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Exceptional Winter Activity Record from Blunt-nosed Viper (*Macrovipera lebetinus*) in Türkiye

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Abstract: The seasonal dynamics of reptile species, particularly their responses to temperature fluctuations, play a crucial role in their ecological functioning. Here we report the winter activity of the Blunt-nosed Viper (*Macrovipera lebetinus*), a reptilian species primarily distributed across the Middle East for the first time. While extensive research exists on various aspects of this species, including taxonomy and distribution, there remains a notable gap in the understanding of its winter behaviors. By conducting field observations in the Direktaşı-Bitlis province of Türkiye, present study offers novel insights into the winter activity of *M. lebetinus*. The study identifies a juvenile specimen of *M. lebetinus* exhibiting activity during December, a period typically associated with hibernation in reptiles. The observed air temperature of approximately 15.1°C is noteworthy as an unusual value. This anomaly prompts an exploration into the potential influences of climate change on reptilian hibernation patterns. The findings highlight the vulnerability of ectothermic creatures to temperature fluctuations induced by climate change, which can disrupt their hibernation cycles and lead to untimely activity. Since this study represents the first time the winter activity of *M. lebetinus* has been documented. Moreover, the study underscores the critical implications of disrupted hibernation for reptilian populations, potentially jeopardizing their survival and reproductive success. The unforeseen activity observed in *M. lebetinus* serves as a poignant example of how climate-induced temperature shifts can disrupt established ecological rhythms, posing significant threats to species viability.

Koca engereğin (*Macrovipera lebetinus*) Türkiye'deki Olağandışı Kış Aktivitesi Kaydı

Anahtar Kelimeler
Engerek,
Sürüngen,
Hibernasyon,
Anadolu

Öz: Sürüngen türlerinin mevsimsel dinamikleri, özellikle de sıcaklık dalgalanmalarına verdikleri tepkiler, ekolojik işlevlerinde önemli bir rol oynar. Bu çalışmada *Macrovipera lebetinus* (Koca Engerek)in kış aktivitesi ilk kez rapor edilmiştir. Bu türle ilgili taksonomi ve dağılım dahil olmak üzere çeşitli yönlerde geniş kapsamlı araştırmalar mevcut olmasına rağmen, kış davranışlarını anlama konusunda önemli bir boşluk bulunmaktadır. Türkiye'nin Direktaşı-Bitlis ilinde yapılan saha gözlemleri ile bu çalışma, Aralık ayında aktivite gösteren *M. lebetinus*'un kış aktivitesi hakkında yeni veriler sunmaktadır. Yaklaşık 15.1°C olarak tespit edilen gözlem hava sıcaklığı olağandışı bir değer olarak dikkat çekicidir. Bu anormallik, iklim değişikliğinin sürüngen kış uykusu desenleri üzerindeki potansiyel etkilerini araştırmaya yol açmaktadır. Zira bu çalışma ile *M. lebetinus*'un kış aktivitesi ilk kez gözlenmiştir. Haliyle bu çalışma, iklim değişikliği tarafından tetiklenen sıcaklık dalgalanmalarının, sürüngenlerin hibernasyon döngülerini bozabileceğini ve aktiviteye yol açabileceğini vurgulamaktadır. Dahası, bu çalışma hibernasyondan erken uyanma, sürüngen popülasyonları için kritik sonuçlara yol açabileceğini ve bunun potansiyel olarak hayatta kalma ve üreme başarısını tehlikeye atabileceğini göstermektedir. *M. lebetinus*'ta gözlenen beklenmedik aktivite, iklim tarafından tetiklenen sıcaklık değişikliklerinin mevcut ekolojik ritimleri nasıl bozabileceğine dair etkileyici bir örnek oluşturmakta olup, türlerin yaşamsallığı için önemli tehditlere örnek olmaktadır.

1. INTRODUCTION

A considerable number of organisms, including reptile species, rely heavily on seasonal temperature fluctuations to perform their daily functions, as their body temperatures are highly sensitive to variations in the surrounding environment [1]. For instance, during the warm seasons, these organisms engage in reproduction, nutrition, biological activity, food capturing, and predator evasion. However, during the cold seasons, their physiological processes become impeded by the low temperature, rendering them incapable of carrying out these activities [1,2-7]. As a result, they restrict their physiological endeavors and exhibit a preference for specialized biological processes like hibernation or brumation [8]. These inclinations enable them to maintain optimal health, dormancy, and shelter beneath the ground or in a nest, thereby consuming minimal energy until the subsequent mild season [8].

Nonetheless, meteorological conditions can occasionally cause atypical fluctuations in temperature. Elevated temperatures that occur in the winter months have the potential to induce transient awakenings and atypical behavior in these organisms [1,9].

The Blunt-nosed Viper (*Macrovipera lebetinus*) is one of two *Macrovipera* species, that inhabits in this region [10]. It is a species that has a very wide distribution in the Middle East and is generally distributed in the south, southeast, east, and northeast of Türkiye [11]. *Macrovipera lebetinus* is listed as Least Concern (LC) on the IUCN Red List. In fact the species is locally threatened in some regions due to habitat loss and persecution, its overall population has a declining trend. Their habitat preferences are generally steppe-like semi-arid areas such as forests, shrubs, rocky areas, and deserts [11,12]. Its vertical distribution generally reaches up to 2500 meters above sea level [11]. However, this altitude preference is between sea level and 1700 m for the Mediterranean region [12].

Although various taxonomic, systematic, phylogenetic, and distributional studies have been conducted on *M. lebetinus* [13-15], ecological studies are quite lacking [12]. For instance, research on the spring activities of males of this species in Türkiye and Cyprus has been conducted; however, information regarding their winter activities is currently unavailable. In this context this study provides novel insights into the winter activity of species of blunt-nosed vipers for the scientific community as a case study.

2. MATERIAL AND METHOD

The *M. lebetinus* specimen was detected during a field study between 13:30 and 14:30 in Direktaşı-Bitlis province (Figure 1) (GPS data: 38.30 N; 41.97 E; elevation about 1500 m asl.). The air temperature and humidity in the observation area were taken with a digital thermometer (HTC 288-ATH ®) and was 15.1°C. The soil surface and under 10 cm temperatures were measured by Fluke Type K Thermocouple Probes. The wind speed was measured by Multicomp Pro Anemometer. The specimen was diagnosed by direct observation and no treatment was performed. Despite this, the specimen's size suggested that it was a juvenile. The photographs of the specimen were captured in the field, and it was subsequently relocated from the location where the specimen was found.

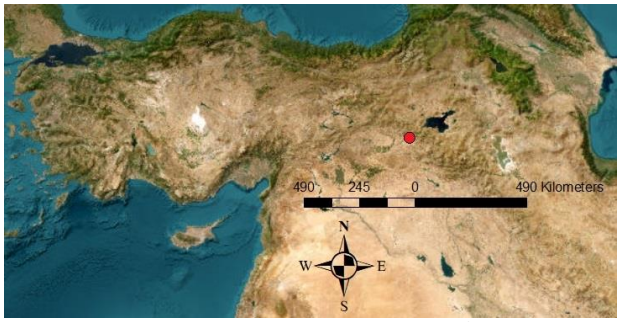

Figure 1. The map shows observed activity locality of *M. lebetinus* species (red circle).

3. RESULTS

The juvenile individual of the Blunt-nosed viper was observed on December 4, 2023 (Figure 2). The sample was detected in the area where pistachio trees were located during pistachio pruning. While the soil surface temperature in the observation area was measured as 17.6°C and the temperature 10 cm below the soil was measured as 20.1°C, the wind in the observation area was calculated as 2m/sec and the humidity was 86.9%.

Figure 2. A juvenile specimen *M. lebetinus*, observed from Direktaşı, Bitlis province (Türkiye) during the winter period (4 December 2023).

4. DISCUSSION AND CONCLUSION

Since *M. lebetinus* is an ectothermic creature like other reptiles, it has to spend the winter months in hibernation. Otherwise, since their physiological activities, which depend on the temperature of the environment, will decrease, it will be difficult for them to reach prey to escape from predators. It may cause both the death of the viper species and a decrease in its body mass due to a lack of calories [1,9,16].

No winter activity investigation on *M. lebetinus* has been documented in the literature up to date. Therefore, this study is the first and an important study showing the activity of this species in December. The fact that the air temperature of the area where the snake was observed is approximately 15°C is perhaps one of the important

reasons for this winter activity. Because it has been reported that the activity temperature of the environment for many snake species is between 10-25°C [7].

The reason why the viper species reported in the present study showed winter activity may be that daily temperature changes are very fluctuating. Otherwise, according to seasonal norms, the air temperature is expected to be lower since the altitude of the area where the viper species is observed is 1500 m above sea level. Therefore, this is not a common occurrence and seems to be very rare for reptile species during the winter months.

Global climate change seems to be one of the important factors affecting the hibernation period of all ectothermic creatures in the near future [12]. This will cause daily temperature activities in the winter months to be unbalanced and reptile species to be warm enough to be active. In addition, reptile species can wake up from hibernation early and exhibit reproductive behavior due to these temperature changes [17-19].

Ultimately, species that are deceived by untimely temperatures and start breeding activities will have to enter hibernation again as a result of the deterioration of air temperatures and decrease in air temperatures. This may cause the extinction of the generation of these reptile species in the year in which winter activity is observed and their offspring not being able to develop [20]. Stűmpel et al. (2019) report that March seems to be the earliest month in which *M. lebetinus* exhibits activity. A four-month interval separates the months of activity that are documented in this research.

The majority of reptile species are sensitive to temperature changes. The reason for this is that these creatures carry out all their biological activities between certain temperatures. When temperatures decrease, they go into hibernation or brumation processes, ensuring the continuity of their lives and minimizing energy losses. Although the *M. lebetinus* specimen observed in this study is normally active after March, this is the first time such a situation has been encountered. This situation is probably a result of daily temperature changes in the winter months caused by climate change.

According to the temperature data provided by the Turkish State Meteorological Service, it is seen that the temperature changes in the area where the species is observed, have decreased significantly in the approximately 2.5-month period since December 4, 2023. This shows that hibernation activity is believed to be continued for all reptile species living in that region. As a result, disruption of hibernation activities in reptile species are important factor that can affect their lives. These temperature fluctuations could put species at risk of extinction in the future.

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