59 [In Russian].

Shcherbak, N. N. 1966. *Amphibians and reptiles of Crimea* (*Herpetologia Taurica*). Naukova dumka, Kiev, 1–240 [In Russian].

Shcherbak, N. N., Shcherban, M. I. 1980. *Amphibians and reptiles of the Ukrainian Carpathians*. Naukova dumka, Kiev, 1–267 [In Russian].

Simović, A., Anderson, N., Anđelković, M., Gvozdenović, S., Đorđević, S. 2014. Unusual amplexuses between anurans and caudates. *Herpetology Notes*, 7, 25–29.

Smirnov, N. A. 2013. On the ecology of *Rana dalmatina* (Anura, Ranidae) in the territory of the Cis-Carpathians (Ukraine). *Modern herpetology: problems and ways of their solutions. Collection of papers of the First International Conference of the Young Herpetologist of Russia and neighboring countries* (Saint-Petersburg, Russia, 25–27 November 2013). Zoological Institute of RAS, St-Petersburg, 137–140 [In Russian].

Strugariu, A., Gherghel, I. 2008. A preliminary report on the composition and distribution of the herpetofauna in the Lower Prut River Basin (Romania). *North-Western Journal of Zoology*, 4, Suppl. 1, 49–69.

Vásquez-Cruz, V., Canseco-Márquez, L., Eduardo, M., Pérez-Gámez E. M. 2019. Two incidents of heterospecific amplexus involving Mexican Treefrogs (*Smilisca baudini*), a Rio Grande Leopard Frog (*Lithobates berlandieri*), and a Morelet's Leaf Frog (*Agalychnis moreletii*) (Amphibia: Anura: Hylidae, Ranidae, and Phyllomedusidae). *Journal Reptiles & Amphibians, Conservation and Natural History*, **26** (2), 140–141.

Willaert, B., Suyesh, R., Garg, S., Giri, V. B., Bee, M. A., Biju, S. D. 2016. A unique mating strategy without physical contact during fertilization in Bombay Night Frogs (*Nictibatrachus humayuni*) with the description of a new form of amplexus and female call. *PeerJ*, 4:e2117. DOI: https://doi.org/10.7717/peerj.2117

Zabroda, S. N., Ilyenko, E. P. 1981. Peculiarities of reproduction and larval development of common spadefoot — *Pelobates fuscus* (Laur.) from the Ukrainian Polesie. *Vestnik zoologii*, 4, 66–71 [In Russian].

Received 21 September 2022
Accepted 24 November 2022