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The Three Reptile New Locality Records and Their Ecological Niche Models in Hakkari Province, Eastern Anatolia, Türkiye

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Abstract: In this study, three reptile species, *Mauremys caspica*, *Mediodactylus orientalis,* and *Laudakia stellio,* were recorded for the first time from Hakkari province, east Anatolia. The ranges of *M. caspica*, *M. orientalis* and *L. stellio* were extended 100 km, 281 km, and 175 km, respectively. For *M. orientalis* and *L. stellio,* these new locality records constitute the eastern border of the species in Türkiye. *M. caspica*, *M. orientalis* and *L. stellio* average AUC (Area Under the Curve) values were calculated as 0.861, 0.867, and 0.821, respectively. Annual mean temperature (Bio1) was determined as the most important bioclimatic variable for *M. orientalis* (79.3%) and *L. stellio* (52.8%), while mean temperature of wettest quarter (Bio8) was the most effective bioclimatic variable for *M. caspica* (37.4%). There is a possibility of new species records due to the important location of Hakkari province geographically; thus, we suggest additional studies in the area.

Keywords: *Mauremys caspica*, *Mediodactylus orientalis*, *Laudakia stellio*, range extension, bioclimatic.

Hakkari Ili, Doğu Anadolu, Türkiye'de Üç Sürüngen Yeni Lokalite Kaydı ve Ekolojik Niş Modelleri

Öz: Bu çalışmada, üç sürüngen türü olan *Mauremys caspica*, *Mediodactylus orientalis* ve *Laudakia stellio*, Doğu Anadolu'daki Hakkari ilinden ilk kez kaydedilmiştir. *M. caspica*, *M. orientalis* ve *L. stellio'nun* yayılışları sırasıyla 100 km, 281 km ve 175 km uzatılmıştır. *M. orientalis* ve *L. stellio* için bu yeni lokalite kayıtları türlerin Türkiye'deki doğu sınırını oluşturmaktadır. *M. caspica*, *M. orientalis* ve *L. stellio* ortalama AUC (Area Under the Curve) değerleri sırasıyla 0.861, 0.867 ve 0.821 olarak hesaplanmıştır. Yıllık ortalama sıcaklık (Bio1) *M. orientalis* (%79.3) ve *L. stellio* (%52.8) için en önemli biyoklimatik değişken olarak belirlenirken, en yağışlı mevsimdeki ortalama sıcaklık (Bio8) *M. caspica* (%37.4) için en etkili biyoklimatik değişken olmuştur. Hakkari ilinin coğrafik olarak önemli konumu nedeniyle yeni tür kayıtları olasılığı vardır, bu nedenle bölgede ek çalışmalar yapılmasını öneriyoruz.

Anahtar kelimeler: *Mauremys caspica*, *Mediodactylus orientalis*, *Laudakia stellio*, yayılış genişletme, biyoklimatik.

1. Introduction

Türkiye is a very rich country in terms of amphibian and reptile fauna in its region. There are 152 reptile species including 10 chelonians, 3 amphisbaenians, 79 lizards, and 60 snakes and 34 amphibians, including 18 salamanders and 16 frogs (Bozkurt & Olgun, 2020; Baran et al., 2021; Karakasi et al., 2021, Kurnaz & Şahin, 2021; Yılmaz et al., 2021; Arribas et al., 2022a, 2022b; Kurnaz et al., 2022; Kafimola et al., 2023). This richness is due to the environmental heterogeneity as there are mountains, different climate types, and vegetation diversity. Additionally, Türkiye is a natural corridor between Asia, Europe, and Africa and the migration movements of European and Asian species that took place in the glacial and interglacial periods in geological times shaped the faunistic structure of Türkiye. Species that migrated to Anatolia during the glacial period of the Quaternary remained in suitable habitats during the interglacial period (Kornilios et al., 2011).

Hakkari (36 57' to 37 48' N, 42 10' to 44 50' E) is located at the southeast end of the Eastern Anatolia Region and covers an area of 7,228 km^2. There are Cilo-Sat Mountains, Black Mountain, and Zap River. There are glacial and crater lakes on Cilo-Sat Mountains and on the outskirts of Black Mountain. The top elevation in the province is the Reşko summit with an elevation approximately 4168 m. on Cilo-Sat Mountains. While in the high parts of the province dominates the harsh continental climate similar to that of Eastern Anatolia, on the valley floor of the province the Mediterranean climate is observed (Hakkari İl Kültür ve Turizm Müdürlüğü 2022).

Hakkari is one of the doorways to Anatolian peninsula animal species coming from different areas of Asia and Europe (Demirsoy, 1996). Since Hakkari is bordered by Iran and Iraq, it is possible that herpetofaunic species, which are found in the mentioned countries but not in Türkiye, will be recorded in Hakkari with future studies. Thus, *Platyceps rhodorachis* (Jan, 1863) was recently

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given as a new record in Hakkari for Türkiye (Yılmaz et al., 2021). The herpetofaunal biodiversity of Hakkari province, however, was never systematically studied. The data available result from species-oriented studies and notes on herpetofauna (Mertens, 1953; Başoğlu & Özeti, 1973; Başoğlu & Baran, 1977; 1980, Eiselt et al., 1992; Baran & Atatür, 1998; Mahlow et al., 2013; Sindaco et al., 2014; Afsar et al., 2015; Jablonski et al., 2019; Yılmaz et al., 2021).

Given the possibility of new species records and the important location of Hakkari and since the inventory studies are important for species conservation plans, we aimed to determine the reptile diversity of the Hakkari province. Modeling the potential distribution areas for a given species is important in understanding the relationship between the actual distribution and the most suitable habitat for a species. The aim of this study is to contribute to the herpetofauna of Hakkari province, which does not have sufficient data in the literature, and to determine the possible distribution of newly recorded species by indicating their ecological niches.

2. Material and Method

The specimens were collected between April and September of 2019 and 2020. The localities where the specimens were seen and captured are shown in Figure A2, A3, and A4. The specimens were actively captured by hand, or using a scoop, if needed. The specimens were collected and fixed (collecting permit no. 21264211-288.04-E.1048399 issued by the Turkish Ministry of Agriculture and Forestry) using traditional processes (Başoğlu & Özeti, 1973; Başoğlu & Baran, 1977, 1980). Voucher specimens are stored at the Hakkari University Zoology Laboratory, Türkiye. We used literature for specimen's determination (Başoğlu & Baran, 1977, 1980; Baran et al., 2021). The morphometric measurements were taken using dial calipers with an accuracy of 0.01 mm. The pholidotic characters were determined under a stereomicroscope.

We conducted ecological niche modelling for the three species configuring new locality records. All the occurrence data of *M. caspica*, *M. orientalis*, and *L. stellio* in Türkiye were obtained from literature (74 records for *M. caspica*; 63 records for *M. orientalis*; 650 records for *L. stellio*). After spatial sample corrections, 71 records for *M. caspica*, 59 records for *M. orientalis*, and 441 records for *L. stellio* remained for analysis. The literatures from which the localities are taken respectively are given in Figure A2, A3, and A4. In cases in which the locality information was not georeferenced in literature, an online geographic system application (i.e., Google Earth Pro) was used to ascertain the most precise location possible.

We used 19 bioclimatic variables downloaded from CHELSA version 2.1 for current conditions (1981-2010) (https://chelsa-climate.org) with a spatial resolution of 30 arc-second (1 km^2) (Karger et al., 2017). Correlation coefficients higher than 0.75 accepted as correlated variables and these variables are excluded from the analysis. Correlation matrix was calculated from R implemented Niche Toolbox web server (Osorio-Olvera et al., 2020). Seven bioclimatic variables for *M. caspica* [Bio1 = Annual Mean Temperature; Bio2 = Mean Diurnal Range (Mean of monthly (max temp - min temp)); Bio3 = Isothermality (Bio2/Bio7) (×100); Bio4 = Temperature Seasonality (standard deviation ×100); Bio8 = Mean Temperature of Wettest Quarter; Bio12 = Annual Precipitation; Bio14 = Precipitation of Driest Month] (Fig. 1), six bioclimatic variables for *M. orientalis* [Bio1 = Annual Mean Temperature; Bio2 = Mean Diurnal Range (Mean of monthly (max temp - min temp)); Bio3 = Isothermality (Bio2/Bio7) (×100); Bio5 = Maximum Temperature of Warmest Month; Bio12 = Annual Precipitation; Bio14 = Precipitation of Driest Month] (F. 2) and nine bioclimatic variables for *L. stellio* [Bio1 = Annual Mean Temperature; Bio2 = Mean Diurnal Range (Mean of monthly (max temp - min temp)); Bio3 = Isothermality (Bio2/Bio7) (×100); Bio4 = Temperature Seasonality (standard deviation ×100); Bio5 = Maximum Temperature of Warmest Month; Bio8 = Mean Temperature of Wettest Quarter; Bio12 = Annual Precipitation; Bio14 = Precipitation of Driest Month; Bio15 = Precipitation Seasonality] (Fig. 3) remained for analysis after the correlation analysis.

Bioclimatic variables and occurrence data were imported to Maxent vers. 3.4.4 (Phillips et al., 2006). Maxent was performed with 50 subsampled replicates, 5000 iterations, and cloglog outputs. Area Under the Curve (AUC) were calculated for estimation of model performance. Predicted distribution maps obtained from Maxent were imported to ArcGIS vers 10.3.1 for visualization.

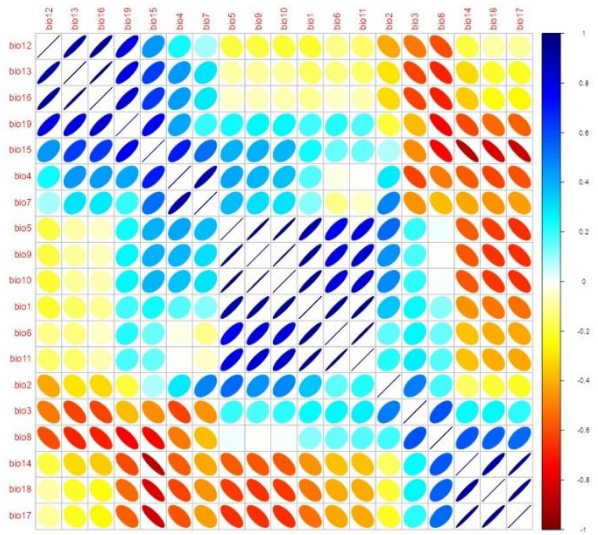

Figure 1. Corelation matrix of *Mauremys caspica*.

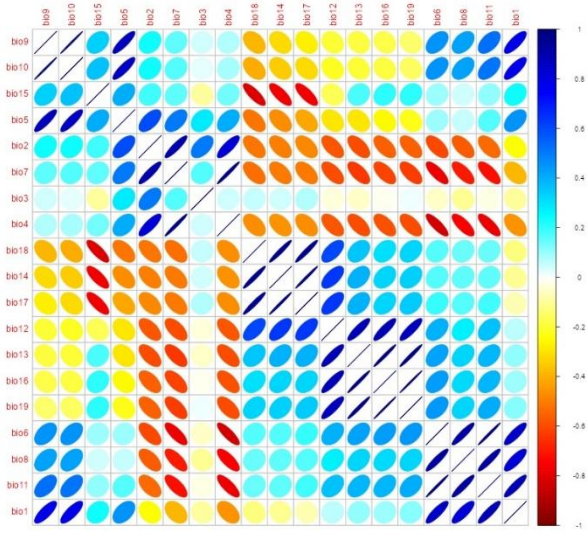

Figure 2. Correlation matrix of *Mediodactylus orientalis*.

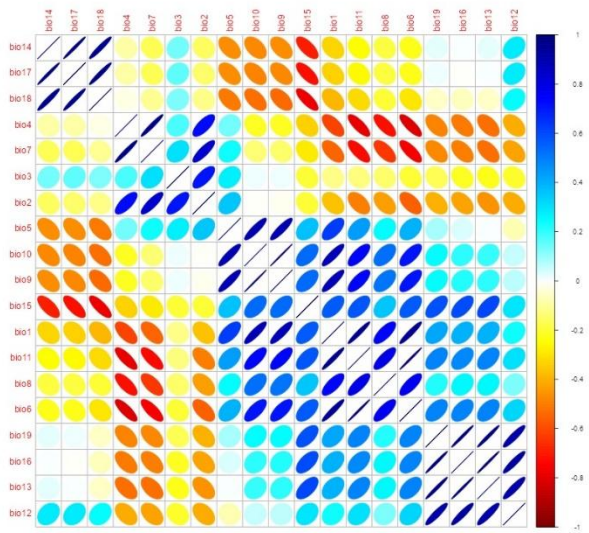

Figure 3. Correlation matrix of *Laudakia stellio*.

3. Results

The turtle *M. caspica* (Gmelin, 1774) and the lizards *M. orientalis* (Stepánek, 1937) and *L. stellio* (Linnaeus, 1758) were recorded for the first time in Hakkari (Additional Fig. A1).

Mauremys caspica (1♀, 11.06.2022, leg. C. Yılmaz, A. Avcı, Ç. Ilgaz, N. Üzüm, E., Bozkurt) was collected from Akçalı-Yeniyol Village of Hakkari. The specimen was released after measurements had been taken to assure determination (Additional Table A1). The distribution range of the species in Anatolia is extended by 100 km of air distance (from Çatak/Van) (Additional Fig. A2). The results of ecological niche modelling (Fig. 4) point to new suitable areas of occurrence for this species: central Anatolia, southeast Anatolia, Kars and Iğdır provinces, and inner parts of the east Black Sea Region (AUC value 0.861 ± 0.160). However, our new locality record for *M. caspica* seems like an unsuitable area. Mean temperature of wettest quarter (Bio8, 37.4%), temperature seasonality (Bio4, 26.0%), and annual precipitaton (Bio12, 16.2%) were the most important climatic variables determining suitable areas (Table 1).

Mediodactylus orientalis (1♀, 26.04.2019, leg. C. Yılmaz, A. Avcı, Ç. Ilgaz, N. Üzüm, E., Bozkurt; 1 juv., 18.05.2019, leg. C. Yılmaz, A. Avcı, Ç. Ilgaz, N. Üzüm, E., Bozkurt) was collected on old houses' walls in the center of Hakkari. The morphometric measurements and pholidolial features of the specimens are given in the Additional Table A2. The distribution range of the species in Anatolia is extended by 281 km of air distance (from Kızıltepe/Mardin to Center/Hakkari) (Additional Fig. A3). The results of the ecological niche modelling point new suitable areas to the species: Aegean Region, Antalya Basin, east Mediterranean Region, and southeast Anatolia (AUC value 0.867 ± 0.143, Fig. 5). Our new record seems like an unsuitable area for *M. orientalis* in terms of ecological niche model. The annual mean temperature (Bio1, 79.3%) and maximum temperature of warmest month (Bio5, 10.7%) were the most important climatic variables determining suitability of occurrence of *M. orientalis* in the area (Table 1).

Table 1. Biovariables. Percent contributions (P.C) and permutation importance (P.I) values of *M. caspica*, Me. orientalis and *L. stellio* under current bioclimatic conditions.

	M. caspica		*M. orientalis*		*L. stellio*	
	P.C	**P.I**	**P.C**	**P.I**	**P.C**	**P.I**
Bio1	7.5	19.3	79.3	82.7	52.8	57.5
Bio2	0.1	0.2	0.0	0.6	2.0	2.9
Bio3	4.6	5.0	3.0	1.8	1.0	1.6
Bio4	26.0	40.7	-	-	11.8	12.5
Bio5	-	-	10.7	1.5	4.6	1.4
Bio8	37.4	20.7	-	-	3.9	5.6
Bio12	16.2	1.2	5.9	5.9	3.8	4.7
Bio14	8.2	12.9	1.0	7.5	0.2	1.6
Bio15	-	-	-	-	20.0	12.3

Finally, *Laudakia. stellio* (1♂, Kırıkdağ, 14.07.2019, leg. C. Yılmaz, A. Avcı, Ç. Ilgaz, N. Üzüm, E., Bozkurt; 1♂ (subadult), 1 juv., Durankaya, 13.06.2021, leg. C. Yılmaz, A. Avcı, Ç. Ilgaz, N. Üzüm, E., Bozkurt) were collected on stony and rocky areas. The morphometric measurements and pholidolial features of the specimens are given in the Additional Table A3. The distribution range of the species in Anatolia is extended by 175 km of air distance (from between Hacımehmet, Hizan, Bitlis Province to Haruna Valley, Şemdinli, Hakkari, Province (Additional Fig. A4). The results of the ecological niche modelling (Fig. 6) point to new suitable areas in the region: Aegean Region, Mediterranean Region, and southwest of Thrace (AUC value 0.821 ± 0.054). The new locality of *L. stellio* turned out unsuitable as in Figure 4. The annual mean temperature (Bio1, 52.8%), precipitation seasonality (Bio15, 20.0%), and temperature seasonality (Bio4, 11.8%) were the most important climatic variables determining potential distribution in the area (Table 1).

4. Discussion

A total of 37 reptile species were recorded in Hakkari according to the results of the previous studies: including one tortoise, thirteen lizards, and twenty-three snakes (Başoğlu & Baran, 1977; Başoğlu & Baran, 1980; Eiselt et al.,

1992, Baran & Atatür, 1998; Mahlow et al., 2013; Sindaco et al., 2014; Jablonski et al., 2019, Baran et al., 2021; Yılmaz et al. 2021). We added new locality records to the list for three species, raising it to 40: one freshwater turtle (*M. caspica*) and two lizard species (*M. orientalis* and *L. stellio*).

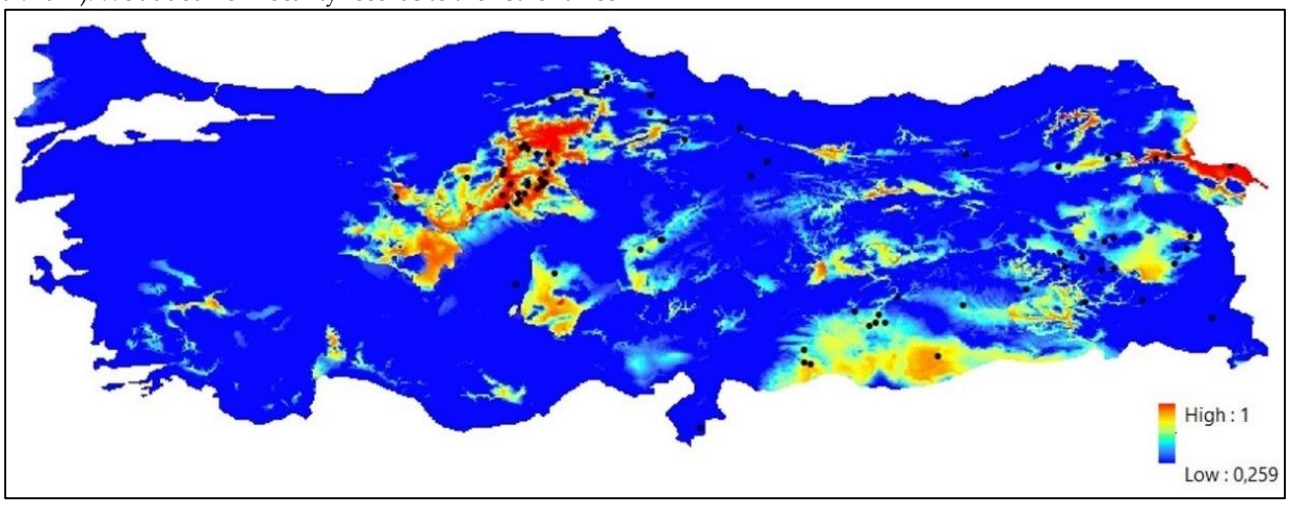

Figure 4. Predicted suitability under the current bioclimatic conditions of *Mauremys capsica,* dots show current locality records.

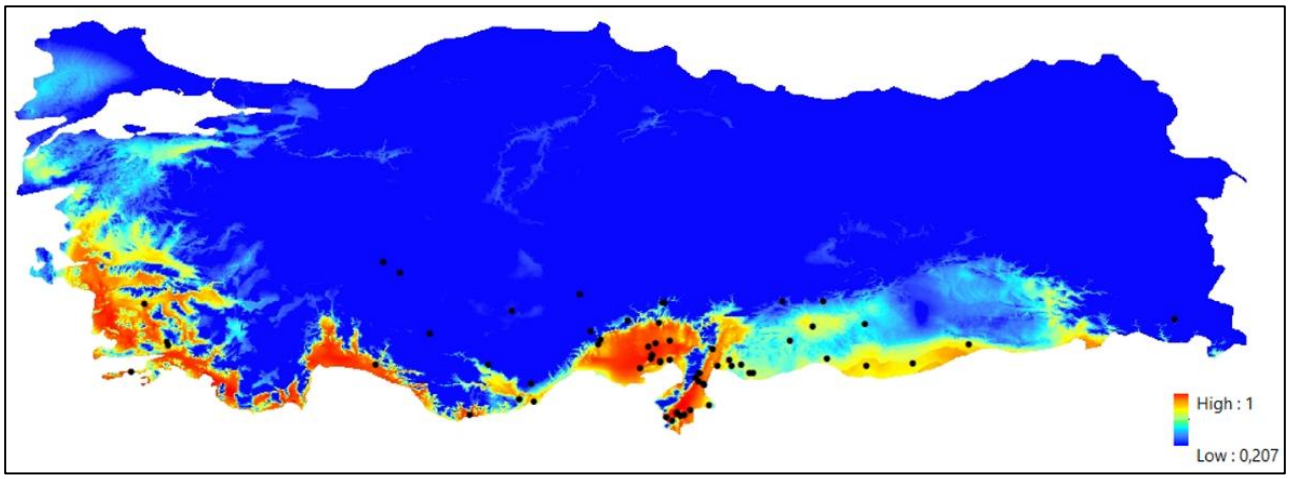

Figure 5. Predicted suitability under the current bioclimatic conditions of *Mediodactylus orientalis,* dots show current locality records.

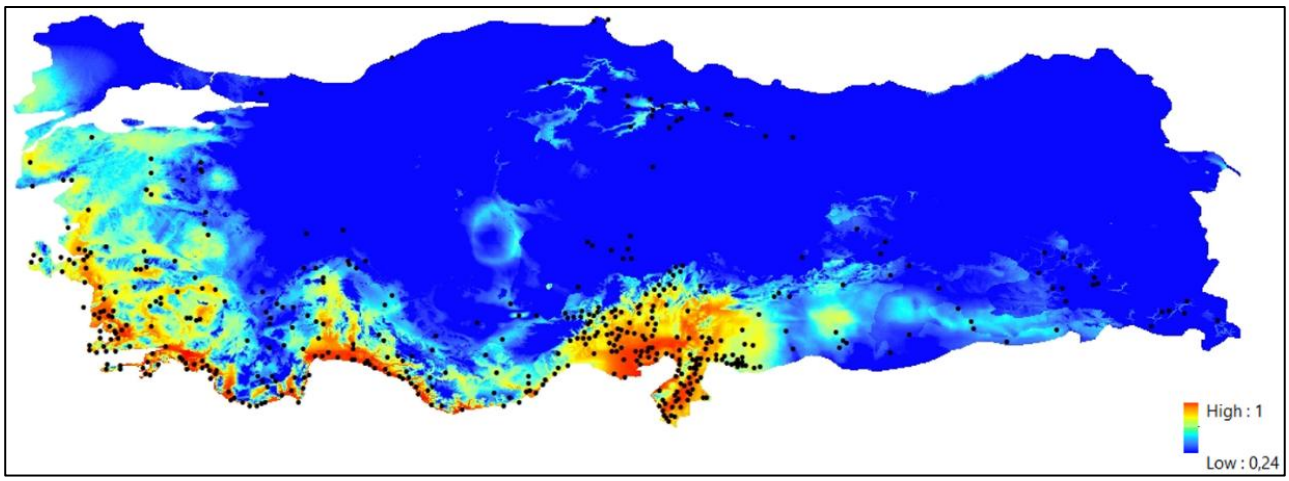

Figure 6. Predicted suitability under the current bioclimatic conditions of *Laudakia stellio,* dots show current locality records.

There are two species of the genus *Mauremys* in Türkiye, *M. caspica* and *M. rivulata* (Valenciennes, 1833) (Baran et al., 2021). These are the most abundant terrapins in the Near and Middle East and South-east Europe (Fritz et al., 2008). According to plastral pattern, these subspecies are different morphologically (Fritz et al., 2008). The ecological niche model and habitat preference of *M. caspica* was conducted by Kurnaz et al. for the first time. (2019). Also Kurnaz et al. (2019) reported that the environmental variables contributed to the highest gain for the distribution of *M. caspica* were Bio12 (annual precipitation), Bio10 (mean temperature of warmest

quarter), and Bio17 (precipitation of driest quarter). Their results also suggested that many regions were unsuitable areas, including Hakkari. The data obtained as a result of our study indicates that the distribution of the species may be wider in Anatolia as opposed to what has been suggested. Urbanization, excessive water withdrawal, and climate changes cause the loss of riverine habitat and these situations threaten aquatic organisms (Palmer et al., 2008). Habitat loss and fragmentation reduce the number of suitable areas and species have to inbreed and there is increased risk of extinction (Bardeh et al., 2021). Therefore, the potential distribution ranges of riverine depended species *M. caspica* were clearly determined by our study and this result can be useful for the conservation of this species.

Mediodactylus, which is one of the 26 genera of the Gekkonidae family, contains 17 species (Uetz et al., 2022).). Now, southern and south-eastern Aegean islands (Samos, Ikaria, and neighboring islets), southwestern Turkey, Cyprus, western Syria, northwestern Jordan, Lebanon, and northern Israel comprises the known distribution area of the species (Kotsakiozi et al., 2018). Our specimens are within the variation limits mentioned for the taxon in the literature (Baran & Gruber, 1982). According to the niche analysis conducted by Domeneghetti et al. (2014), it was stated that *M. kotschyi* has not yet spread in all climatically suitable areas in Italy and that factors other than climate may limit the distribution of the species. The authors also stated that this species may have come to Italy through human influence. In our study, *M. orientalis* was found 281 km away from its known distribution, suggesting that its distribution was similarly affected by human influence.

Regarding morphological data, the specimens of *L. stellio* from Hakkari examined in present study are within the variation limits mentioned for the taxon in the literature (Baran & Öz, 1985; Gül & Tosunoğlu, 2011). Şahin (2021) gave a new locality record for *L. stellio* from Devrek-Zonguldak and reported that Bio6 (minimum temperature of coldest month) and Bio12 (annual precipitation) were more contributing bioclimatic variables. There are differences between our study and Şahin (2021) in the most effective bioclimatic variables. This is due to the sites from which the climatic data were obtained, the programs used, and the localities used in the analysis.

Their ranges extended 175 and 281 km for *L. stellio* and *M. orientalis*, respectively. Result of ecological niche modeling, Hakkari is not seen as a suitable area for *L. stellio* and *M. orientalis*. The occurrence of the both species in such distant regions from their main distribution sites can be explained by various theories such as introduced by man as in *Phoenicolacerta laevis* in Georgia (Tarkhnishvili et al., 2017), habitat fragmentation as in *Podarcis siculus* (Senczuk et al., 2017), relict population as in *Lacerta agilis* in Sweden (Berglind, 2000) or lack of sufficient studies on the species. After the ecological niche model of our study, possible distribution areas can be studied and new population can be determined. Also, molecular approaches can be handled for *Me. orientalis* and *L. stellio* to understand the relationship between new locality and main distribution ranges.

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Ethics committee approval: This study was conducted in accordance with ethical standards for animal experiments. Legal research ethics committee approval was obtained from the Hakkari University Animal Experiments Ethics Committee (No: 20/03/2019-2459).

Conflict of interest: The authors declare that there is no conflict of interest.

Author Contributions: Conception – C.Y., Ç.I., E.B., N.Ü., A.A.; Design – C.Y., Ç.I., E.B., N.Ü., A.A.; Supervision – C.Y., Ç.I., E.B., N.Ü., A.A.; Fund – C.Y., Ç.I., E.B., N.Ü., A.A.; Materials – C.Y., Ç.I., E.B., N.Ü., A.A.; Data Collection and Processing – C.Y., Ç.I., E.B., N.Ü., A.A.; Analysis Interpretation – C.Y., Ç.I., E.B., N.Ü., A.A.; Literature Review – C.Y., Ç.I., E.B., N.Ü., A.A.; Writing – C.Y., Ç.I., E.B., N.Ü., A.A.; Critical Review – C.Y., Ç.I., E.B., N.Ü., A.A.

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Supplemental Tables

Table A1. The morphometric measurements (in mm) of *Mauremys caspica* specimens examined in this study.

	Female
Straight Carapace Length	180.34
Curved Carapace Length	196.44
Maximum Carapace Width	121.04
Maximum Carapace Height	66.84
Midline Plastron Length	167.19
Plastron Width from Humeral	83.34
Plastron Width from Abdominal	84.50
Gular Suture Length	19.64
Humeral Suture Length	17.61
Pectoral Suture Length	23.92
Abdominal Suture Length	43.33
Femoral Suture Length	38.97
Anal Suture Length	14.19
Nuchal Length	10.50
Nuchal Width	11.87

Table A2. The morphometric measurements (left/right, mm) and pholidosial features (left/right)of *Mediodactylus orientalis* specimens examined in this study.

	Female	**Juvenil**
Supralabials	9/9	9/9
Sublabialias	8/8	8/8
Number of rows of longitudinal dorsal tubercules	10	9
Ventrals	24	23
Number of scales under the 4th toe of the hind foot	18/18	17/17
Snout-vent Length	47.33	25.38
Tail Length	-	27.68
Total Body Length	-	53.06
Head Length	11.71	6.64
Head Width	9.16	4.79
Distance between Nostril and Eye	3.15/3.32	-/-
Head Height	5.45	2.98
Vertical Eye Diameter	1.91/1.95	-/-
Distance between Eye and Ear Opening	3.82/3.78	-/-
Vertical Ear Diameter	1.97/1.79	-/-

Table A3. Their indexes and the morphometric measurements (left/right, mm), pholidosial features (left/right) of *Laudakia stellio* specimens examined in this study.

	Male	Male (Subadult)	Juvenil
Supralabials	11/11	12/11	11/12
Sublabialias	12/12	12/11	11/11
Ventrals	41	39	42
Subdigital Lamellae Underneath the Fourth Toe of the Hindlimb	21/20	20/20	20/20
Subdigital Lamellae underneath the Third Finger of the Forelimb	18/17	17/18	18/17
Scales in the 5th Ring from the Beginning of the Tail	18	16	19
Ventral Glandular Scales	32	30	30
Preanal Glandular Scales	34	33	32
Total Body Length	278.97	210.50	97.36
Snout-vent Length	131.26	94.70	41.70
Tail Length	147.71	115.80	55.66
Head Length	35.52	24.85	11.85
Head Width	39.21	26.42	11.04
Dorsal Spot Length	15.33	10.60	3.50
Dorsal Spot Width	10.20	6.26	12.90
Forelimb Length	55.64	41.04	19.26
Hindlimb Length	82.10	60.58	28.52
Head Height	16.98	12.00	6.85
Tail Length / Snout-vent Length	1.12	1.22	1.33
Head Index	90.59	94.06	107.34
Head Flatness Index	209.19	207.08	172.99
Head Length Index	27.06	26.24	28.42
Snout-vent Length / Head Length	3.69	3.81	3.52
Head Length / Head Width	0.90	0.94	1.07
Hindlimb Length / Forelimb Length (Foot Ratio)	1.47	1.48	1.48

Supplemental Figures

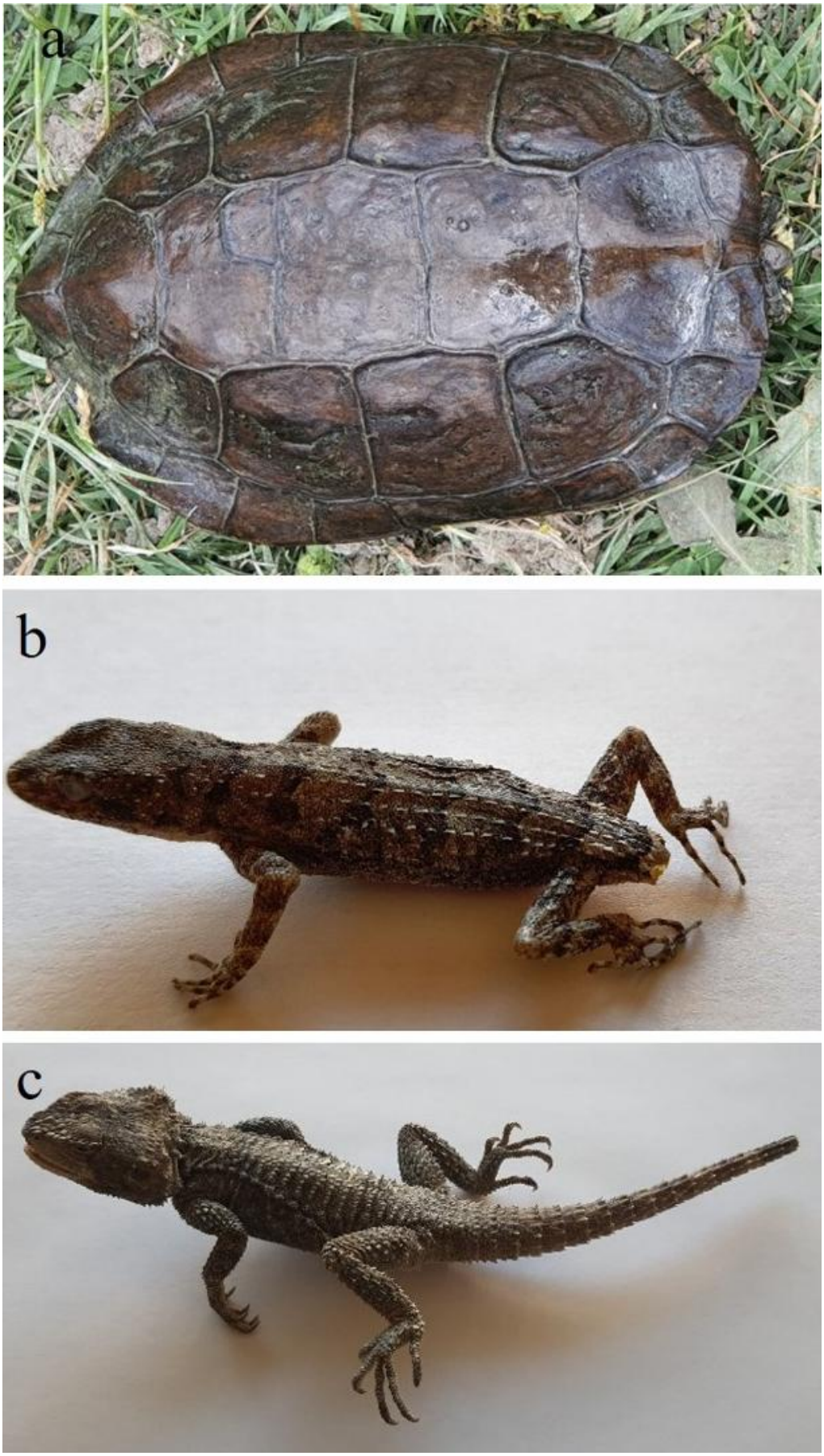

Figure A1. The reptiles recorded for the first time from Hakkari province. (a) *Mauremys caspica*, (a) *Mediodactylus orientalis*, (a) *Laudakia stellio*.

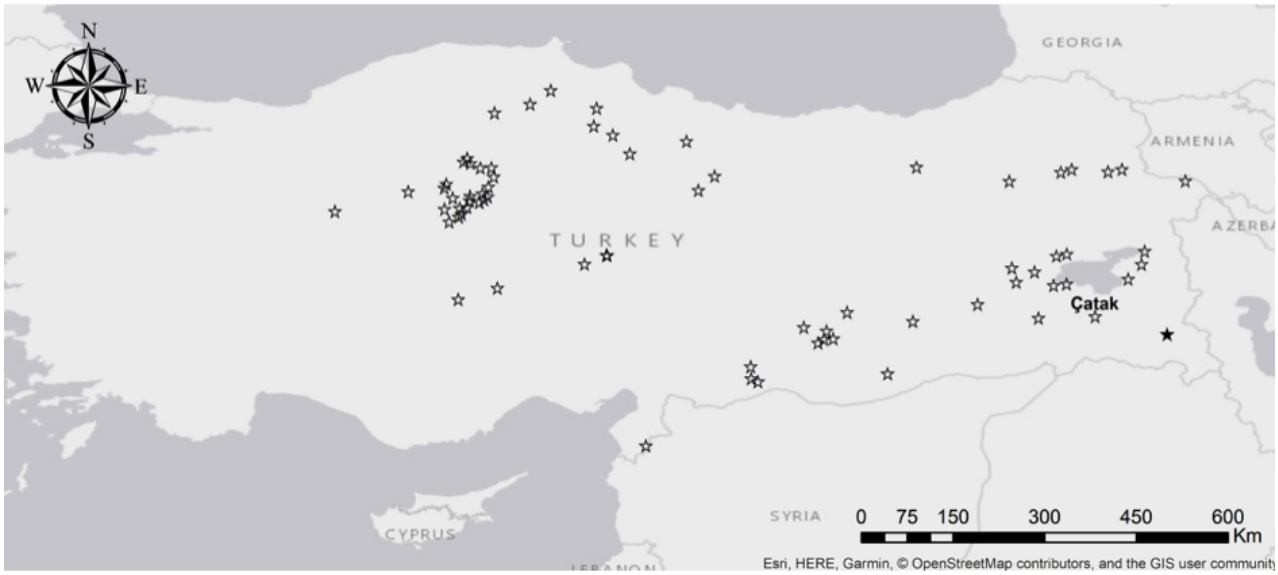

Figure A2. Distribution of *Maureymys caspica*, the known distribution according to the literature data, with a black star for the new locality. Data from Teynie (1981), Fritz and Freytag (1993), Schweiger (1994), Taşkavak et al. (1998), Fritz et al. (2008), Tosunoğlu et al. (2010), Akman et al. (2018), Kurnaz et al. (2019), Akman et al. (2020) and Yıldız et al. (2021).

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Figure A3. Distribution of *Mediodactylus orientalis*, the known distribution according to the literature data, with a black star for the new locality. Data from Baran (1980), Uğurtaş et al. (2000), Baran et al. (2001), Uğurtaş et al. (2007), Hür et al. (2008), Afsar et al. (2011), Cihan and Tok (2014), Özcan and Üzüm (2014), Ege et al. (2015), Çiçek et al. (2015a), Afsar et al. (2017), Sarıkaya et al. (2017a, 2017b), Arslan et al. (2018), Çakmak (2018), Yıldız et al. (2019), Boran et al. (2020) and Candan et al. (2020).

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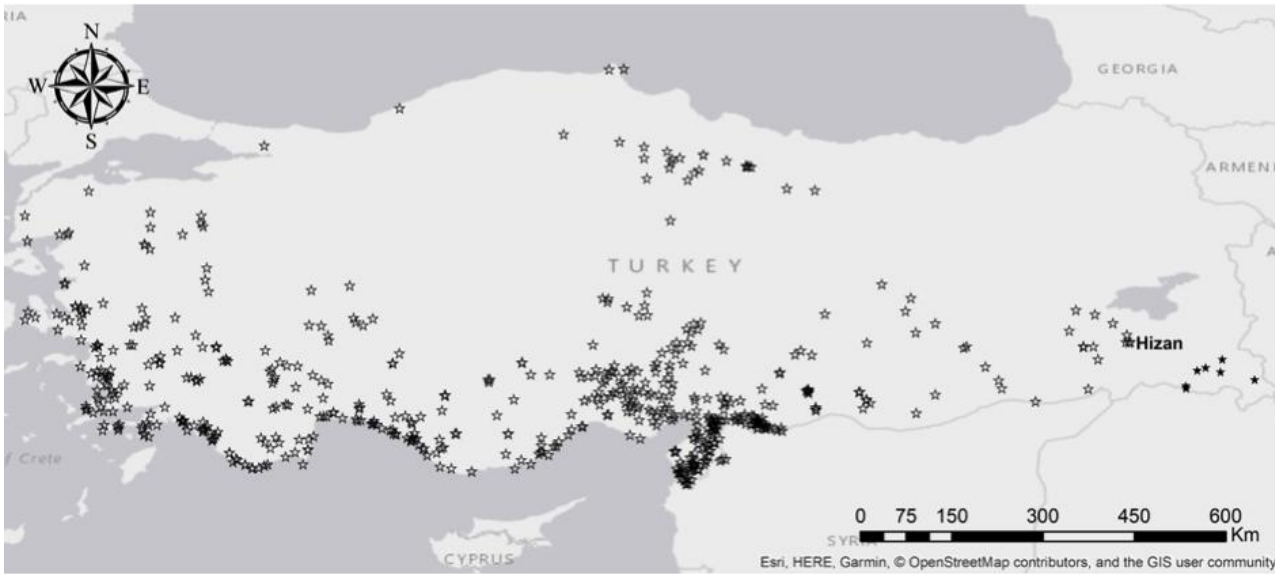

Figure A4. Distribution of *Laudakia stellio*, the known distribution according to the literature data, with a black star for the new localities. Data from Başoğlu and Hellmich (1970), Clark and Clark (1973), Baran (1980), Teynie (1987), Baran et al. (1989), Mulder (1995), Budak et al. (1998), Tok (1999), Uğurtaş et al. (2000), Düşen and Öz (2001), Kumlutaş et al. (2001), Uğurtaş et al. (2001), Erdoğan et al. (2002), Franzen and Wallach (2002), Tok et al. (2002), Göçmen et al. (2003), Geniez et al. (2004), Kumlutaş et al (2004), Lo Cascio and Masseti (2004), Almog et al. (2005), Kete et al. (2005), Kır (2005), Afsar (2006), Göçmen et al. (2007), Kumlutaş et al. (2007), Olgun et al. (2007), Akelma (2008), Hür et al. (2008), Eser (2009), Göçmen et al. (2009), Yıldız et al. (2009), Arıkan et al. (2010), Gül et al. (2010), Gül (2011), Gül and Tosunoğlu (2011), Tosunoğlu and Gül (2011), Özcan (2012), Ünal (2012), Cumhuriyet (2014), Göçmen et al. (2014), Karış and Göçmen (2014), Kumaş and Ayaz (2014), Tok and Çiçek (2014), Çiçek et al. (2015b), Ege et al. (2015), Kucharzewski (2015, 2016), Kumlutaş et al. (2015), Baycan and Tosunoğlu (2017), Göçmen et al. (2017), Sarıkaya et al. (2017b), Akman et al. (2018), Avcı et al. (2018), Bozkurt (2018), Günay et al. (2018) Mermer (2018), Şahin and Afsar (2018), Afsar et al. (2019), Yıldız et al. (2019), Gidiş and Başkale (2020), Yıldız (2020) and Bülbül et al. (2021).

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