



A case study on earlier activation of the variable toad, *Bufotes variabilis* (Pallas, 1769)

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Abstract

Amphibians are one of the most vulnerable group that are directly affected by environmental factors. Researchers report that nearly one third of species threatened with extinction. Amphibians in the temperate zone hibernate in winter season under normal conditions and fluctuations in climate impact indirectly the summer and winter activity of these ectothermic animals. In this study, we report data on the extraordinary activity of *Bufotes variabilis* in winter period and evaluated that variable toad could be active throughout the year due to global climate changes.

Key words: hibernation, winter activity, climate change, temperature, Adana

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Değişken desenli gece kurbağası, *Bufotes variabilis* (Pallas, 1769)'in erken aktivasyonu üzerine bir örnek çalışma

Özet

Amfibiler, çevresel faktörlerden doğrudan etkilenen en savunmasız gruplardan biridir. Nitekim araştırmacılar, türlerin neredeyse üçte birinin neslinin tükenme tehlikesinde olduğunu bildirmişlerdir. Ilıman bölgedeki amfibiler normal şartlar altında kış mevsiminde uykuya yatarlar ve iklimdeki dalgalanmalar bu ektotermik hayvanların yaz ve kış aktivitesini dolaylı olarak etkiler. Bu çalışmada, *Bufotes variabilis*'in kış mevsiminde olağandışı aktivitesi hakkında bir veri sunuyor ve değişken desenli gece kurbağasının küresel iklim değişikliğinden dolayı yıl boyunca aktif olabileceğini değerlendiriyoruz.

Anahtar kelimeler: hibernasyon, kış aktivitesi, iklim değişikliği, sıcaklık, Adana

1. Introduction

Since one-third of the amphibians are on the IUCN red list, it is clear that these animals are the most vulnerable group in the World [1]. Although there are many factors that threaten amphibians, climate change is one of the most frequently mentioned threats in recent years [2,3,4]. Due to being poikilotherm, high permeability skin and complex life cycles, amphibians are strongly dependent on temperature, humidity and precipitation factors that are directly affected by climate change. Changes in air temperature (e.g. global warming) can alter the reproductive behavior of amphibians, affect reproductive success, reduce immune functions and increase amphibian sensitivity to chemical pollutants [2,5,6].

Amphibians in the temperate zone hibernate in winter season under normal conditions and fluctuations in climate impact the summer and winter activity of these ectothermic animals. The beginning of activity period of the hibernating ectothermic species probably rely on the climatic release as well as the photoperiod of the day, progressive temperature increase, barometric pressure changes and the elevation of the habitat [7]. Hibernation in amphibians most likely is a direct response to cold temperatures and secondarily to changes in resource availability [8]. However, some amphibian species do not conform this tendency [9,10] and may be active in winter period.

Being one of the three known representatives of the Bufonidae family in Turkey, the variable toad *Bufotes variabilis* (syn. *Pseudepidalea variabilis*) is a widespread species ranging from the eastern Mediterranean countries to Central Asia, and from Russia to some northern Europe countries. Green toads (*Bufotes viridis*, *Bufotes variabilis*) are

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hibernating species as known from the literature [11-16]. In the present study, we report data on the extraordinary activity of *Bufo variabilis* in Turkey.

2. Materials and methods

The individuals were found during excursions in the province of Adana (in December 2017 and January 2018). Adana is located in the south of Turkey and has a typical Mediterranean climate with dry and hot summers. The observation site, a small temporary pond with a surface area of about 12 m² and a maximum depth of 80 cm, was located at the 13 m a.s.l. (36° 53' 23'' N; 35° 33' 22'' E). For each individual, sex was determined by the examination of external secondary sexual characters. Air and water temperatures were measured at the nearest 0.1 °C with a digital thermometer.

3. Results

A male specimen and three adult individuals (2 males and 1 female) of *B. variabilis* were observed between 10 December 2017 and 23 January 2018 (Yüreğir district, Adana, Turkey), shown in Figure 1. Our first observation on the extraordinary activity of *Bufo variabilis* was in 10 December 2017. In that day the air temperature in the site was 13°C and water temperature was identified as 11 °C. The second observation was 11°C in 23 January 2018 and air temperature and water temperature was identified as 11 °C and 8 °C, respectively.



Figure 1. A male specimen (A) and three adult individuals (B, 2 males (middle and right) and 1 female (left)) observed from Yüreğir district, Adana (Turkey) during the winter period (December 2017 and January 2018)

4. Conclusions and discussion

Although active periods during the winter were reported for the European green toad, *B. viridis* [9,10], this phenomenon was not previously reported for *B. variabilis*. Since the green toads are distributed on a wide scale, it is subject to very different climatic conditions, which leads to a high degree of variation in its seasonal activity and reproductive cycle [10,17].

In a study [10] conducted in Sicily island, researchers reported some observations carried out on the breeding phenology of *Bufo viridis* species over a two year period in Mediterranean temporary ponds. They measured the minimum air temperatures at which breeding activity was observed around the reproductive site as 7.6 °C at La Fossa (Palermo) and 7.4 °C on Ustica island populations. In addition to this, while they did not observe breeding activity in the winter period for the La Fossa population, they monitored calling activity, pairs and eggs/embryos in the two populations of Ustica island. The situation in the second population is similar with the case in our study. The earlier activation period seen in these locations where the average annual temperature is around 19 °C may be related to global warming.

According to Başkale et al. study's [13], the breeding season of *B. variabilis* in the Kocaçay Stream, Izmir, Turkey started on 1 February for year 2007 and 8 February for year 2008. Unlike what we observed in our study, in the Kocaçay population researchers reported that water temperature ranged from 8 °C to 12 °C and toads had later activity period than our observed case. Since the average annual temperature in that locality is lower than in Adana and Italy locality, it can be concluded that there is no winter activation of the population living in Kocaçay as a result of the effects of local climatic conditions and nutrients,

The fact that the the studied area is close to sea level (13 m a.s.l.) and the air temperature is relatively high in the observation periods may have enabled the variable toads to be active in the winter period.

In conclusion, as other populations of the variable toad are likely to be affected by climate change, we will have the opportunity to learn more about the winter activities of these animals by investigating their populations in terms of reproductive ecology under different ecological conditions.

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