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Annual activity pattern of *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006, with notes on its natural history
(Squamata: Serpentes: Viperidae)

Die Jahresaktivität von *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006, nebst Angaben zu ihrer Biologie
(Squamata: Serpentes: Viperidae)

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KURZFASSUNG

Die Spinnenschwanzviper *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006 ist ein Endemit des Westirans. Sie verwendet eine raffinierte Struktur am Schwanzende, um Vögel, ihre Beute, anzulocken. Zu dreißig in ihrem Lebensraum entdeckten Individuen von *P. urarachnoides* wurden ausgewählte Habitatmerkmale erhoben, die Aktivität von zehn Individuen wurde für die Dauer von 13 Monaten in ihrem Lebensraum überwacht. Die Jahresaktivität der Viper an der Erdoberfläche beginnt mit ihrem Erscheinen nach der Winterruhe im zeitigen April und endet mit dem Einwintern im späten November; ihr Verlauf ist zweiphasig mit Aktivitätsgipfeln im Frühjahr und Spätsommer/Herbstbeginn. Zum Auflauern der Beute bevorzugt *P. urarachnoides* die Deckung von Bäumen mehr als die von Büschen und zieht Verstecke bei Höhlungen im steilen Gelände wie sie aufragende Kalkfelsblöcke bilden, flachen Lauerplätzen vor. Die Oberflächenpräsenz korreliert nur während einiger Monate signifikant mit der Umgebungstemperatur und der Luftfeuchte. Die gemachten Beobachtungen sollen Grundlage sein für künftige biologische und ökologische Untersuchungen wie z. B. Schätzungen von Populationsgrößen, Schutzprogrammen und Entscheidungen bezüglich Tourismus und Habitatmanagement.

ABSTRACT

The Spider-tailed Viper, *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006, is an endemic snake of western Iran that uses an elaborate caudal structure for luring avian prey. As many as 30 individuals of *P. urarachnoides* were detected in the field, their habitat associations were revealed and the annual activity pattern of 10 individuals was monitored for 13 months. The annual above-ground activity of this viper begins with the emergence from hibernation in early April and ends with the entry into the hibernaculum in late November. The activity pattern is bimodal with peaks in spring and late summer / early autumn. For ambush, *P. urarachnoides* favors the concealment by trees over bushes; it prefers ambushing in holes of steep slopes, such as vertical limestone rocks, to flat substrates. Above-ground presence is significantly correlated with temperature and humidity only during some months. These findings contribute fundamental knowledge for future biological and ecological studies, such as population estimation, conservation programs, tourism, and habitat management decisions.

KEY WORDS

Squamata: Serpentes: Viperidae; *Pseudocerastes urarachnoides*; ecology, behavior, annual activity pattern, natural history, habitat, Zagros Mountains, Iran

INTRODUCTION

Annual activity in a snake species is related to biological (e.g., feeding, mate searching by adult males, migration of gravid females) and environmental factors (e.g., hibernation, long dry periods, seasonal rainfalls, frost periods) (GIBBONS & SEMLITSCH 1987; LILLYWHITE 1987; BONNET et al. 1999; SUN et al. 2001; BROWN & SHINE 2002). Activity levels vary from day to day within season due to the effects of proximate stimuli (such as weather conditions) that vary on a short timescale (BROWN & SHINE 2002). Local snake populations may be adapted to local conditions such as the relationship between specific weather conditions, prey availability and predator activity. It is therefore important to understand the effects of day-to-day variation in activity pattern on the ecology of snakes. Such variations may have impacts on total food intake, rates of growth and reproduction and vulnerability to predators (CAUGHLEY 1977; CAUGHLEY & SINCLAIR 1994; GIBBS 2000; SUN et al. 2001).

The Spider-tailed Viper, *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006, is endemic to the western foothills of the Zagros Mountains in western Iran (FATHINIA 2014). In recent years, studies were carried out on different aspects of the biology and natural history of this viper (FATHINIA et al. 2009), distribution (FATHINIA & RASTEGAR-POUYANI 2010), molecular systematics (FATHINIA et al. 2014) and predatory behavior (FATHINIA 2014; FATHINIA et al. 2015). There is no information on the conservation status of this viper. Thus, the status of this viper was assigned as data deficient in the IUCN red-list (ANDERSON & PAPENFUSS 2009) with an unknown population trend.

Here, the authors provide information on the following aspects of the ecology of *P. urarachnoides*: i) duration of the annual activity period, ii) physical habitat preferences (e.g., slope, temperature, humidity, habitat type and cover), iii) level of aboveground activity during the year and, iv) abiotic and biotic causes of the variation in the annual activity. This additional information to the ecology and natural history of *P. urarachnoides* is meant to serve as a basis in the planning of future biological and ecological studies, such as population estimation, conservation programs, management and tourism.

MATERIALS AND METHODS

In snakes, such factors as prolonged inactivity and ecologically independent individuals as a result of body size variation lead to a biased population estimation and variation in activity patterns and observability (POUGH 1980; GREENE 1984; SHINE et al. 1998). To obtain ecological data of a certain snake population via direct count and observation, the following conditions must be satisfied: snake being of large size, existing at high densities, occupying an open homogenous habitat, being sedentary, easily detectable when active but hidden when inactive, and not escaping from human presence (SUN et al. 2001). These preconditions fitted relatively well to our study species.

Thirty individuals of *Pseudocerastes urarachnoides* were detected and data was acquired in the wild during a survey of 13 months in four separated localities in the Ilam Province, western Iran: Bina & Bijar No-hunting Area in Ilam Township, Kooleg Preserved Area in Mehran Township, Zarin-Abad in Dehloran Township, and Dinar-Kooh in Abdanan Township (Fig. 1). A subsample of 10 adult *P. urarachnoides* was closely monitored to obtain information about the annual activity cycle in the Bina & Bijar No-hunting area. The vipers were visited on a total of 228 days between March 21, 2011, to April 22, 2012. During the activity period of spring, summer and autumn, vipers were monitored during the morning hours, 5-7 days per week on average. The study area was also monitored during some nights. Monitoring was continued 4-5 times per month during hibernation. To identify individual vipers, photo-identification was used. Graphs of the annual activity pattern were drawn using MS Excel 2010. Definition of distinct stages of annual activity was based on the observation that $\leq$ 50 % of the individuals (at least five) were engaged in a particular stage-defining behavior. Information regarding the microhabitat associations of this viper, including substrate type (limestone or rocky), coverage (whether this viper was found under or near bushes or trees) and slope data was obtained for all the 30 observed specimens. Slope data (in degree) of points where a viper was found was determined using the Android application 'Clinometer & Spirit Level' v. 1.0. Data on mean daily air temperature and humidity of the study site came from the Meteorological Office of Ilam Province. This climatic data was investigated in parallel with any effect

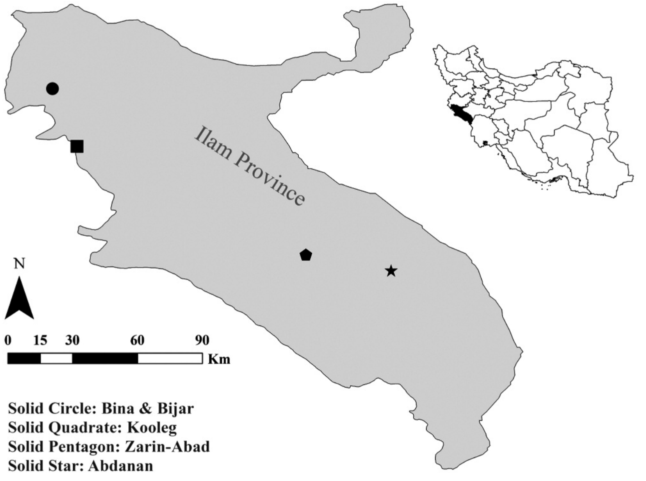

Fig. 1: Position of the Province of Ilam in western Iran (right, black area) and the study sites of *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006, in that province (left).

Abb. 1: Lage der Provinz Ilam im Westiran (rechts, schwarzes Gebiet) und der Untersuchungsorte von *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006 in dieser Provinz (links).

on the annual activity pattern of *P. urarachnoides*. The Pearson Correlation Coefficient was used to test the correlation between number of observed individuals and temperature or humidity during above-ground activity months.

The authors counted the number of observed individuals per each visit to the study area. To test for presence or absence of significant month-to-month differences in the number of monitored individuals of *P. urarachnoides*, a two-way non-parametric homogeneity of variance analysis (Friedmann test) was used. The hibernation period of surface inactivity (December to March) was excluded (variance of observations was constant). The coefficient of seasonality (CS) as defined by LEYNAUD et al. (2008) was calculated according to the formula CS = 100 * (N1-N2)/(N1+N2), where CS is the coefficient of seasonality, N1 = the number of observed individuals in the season with the highest number of observations, N2 = the number of observed individuals in the season with the lowest number of specimens. The values of CS range from 0 (no seasonality) to 100 (maximum seasonality). Pearson Chi-Square Tests were applied to see if there is a significant difference in the preferred slopes and cover types.

RESULTS

Habitat associations.– *Pseudocerastes urarachnoides* is mostly confined to limestone sediments in the western foothills of the Zagros Range, but penetrates to some extent into rocky habitats. Only three out of 30 specimens were found in rocky habitats. The inclination of the slopes occupied ranged from zero to 90 degrees, but with an increased frequency at steeper slopes ($\chi^2 = 60$, $P < 0.05$). Only five out of 30 specimens were observed on flat substrates (from zero to around 10°), three on slopes of about 40° and 22 on vertical walls (90°).

All specimens were associated with plant cover, mainly composed of sparse bushes and trees, with a preference of trees over bushes ($\chi^2 = 19.4$, $P < 0.05$). Five specimens were associated with bushes, the remaining 25 with four tree species: *Pistacia khinjuk* and *P. atlantica* (11 specimens),

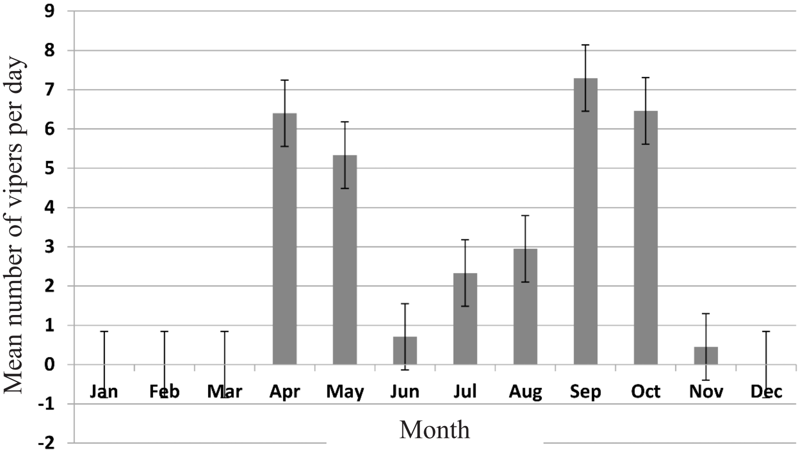

Fig. 2: Number of daily observed individuals of *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006, out of a subsample of 10 individuals monitored. Monthly means are indicated. Study period: March 21, 2011, to April 22, 2012; Bina & Bijar No-hunting Area, Province of Ilam, western Iran. ($\chi^2 = 75.63$; $P < 0.05$; $N = 13$). Error bars represent ± one standard deviation.

Abb. 2: Anzahl der täglich beobachteten Individuen aus einer beobachteten Gruppe von 10 *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006. Die Monatsmittelwerte sind angegeben. Untersuchungszeitraum: 21. März 2011 bis 22. April 2012; Bina & Bijar Gebiet, Provinz Ilam, Westiran. Die Fehlerbalken stellen ± eine Standardabweichung dar.

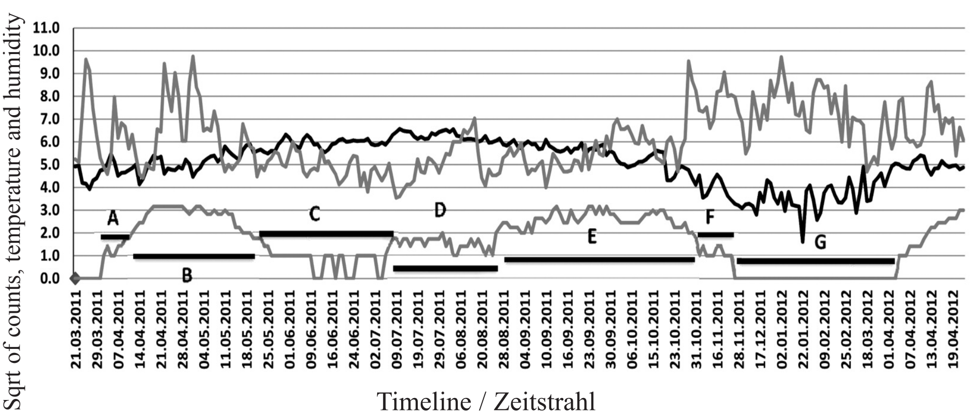

Fig.3: Mean ambient humidity (above, gray line), mean air temperature (middle, black line), and activity (below, gray line) of *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006, from the studied sample in the Bina & Bijar No-Hunting Area, Ilam Province, western Iran.
The values on the Y axis represent square roots (Sqrt) of relative air humidity (%), air temperature (°C) and viper counts. Letters A to G represent the following annual phases of activity: A – hibernation emergence; B – sitting in ambush stage; C – primary reduction stage; D – reappering stage; E – secondary sitting in ambush stage; F – secondary reduction stage and G – hibernation stage.

Abb. 3: Mittlere Luftfeuchte (obere graue Linie), mittlere Lufttemperatur (mittlere schwarze Linie) und Aktivität (untere graue Linie) von *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006 in der untersuchten Stichprobe des Bina & Bijar Gebietes, Provinz Ilam (Westiran).
Die Y-Achse gibt die Werte der relativer Luftfeuchte (%), Temperatur (°C) und Individuenzahl in ihren Quadratwurzeln (Sqrt) an. Die Buchstaben A bis G stellen die folgenden Phasen der Jahresaktivität dar: A – Auftauchen aus der Winterruhe; B – Lauerphase; C – primäre Rückzugsphase; D – Wiederkehrphase; E – sekundäre Lauerphase; F – sekundäre Rückzugsphase, G – Überwinterungsphase.

Table 1: Monthly number of monitoring days (N) from March 21, 2011, to April 22, 2012.

Tab. 1: Monatliche Anzahl der Untersuchungstage (N) zwischen 21. März 2011 und 22. April 2012.

Year Jahr	Month Monat	N
2011	March	5
2011	April	25
2011	May	27
2011	June	24
2011	July	21
2011	August	19
2011	September	27
2011	October	24
2011	November	15
2011	December	5
2011	January	5
2011	February	4
2012	March	5
2012	April	22

Quercus brantii (4 specimens), and *Ficus carica* (10 specimens). Of the latter 10 specimens, eight were found collectively in close vicinity to a tree. These Spider-tailed Vipers had gathered in an area of less than 30 square meters around one big *F. carica* tree, with one viper specimen exposed to the sun, almost three meters from the trunk and the others along limestone walls shaded by the canopy or on the base of main branches. Most specimens associated with trees were in ambush under the canopy, only three out of 25 were from three to five meters away from and out of the canopy.

Annual activity pattern.– There were significant fluctuations in the number of observed individuals from month to month during the seasons of activity (two-way Friedman test, $P < 0.05$), with maximum numbers in April-May and September-October. Thus, *P. urarachnoides* showed a bimodal activity pattern with peaks in spring and late summer / early autumn (Fig. 2). The coefficient of seasonality for *P. urarachnoides* was maximum (CS = 100) across the year.

A total of 228 days during 13 months were spent monitoring 10 individuals from the Bina & Bijar sample (Table 1). Monitoring was carried out almost every day during activity seasons from morning to noon. Mean air temperature and humidity ranged from 2.6 - 43.1 °C and 12.5 - 95 %, respectively. According to the data obtained from monitoring, a serious fluctuation in the annual activity graph is recognized (Fig. 3). The annual activity cycle was subdivided into seven distinct stages: a) hibernation emergence (H.E.), when the population started its surface activity around beginning of April and less than half of the population (four out of 10 specimens) was active for 10 days (i.e., April 1-11); b) sitting in ambush stage (S.A.S.), during which all individuals of this sample were found in ambush (10 individuals), retaining this phase during the following 32 days (April 12 to May 13); c) primary reduction stage (P.R.S.), in which the above-ground presence of the individuals decreased gradually during 54 days (May 15 to July 5). At the beginning of P.R.S., 50 % or more of the sample were not detected, followed by a period in which around 90 % to occasionally 100% of the vipers were absent from the surface; d) during the subsequent reappearing stage (R.S.) an increase occurred in the number of individuals observed at the surface; during this phase that started on July 7, and lasted to August 27, the above-ground presence fluctuated from 30 % to 50 % of the maximum rate; e) the secondary sitting in ambush stage (S.S.A.S.), during which more than 50 % of individuals were visible on the surface on average, lasted for 46 days (from August 28, to October 22). In this period above-ground presence was 100 % in some days; f) secondary reduction stage (S.R.S.), (from October 23, to November 24) at which the number of individuals visible at the surface gradually decreased from 50 % to 10 %; and g) hibernating stage (H.S.), which lasted for around four months. After November 26, 2011 no individual was observed until April 4, 2012 (Fig. 3.). Figure 3 shows that above-ground presence of *P. urarachnoides* started at an ambient temperature and humidity of 20 °C and 30 %, respectively, and reached its peak after an average increment in temperature at 25 °C and 60 % humidity during S.A.S. With increasing temperature to above 35 °C and decreasing humidity to around 25 % on average, the activity rate began to decrease. Rappearing stage started when mean temperatures exceeded 40 °C and mean humidity fell below 20 %. The proportion of individuals

Table 2: Correlation of the activity (number of observed individuals per day) of *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006, with ambient mean air temperature and mean air humidity in the study area (Bina & Bijar No-hunting area, Province of Ilam, western Iran). *r* – correlation coefficient; H – mean relative air humidity (%); N – mean number of individuals observed per day; T – ambient mean air temperature (°C); SEM – standard error of the mean; *P* – *P* value. *r* and *P* values in bold indicate significant correlations between activity and temperature or humidity.

Tab. 2: Die Beziehungen zwischen der Aktivität (Anzahl je Tag beobachteter Individuen) von *Pseudocerastes urarachnoides* BOSTANCHI, ANDERSON, KAMI & PAPENFUSS, 2006 und der Umgebungstemperatur bzw. Luftfeuchte im Untersuchungsgebiet (Bina & Bijar Gebiet, Provinz Ilam, Westiran). *r* – Korrelationskoeffizient; H – mittlere relative Luftfeuchte (%); N – mittlere Anzahl der täglich beobachteten Individuen; T – mittlere Lufttemperatur (°C); SEM – Standardfehler des Mittelwertes; *P* – *P*-Wert. *r*- und *P*-Werte in Fettschrift verweisen auf signifikante Korrelationen zwischen Aktivität und Lufttemperatur bzw. Luftfeuchte.

	April	May	June	July	August	September	October	November
N ± SEM	6.40 ± 0.72	5.30 ± 0.63	0.70 ± 0.09	2.30 ± 0.23	2.95 ± 0.39	7.30 ± 0.36	6.45 ± 0.33	1.00 ± 0.19
T ± SEM	24.00 ± 0.63	30.06 ± 0.83	35.61 ±0.45	39.14 ± 0.61	37.42 ± 0.51	32.91 ± 0.36	24.96 ± 0.86	14.74 ± 1.09
H ± SEM	42.68 ± 4.03	36.60 ± 3.35	24.25 ±1.11	21.38 ± 1.08	30.76 ± 2.12	27.00 ± 1.08	41.85 ± 3.24	58.92 ± 2.93
r (T, N); *P*	0.14; 0.52	**-0.7**; **0.001**	0.16; 0.45	**0.67**; **0.001**	**-0.54**; **0.016**	**-0.49**; **0.009**	**0.78**; **0.001**	**0.65**; **0.015**
r (H, N); *P*	0.35; 0.08	**0.57**; **0.002**	-0.08; 0.71	0.09; 0.70	-0.013; 0.58	0.25; 0.21	**-0.60**; **0.002**	0.28; 0.36

visible at the surface increased gradually with steadily decreasing temperatures in early September to mid-October, while the humidity remained almost constant at around 25 % on average. The subsequent decrement in above-ground presence was accompanied by more and more decrease in temperature and increase in humidity from late October to late November. Above-ground presence ceased in late November with the dropping of mean ambient temperature to around 10 °C and the increase of mean humidity to around 50 %. Above-ground presence was significantly correlated with temperature in May, July, August, September, October and November, whereas, with humidity in May and October (Table 2).

All of the 30 specimens were observed during the whole daylight period in spring, summer and autumn. They were active on ambush sites before sunrise to after sunset in spring. During late spring and summer, the circadian surface presence is confined to cool hours of the day (i.e., morning and evening). During night trips to the same areas in mid- to late spring, three adult and two juvenile snakes were observed to be active.

DISCUSSION

Unlike its congeners, *Pseudocerastes fieldi* SCHMIDT, 1930, and *P. persicus* (DUMÉRIL, BIBRON & DUMÉRIL, 1854), which are predominantly nocturnal (MALLOW et al. 2003; LATIFI 2000, PHELPS 2010), the present results show that adult Spider-tailed Vipers are mainly diurnal. This diurnal activity pattern in adult *P. urarachnoides* is most likely due to its feeding technique, using caudal luring to visually attract birds. Subadult specimens hunt lizards as well (FATHINIA et al. 2015) which is why juveniles or subadults may be active also by night or in the twilight. The presence of *P. urarachnoides* was strongly, positively correlated with the presence of vegetation. No specimen of the 30 individuals studied was found in bare areas. So, undoubtedly, vegetation plays a vital role in microhabitat selection of this viper. As most of these individuals were associated with big trees, one can presume that the vipers, under otherwise equal conditions prefer microhabitats associated with big trees and, thus big canopies, compared to small bushes. Big trees with their spacious canopies certainly provide richer and more diversified assemblages of insects and their larvae, consequently are more attractive to insect-eating birds, and therefore favored by the viper over smaller trees. Also, high canopies may be preferred by birds because of the availability of higher perching site, hence wider views over the area that can be scanned for prey. Moreover, wider canopies may provide better ambush and concealment conditions for this viper. Aggregation of eight vipers around, under and on perches of one and the same *Ficus carica* tree, in spite of the presence of bushes nearby, provide good evidence for the accuracy of the above speculation.

Annual activity pattern of *P. urarachnoides* shows fluctuations in concordance with shifts in ambient temperature, humidity and, probably, prey availability. Each spring, certain passerine birds (warblers and shrikes) migrate from Africa to Eurasia for breeding and back again in autumn for wintering (Newton 2008). *Pseudocerastes urarachnoides* preys on these migratory passerines rather than sedentary birds (Fathinia et al. 2015). *Pseudocerastes persicus* feeds on migratory birds during spring and autumn (Mallow et al. 2003) as well as lizards, rodents (Latifi 2000; Phelps 2010) and arthropods (Khan 2002). Bird predation is also reported for *P. fieldi* (Disi et al. 2001). Two peak stages of surface presence (S.A.S. and S.S.A.S.) in the annual activity cycle of *P. urarachnoides* coincide with April-May and September-October, i.e., periods of increased abundance of migratory passerines in the study area (Fathinia, unpublished) and optimum temperature and humidity as well. It is reasonable to assume that this viper must take advantage of such suitable conditions and valuable resources to build fat reserves in April-May for successful mating in late May / early June (Fathinia 2014) and in September / October for hibernation. Along with the significant numerical decline in active individuals during primary reduction stage (P.R.S.) and reappearing stage (R.S.) which together last about three months (from May to August), climatic conditions become more harsh (i.e., increase in temperature and decrease in humidity to 36.5 °C and 21 %, respectively) and migrating passerines migrate to higher altitude localities of the Zagros Mountains (Fathinia, unpublished) and also a more northern destination. During the hibernation period, the habitat's surface average humidity increases to around 42 % and mean air temperature decreases to around 13 °C, which is obviously too cold for the viper to live an active life at the surface. The interplay of the various biotic and abiotic factors in the annual above-ground presence pattern of this viper remains not fully understood. Some variation in the annual activity cycle of this viper must, however, be expected because of year-to-year shifts in climatic and biotic conditions.

The coefficient of seasonality (CS) mirrors the effect of the amplitude of the climatic conditions on a species' activity period in a given area. The more rigid the climatic conditions, the higher the CS value (Leynaud et al. 2008). The highest possible CS value (i.e., 100) for *P. urarachnoides* in the study area indicates a very strong impact of the climatic conditions such as heat and dryness on the annual life cycle of the viper.

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REFERENCES

Anderson, S. C. & Papenfuss, Th. (2009): *Pseudocerastes urarachnoides*. The IUCN Red List of Threatened Species 2009: e.T164664A5916336. WWW document available at < http://www.iucnredlist.org/details/164664/0 > http://dx.doi.org/10.2305/IUCN.UK.2009.RLTS.T164664A5916336.en. [downloaded on August 5, 2016].

Bonnet, X. & Naulleau, G. & Shine, R. (1999): The dangers of leaving home: dispersal and mortality in snakes.- Biological Conservation, Barking; 89 (1):39-50.

BOSTANCHI, H. & ANDERSON, S. C. & KAMI, H. G. & PAPENFUSS, T. J. (2006): A new species of *Pseudocerastes* with elaborate tail ornamentation from western Iran (Squamata: Viperidae).- Proceedings of the California Academy of Sciences, San Francisco; 4: 443-450.

BROWN, G. P. & SHINE R. (2002): Influence of weather conditions on activity of tropical snakes.- Australian Journal of Ecology, Oxford; 27: 596-605.

CAUGHLEY, G. (1977): Analysis of vertebrate populations. New York (John Wiley and Sons), pp. 234.

CAUGHLEY, G. & SINCLAIR, A. R. E. (1994): Wildlife ecology and management. Boston (Blackwell Science), pp. 334.

DISI, A. M. & MODRÝ, D. & NEČAS, P. & RIFAI, L. (2001): Amphibians and reptiles of the Hashemite Kingdom of Jordan: An atlas and field guide. Frankfurt am Main (Edition Chimaira), pp. 408.

FATHINIA, B. (2014): Taxonomic status of the genus *Pseudocerastes* BOULENGER, 1896 (Ophidia: Viperidae) in Iran based on molecular and morphological characters. PhD. Thesis, Razi University, Kermanshah, pp. 195.

FATHINIA, B. & ANDERSON, S. C. & RASTEGAR-POUYANI, N. & JAHANI, H. & MOHAMADI, H. (2009): Notes on the natural history of *Pseudocerastes urarachnoides*.- Russian Journal of Herpetology, Moskva; 16: 134-138.

FATHINIA, B. & RASTEGAR-POUYANI, N. (2010): On the species of *Pseudocerastes* (Ophidia: Viperidae) in Iran.- Russian Journal of Herpetology, Moskva; 17: 275-279.

FATHINIA, B. & RASTEGAR-POUYANI, N. & RASTEGAR-POUYANI, E. & TODEHDEHGHAN, F. & AMIRI, F. (2015): Avian deception using an elaborate caudal lure in *Pseudocerastes urarachnoides* (Serpentes: Viperidae).- Amphibia-Reptilia, Leiden; 36: 223-231.

FATHINIA, B. & RASTEGAR-POUYANI, N. & RASTEGAR-POUYAN, E. & TOODEH-DEHGHAN, F. & RAJABIZADEH, M. (2014): Molecular systematics of the Genus *Pseudocerastes* (Ophidia: Viperidae) based on mitochondrial cytochrome *b* gene.- Turkish Journal of Zoology, Ankara; 38: 575-581.

GIBBONS, J. W. & SEMLITSCH, R. D. (1987): Activity patterns; pp. 396-421. In: SEIGEL, R. & COLLINS, J. T. & NOVAK, S. S. (eds.): Snakes: ecology and evolutionary biology. New York (Macmillan).

GIBBS, J. P. (2000): Monitoring populations; pp. 213-252. In: BOITANI, L. & FULLER, T. (eds.): Research techniques in animal ecology. Controversies and consequences. New York (Columbia University Press).

GREENE, H. W. (1984): Feeding behavior and diet of the eastern coral snake, *Micrurus fulvius*; pp. 147-162. In: SEIGEL, R. A. & HUNT, L. E. & KNIGHT, J. L. & MALARET, L. & ZUSCHLAG, N. L. (eds.): Vertebrate ecology and systematics – Tribute to Henry S. Fitch. Lawrence (University of Kansas) [University of Kansas Museum of Natural History Special Publication, Lawrence; 10: 147-162].

KHAN, M. S. (2002): A guide to the snakes of Pakistan. Frankfurt am Main (Edition Chimaira), pp. 265 [Frankfurt Contributions to Natural History, volume 16].

LATIFI, M. (2000): Snakes of Iran. Tehran (Department of the Environment), pp. 478.

LEYNAUD, G. C. & REATI, G. J. & BUCHER, E. H. (2008): Annual activity patterns of snakes from central Argentina (Córdoba province).- Studies on Neotropical Fauna and Environment, Abingdon; 43: 1-6.

LILLYWHITE, H. B. (1987): Temperature, energetics, and physiological ecology; pp. 422-477. In: SEIGEL R. & COLLINS, J. T. & NOVAK, S. S. (eds.): Snakes: ecology and evolutionary biology. New York (Macmillan).

MALLOW, D. & LUDWIG, D. & NILSON, G. (2003): True vipers: Natural history and toxinology of Old World vipers. Malabar (Krieger Publishing Company), pp. XIV, 359.

NEWTON, I. (2008): The migration ecology of birds. London, Amsterdam (Elsevier-Academic Press), pp. viii, 976.

PHELPS, T. (2010): Old world vipers: A natural history of the Azemiopinae and Viperinae. Frankfurt am Main (Edition Chimaira), pp. 558.

POUGH, F. H. (1980): The advantages of ectothermy for tetrapods.- American Naturalist, Chicago; 115: 92-112.

SHINE, R. & HARLOW, P. S. & KEOGH, J. S. & BOEADI (1998): The influence of sex and body size on food habits of a giant tropical snake, *Python reticulatus*.- Functional Ecology, Oxford; 12: 248-258.

SUN, L. & SHINE, R. & ZHAO, D. & TANG, Z. (2001): Biotic and abiotic influences on activity patterns of insular pit-vipers (*Gloydius shedaoensis*, Viperidae) from north-eastern China.- Biological Conservation, Barking; 97: 387-398.

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