HERPETOZOA 22 (3/4): 173 - 180
Wien, 30. Dezember 2009

Nocturnal or diurnal? Notes on the daily activity pattern and life history of the Middle Eastern Elegant Racer *Platyceps elegantissimus* (GÜNTHER, 1878)

(Squamata: Serpentes: Colubridae)

Nacht- oder tagaktiv? Bemerkungen über die zirkadiane Aktivität und das Verhalten der vorderasiatischen Prachtzornnatter *Platyceps elegantissimus* (GÜNTHER, 1878)

(Squamata: Serpentes: Colubridae)

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KURZFASSUNG

Beobachtungen zur zirkadianen Aktivität und zum Verhalten von *Platyceps elegantissimus* (GÜNTHER, 1878) erfolgten regelmäßig an zwei in Terrarien gehaltenen (beobachtet im Sommer und Spätherbst) und zufällig an vierzehn freilebenden Exemplaren. Das Aktivitätsmuster der gefangenen Exemplare war zweigipfelig. Der erste Gipfel lag zwischen 10.00 und 11.00 Uhr im Sommer und Herbst; der zweite zwischen 18.00 und 19.00 Uhr im Sommer, und zwischen 14.00 und 15.00 Uhr im Herbst. Neun der 14 freilebenden Exemplare wurden bei Tageslicht beobachtet, eines während der Dämmerung und zwei in Dunkelheit (frühmorgens und spätabends), zwei weitere Exemplare wurden tagsüber in ihren Unterschlupfen gefunden. Gefangene Exemplare merkten sofort jede Bewegung in der Nähe des Terrariums, reagierten mit rascher Flucht oder mit Erstarrung in der jeweiligen Körperhaltung. Ein gefangenes und ein freilebendes Exemplar wurden morgens beim Sonnen beobachtet. Im Gegensatz zur verbreiteten Meinung, führt *P. elegantissimus* kein nacht- sondern ein tagaktives, wennauch verborgenes Leben.

ABSTRACT

We present life history notes on two captive (observed during summer and late autumn) and on fourteen, randomly encountered free-ranging specimens of *Platyceps elegantissimus* (GÜNTHER, 1878). Activity patterns of the captive specimens were bimodal, their morning activity peaking between 10:00 and 11:00 both in summer and autumn. The afternoon activity peaked between 18:00 and 19:00 in summer and between 14:00 and 15:00 in autumn. Nine among the 14 wild-ranging specimens encountered were observed in daylight, one at dusk and two in full darkness (early morning and late evening), two were inactive when found in their shelters during the day. Captive specimens immediately noticed any movement around the terrarium, reacting by quick flight or by freezing their body. One captive and one wild-ranging specimen were observed basking in the morning. Contrary to widely accepted views that *P. elegantissimus* is nocturnal, it conducts a predominantly diurnal, although cryptic lifestyle.

KEYWORDS

Reptilia: Squamata: Serpentes: Colubridae: *Platyceps elegantissimus*, behavior, daily activity pattern, field observations, observations in captivity, Israel, Jordan, Middle East

INTRODUCTION

Focused efforts in past decades considerably increased our general knowledge of the herpetofauna in Arabia and its immediate vicinity: an excellent overview of the snakes of Arabia exists (GASPERETTI 1988); LEVITON et al. (1992) and EGAN (2007) provided useful guides to the herpetofauna of the Middle East and, within it, Arabia. Several articles presented species lists of the peninsula (i.e. HAAS 1957; WERNER 1971; ARNOLD & GALLAGHER 1977; ARNOLD 1980; AL-SADOON 1989; AL-SADOON et al. 1991). Others provided detailed analyses of the zoogeographic affinity (ARNOLD 1987; JOGER 1987) and ecology (ARNOLD 1981; 1984; YOM-TOV & WERNER 1996; NATHAN & WERNER 1999)

of species of the Middle Eastern herpetofauna. From time to time new taxa are still being described in many groups: i.e. in *Hyla*, GRACH et al. 2007; in *Acanthodactylus*, MORAVEC et al. 1999, WERNER 2004, BAHA EL DIN 2007; in *Mesalina*, SEGOLI et al. 2002; in *Laudakia*, LACHMAN et al. 2006; in *Pseudotrapelus*, MORAVEC 2002; in *Cerastes*, WERNER et al. 1999; in *Echis*, BABOCSAY 2003; 2004; in *Eirenis*, SIVAN & WERNER 2003; in *Platyceps* SCHÄTTI & MCCARTHY 2004; in *Micrelaps* WERNER et al. 2006; and in *Testudo*, PERÄLÄ 2001.

Despite these and other efforts, the biology of reptiles of this area is poorly or not known. One of the hardly known species is a racer, *Platyceps elegantissimus* (GÜNTHER, 1878). Some uncertainties related to its taxonomy were recently addressed (MARX 1968; WERNER & SIVAN 1991; SCHÄTTI & UTIGER 2001). This enigmatic snake inhabits the southern part of the Wadi 'Arava in the Levant and the northern and northwestern parts of the Arabian Peninsula (GASPERETTI 1988; WERNER & SIVAN 1991; LEVITON et al. 1992). Despite its highly conspicuous appearance (often bright yellow with wide, jet black cross-bands), it is rarely observed in the field. Consequently, little information is available on its daily activity pattern. Racers (*Coluber* s. l.) are usually diurnal species, but in desert conditions, some related colubrines such as *Spalerosophis diadema* (SCHLEGEL, 1837) (WERNER 1970) and *Lytorhynchus diadema* (DUMÉRIL, BIBRON & DUMÉRIL, 1854) (BOUSKILA & AMITAI 2001) conduct – at least seasonally – a nocturnal lifestyle. Most authors consider *P. elegantissimus* nocturnal or crepuscular. GASPERETTI (1988) reported that this species is "never seen abroad in daylight; however, some specimens were found dead on the road, usually near midnight". AL SADOON (1989), SCHÄTTI & GASPERETTI (1994) and DISI et al. (2001) simply state that this species is nocturnal. ARNOLD (1980) reports a specimen of *Coluber thomasi* PARKER, 1931, a probably closely related species, emerging at dusk. Only BOUSKILA & AMITAI (2001) claim that *P. elegantissimus* is diurnal.

Hence the available information is controversial. Here, we provide some data on the daily activity patterns and other aspects of life history of *P. elegantissimus*, derived from two specimens kept in captivity at the herpetological collection of the Hebrew University of Jerusalem and from 14 free ranging specimens randomly encountered in the southern Levant.

MATERIALS AND METHODS

Observations in captivity – Between 1997 and 2001 the authors regularly checked cement chambers protecting access points to water pipes that incidentally trapped snakes in the Israeli Rift Valley and the Negev desert. Rescued snakes were released on the spot, but some were collected for the herpetological collection of the Hebrew University of Jerusalem (HUJ). Some of these snakes were kept in captivity for observation in the reptile room of the herpetological laboratory. From these, a male (collected near Qetura, Israel, 30º02'N, 35º04'E; deposited as HUJ-R 21270; total length: 465 mm) and a female (collected near Yotvata, Israel, 29º53'N, 35º03'E; deposited as HUJ-R 21224; total length: 480 mm) *Platyceps elegantissimus* were kept from 04 May 2000 through the end of February 2001 (female died from unknown causes) and the end of July 2001 (male euthanized) in a glass terrarium. Their daily activity patterns were recorded.

The terrarium housing the snakes had a size of 40 cm (width) x 60 cm (depth) x 40 cm (height). Sand was used as substrate, bark and stones were provided as shelters. The reptile room was covered with opaque glass on two sides and on ca. 75% of the ceiling. Filtered sunshine through the glass reached parts of the terrarium, additional illumination was not applied. The photoperiod and the temperature regime followed that of Jerusalem (31º47'N; 35º13'E; see Atlas of Israel 1985), except that the building harboring the room provided some shading in the early morning and late afternoon, and to some extent buffered the ambient temperature. The snakes were fed with small lizards, geckos and baby mice at variable frequencies

(on average, about once a week). Water was provided ad libitum from a Petri dish.

Observation periods spanned between 12 May through 23 July 2000 (73 days, summer) and between 30 October through 13 November 2000 (15 days, autumn) and included 22 days during which snakes were recorded as active. The snakes were checked several times a day and their behavior was noted down. Although the checks were not systematically scheduled and in some periods (both within days and within weeks) were scarce, most times of the day (including night hours) were covered. The snakes were considered active when their head stuck out of shelter regardless to which extent their body was exposed. However, snakes were not considered active when in extremely hot days, for cooling their body, they coiled themselves uncovered around the Petri dish.

Observations in the field – are based on 14 incidents. The second author (R.T.) made observations and recorded observations by others, on *P. elegantissimus* in the field within and near Qibbuz Samar, Israel (29°47'N; 35°02'E). One observation was made by the first author (G.B.) in the Wadi al Yutm area (29° 37'N; 035°11'E), southern Jordan. Most snakes were accidentally found, but the date and time of the snakes' activity and other variables (see Table 1) were recorded. These observations are biased in the sense that most of them were made during normal human activities occurring mainly at daylight in this area. And of course, visual detection of these slender snakes is easier during the day.

RESULTS

Activity pattern in captivity – As can be seen from 68 observations, both *Platyceps elegantissimus* specimens showed bimodal activity patterns in the terrarium (Figures 1 and 2). The snakes were active in the morning (between 08:00 and 12:00) and late afternoon (between 15:00 and 22:00) hours. In the summer the activity peaked between 10:00 and 11:00 and between 18:00 and 19:00, in autumn between 10:00 and 11:00 and between 14:00 and 15:00.

Behavior in captivity – When approached, captive *P. elegantissimus* often (number of occasions not recorded) immediately noticed movement (however slow and cautious) even through a dense mosquito mesh of the door of the reptile room, and reacted with sudden flights to shelter or by freezing their body. While active, both specimens often stood raising their head high, directing it forward with the neck standing perpendicular to the ground or were agile and restless, quickly crawling and searching around in the terrarium. The male was once observed while using its head as a spade turning it alternately left and right and with it dug the sand out from under a piece of tree bark.

The male was observed twice basking in the morning, once at about 10.00 (9/Nov) and once at 09.30 (13/Nov). It flattened its body and its head rested on a stone; it did not flee from the observer, but froze in the basking posture.

On several occasions during extremely hot afternoon hours (for instance on 14 June at 14:00 and 17 June at 15:45, but also some other days in early July), after an initial activity in the morning the snakes coiled themselves around the Petri dish to cool their body. At these occasions they did not seek shelter when disturbed. On the above two occasions temperatures measured 38°C and 34ºC, respectively, on the top of the terrarium.

Activity in the field – Fourteen field observations of *P. elegantissimus* derive from the period between October 1997 and October 2008 (Table 1). On nine occasions, the snakes were active (moving or basking) at daylight. One specimen was observed at dusk and two specimens in dark hours (once early morning and once early evening). In two cases the snakes were found under shelter.

Behavior in the field – Snakes were mostly found moving on the ground (Table 1). However, one specimen was observed climbing up a palm tree trunk (also once a snake shedding was found on the trunk of a date palm; data not shown) and in one case a specimen was observed basking near a bush at 09:50.

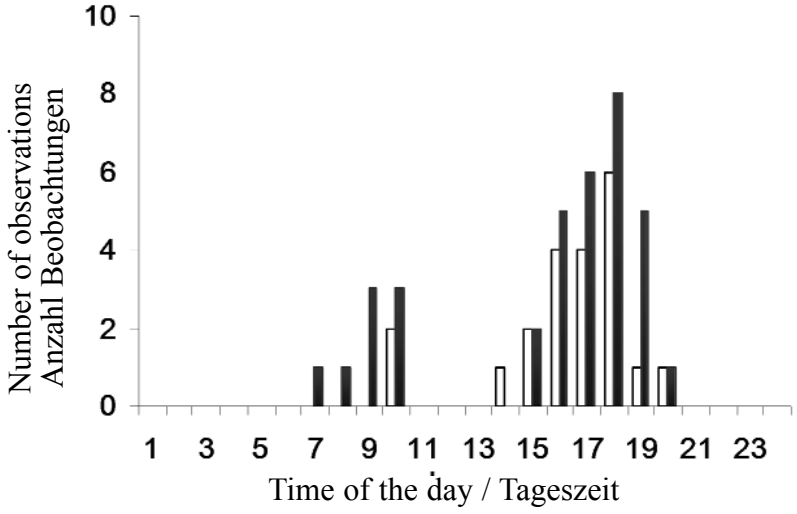

Fig. 1: Summer (12 May – 23 July) activity patterns of two *Platyceps elegantissimus* (GÜNTHER, 1878) specimens kept in the terrarium under natural illumination regime.
Diagram based on 56 observations. Hollow bars: male; solid bars: female.

Abb. 1: Sommer-Aktivitätsmuster (12. Mai – 23. Juli) eines Männchens und Weibchens von *Platyceps elegantissimus* (GÜNTHER, 1878) im Terrarium unter natürlichem Beleuchtungsregime.
Diagramm auf Grundlage von 56 Beobachtungen. Leere Balken: Männchen; ausgefüllte Balken: Weibchen.

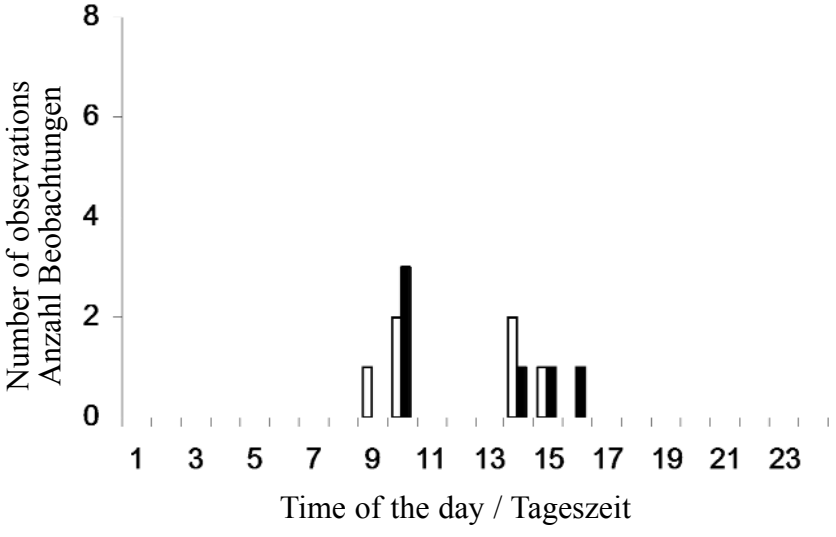

Fig. 2: Autumn (30 October – 13 November) activity patterns of two *Platyceps elegantissimus* (GÜNTHER, 1878) specimens kept in the terrarium under natural illumination regime.
Diagram based on 12 observations. Hollow bars: male; solid bars: female.

Abb. 2: Herbst-Aktivitätsmuster (30. Oktober – 13. November) eines Männchens und Weibchens von *Platyceps elegantissimus* (GÜNTHER, 1878) im Terrarium unter natürlichem Beleuchtungsregime.
Diagramm auf Grundlage von 12 Beobachtungen. Leere Balken: Männchen; ausgefüllte Balken: Weibchen.

Table 1: Field observations of *Platyceps elgantissimus* (GÜNTHER, 1878) near Qibbuz Samar, Wadi 'Arava, Israel (29°47'N; 35°02'E) and in Wadi al Yutm area, Jordan (29°37'N; 035°11'E).

Tab. 1: Feldbeobachtungen von *Platyceps elegantissimus* (GÜNTHER, 1878) aus der Nähe des Qibbuz Samar, Wadi 'Arava, Israel (29°47'N; 35°02'O) und aus dem Wadi al Yutm, Jordanien (29°37'N; 35°11'O).

ID	Date Datum	Time Uhrzeit	Location Fundstelle	Behavior Verhalten	Illumination Lichtverhältnisse	Environment/Habitat Umgebung/Lebensraum	Air Temperature (ºC) Lufttemperatur (°C)	Total length (cm) Gesamtlänge (cm)
1	19/10/1997	13:00	Date grove, Samar	Under shelter	Daylight	Under shelter inside greenhouse	25	40
2	11/10/1999	17:00	Date grove, Samar	Moving	Daylight	Under shelter in building	27	35
3	13/08/2003	10:00	Qibbuz	Moving	Daylight	In building	31.5	adult
4	10/09/2004	12:30	Date grove, Samar	Under shelter	Daylight	Under shelter in building	32	juvenile
5	02/08/2005	12:00	Qibbuz	Moving	Daylight	Climbing date tree in the qibbuz	38	66.5
6	07/12/2005	09:50	Qibbuz	Basking	Daylight	Near bush in the qibbuz	21	41.7
7	27/02/2006	18:15	Samar road	Moving	Darkness	On road near bushy area	22.6	72
8	05/06/2006	19:00	Qibbuz	Moving	Daylight	Near bush in the qibbuz	39	44.6
9	20/05/2007	04:05	Samar road	Moving	Darkness	On road near bushy area	20.5	60.7
10	29/08/2007	10:15	Date grove, Samar	Moving	Daylight	Climbing in tree in the qibbuz	33	23,5
11	04/09/2007	19:00	Qibbuz	Moving	Dusk	Near building in a qibbuz garden	35	-
12	29/09/2007	09:10	Date grove, Samar	Moving	Daylight	Near building in a qibbuz garden	27	57
13	03/05/2008	08:00	Qibbuz	Moving	Daylight	In bushy olive orchard in the qibbuz	28	65
14	25/10/2008	15:00	Wadi al Yutm	Moving	Daylight	On gravel on open wadi bottom	~25	adult

DISCUSSION

We observed two specimens of *Platyceps elegantissimus* in captivity for their activity pattern and summarized data from occasional field observations on 14 wild-ranging specimens.

Bias in observation – The behavioral patterns observed in captivity indicate that the animals were not in apathy or disturbed, common states in captive animals. They did not show monotonous movements such as endlessly digging in a corner of the terrarium or struggling to climb towards the lid, therefore we consider the observed behavior close to natural.

There is a clear bias in the field observations in the sense that the observations were made mostly by qibbuz members who work during daytime. Also, these slender snakes are more easily noticed at daylight than by night. We, however, believe that the relatively large number of day observations indicates that these snakes are usually active during the day and that these observations do not reflect anomalous behavior.

Daily activity pattern – The two captive specimens were active during the day and sometimes at dusk, but were never observed active after nightfall. Usually, they were active during the morning hours (between 07:00 and 11:00) or in the afternoon (between 14:00 and 21:00). Among the 14 free ranging snakes observed as active in the field nine were seen at daylight. Despite probable bias, the occasional field observations yield patterns that correspond with those from captivity.

Our results agree with information on other desert snake species, *Malpolon moilensis* (REUSS, 1834) (GASPERETTI 1988; DISI et al. 1988, 2001), *Psammophis sibilans* (LINNAEUS, 1758) (HUSSEIN et al. 1973a) and *Psammophis aegyptius* MARX, 1958 (BOUSKILA & AMITAI 2001), which were reported to be mostly diurnal despite high day temperatures of their habitat. *Platyceps saharicus* SCHÄTTI & MCCARTHY, 2004, a possibly closely related species was observed as active at noon on a late October day in the Sahara (GENIEZ & GAUTHIER 2008). Indeed, BOUSKILA & AMITAI (2001) and DISI et al. (2001) consider *P. saharicus* diurnal, but note that they refer to snakes belonging to

two different species (SCHÄTTI & MCCARTHY 2004) then under the name, *Platyceps rhodorachis* FLOWER, 1933. However, it is fair to add that information on the snakes above may sometimes refer to unconfirmed observations, therefore, similarly to the case of *P. elegantissimus*, some of the statements on their daily activity may turn out to be needing revision. For instance, occasional observations of *Psammophis schokari* (FORSKÅL, 1775) hint that, contrary to the widely accepted belief that it is purely diurnal, it may be active during the night in the peak heat of the summer, at least as seen on sand dunes in the coastal plain and the Wadi 'Arava of Israel (SHACHAM 2004; D. EHRLICH, pers. comm.). These observations also parallel those on *M. moilensis* and *P. aegyptius*, which tend to be crepuscular in the hottest part of the year (GASPERETTI 1988; BOUSKILA & AMITAI 2001). Crepuscular or occasionally nocturnal activity may occur in *P. elegantissimus* too, as some of our observations (including the two after dusk) indicate (see Table 1).

The captive *P. elegantissimus* had a bimodal activity pattern, which is not rare in reptiles inhabiting desert habitats. The poikilothermic reptiles often trade off between their activity time and their physiological performance, and need to retreat in the hottest day hours (GRANT 1990). At midday, lethal temperatures (in an experimental setting 42°C – 47°C, depending on duration and species; HUSSEIN et al. 1973b) may easily occur in the habitat of *P. elegantissimus* and may regularly enforce the observed bimodality.

Taking our results into consideration, the conspicuously infrequent observations of this species may be attributed to its shyness and to its capacity to detect threats from long distances rather than its activity in dark hours. Its alertness is coupled with elusiveness, and as a reaction to the appearance of a potential predator, it swiftly seeks shelter.

It is worth mentioning that information on the daily activity pattern of *Coluber sinai* (SCHMIDT & MARX, 1956), a species with confusingly similar appearance (MARX 1968; WERNER & SIVAN 1991), is similarly controversial (see BOUSKILA & AMITAI 2001; DISI et al. 2001). The distributions of the two species overlap in southern Israel and southern Jordan (SINDACO at al. 1995; BOUSKILA & AMITAI 2001; DISI et al. 2001). Their striking resemblance may be tempting to suspect that their activity is also similar. Besides that such speculations should be treated with certain caution, difference in their eye size (suggesting difference in habits) and their possibly remote taxonomic relatedness (WERNER & SIVAN 1991) warns against such far reaching conclusions.

Behavior – We observed the two captive *P. elegantissimus* behaving like many diurnal colubrids: they raised their heads above the ground and directed it forward, while the neck was almost perpendicular to the ground; presumably a posture of observation. The snakes also easily detected movements outside the terrarium, even through a dense mosquito mesh (the firm, linoleum coated cement floor probably prevented the snakes from feeling minor vibrations deriving from cautious steps), which indicates that they have an excellent eyesight and are alert to distant and minor movements (unfortunately there were no real long distances in the reptile room to test how far they can detect moving objects). They also often flew under shelter or froze as a reaction to movements around them. It seems that their relatively large eyes (WERNER & SIVAN 1991) serve for detecting threats and prey from long distances in open desert landscapes rather than enhancing vision in the dark.

They were observed basking both in captivity and in the field. While doing so the captive specimen flattened its body. This behavior is an active thermoregulation that in this species presumably serves for setting body temperature for subsequent hunting or searching activity. By flattening its body the snake increases the body surface capturing the radiation of the sun. Together with the observed searching behavior it suggests that this species may be an actively foraging species.

Our results strongly suggest that contrary to the widely persisting (see exception of BOUSKILA & AMITAI 2001) belief, *P. elegantissimus* conducts a predominantly diurnal, although probably cryptic lifestyle. Its day activity may be occasionally seasoned with after dusk and before dawn activity. It

would be desirable to make further, meticulous field observations on the life history of this enigmatic species to reveal more information on its behavior, but we also understand that its extremely hot desert habitat makes such work difficult and often unbearable.

ACKNOWLEDGEMENTS

We thank Y. L. Werner (Jerusalem) for his valuable advice on this manuscript. We owe special thank to qibbuz members who kindly handed us the details of their observations on *Platyceps elegantissimus*. We also thank those friends and family members who withstood the desert sun while we searched for trapped snakes: Á. and G. Babocsay, M. Belmaker, A. Chipman, S. Gafny, N. Herling, R. Prasse, G. Romero, B. Sakkal, S. and Y. Seligmann. S. Shacham and Y. Thieberger.

Note: fortunately, due to upgrading of the waterworks pipeline system, most of the concrete chambers earlier trapping many snakes and lizards were removed and pose no more threat to these animals.

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DATE OF SUBMISSION: March 23, 2009 Corresponding editor: Heinz Grillitsch

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