

## FOOD INTAKE OF CAPTIVE PORCUPINES *HYSTRIX CRISTATA* (RODENTIA, HYSTRICIDAE)

**Abstract** - Experimental meals were offered to captive adult porcupines to investigate the daily mean food intake. We also recorded the throughput time of some food items. Experimental meals were respectively composed by: *a*) taproots of herbs; *b*) fruits of shrubs and trees; *c*) barks of shrubs and trees. The individual daily mean food intake was: *a*) = 387 gr.; *b*) = 308 gr.; *c*) = 575 gr. The throughput time was estimated to be about 24 hours for taproots and barks, about 48 hours for fruits.

**Key words** - Porcupine, Food intake, Throughput time.

**Riassunto** - *L'ingestione di cibo nell'istrice (Hystrix cristata) in cattività.* Scopo di questa ricerca è stato valutare il livello medio giornaliero di ingestione di cibo nell'istrice tramite pasti sperimentali. Sono stati anche registrati i tempi di attraversamento dell'intestino di alcune categorie alimentari: (*a*) radici a fittone, *b*) frutti, *c*) cortecce). L'ingestione media giornaliera individuale è stata rispettivamente: per *a*) = 387 gr.; per *b*) = 308 gr.; per *c*) = 575 gr. Il tempo di attraversamento dell'intestino è stato stimato in circa 24 ore per radici e cortecce e in circa 48 ore per i frutti.

**Parole chiave** - Istrice, ingestione di cibo, tempo di attraversamento.

### INTRODUCTION

The crested porcupine *Hystrix cristata* is a large, nocturnal hystricomorph rodent distributed from Central Africa to Central Italy (Kingdon, 1974; Lovari, 1993). While very little reliable information has been collected on the biology of the species in nearly all its range in Italy, several studies have been carried out in Tuscany (Santini, 1980; Pigozzi and Patterson, 1990; Corsini *et al.*, 1995; Bruno and Riccardi, 1995). He is herbivorous and feeds on roots, hypogeal storage organs, fruits and green vegetation (Pigozzi and Patterson, 1990; Bruno and Riccardi, 1995). During a study on porcupine's diet by faecal analysis in Tuscany, feeding trials with captive specimens were undertaken to obtain reference faecal samples of digested plant parts (Bruno and Riccardi, 1995). In the present paper we report on the daily food intake of adult porcupines. We also describe preliminary data on the interval between first ingestion of different plant parts and their first appearance in the faeces («time of throughput», Stewart, 1967).

### METHODS

#### *Animals and Enclosures*

Experiments were performed with adult porcupines (1 or 2) trapped from the wild and housed in outdoor enclosures. For this purpose we used box traps (140 x 40 x 50 cm) baited with maize, potatoes and apples. Experiments were carried out either in a wire-meshed enclosure (30 x 60 x 170 m), at the Entomological Institute of the University of Pisa, or in a roofed enclosure (3.92 x 3.65 x 175 m) next to a private house, in Siena countryside. Prior to and between experiments the animals were fed with fresh fruit and vegetables, consisting predominantly of apples, potatoes, carrots, maize and beets. Water was provided *ad libitum*.

#### *Experimental procedure*

We conducted a total of four experiments. Each experiment was preceded by a 3-day period during which porcupines were maintained on *ad lib.* water and no food, so that only indigested remains of the experimental meals would constitute the faecal samples collected during the experiment. On the first day of the test, all the old faeces were removed from the enclosure and fasted animals were offered the experimental meal. Afterwards, faeces were collected daily, until 2-3 days after the whole consumption of the meal. They were frozen and then analysed as described by Bruno and Riccardi (1995).

In the first experiment (*a*) porcupines were given taproots of herbaceous plants (Tab. 1). The experiment lasted from 13 to 20 October 1991 and involved two adult females. Daily measurements were made of the weights of food given and remaining to record the food intake.

In the experiment *b* fruits of trees and shrubs (Tab. 2) were offered to one adult female. This experiment lasted from 1 to 12 October 1992. Daily intake of the whole meal and of the single fruit species was measured as in experiment *a*.

We met with difficulties for the accomplishment of experiment *c* (meal of barks), which had to be carried out twice. In the first trial barks of *Acer campestre*,

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Tab. 1 - Species composition of taproot experimental meal.

| Taproot species   | Weight offered (gr) |
|---|---------------------|
| <i>Rumex</i> spp  | 3030                |
| <i>Linaria vulgaris</i> and <i>Amaranthus retroflexus</i> | 264                 |
| <i>Tussilago farfara</i>                                  | 7                   |
| <i>Inula viscosa</i>                                      | 239                 |
| TOTAL   | 3540                |

Tab. 2 - Species composition of fruit experimental meal.

| Taproot species         | Weight offered (gr) |
|-------------------------|---------------------|
| <i>Pyrus pyrastrer</i>  | 2150                |
| <i>Sorbus domestica</i> | 340                 |
| <i>Malus sylvestris</i> | 400                 |
| <i>Prunus</i> spp.      | 150                 |
| <i>Rosa canina</i>      | 125                 |
| TOTAL                   | 3165                |

*Quercus cerris*, *Ulmus minor*, *Sorbus domestica*, *Prunus spinosa* and *Ligustrum italicum* (1400 gr., on the whole) were stripped from the base of trunks with a knife and were offered to two adult females. During the three following days the animals did not eat any bark, even when the bark was smeared with minced apple or peanut butter. In the second trial, involving one adult female, a bunch of 16 branches of *Quercus pubescens* and 9 branches of *Acer campestre* (3450 gr., on the whole) was fastened to the enclosure. The mean girth of branches was 5 cm.

## RESULTS AND DISCUSSION

### a) Taproot experimental meal

Daily individual food intake is shown in table 3. The individual value of the food intake was estimated as the mean of the whole consumption by the two experimental porcupines. Taproots have occurred in faeces since the first day of the test, so their throughput time in the porcupine's gut seems to be about 24 hours. The highest food intake was recorded in the first two days of the experiment, most likely as a consequence of the previous fast.

Tab. 3 - Daily individual food intake and conversion factor of taproot.

| Daily individual food intake (gr) | Digested taproots (dry weight gr) | Conversion factor    |
|-----------------------------------|-----------------------------------|----------------------|
| 616.5                             | 0.105                             | $1.7 \times 10^{-4}$ |
| 687.5                             | 0.200                             | $2.9 \times 10^{-4}$ |
| 87.5                              | 0.135                             | $1.5 \times 10^{-3}$ |
| Mean                              | Mean                              | Mean                 |
| 463.8                             | 0.147                             | $6.5 \times 10^{-4}$ |

Tab. 4 - Daily mean intake of fruit species.

| Species                 | Daily mean intake (gr) |
|-------------------------|------------------------|
| <i>Pyrus pyrastrer</i>  | 234.4                  |
| <i>Sorbus domestica</i> | 106.0                  |
| <i>Malus sylvestris</i> | 133.0                  |

A conversion factor (i.e. Adams *et al.*, 1962) was calculated as the ratio of digested taproots (in grams) on the food intake (Tab. 3). It can be applied to estimate the amount of taproots eaten by free-living porcupines from dry weight of faecal fragments.

### b) Fruit experimental meal

The daily mean consumption of fruits was 307.7 gr. The daily mean intake of the different species of fruits is shown in table 4.

As in the previous experiment, the food intake was higher in the first two days. Fruit remains were found first in the faeces collected two days from the beginning of the test. Therefore, the throughput time of fruits was estimated to be 48 hours.

During the first three days the porcupine fed mainly on apples (*Malus sylvestris*) and sorb-apples (*Sorbus domestica*), respectively 94% and 100% of the offered amount, while in the remaining days it consumed 98% of pears (*Pyrus pyrastrer*). It did not eat at all the other fruits offered. However, sloe drupes (*Prunus* sp.) were made inaccessible because, in the course of this experiment, a heavy rainfall mashed and covered them with earth.

### c) Bark experimental meal

The porcupine debarked all branches fastened to the enclosure and consumed about 1150 gr. of barks in

two days (daily mean = 575 gr.). As barks have occurred in faeces since the first day of the test, their throughput time in the porcupine's gut seems to be about 24 hours.

It might be hypothesised that porcupines did not eat barks in the first trial (see Methods) because they had been previously stripped off trees.

The only data on the food intake of *Hystrix* is available for *H. indica* (Alkon et al., 1986), a related species of similar size. The daily dry matter intake of pelleted rodent ration averaged 450.2 gr. per animal: a quantity comparable to our findings.

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