

SHORT NOTES

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MICROHABITAT PARTITIONING IN A MOUNTAIN LIZARD COMMUNITY IN JEBEL AKHDAR, OMAN

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Jebel Akhdar is the highest sector of the Hajar, a continuous mountain range extending from the Musandam peninsula to the easternmost tip of Arabia at Ras al Hadd. Jebel Akhdar, composed largely of eroded Permian to late Cretaceous limestones (Glennie *et al.*, 1974), extends for about 80 km in an east-west direction, and reaches a maximum elevation of 3009 m. The mountains are sufficiently high to induce orogenic rainfall, which allows the development of relatively dense vegetation cover at the higher elevations and in the valleys or wadis (Ghazanfar, 1991). Many wadis have some surface water for much of the year.

The lizard fauna of the mountains reflects these conditions, showing a typical pattern of mountain endemism and range restriction (Arnold & Gallagher, 1977; Arnold, 1987). The montane lizard fauna totals 14 species from four families: Lacertidae (2 species), Scincidae (2 species); Agamidae (1 species) and Gekkonidae (9 species). The lizard fauna of Jebel Akhdar has received little study other than descriptions of collections, though notes on lizard habits and habitats have been published for the more northerly sectors of the Hajar range (Arnold, 1972; Arnold & Gallagher, 1977; Arnold, 1977; Bischoff, 1989; Böhme & Leptien, 1990).

The study site, at the head of Wadi Halfayn is an eastward draining valley that cuts deeply into the limestone strata of the 2000 m high Saiq plateau. There is some permanent surface water in the upper reaches, and sub-surface flow supports a well developed wadi vegetation including moderate sized trees at lower elevations. The trees include *Ziziphus spina-*

christi, *Moringa peregrina*, *Acacia tortilis*, *Ficus salicifolia*, *Maerua crassifolia*, and *Acridocarpus orientalis*. The vegetation falls within the mountain wadi associations described by Mandaville (1977), and the hillsides immediately above the wadi bed belong to the *Acacia tortilis-Rhazya-Moringa* plant association (Ghazanfar, 1991). Eight species of lizards were encountered along a 3 km stretch of the wadi at altitudes of 700 m to 800 m. These were a large lacertid, *Lacerta jayakari*, a skink (*Mabuya tessellata*), three nocturnal geckos (*Asaccus elisae* sens. lat., *Pryodactylus hasselquistii*, *Hemidactylus persicus*), and three species of diurnal geckos (*Pristurus rupestris*, *Pristurus gallagheri*, and *Pristurus celerrimus*). This paper reports a preliminary study of the habitat partition within this lizard community, particularly of the diurnal species.

Field observations were made on six days, at irregular intervals between November 1988 and August 1992 (21.11.1988; 12.12.1988; 7.7.1989; 28.8.1991; 28.2.1992; 24.8.1992), encompassing both summer and winter observations. Forty-two man hours of observations were made between 0600 and 1600 hrs. The location of each lizard on first sighting was recorded using the following pre-assigned microhabitat categories: substratum (ground; rock face; tree; cave), height above ground (≤ 0.5 m; >0.5 m and ≤ 1.0 m; >1.0 m and ≤ 2.0 m; >2.0 m), tree species (for arboreal sightings), sun or shade. Sightings were made by walking slowly up the valley with one observer on the wadi bed and the other on a disused drystone falaj (water conduit) about 5 m above the wadi bed on the northern side. No attempt was made to estimate relative abundance of the species. Rather, a range of different microhabitats were preferentially searched, so trees, caves and rock faces were searched with far greater intensity than the large areas of gravel and scree. The nocturnal species were found in their daytime retreats.

Table 1 summarises 285 lizard sightings. The data illustrate the clear microhabitat resource partitioning between the three *Pristurus* species. Based on these microhabitat categories, Levins' standardised niche breadth (Hurlbert, 1978) is 0.175 for *Pristurus rupestris*, 0.335 for *P. gallagheri* and 0.319 for *P. celerrimus*. Niche overlaps, calculated using Piankas' (1973) symmetrical formula, are very low between *P. rupestris* and *P. gallagheri* (0.110) and between *P. celerrimus* and *P. gallagheri* (0.020), and rather higher between *P. rupestris* and *P. celerrimus* (0.390). At this site, *P.*

lizard species	microhabitat category									
	ground	cave	rock base	low rock	mid rock	high rock	tree base	low tree	mid tree	high tree
<i>Pristurus rupestris</i> (106)	50.9	-	34.9	1.9	-	0.9	6.6	4.7	-	-
<i>Pristurus gallagheri</i> (101)	3.0	-	-	1.0	-	1.0	13.9	19.8	28.7	32.7
<i>Pristurus celerrimus</i> (16)	6.3	-	25.0	12.5	37.5	18.8	-	-	-	-
<i>Pryodactylus hasselquistii</i> (30)	-	56.7	3.3	13.3	6.7	20.0	-	-	-	-
<i>Asaccus elisae</i> (19)	-	-	100.0	-	-	-	-	-	-	-
<i>Hemidactylus persicus</i> (2)	-	100.0	-	-	-	-	-	-	-	-
<i>Lacerta jayakari</i> (10)	70.0	-	10.0	-	-	10.0	-	-	10.0	-
<i>Mabuya tessellata</i> (1)	-	100.0	-	-	-	-	-	-	-	-

TABLE 1. Daytime microhabitat resource utilization by eight lizard species in Wadi Halfayn. The data represent the microhabitat category in which the lizard was first sighted, as percentages within each species. The total number of observations was 285. For the rock and tree categories, the following definitions apply: base ≤ 0.5 m; low >0.5 m and ≤ 1.0 m; mid >1.0 m and ≤ 2.0 m; high >2.0 m above ground level. Sample size are given in parentheses.

rupestris is a rupicolous species found on the ground, gravel and scree and rarely venturing onto larger boulders, rock faces or trees. *P. gallagheri* is an arboreal species, very rarely seen outwith trees, while *P. celerrimus* is a gecko of cliff faces and large boulders.

Although low overlap in microhabitat use must greatly reduce competition in a community, one cannot reliably conclude that competition has been the causal factor in bringing about the observed resource utilization (e.g. Schoener, 1982, Pianka, 1986). However, the microhabitats used by two of these *Pristurus* species have been observed to vary over the species' ranges. Hence, over most of its range *P. rupestris* is usually encountered on rocks, stones and other hard objects (Arnold, 1977, 1980), but in the *Prosopis cineraria* woodlands bordering the Wahiba Sands, eastern Oman, this species is arboreal (Gallagher & Arnold, 1988). At this locality, *P. celerrimus* and *P. gallagheri* are not found, but the sandy substrate under the trees is home to *Pristurus minimus*. *P. celerrimus*, in the northern part of its range, as at Ruus al Jibal, appears to be less restricted to steep rock faces and may be found on rocky ground and scree. This lability in habitat use does suggest that the more restricted resource usage in the Wadi Halfayn community is likely to have arisen in order to reduce past or present competition. Ninety six individuals of *Pristurus gallagheri* were sighted in trees of the following species: *Moringa peregrina* (51.0%), *Ziziphus spina-christi* (21.9%), *Acacia tortilis* (17.7%), *Ficus salicifolia* (6.3%), *Maerua crassifolia* (2.1%), dead trees (1.0%). This apparently indicates a strong preference for *Moringa* which is far from being the commonest tree species, both *Ziziphus* and *Acacia* being much more abundant.

The majority of these sightings were of lizards on the trunk or a major branch facing head down on the shady side of the tree. The body was often held well off the bark and the geckos appeared to be highly alert. Ants were seen to be taken on occasion, with the gecko using a 'sit and wait' strategy until the ant approached within a few centimetres.

The observations of *Pristurus gallagheri* confirm the arboreal habit of this species, alluded to from the collection data for the type series (Arnold, 1977, 1986), and the similarity of its habits with those of its sister species, *Pristurus flavipunctatus* (Arnold, 1990).

Lacerta jayakari and *Mabuya tessellata* are basically ground dwellers, though both are able to climb agilely on rocks and drystone walling. *Asaccus elisae* sens. lat. and *Hemidactylus persicus* were only found in two small caves, and were presumably using these as daytime refuges. Both caves contained traditional egg laying sites, which appeared to have been used for many years. The only fresh gecko eggs were three pairs found in August 1991 and August 1992. Two heavily gravid *A. elisae* sens. lat. were observed in August 1992 in one cave. *Ptyodactylus hasselquistii* was usually found in caves and shady crevices, but some individuals were seen in the open, in deep shade on vertical cliffs at the edge of the wadi. These individuals did not appear to be active. This analysis of daytime microhabitats does not indicate differences in microhabitat utilization between the three nocturnal gecko species. These species are of approximately the same size and all have scansorial pads for climbing on rock faces. In order to determine their niche relationships, one would need to investigate other parameters such as microhabitat utiliza-

tion during the geckos' active periods, timings of activity, or dietary differences.

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