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The Unusual Winter Activity and Negative Effects of Pollution on Breeding of *Ommatotriton ophryticus* (Berthold, 1846) in Turkey

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Abstract

The northern banded newt, *Ommatotriton ophryticus* (Berthold, 1846) is a poikilotherm (ectoterm) and hibernating amphibian species. Therefore, the records related to the winter activities of *Ommatotriton ophryticus* are very rare. In the present study, a winter activity belonging to *Ommatotriton ophryticus* was recorded in a channel containing stagnant water throughout the year in the province of Trabzon. It was observed that the newts were active during the winter season, between December 2017 – March 2018. In the water environment where the study was carried out, the population density of newts was high and the numbers of male individuals were higher than that of females. Additionally, some female individuals were observed as gravid. Environmental pollution is a source of stress for amphibians. It was observed that the newts which did not hibernate during a winter period and performed their breeding activities in the water as a result of the acute contamination due to pesticide use in their water environment at the end of March 2018 left the aquatic environment which they used for breeding. Although the area was subsequently visited at different times, these newts were never seen again and no information was obtained on whether the animals had gone to another aquatic environment. Urgent measures should be taken against the pollution caused by pesticides, which have a clearly negative impact on animals.

Keywords: The northern banded newt, Trabzon, hibernation, Salamandridae

Ommatotriton ophryticus (Berthold, 1846)'un Türkiye'deki Olağandışı Kış Aktivitesi ve Kirliliğin Bu Türün Üremesi Üzerindeki Olumsuz Etkileri

Öz

Kuzey şeritli semenderi, *Ommatotriton ophryticus* (Berthold, 1846) soğukkanlı ve kış uykusuna giren bir amfibi türüdür. Bu sebeple, *Ommatotriton ophryticus*'un kış aktivitelerine ait kayıtlar oldukça nadirdir. Bu çalışmada *Ommatotriton ophryticus*'a ait bir kış aktivitesi, Trabzon ilinde yıl boyunca durgun su içeren bir kanalda kaydedilmiştir. Semenderlerin, 2017 yılının Aralık ayı ile 2018 yılının Mart ayı arasındaki kış sezonunda aktif olduğu gözlenmiştir. Çalışmanın gerçekleştirildiği su ortamında, semenderlerin popülasyon yoğunluğunun yüksek olduğu ve erkek bireylerin sayısının dişilerden daha fazla olduğu tespit edilmiştir. İlaveten, bazı dişi bireyler gebe olarak gözlenmiştir. Çevre kirliliği amfibiler için bir stres kaynağıdır. Bir kış dönemi boyunca hibernasyon yapmayan ve suda üreme faaliyetleri içerisinde bulunan bu semenderlerin, 2018 yılının mart ayının sonunda su ortamlarında pestisit kullanımına bağlı akut kontaminasyonun bir sonucu olarak üreme için bulundukları su ortamını terk ettikleri gözlemlenmiştir. Alan daha sonra farklı zamanlarda ziyaret edilmesine rağmen, bu

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semenderler bir daha hiç görülmemiştir ve hayvanların başka bir su ortamına gidip gitmedikleri hakkında hiç bir bilgi elde edilememiştir. Hayvanlar üzerinde açıkça olumsuz etkisi olan pestisitlerin neden olduğu kirliliğe karşı acil önlemler alınmalıdır.

Anahtar Kelimeler: Kuzey şeritli semenderi, Trabzon, kış uykusu, Salamandridae

Introduction

The northern banded newt, *Ommatotriton ophryticus* (Berthold, 1846) is distributed from the western Caucasus in southern Russia and Georgia (in the mountain forest belt on the northwestern and southwestern slopes of the Main Caucasian Ridge), through northwestern Armenia and northern Turkey. It is classified as "Near Threatened" in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species [1]. *Ommatotriton ophryticus* hibernates from September and October to February-March at low elevations while hibernation ends in April-May in the highland populations of the species [2].

The seasonal periods of low temperatures cause the hibernation of ectotherm animals in winter [3]. However, the amphibians may be active in winter as long as the air temperature values allow them [4-6], *Rana dalmatina* [5], *Salamandra salamandra* [7], and *Epidalea viridis* [4]. The adult individuals of *Ommatotriton ophryticus* were found active with their nuptial colorations at the beginning of January in Krasnodar Region in the North Caucasus. Although the literature shows the unusual winter activity of *Ommatotriton ophryticus* in Russia [2], there is no report related to extraordinary activities of the species in Turkey.

The present study provides the first observation of non-hibernating *Ommatotriton ophryticus* in a lowland area of Turkey.

Material and Method

The specimens were observed at the edge of a stream in Ortahisar, in the province of Trabzon, Turkey (GPS data, N: 40° 59' 374'' and E: 39° 46' 049'', 118 m a.s.l.) during day excursions (Figure 1). The temperatures of air and water and the pH of water were recorded. The sexes of the individuals were diagnosed based on their secondary sexual characters: In the breeding season, middorsal and caudal crest of adult males is notched and very high (up to 30 mm), yellowish or brownish, with dark vertical stripes. During this season, the male's tail is covered with dark spots from above and with blue and/or greenish spots from the

sides and below [2]. All the specimens were photographed with a professional camera (Canon 500D). After determining sex and taking photos, the individuals were released back into their habitat.

Figure 1. *A general view of the study area in Ortahisar, Trabzon where the newts were observed.*

Results

The newts were observed between December 2017 and March 2018. We observed that the numbers of the male specimens were higher than female specimens. Moreover, some female specimens were gravid. The results of the present study leads to the conclusion that this species may be active during the winter months.

December

In total, 7 specimens (6 males and 1 female) of *Ommatotriton ophryticus* were found during an excursion in Ortahisar, in the province of Trabzon, Turkey between 2 and 4 p.m. on December 29, 2017 (Figure 2a). The newts were observed in a channel which was covered with brownish faded leaves. The air temperature was 13°C at the time of the observation. The temperature of the water was 16°C and pH was 7.82. The males had breeding coloration and the female had eggs in its bellies.

January

In the same site, 9 female and 3 male individuals of *Ommatotriton ophryticus* were observed during an excursion between 2 and 3 p.m. on January 12, 2018 (Figure 2b). They were still active in the water. The air temperature was 12°C at the time of the observation. The temperature of the water was 15°C and the pH was 7.79. The males had breeding coloration and the bellies of the females were more bulging.

February

The next visit to the study area was performed on February 14, 2018 and 4 female and 8 male individuals of *Ommatotriton ophryticus* were observed in the water (Figure 2c) during an excursion between 3 and 4 p.m. The temperatures of the air and water were 11 and 15°C, respectively. The pH of the water was 7.78. The females had still not spawned.

March

We performed our last visits to the study site in March 2018. In the first visit, there were still some (2 females and 4 males) active individuals of *Ommatotriton ophryticus* in the water. The observation was performed during an excursion between 3 and 4 p.m. on March 2, 2018 (Figure 2d). The temperatures of the air and water were 9 and 15°C, respectively. The pH of the water was 7.82. Additionally, 4 females and 14 males were observed in the water during an excursion between 11 a.m. and 1 p.m. on 19th March 2018 in the second visit. The air temperature was 12 °C while the water temperature was 16°C and the pH was 7.80. The males were still maintaining courtship behavior and the females had still not spawned.

Figure 2. *Two male individuals (a and c) on December 29, 2017 and February 14, 2018. Three gravid female individuals (b and d) on January 12, and March 2, 2018.*

We made our final visit to the study area on March 30, 2018. There were some chemical wastes (pesticide containers thrown into the water) which were not observed in our previous visits (Figure 3). There were no individuals in the channel.

During our following visits to the study site on different dates (April 15, May 2, and May 20, 2018), we did not observe any individuals.

Figure 3. *The general view of water pollution caused by the pesticide wastes in the study area.*

Discussion

Amphibians are poikilothermal animals and are directly affected by ambient conditions. The environmental factors may affect important processes such as breeding phenology, migrations, and mating [8-11]. Two climate components are very important on the population dynamics of amphibians: (1) Because the skin is highly permeable, amphibians are sensitive to moisture conditions [12-13]. (2) Temperature acts as a controlling agent for many physiological processes, including rates of oxygen uptake, heart rate, locomotion, water balance, digestion, developmental rate, sex determination, and immune function [14]. In addition, the gametogenesis and growth rates of larval and postmetamorphic individuals are also temperature-dependent [8 and 15].

Hibernation as a behavioral response to seasonal change is most likely a direct response to cold temperatures and secondary to changes in resource availability [16]. In some abnormal cases (effects of global warming, instantaneous temperature changes, etc.), amphibians do not comply with known hibernation periods and may be active in winter. In warm years, individuals of the northern banded newt living at low elevations remain active throughout the year [2].

The adult individuals of *Ommatotriton ophryticus* were found active with their nuptial colorations at the

beginning of January in Krasnodar Region in the North Caucasus [2]. In the present study, individuals of *Ommatotriton ophryticus* were active one month earlier than January and did not hibernate.

The study area in our research is located at a low altitude. Since there was no snowfall during the winter season (between October 2017 and March 2018) when the observations were made, the individuals of *Ommatotriton ophryticus* did not begin their hibernation. In warm years, the newts living at low elevations remain active throughout the year [2].

On the other hand, the seasonal temperature changes are not the only negative factor in amphibian populations. Amphibians are more sensitive to pollution than other animal groups due to their permeable skin. Therefore, the toxins such as insecticides, pesticides, and herbicides may damage critical amphibian organs [17]. These newts, which did not hibernate and maintained their breeding activities due to the lack of snowfall and low air and water temperatures, disappeared without completing their spawning functions at the beginning of the spring as a result of acute contamination of their water environment due to pesticide use. This situation had a negative effect on the breeding of these newts. We could not observe whether the females found another water environment or completed their spawning procedures. In this watery environment where the study is carried out and in the other aquatic environments in which these aquatic animals enter their breeding area, the elimination of the pollution caused by pesticides and other pollutants should be carried out immediately.

Based on the obtained results, we can conclude that individuals of *Ommatotriton ophryticus* may be active throughout the year. The unexpected winter activity may be a result of global warming in the Northern Hemisphere. The results of the present study showed that environmental conditions affect the hibernation of *Ommatotriton ophryticus* and the individuals of this species are sensitive to the contamination of the aquatic environment where they are breeding.

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