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Research Article

Nocturnal activity and habitat selection of Hotson Jerboa, *Allactaga hotsoni* Thomas, 1920 (Rodentia: Dipodidae)

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Abstract

Investigation about the activity pattern of the Hotson Jerboa with motorcycle and search light indicated that there is significant relationship between moon light intensity and encountering with the Hotson Jerboa' or it's trapping success. The results showed that the more moon light intensity the less the activity of this Jerboa. In the other word we can infer that the encounter rate with the individuals reaches its highest amount in the first and the last days of the lunar month and closing to the middle weeks of the month, they hardly can be detected. Although in completely cloudy nights even in the middle of the month the encounter rate increased as well. This is a predator-prey coevolutional mechanism that lowers the predation risk. Additionally, the activity shifted somewhat from the open to vegetation cover when the moon was high, however the least encounter rate was recorded in full moon status.

Keywords: Moon phases, Encounter rate, Predation risk, Habitat preferences.

Introduction

Bipedal locomotion is one of the important anatomical adaptations of the Jerboas in desert areas and such movement mechanisms needs special physiognomic characteristics of the habitat and some special behaviors during nocturnal activity. Better and faster entering to the burrows in full moon status is a critical behavior in anti-predatory mechanisms (Hemami *et al*. 2011).

Investigation about the North American desert rodents showed that nocturnal activity of these rodents completely related to the moonlight status (Wolfe and Summerline 1989, Butynski 1984, Kotler et al. 1988, Lockard and Owings 1974). Such significant relationships had been reported for other mammal's members too for example lagomorphs (Butynski 1984, Gilbert and Boutin 1991), badgers (Cresswell and Harris 1988), Opossums (Laferriere 1997).

All of these studies have shown that these mammals reacted to an increase in the intensity of nocturnal illumination by reducing the use of open space, restricting foraging activity, microhabitat shifts movements, or the duration of the period of activity; or by switching the activity to dark periods, an antipredation adaptation (Abramsky *et al.* 2004). Price *et al.* (1984) reported that bright moonlight reduces the overall activity of nocturnal rodents. In particular, rodents that live in sandy deserts reduce their activity and avoid open habitats on moonlit nights when predation risk is high (Lockard and Owings 1974, Kaufman and

Kaufman 1982, Kotler and Brown 1988, Kotler *et al.* 1993). The risk of predation influences both activity pattern and habitat use (Werner *et al.* 1983, Berger 1991). Specifically, to test whether the intensity of moonlight influences the activity pattern of *A. hotsoni*, activity of the individuals was recorded and compared to the brightness of the moon by addressing the following questions: Does time allocation of staying out of burrows and that of being active vary with the levels of moon light intensity?

Material and methods

Study area

During intensive sampling from May to September 2011 we studied Hotson's Jerboa activity behavior with regard to moon light intensity in a arid steppe habitat located 5 km north of Chupanan, Isfahan Province (33°35'N and 54°27'E). This province was introduced as a new recorded site for the Hotson Jerboa by the authors (unpublished data). The study area usually has the least rainfall in comparing to other urban and rural areas of the Isfahan province since there is no recorded rainfall during June to September.

The mean annual precipitation in the study area is less than 100 mm (Institute of Whether and Climatology, Isfahan 2011). The vegetation comprises different bush and shrub species such as *Atriplex sp*, *Artemisia siberi*, *Peganum harmala*, *Atraphaxis spinosa*, *Haloxylon sp*, *Calligonum comosum*, *Hamada salicornica*, *Zygophyllum sp* and *Tamarix sp*. Some predator species such as Red fox (*Vulpes vulpes*), Jackal (*Canis aureus*), Sand fox (*Vullpes rueppellii*) and Sand cat (*Felis margarita*) was observed and recorded in the study area too. The altitude is approximately 950 m above sea level and the climate is markedly seasonal with a dry and harsh season from May to October. The physiognomy of the habitat presented a total woody and non-woody plant cover.

Data recording and statistical analysis

For the investigation of the possible different activity level during the lunar nights we recorded the amount of the activity of the Hotson Jerboa in different lunar nights: new moon and full moon (the first and the last weeks of the lunar month were assumed as new moon and the two middle weeks as full moon) (Hemami *et al.* 2011). For this porpoise we have traversed multiple line transect with motorcycle and search light during five months by applying the same sampling effort in different nights in completely random design (each transect line on average between 10-15 km).

Totally 1670 km were traversed in 63 nights and 48 individuals were recorded during the study period. We measured encounter rate with the individuals in different habitat types since each observation point was recorded by GPS.

Statistical Analysis

For controlling temperature effect on its nocturnal activity pattern we measured ambient air temperature and used partial correlation test. Regression analysis was used for the investigation of correlation between the encounter rate and the lunar nights. ANOVA was used to test significant differences in diverse habitat vegetation type usage. The Square root transformation was used in case of data non normal distribution.

Results

The encounter rate of the individuals was higher in new moon than in full moon (R^2=0.69, t= 9.3 and P<0.001). A partial correlation analysis in controlling the temperature variable showed that this factor don't contribute in shaping Hotson Jerboa's activity pattern during spring and summer seasons (R^2=0.43, P<0.001). It seems that the feeding habits of the Hotson Jerboa contribute to somewhat in its activity pattern since ANOVA analysis showed that there are

significant differences in encounter rate of the individuals in different habitat types (ANOVA: F=18.56, P<0.001) Totally four main habitat types were recorded in the study area including *Calligonum comosum*, *Hamada salicornica*, *Zygophyllum sp* and Barren areas (Fig. 2). With closing to the middle weeks and increasing moonlight, Hotson Jerboa selects more barren areas for activity and conversely in new moon status it can be recorded more among the shrubs specially *Hamada salicornica* that constitute an important feeding item. Therefore, foraging behavior can be regarded as a reflection of the balance between two opposing demands for increasing fitness: maximizing energy intake and avoiding the risk of predation (Price 1984).

Discussion

The adaptational value of selecting barren areas for activation times most likely results from the possibility for better and faster entering to the burrows a bihaviour that can be regarded to somewhat an antipredation adaptation. These finding are in accordance with the previous studies (Hemami et al 2011, Lockard and Owings 1974, Kaufman and Kaufman 1982, Kotler et al. 1993).

Previous studies about the other nocturnal mammalian species indicated that such animals reacted to an increase in the intensity of nocturnal illumination by reducing the use of open space, by restricting foraging activity, movements or the duration of the period activity or by switching the activity to dark periods (Butynski 1984, Gilbert and Boutin 1991, Wolfe and Summerlin 1989). But our findings about the Jerboas showed a reverse trend since individuals had been shifted to more barren areas with an increase in the moon light intensity during full moon status, in spite of their lower overall activity outside the burrows (Hemami *et al.* 2011).

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