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# ECOLOGY OF THE WESTERN PYGMY CHAMELEON *RHAMPHOLEON SPECTRUM* BUCHHOLZ 1874 (SAURIA: CHAMAELEONIDAE)

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## INTRODUCTION

The aim of this paper is to present and discuss information from field records of 322 observations of *Rhampholeon spectrum* accumulated by the author over the course of 12 months field work in the South-West and Littoral Provinces of Cameroon, West Africa, carried out during 1990 and 1992/3/4. Field relations with the genus *Chamaeleo* are considered and notes given on the diet, altitudinal occurrence and microhabitat utilisation by the species.

## TYPE LOCALITY

The type locality for *R. spectrum* (Buchholz, 1874) is Victoria (=Limbe) and Bonjongo, Kamerun (=Cameroon), later restricted by Mertens (1938) to Bonjongo. Both these localities lie near sea-level on the southern aspect of Mount Cameroon.

## SYSTEMATICS

The taxon *boulengeri* (Steindachner), considered by Loveridge (1951) to be a subspecies of *Brookesia spectrum*, is presently considered by Böhme (pers. comm, 1994) to be a valid species and a somewhat distant relative of *Rhampholeon spectrum*. In addition, Böhme (pers. comm., 1994) considers *R. affinis* (Steindachner, 1911) from Beni, Kivu-District, Zaire, (synonymised with *R. boulengeri* by Werner, 1911), to be conspecific with *R. spectrum*. Presently, however, there is insufficient data to determine whether the Kivu population deserves subspecific status to distinguish it from the allopatric western equatorial populations. Pending further taxonomic investigation, *R. spectrum* may be regarded as a monotypic species with a disjunct distribution (Böhme, pers. comm, 1994).

## DISTRIBUTION AND BIOTOPE

In contrast to the chameleons of the genus *Chamaeleo*, there has been no radiation within the genus *Rhampholeon* in the montane forests and adjacent highlands of Cameroon. The distribution of montane and restricted range species of *Rhampholeon* is confined to forested parts of the East African highlands where the genus exhibits its' greatest diversity. *R. spectrum* is a lowland, euryzonal species of the Central African rainforest. In the western equatorial populations referred to in this paper, *R. spectrum* occurs in the Congo, Gabon, Equatorial Guinea (including the island of Bioko), Cameroon to south-eastern Nigeria. The species is known from coastal lowland and inland evergreen and semi-evergreen rainforests near sea-level and closed canopy montane cloudforest up to 1900m above sea-level. The distribution of the geographically isolated populations of *R. spectrum* from Kivu (Zaire), await further investigation.

The distribution of *R. spectrum* is confirmed to rainforests which experience precipitation in excess of 1600mm per annum. According to Tye (1986), areas north

of 6°N (southern Nigeria and south west Cameroon) have a tropical climate with one wet and one dry season. At the beginning and end of the wet season, rainfall comes in intense thunderstorms. During the main part of the wet season, rain is less heavy but more prolonged and many days are completely overcast. Areas south of 6°N (southern Cameroon and neighbouring Gabon and Equatorial Guinea) experience reduced rainfall between June and August. Consequently this region has a double rainfall maxima with a small dry season from June to August and therefore experiences the four seasons of a true equatorial climate.

Specific localities in Cameroon where the author recorded this species are: Mt. Rata (Dikome Balue) 1100-1400m; Mt. Manenguba 1900m; Mt. Kupe 400-1800m (Ndom 850m, Kack 850m, Nyasoso 700-900, Mbulle 750m, Tombel 400m); Kupe-Manenguba intermontane ridge 1000m (Ngombo-aku 1000m, Abang 1000m); Bakaka Forest Reserve 300-600m (Ekomtolo, Badjong, Badjoki, Balondo Nlonako); Bakossi Highlands 180-1250m (Bangone 180m, Edib 1100m, Lake Edib 1250m, Messaka 450m, Nlog 600m, Ngusi 450m, Babubok 450m); Manehas Forest Reserve 800-1100m (Nyang 800m).

### EURYZONALISM AND SYMPATRY

The ability of a species to exhibit a broad altitudinal amplitude from true lowland rainforest near sea-level to wet montane forest above 1500m a.m.s.l. (euryzonal) is a relatively rare phenomenon in the Afro-tropical rainforest herpetofauna. In the Cameroon Highlands a number of ophidian species demonstrate euryzonalism (Wild, in preparation) but of the saurian taxa, apart from *R. spectrum*, only a few skinks of the genus *Panaspis*, a lacertid *Adolphus africana* and possibly a gecko *Cnemaspis koehleri* do so. In the savannah zone however, euryzonalism is common with numerous typical lowland species occurring at altitudes in excess of 1500m.

The euryzonal distribution of *R. spectrum* has resulted in a wide sympatry with many other lowland and montane chameleons (*Chamaeleo*) in the region. In the field the author found *R. spectrum* to be sympatric with ten of the eleven recognised species of *Chamaeleo* (*C. camerunensis*, *C. cristatus*, *C. eisentrauti*, *C. g. gracilis*, *C. montium*, *C. oweni*, *C. pfefferi*, *C. q. quadricornis*, *C. wiedersheimi perreti*) occurring in the rainforests of Cameroon. In addition, various museum records (as yet unverified) suggest that this species is also sympatric with other members of the genus *Chamaeleo* which occur within its' range: *C. chapini* in Gabon, *C. dilepis* and *C. quilensis* in Equatorial Guinea and *C. feae* in Bioko. This general sympatry with *Chamaeleo* is attributal to *R. spectrum* being essentially terrestrial when diurnally active whereas the prehensile tailed *Chamaeleo* are exclusively arboreal in habit. Of the ten sympatric species found by the author, three were found to be restricted to the shrub layer in primary forest. These were, *C. cristatus*, *C. camerunensis* and *C. wiedersheimi perreti*, none of which however, were found on forest floor leaf litter. The distributional ecology and sympatric relations of the *cristatus* species group will be discussed in more detail in a separate forthcoming paper.

*R. spectrum* was invariably found to be abundant in premontane, submontane and montane forests between 500 and 1700m on and adjacent to mountains (e.g. Mt. Rata, Mt. Kupe, Edib Hills, Bakaka Forest Reserve, Mt. Manenguba). In contrast, this species was found only occasionally in lowland forest more than 5km away from the 500m contour surrounding mountains despite apparently suitable habitat being available e.g. Dja Faunal Reserve and the lower Bakossi forests near the Mungo River. A higher level of incidence of this species was also found by Lawson (1993) in mountainous areas (Mt. Yuhan, Nta Ali and Rumpi Hills) compared to the Korup lowlands. The relatively high density of sympatric species of *Chamaeleo* in montane

areas (e.g. seven species around Mt. Manenguba whereas the maximum number of sympatric *Chamaeleo* in lowland Cameroon is four species) is concordant with higher local abundance of *R. spectrum*. This suggests that there exists a negligible overlap in niche competition between *Rhampholeon* and *Chamaeleo*.

### DIMENSIONS

Measurements of head-body length, mouth width, and body weight from 147 mature adults were taken in the field and are presented Table 1.

TABLE 1

MALES	n=82	max	mean	st. dev
Mouth width (mm)		11	9.4	0.825
Snout-vent length (mm)		58	44.9	4.998
Weight (g)		5	4.2	0.677
FEMALES	n=65	max	mean	st. dev
Mouth width (mm)		10.5	8.8	0.525
Snout-vent length (mm)		57	48.3	6.20
Weight (g)		7	4.6	1.17

Note: the greater body weight of females was attributal to gravid individuals.



Plate 1. Male *Rhampholeon spectrum* on specific daytime foraging microhabitat of forest floor leaf litter. Photo by Chris Wild.



**Plate 2.** Cloud forest at 1800 metres on Mount Kupe. Habitat for *Rhampholeon spectrum*, occupying leaf litter by day, and roosting on exposed plants mainly below one metre at night. Photo by Chris Wild.

### COLOUR

This species has limited ability to change colour, the main ground colour usually being a shade of brown with between one and three distinct dorso-lateral black stripes diagonally aligned across the body. The chromatic state of individuals varies greatly, however, with specimens often being more brightly coloured at night whilst roosting. Many individuals, particularly females, were red in colour. Occasionally males may be a pale pinkish-white with between one and three distinct black dorso-lateral stripes. This may be indicative of male courtship activity. In all cases individuals tended to be paler ventrally. One remarkable adult male collected by the author at night from Mt. Rata at 1300m, exhibited a brownish black body colour irregularly spotted with numerous bright metallic green and gold spots. This rare and unusual chromatic state disappeared by daylight the following day. Colour and pattern are a major factor in the cryptic defence which is further aided by the disrupted body profile and slow, discreet locomotion when foraging.

### FORAGING ECOLOGY AND MICROHABITAT PREFERENCES

Only 27 observations of *R. spectrum* were made during day-time by the author during the entire fieldwork period. This is thought to be due to the fact that this species is remarkably cryptic thus preventing it from being seen easily. Of these, 25 observations (3 juveniles, 22 adults) were of the animals walking on leaf litter debris on the forest floor. Another adult was found perched at the base of a raphia plant *Raphia sp.*, some 37cm above the ground amongst dead fronds. The other specimen was seen in dead vegetation overhanging a large rock near a stream. The species has a patchy distribution in the forest and was found to be particularly abundant in riparian vegetation where it was regularly found at night roosting on the banks of running

or dry, intermittent, and seasonal streams. Elsewhere in the forest it appeared to favour closed canopy forest with moderate ground cover and moist shaded leaf litter. It is not clear whether the habitat requirements for the species are determined more by its' diurnal foraging ecology or its' nocturnal roosting requirements. The occurrence of the species appears to be concordant with changes in habitat physiognomy, being scarce or absent from areas with an open canopy and resultant dense herb layer, such as in severely degraded forest or farmbrush. Although this species was found in secondary forest where it was recorded in abundance near streams and where there was a lesser herb layer, only 6 records were made from agricultural farmbrush. Moreover, these six records were all from remnant thicket or clearings with canopy cover and a leaf litter substrate. It is unlikely therefore that *R. spectrum* can tolerate extensive habitat disturbance, although it seems able to persist in small habitat islands < 100 metres square.

Two observations of individual specimens feeding were made. The first observation included an adult male avidly feeding upon a colony of termites (Isoptera) on the forest floor. Another individual consumed a bug (Hemiptera) whilst being photographed at it's discovery site in the forest. Intestinal and stomach contents from ten adult specimens of *R. spectrum* collected from primary forest around 1000m on Mt. Kupe (Cameroon) were examined (see Table 2). All stomachs contained food and were represented by invertebrates from four classes and eight orders indicating a catholic diet for the species. The frequency of prey items in the pooled sample was dominated by spiders (34%), crickets (22%) and juvenile cockroaches (15%). Crickets and juvenile cockroaches however, dominated the volume of the sample and are therefore probably the most significant prey item. A full list of contents from the pooled sample is given in Table 2.

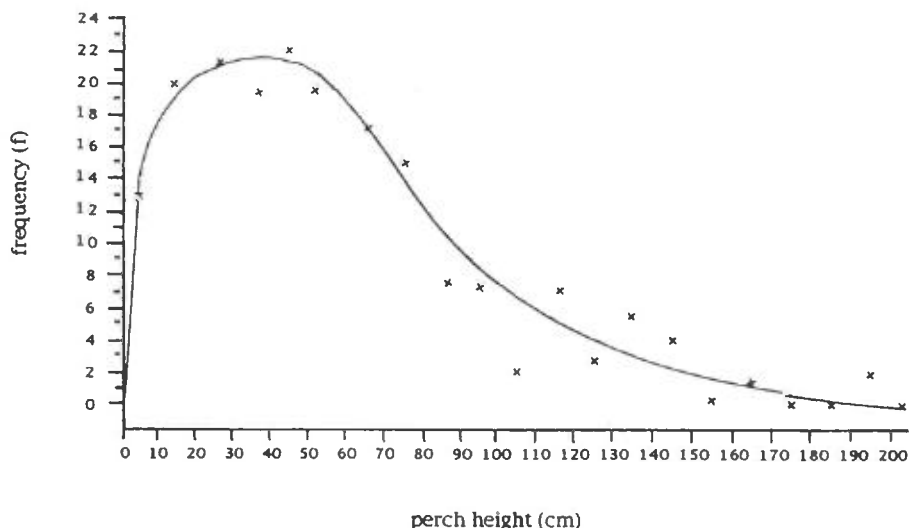
TABLE 2

CLASS	ORDER	TYPE AND FREQUENCY
INSECTA	Orthoptera	crickets (7), grasshopper (1)
	Dictyoptera	cockroaches (5)
	Diptera	fly (1)
	Lepidoptera	moths (2), green caterpillar (1)
	Hymenoptera	honey bee (1)
ARACHNIDA	Aranea	spiders (11)
DIPLOPODA	-	millipedes (2)
MALACOSTRACA	Isopoda	woodlouse (1)

### ROOSTING ECOLOGY AND ANTI-PREDATOR STRATEGIES

Individuals were found easily at night by torchlight when they were conspicuous roosting on perches above the forest floor. The night-time perching habit of the species contrasts sharply with the day-time perching habit which is essentially confined to forest floor leaf litter. A total of 295 individuals were seen roosting at night in this manner with measurements of perch height taken with a tape measure for 188 individuals. From the roosting records only one individual (a juvenile) was actually perched on the leaf litter itself. The remaining 187 were on perches ranging between 2 - 196cm above the ground. 91% of observations were below 100cm; the mean perch height was 48 cm. Typical perches varied between dead or living stems, broad or narrow leaves, fern fronds etc, but most were characterised by being raised above the leaf litter in an exposed and isolated position. Preference was shown for small herbaceous plants and woody stems protruding from the leaf litter rather than on the peripheral perches of larger shrubs. It is suggested that these arboreal roosting perches, not normally utilised during the species day-time behaviour, are an anti-

predator strategy against active nocturnal foraging predators which may include opisthogyphous colubrid snakes such as *Dipsadoboa* spp. and *Toxicordryas* (*Boiga*) spp. Broadley and Blake (1979) reported much greater night-time perch heights of up to 4.5m for *Rhampholeon m. marshalli*.



**Figure 1.** Frequency graph of roosting perch heights of *R. spectrum* in centimetres. total number of individuals = 188.

The author noted that when this species is held in the hand (and therefore under stress) it is capable of emitting a series of short inaudible vibrations which are initially alarming and irritating. The duration of an emission was approximately 1 second and could be repeated every few seconds until the animal either became exhausted or relieved of the cause of threat. The function of these emissions is not known but they appear to be defensive. Lawson (1993) provides additional notes on this behaviour.

## REPRODUCTION

Courtship was never observed but on 7 occasions an adult pair (male and female) were found roosting together on the same perch. Gravid females from Mt. Kupe were recorded in all months from January through to July (inclusive). It was not possible to examine any adult females from August to December but it is possible that this species reproduces all year round as is the case with *Chamaeleo montium* on Mt. Kupe (Wild, unpubl. data.). Two gravid females were found to contain two eggs each. Palpation of other gravid females indicated that two eggs were a typical clutch size and no more were recorded in any single individual. One captive female deposited two relatively large eggs, each measuring 14 x 7mm. According to Broadley and Blake (1979), *Rhampholeon m. marshalli* lays eggs of similar dimensions (13 x 8 mm) but in contrast to *R. spectrum* lays clutches of up to 18 eggs (Fitzimons, 1943).

## DISCUSSION

Factors limiting population density of *R. spectrum* in relation to their proximity to mountains, both biotic and abiotic, invite further research. From my own observations I found a negative correlation between the local occurrence of *Bufo*

*camerunensis*, a diurnal, leaf litter anuran found to predate upon crickets, and *R. spectrum*. There appears to exist an inverse relationship in local abundance between these taxa in all localities visited, whereby *R. spectrum* was found to be very scarce or even absent in areas where *Bufo camerunensis* occurred. Consideration of their diet, diel activity, and microhabitat utilisation, suggests that there may exist a significant overlap in the niche of these two species.

In addition, mountainous areas are known for their unique gradient of microclimatic conditions (Tye, 1986). Increased local rainfall and humidity, coupled with reduced insolation and decreasing temperatures with increasing altitude, may have a significant effect on the local occurrence of *R. spectrum*.

The limited abundance of this species in severely degraded habitats indicates that the species is locally threatened where there is extensive habitat destruction resulting in increased insolation and changes in forest floor vegetation. It is not apparent however, that the species as a whole is threatened at present.

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