Notes on the ecology of *Cryptotis montivaga* Anthony, 1921 (Insectivora, Soricidae), a high-altitude shrew from Ecuador

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Summary. — *Cryptotis montivaga* is the most southerly member of a widespread genus. Little has been published on the ecology of the species since its original description in 1921. Here ecological data is presented on 12 *C. montivaga* collected between 1981 and 1987 in Southern Ecuador. Habitat preferences and the possibility of competition with other insect-eating small mammals are considered.

Résumé. — *Cryptotis montivaga* est le représentant actuel le plus méridional d'un genre de vaste répartition. On a peu publié sur l'écologie de l'espèce depuis sa description originale en 1921. Dans ce travail on présente des données écologiques sur les 12 *C. montivaga* collectés entre 1981 et 1987 dans le sud de l'Équateur. Le choix de l'habitat et les possibilités de compétition avec d'autres petits mammifères insectivores sont envisagés.

INTRODUCTION

According to Nowak and Paradiso (1983), the genus *Cryptotis* consists of 13 named species. From a probable centre of origin in southern Mexico, the genus now extends from extreme south-easthern Canada, through Central America, to southern Ecuador in South America (Choate 1970). The North American species, *C. parva,* has been comparatively well-studied (see, for example, Hoditschek *et al.* 1985 ; Mock 1985 ; Dueser and Porter 1987 ; Tolliver and Roberts 1987), and Central American taxa have also received some attention (eg. Hall and Dalquist 1963 ; Choate 1970). In contrast, with the exception of some parasitological work (eg. Brenan and Goff 1977 ; Guerrero 1983), the four species of *Cryptotis* in South America remain largely unstudied.

Here I report on ecological observations of the southern-most member of the genus, *C. montivaga,* made between 1981 and 1987 in the Andes of southern Ecuador.

STUDY SITES

Studies were conducted on the Cajas Plateau, a 25 × 27 km outlier of the western cordillera of the Andes, situated about 25 km north-west from Cuenca (2'53''S, 87'59''W - see Map 1). Since 1976 it has been protected as a National

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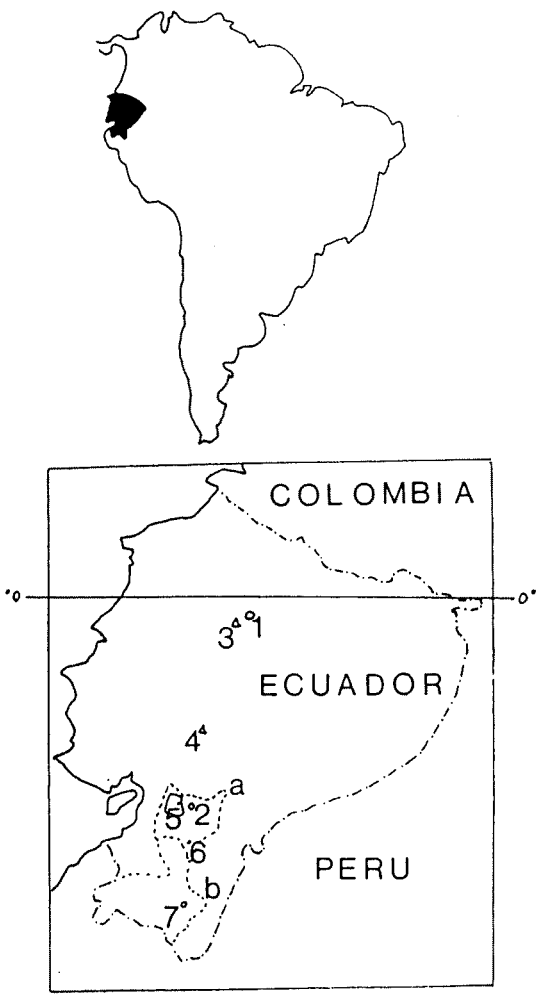

Fig. 1. — Quito ; 2 — Cuenca ; 3 — Mount Pichincha ; 4 — Mount Chimborazo ; 5 — Cajas Plateau ; 6 — El Oro ; 7 — Loja ; a —Azuay Province ; b — Loja Province.

Recreation Area. The mean altitude is 3700 m with peaks to 4445 m. Formations of the *paramo* ecotype occur at above 3000 m. This includes *Stipa* grassland, where grass tussocks reach 1.5 m and low *Andropogon* grassland, less than 10 cm tall. *Quenoa* forests occur in protected areas, these are dominated by small trees of the genus *Polylepis* (Rosaceae). In gullies and along high river banks a scrub formation occurs, here shrubby composites (especially *Baccaris* spp.), *Cavendishia* (Ericaceae), *Hypericum* spp. (Hypericaceae) and scrambling Bomareas (Alstromeriaceae) are characteristic. A detailed botanical description can be found in Ramsey (1988).

Seven locations were trapped. Altitudes ranged from 3300 m to 4000 m.

Montane forest occurs below 3000 m. Forests on both the western and eastern sides of the cordillera were trapped. Those on the eastern side are dominated

by an *Ocotea-Podocarpus* association (see Fleming 1986 and Jacques *et al.* 1986, for botanical descriptions). Western-facing forests were dominated by *Chusquea* (Graminae : Bambusoidae).

Three locations were trapped. Altitudes ranged from 2800 to 3100 m.

METHODS

Longworth live-traps were used with a variety of snap traps (including Nippers, Museum Specials, Fox). Surveys were qualitative not quantitative so grids were not used, traps being set in suitable runs and at holes. A foundation of rolled oats and peanut butter was used as bait. Tuna, meat, banana or sausage were added on occasion. Traps were tied to avoid removal by small carnivores. Small orange marker flags were used to aid relocation. Traps were checked between 6 am and 7 am, and again between 5 pm and 6 pm. The terrain was generally too rough and isolated for nocturnal checks. Specimens were weighed and measured following Corbet (1968). With the exception of one donated to the Ecuadorian Museum of Natural Sciences (MECN), all are now in the collection of the Natural History Museum, London (BMNH). During all years, field work occurred between June and October.

RESULTS

A combined total of 5942 trap nights caught 483 small mammals, 12 (7 male, 5 female) of them *Cryptotis montivaga*. One of these was caught in montane forest, five in quenoa forest, six in streamside scrub. None were taken from grassland habitats.

Four males were adult, one female was pregnant, two were lactating. Measurements of nine specimens are given in Table 1.

TABLE 1. — Measurements from specimens from Cajas (all measurements in millimeters, weights in grammes).

Sex	Head & Body	Tail	Hind Foot*	Weight	BMNH No.
M	65	35	14	09	84.385
M	74	31	12	09.5	84.386
-	82	38	13	10	84.387
F	82	28	14	10.75	84.388
M	81	28	14	11.25	84.389
-	85	30	13.25	14	87.917
M	84	26	13	13	87.918
F	73	22	14.5	13	87.919
-	77	32	12	15	-

* without claws

Preliminary analysis of five *Cryptotis* stomachs showed beetle elytra, spider legs and caterpillars among the recognisable fragments. There were also amounts of pulpy white material that resembled cominuted arthropod larvae. The more

mesic nature of the preferred habitat may offer more food and protection, important where daily energy budgets enforce almost continuous activity (Barrett 1969).

Trapping indicates that *C. montivaga* has a strong preference for closed continuous vegetation. This makes them sensitive to habitat disturbance. No specimens were trapped in quenoa forests where cows and firewood collectors had destroyed the ground cover, though they were caught in intact forests immediately adjacent to such degraded areas.

In Cajas the contemporanious presence of smaller greyer-furred animals and reproductively-active females indicated at least two litters a year. Litter size was two — this is smaller than the norm for the genus and may indicate that these high altitude populations are more K-selected.

DISCUSSION

C. montivaga was originally described by Anthony (1921) from a series of five specimens he had collected in July of that year from 3000 m in the Bestion region of Azuay Province in southern Ecuador (see Fig. 1). It can be distinguished from the other two species of Ecuadorian *Cryptotis (equatoris* and *osgoodi)* by its much greyer pelage. Each is largly restricted to a single montane massif; *C. equatoris* to Chimborazo (Tate 1932), *C. osgoodi* to Pichincha (Stone 1914; Lonnberg 1921). *C. montivaga* appears to be more widely distributed. According to Tate (1932) a series of nine specimens of this species in the collections of the American Museum of Natural History are from Loja, some 230 km south of the original collection locality. The present collection from the Cajas Plateau is not a novel biogeographical contribution; it is only some 50 km north-west of Bestion.

Anthony (1921) makes no mention of the habitat from which the type series were taken. But Tate (1932) gives the habitat of the genus as brush-filled gullies (« quebradas ») in the paramo and upper forest zone. He also mentions forests where the trees are « gnarled and moss-covered »; this refers, almost certainly, to quenoa forests. All of the high-altitude Cajas specimens were taken in such habitats; none on the open paramos, nor in the isolated rock outcrops favoured by *Phyllotis* (Barnett 1983). On open paramo the night-time temperature frequently drops below freezing. This would greatly reduce insect activity. Also, the tussocky nature of the grasslands probably induces a concommitant patchyness in insect distribution. In the more equitable environs of the protected habitats insect distributions are likely to be more even and favourable to a shrew foraging mode of essentially random encounters with prey items (Pokropus and Banta 1966).

Hall and Dalquist (1963) note that *C. mexicana* also shows a marked preference for moist, dense vegetation.

A number of Central American *Cryptotis* have wide habitat tolerances and correspondingly large altitudinal ranges. Data in Choate (1970) shows that, while some species occur in paramo (eg. *C. endersi*) the genus appears to be more commonly found in montane and sub-montane forest habitats (eg. *C. mexicana, C. goeldmanni*). It is interesting then that *C. montivaga* was trapped much less frequently in montane forest than in paramo. Several authors (eg. Cope 1949; Getz 1962; Golley 1962; Hall and Dalquist 1963; Kale 1972) have noted the apparent density of *Cryptotis* is highly dependant on trapping technique and

bait type used. But in Cajas bait and techniques were similar in all habitats so the lower number of animals in montane forest is unlikely to be a methodological artifact. A plausible, though as yet untested, explanation is the presence in montane forests of two species of *Caenolestes*. These largely insectivorous marsupials may compete with the smaller *Cryptotis* for food displacing it into a more marginal role than in the paramo, from which they are absent (see Barnett 1991). In this context it is to be lamented that more data is not available in the high altitude small mammals communities elsewhere in Ecuador.

From localities of specimens in the BMNH collections and published data (eg. Anthony 1921, 1923; Gregory 1922; Tate 1931, 1932; Kirsch and Calaby 1977; Kirsch and Waller 1979), it is evident that the two genera are often found together in paramo and montane forest. However, the lack of fine-grained distribution data and of detailed observations at such sites nullifies any attempts to assess the extent of competition or coexistence between their Caenolestids and Cryptotids (though Tate [1932, p. 226] does record that *Cryptotis* « shares the runways of *Caenolestes fuliginosus* »).

Reproductive data for South American *Cryptotis* is generally unavailable. Of the 30 specimens of Ecuadorian *Cryptotis* in the BMNH collections, only nine have accompanying field notes and none of the remaining 21 have any data on the reproductive state of the individuals at time of capture. The North American *C. parva* is a seasonal breeder (Nowak and Paradiso 1983), with two litters a year. Based on within-sample distribution of size and pelage colour, Choate (1970) believes that all Central American *Cryptotis* breed throughout the year. Other information comes from Hall and Dalquist (1963), who reported a female *C. mexicana* with three embryos, each 5 mm long, and from Mock and Conway (1975) who recorded a gestation time of 21-22 days for *C. parva* and a mean litter size of 4.26, with a range of one to nine.

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Erratum

Barnett, A. A., 1992. – **Notes on the ecology of *Cryptotis montivaga* Anthony, 1921 (Insectivora, Soricidae), a high-altitude shrew from Ecuador.** *Mammalia*, 56 : 587-592

There are some faults and discrepancies between text and references :

Tolliver D. K. and L. W. Roberts , cited as " 1987 " in text and " 1985 " in bibliography. 1987 is correct.

Stone W. H., 1912 : read " Stone, W.H H., 1914. Proc. of the National Acad. of Sciences, Philadelphia, 66 : 9-19 ".

Brennan : read Brenan

Some references are missing in the bibliography :

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p. 523 : Optimum prey size, first paragraph, last two lines, read : « The collective weight of adult dholes, who do the hunting, in the study pack was around 120 kg. Nevertheless, less than 100 kg prey formed 99% of the dhole kills.