

Mating patterns of common toad *Bufo bufo* in a Slovenian pond

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斯洛维尼亚池塘中大蟾蜍的交配模式

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摘要 为了解大蟾蜍 (*Bufo bufo*) 的配对成功是否与身体大小有关, 在蟾蜍产卵之前, 我们在斯洛文尼亚捕捉和测量了2 224只成体样本。在这些捕获的个体中, 1 772只为雄性, 452只为雌性, 其中355对处于抱对状态。雌性的体长(从吻端到泄殖腔的距离)一般比雄性稍长。无论雄性还是雌性, 抱对者的体长均大于未抱对者。抱对的雄性和雌性的体长具有显著的正相关。我们所发现的大小匹配的交配模式, 与从其它普通蟾蜍种群得到的结果一致 [动物学报 51 (3): 513–515, 2005]。

关键词 大蟾蜍 大小匹配配对 斯洛维尼亚

Key words Common toad, *Bufo bufo*, Size-assortative mating, Slovenia

In “explosive breeder” systems (Wells, 1977) with a short breeding season lasting only for a few days, male “scramble competition” for females seems to prevail, with the result that larger males are more likely to mate than small males (Davies and Halliday, 1979; Howard, 1980; Berven, 1981).

The common toad *Bufo bufo* is an explosive breeder for which it is already well known that larger males have a higher reproductive success (Davies and Halliday, 1977, 1979). In this paper we present field observations of the size of *Bufo bufo* at the time of reproduction. The main aim of this paper is to test the assumption that bigger males have better mating success than smaller ones using a large sample size.

1 Material and methods

Toads were captured and at the artificial lake in Slivnica, Slovenia (central Europe) (approximately 46°11'N, 15°27'E, altitude 300 m a. s. l.) and the nearest fishpond complex, during a toad patrol—rescue project of toads on the road in 1995 (Vogrin, 1997). The area of the lake is 84 ha. The landscape within 200 m of the lake and ponds is dominated by extensive agriculture (mainly meadows), mixed wood and individual buildings. See also Vogrin

(1997) for a more detailed description.

Each toad was measured for total length (snout-vent-length = SVL) to the nearest mm on land before the start of spawning. After measuring each toad was marked by toe-clipping (a very small part) to prevent double measurements. No specimen was killed or injured during the study. Toads were sexed according to the nuptial pads on the fingers. Captured toads were divided into four categories: males, females, males in amplexus and females in amplexus.

All statistical tests were two-tailed, with α set at 5%. The Pearson correlation coefficient was used to examine size-dependent relationships. All statistical tests were performed with the SPSS 8.0 statistical package for Windows.

2 Results and discussion

A total of 2 224 adult toads were caught near the lake during a period of 23 days. Among them, 1 772 were males and 452 were females. 79% had a male in amplexus. On the other hand, only 20% of males were paired. This result is very similar to that of Davies and Halliday (1979), who found 84.4% of females and 17.9% of males in amplexus before they reached the breeding sites.

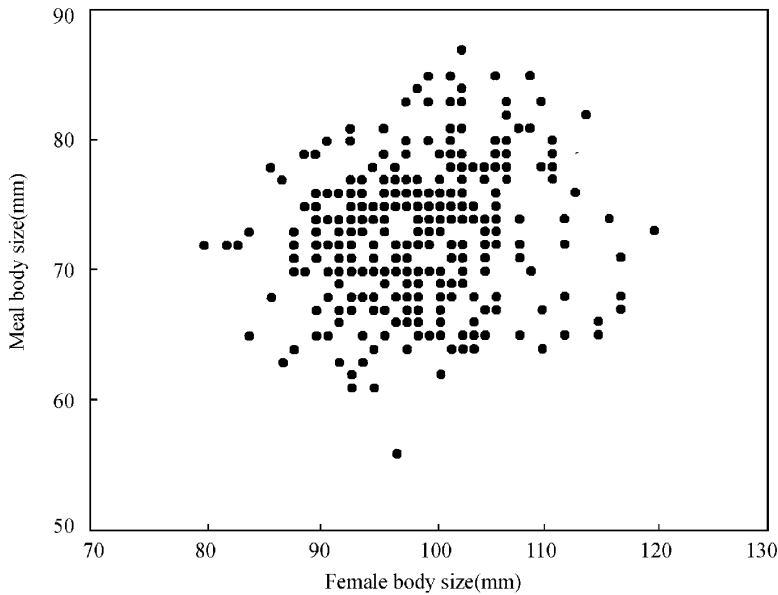


Fig. 1 Relationship between body size of males and females found in amplexus

The body size distribution of breeding toads is shown in Table 1. Females were much larger than males ($t = 620.3$, $P < 0.0001$). The smallest female caught in the 1995 breeding season was 80.0 mm (in amplexus), whereas the smallest male measured was 56.0 mm (in amplexus). Males in amplexus are much bigger than unpaired ones ($t = 198.8$, $P < 0.001$) and the same is true also for females ($t = 109.8$, $P < 0.001$).

Bigger males paired with bigger females ($r = 0.61$, $n = 355$, $P < 0.05$), suggesting a size-assortative mating. The result was consistent with a previous study by Davies and Halliday (1979). However, the authors found no significant correlation between body sizes before the start of spawning, this could be due to their small sample size.

We found a positive relationship between the body size of single males and those in amplexus ($t = 10.12$, $n = 355$, $P < 0.005$) as well as in single females and females in amplexus ($t = 34.24$, $n = 97$, $P < 0.05$).

Table 1 Body size (SVL) of common toads *Bufo bufo* captured in the pairing season from Slovenia

	Max.	SD	Min.	Mean	<i>n</i>
Male	98	5.57	57	75	1 417
Females	120	6.68	82	98	97
Males in amplexus	87	5.06	56	83	355
Females in amplexus	120	6.52	80	99	355

It is well known that females choose larger males based on their more deeply pitched croaks (Davies and Halliday, 1978). Female choice for larger males would also be advantageous if the larger males possess

better genes. This would be the case if bigger males were also older with a higher survival (Berven, 1990).

An interesting finding in this study is that males also choose bigger females (Fig. 1). Since a positive relationship between clutch size and female body size has been documented for many anuran species (Howard and Kluge, 1985; Tejedo, 1992), including common toad (Davies and Halliday, 1977), it seems reasonable that males prefer to mate with females producing bigger clutches, allowing them to fertilise more eggs.

In a study of *Bufo americanus*, Licht (1976) supposed that females should choose males with body sizes that guarantee an optimal fertilization rate by accurate juxtaposition of the male's and female's cloacae during amplexus. Davies and Halliday (1977) found the same results for common toad. According to Davies and Halliday (1997), fertilisation rates decline with increasing female/male size ratio. However, intense male scramble competition rather than female choice is probably responsible for the observed mating pattern (Arak, 1983). We also frequently observed that male scramble competition and male croaks, where larger males substitute for smaller ones already in amplexus.

It should be noted that at our study site, the mating season of the toads was long and therefore mate assortment, might have been involved (see Hoglund and Robertson, 1987; Reading and Clarke, 1983).

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