

FEEDING HABITS OF A DORMOUSE POPULATION
(*MYOXUS GLIS*) OF THE ASIAGO PLATEAU
(VENETIAN PREALPS) (*)

ABITUDINI ALIMENTARI DI UNA POPOLAZIONE
DI GHIRO (*MYOXUS GLIS*) DELL'ALTOPIANO DI ASIAGO
(PREALPI VENETE) (*)

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ABSTRACT

A new and simplified method was used to investigate on the feeding habits of a Dormouse population of the Asiago Plateau, Venetian Prealps; it is based on the volume evaluation of plant and animal components of the stomach contents by stain proceedings and by the identification of the large-sized remains. The population studied has more Carnivorous habits than others cited in the literature, and presents an increasing percentage of animal food in stomach contents during: (1) the summer decrease in body weight (linked to an higher energy consumption), (2) sexual activity and (3) the period preceding hibernation. The diet variety is lower and the ground level predation higher than those reported for other populations. This anomalous trophic behaviour is probably a consequence of changed conditions of the biocenosis, originally based on Beech stands and now on artificial pure stands of Norway Spruce, which is not frequently utilized as food. The adaptation to this particular diet is prompt and general, and it must be related to social learning.

Key words: Feeding habits, Rodentia, Italy

RIASSUNTO

Per studiare il comportamento trofico di una popolazione di Ghiro (*Myoxus glis* L.) dell'Altopiano di Asiago, Prealpi Venete, è stato utilizzato un metodo nuovo e semplificato rispetto ai precedenti, basato sulla valutazione dei volumi della componente animale e vegetale mediante analisi di tipo colorimetrico, e sulla classificazione dei residui di maggiori dimensioni dei contenuti stomacali. La popolazione in esame è risultata di abitudini più Carnivore (con differenze tra i maschi e le femmine) rispetto a popolazioni studiate da altri autori, presentando una maggiore percentuale di cibo animale nel

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contenuto stomacale durante la diminuzione estiva in peso corporeo (associata a sua volta ad un elevato consumo energetico), durante l'attività sessuale e prima del letargo. Anche la varietà della dieta e la predazione a livello del suolo sembrano essere rispettivamente minore e maggiore se confrontate con quelle delle popolazioni citate in letteratura. Questo comportamento trofico anomalo sembra spiegato dalle mutate condizioni della biocenosi, fondata originariamente su fustaie disetanee o cedui di Faggio e oggi sostituita artificialmente da fustaie coetanee di Abete rosso, utilizzato solo marginalmente dal Ghiro come fonte diretta di cibo. L'adattabilità del Ghiro a questo particolare regime alimentare risulta rapida e generale, forse anche a causa di un apprendimento sociale sottovalutato sinora in questa specie.

Parole chiave: Abitudini alimentari, Rodentia, Italia

INTRODUCTION

Analysis of stomach contents represents one of the best and most direct ways to investigate vertebrates' food habits (Drozd, 1975). This kind of research is indispensable both for demographic studies and for an investigation about the influence of the population dynamics on the environment (Hubert et al., 1981).

The hitherto literature data are generally referred to the analysis of the digestive tract (mainly stomachs) of trapped animals, or to feeding experiments in captive individuals.

Concerning first case, results provide information on the quality of the food ingested and its dynamic changes during the year. Other possible information deals with the feeding behaviour and the selectivity capacity of the animals investigated (Holisova & Obrtel, 1974).

As a rule, it is not possible to obtain in this way quantitative data on the trophic drawing from the biocenosis (see Drozd, 1975).

There are few data reported in the literature about the feeding habits of the Dormouse, and nearly all of them come from animals collected in environments which have to be considered as the optimum for the species (Holisova, 1968; Kahmann, 1965; Santini, 1978, 1983; Von Schulze, 1970; Vietinghoff-Riesch, 1960).

This paper follows a series of studies carried out on the Dormice of the Asiago Plateau from 1984 to 1986 and deals with the feeding habit of a population in an environment which seems to be unusual for the species according to the observations of Kahmann (1965), Le Louarn & Saint Girons (1977), Saint Girons (1973), Toschi (1965) and Von Storch (1978).

I performed a qualitative comparison of the stomach contents between males and females of different age classes, considering their dynamic variation during the active season.

MATERIALS AND METHODS

I used **55** stomachs drawn by random stratified sampling (age and sex) of specimens captured during **1984**.

The Dormice were captured during a wide ranging trapping for the population control: Dormice seriously damage tree stands by gnawing away in a ring-like manner branches of various species, **as** generally stated by Platt & Rowe (**1964**), Santini (**1978, 1983**) and Zocchi (**1957**).

Mostly young Norway Spruce trees in artificial pure stands had been damaged. The predatory balance in this environment was previously altered by a wrong hunting management (Franco, **1986**; pers. comm. of Dr. Zovi, Forest Inspector in Asiago).

The area studied belongs to the Fagetum phytoclimatic area (Pavari, **1916**) or to the Fagus-Abies vegetational fascia (Shmid, **1963**). Artificial pure stands of Norway Spruce with their typically poore underbrushes (with few nuclei of beech copse) substitute the ancient beech mixed forest.

Concerning the qualitative analysis of the stomach contents, Williams and Holisova developed a method improved by others (see Drozd, **1975**), which gives good results. It **is** however necessary a preventive stomach treatment for the collecting, the recovering, and the identification of animal and plant tissues.

In this paper I describe a simplified method that allowed to remove the plant and animal remains that are surely and immediately recognizable, and then to split with stain analysis the animal and plant smallest fragments.

The stains choice (Beccari, **1946**; Conn's, **1969**) was difficult for the particular features needed: **1**) clear specificity for animal or plant tissues, **2**) the highest staining range for each animal and plant component, **3**) low need of chemical manipulations to avoid both excessive modification **of** stomach contents and alterations during the staining treatments.

I tested Brilliant Blue, Congo Red and Iodine Green.

Iodine Green resulted the **only** effective dye: when used in sub-acid buffer it stained clearly and in a variously intense way the plant tissues (less bark and entire seeds, anyway easily recognisable), whereas it did not stain, nor even lightly, the animal component (in this case: fats, **chitin**, hairs and muscle). It has not been possible to utilize it in the well **known** coupling with Congo Red because the latter stained also animal parts.

Stomachs were taken out from the freezer and soaked in water for nearly 1 hour and after the rehydration the wall of each stomach was separated from its content. After weighing, the remains immediately

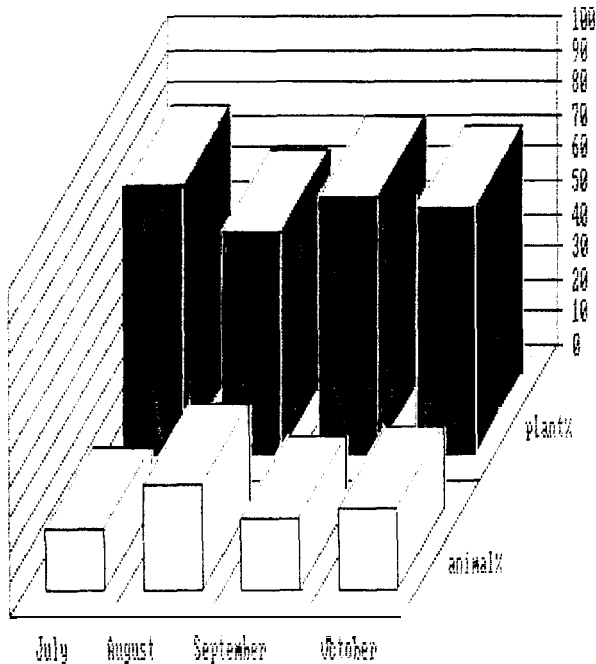


Fig. 1 - Trophic behaviour in the whole sample. Vertical axis: volume percentages of stomach content (black bars represent plant component and white bars represent animal component); horizontal axis: time values.

recognizable were collected and their volume was estimated by sight as the percentage of the whole content.

The stomach content was dipped in Acetic acid 1% v/v for 5 minutes. Afterwards Iodine Green 1% v/v at the rate of 0.5 cm³ for 60 cm³ of employed solution was added; after 5-10 minutes the content was destained. The swill was put on a sieve (mesh of 0.5 x 0.5 mm), rinsed with distilled water, dipped in alcohol 95 v/v for 5 minutes and then rinsed again.

After the staining, the swill combined with distilled water was put in a Petri dish, with variable diameter from 6 to 15 cm to obtain a deposit as uniform and thin as possible, and dried in an oven to complete dehydration. The dishes were then put on a lighted base of a zoom stereo-microscope (magnification of 10x7-4.5) equipped with millimetric reticle. I evaluated for every surface unit (cm²) the percentage occupied by animal and vegetable component, that, averaged, gave the correspondent volume value of stomach content⁽¹⁾. I drew at random 14 fields of

(1) In the method previously cited the Authors considered the surface percentage that corresponds to the volume percentage, assuming them without thickness.

vision (1 cm^2) for every dish, minimizing the evaluation error; the empty space of every field of vision was inserted (by estimation) in the surfaces covered by both animal and vegetable matter, with an estimated error of nearly 10%.

The few recognizable fragments were preserved in alcohol 75% v/v for identification.

RESULTS

The analysis of the trophic behaviour of the whole sample shows that the Dormice studied are omnivorous, with a preference for vegetable food. As a general trend, animal food eating increases in absolute values from July to August and then decreases till October, and the percentage of animal matter in this month is greater than that of July (Fig. 1).

The males show a lightly but constant more carnivorous habit, with a difference in the volume taken up by animal component that is, on average, equal to 10% (Fig. 2).

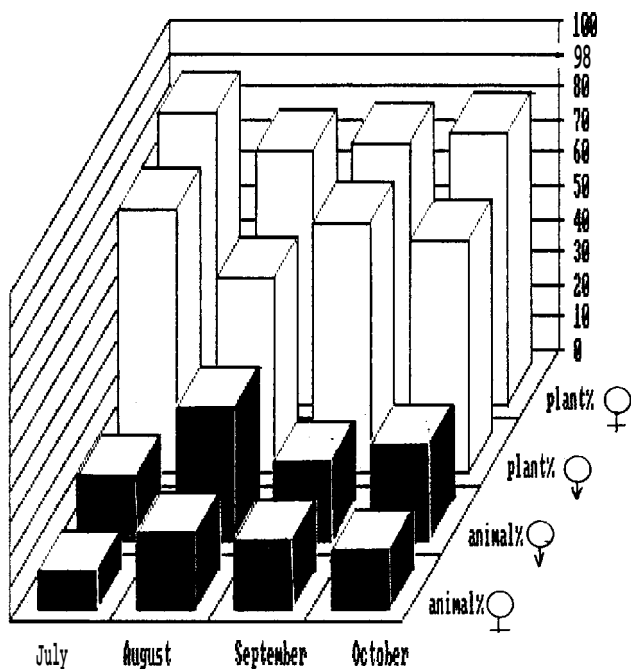


Fig. 2 - Differences of diet between the males and the females in the whole sample. Explanations as in figure 1.

In comparisons between yearlings and mature specimens' stomachs (Fig. 3), yearlings strictly maintain a vegetarian diet.

Concerning mature individuals (Fig. 4), those that are 1 to 2.5 years old result remarkably more carnivorous than adults and the heaviest specimens of the sample has been found in this age range.

As regard the preserved material, the results seem to be enough interesting for a descriptive analysis.

No vegetable remain was identified in July; the insects found in 5 stomachs were identified as Aphidoidea of the Lachnidae family (in variable number from 2 to 24); in addition, one larva of Coleoptera (Coccinelidae) was found, probably ingested during aphids predation.

A remarkable amount of *Lonicera* (spp.) seeds were found in August in 3 stomachs (from 14 to 115 entire seeds), and in a fourth stomach there was a scale-leaf (probably of *Picea excelsa* (Lam.) Link); furthermore, the vegetable component of 2 stomachs resulted in nearly 70% of woody fibre. I found entire insects in 14 stomachs: in 7 of them there were Lachnidae (from 1 to 11 specimens) and in 6 Adelgidae (1-8 adults;

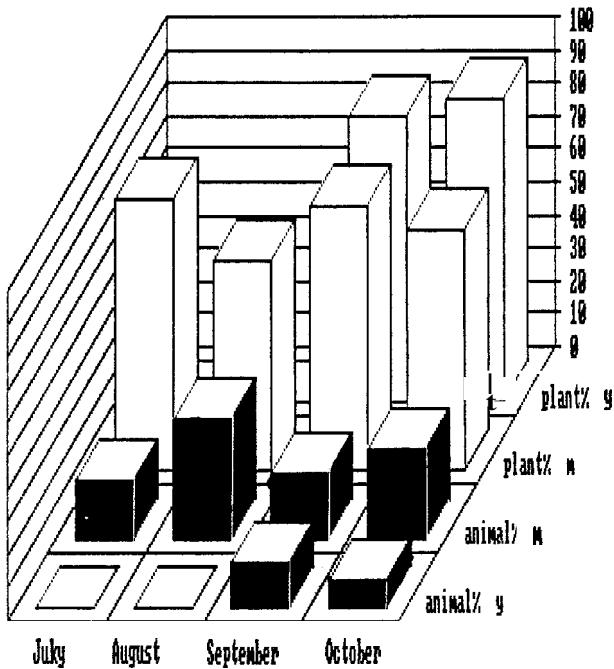


Fig. 3 - Differences of diet between the yearlings and the mature individuals: y=yearlings, m=matures. Explanations as in figure 1.

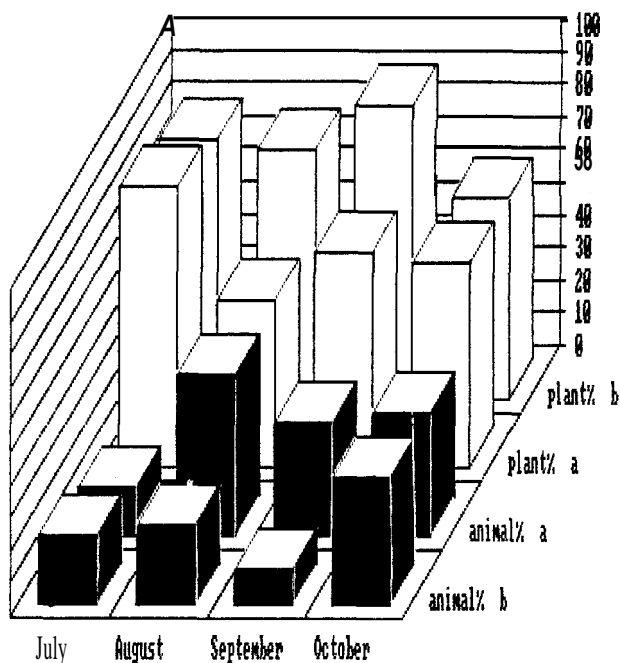


Fig. 4 – Differences in the diet between mature individuals of different ages: a = individuals from 1 to 2.5 years old, b = individuals from 2.5 years onward. Explanations as in figure 1.

.3-7 nymphae); 1 egg, 1 larva and 1 aphid were not identified. It is remarkable that larvae of *Cephalcia arvensis* Panzer (Hymenoptera Pamphiliidae), from 1 to 6, all beheaded before ingestion, were found from August 19th onwards.

During the first half of September, 65 seeds of *Lonicera* (spp.) and 3 seedlings (n.c.) were found in one stomach, and in 3 others bark and woody fiber (till 80% of the stomach content in one case) and in a fourth there were needles of Norway Spruce. In the following half of the month, remains of deciduous angiosperm leaves were found in one stomach, and some musk remains in another. One hides of *Cephalcia arvensis*, all beheaded, were found in 7 stomach (to 14 in one case). Lachnids were found in 3 stomachs (from 4 to 10) and Adelgids in 3 stomachs (from 1 to 7). At the end of the month I found remarkable flesh remains in a stomach.

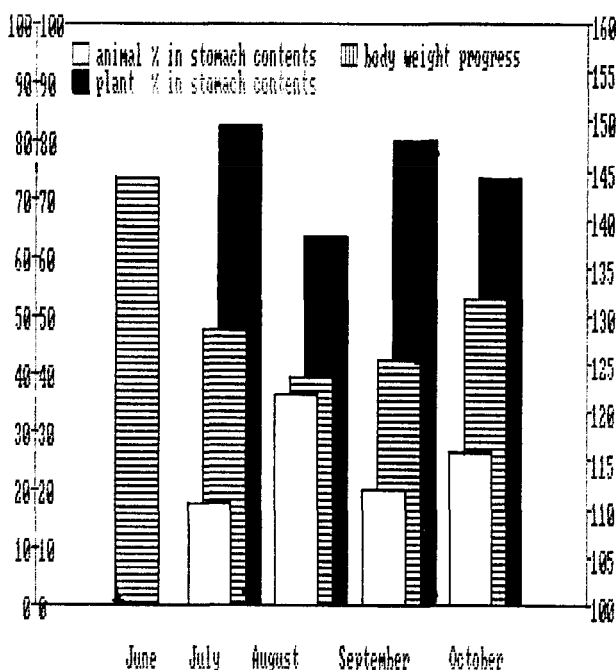


Fig. 5 - General body weight progress of the *Myoxus glis* population, from which the sample was drawn, and general progress of animal and plant components of the sample stomach contents from June to October. Explanations: ordinate, weight values from 100 to 160 grams and percentages of animal and plant components; abscissa, time values.

Only 2 seeds of *Lonicera* (sp.) were found in one stomach in October, and other two contained chewed-furs; in a third one half of the animal component was made up of traps bait (smoked-fat).

DISCUSSION AND CONCLUSION

From the general analysis of the diet of this population during the active period, it turns clearly out that the consumption of animal food is anything but occasional, in agreement with data reported in the literature (Holisova, 1968, Kahmann, 1965; Le Louarn & Saint Girons, 1977; Saint Girons, 1973; Santini, 1978; Von Storch, 1978; Toschi, 1965)⁽²⁾.

The animal food consumption in males is higher than 10%.

- (2) Remarkable predatory actions against fledged in particular conditions were observed (Schulze, 1970; Viethingoff-Riesch, 1960).

The animal food ratio in the diet increases during the Summer, and it is correlated with: (1) a progressive decrease of body weight that continues till August and that is followed by a gradual increase till the hibernation (Fig. 5), (2) a great energetic demand that exhausts the remain in winter body supplies, (3) an intensification of sexual activity (Fig. 6) (Franco, 1986). All this explains the great consumption of high nourishing food (like seeds and animal food) during this period (Holisova & Obrtel, 1974; Hubert et al., 1981).

Although animal food consumption decreases during the weaning of sexual activity, it is still remarkable, and it tends to increase again in October, probably in concomitance with the lack of likewise energetic vegetable food.

The males, even if their sexual activity exhausts in August (Franco, l.c.), have to store up remarkable supplies of lypodermic fat for hibernation. The females, furthermore, need high energy rate for sicklings and delivers that go on till half September (Franco, l.c.); this reasonably

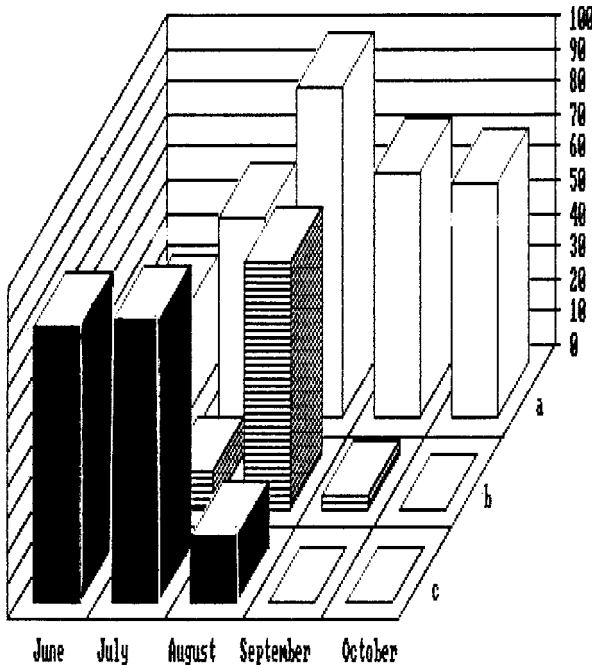


Fig. 6 - Sexual activity of *Myoxus glis* population. Explanations: vertical axis, percentages of a) females with sure mating traces, b) litters, c) males sexually active; horizontal axis, time values. The trapping conclusion did not allow a complete evaluation of litters during September and October; sucklings start in August.

explains the stomachs rate of animal food, substantially greater in September than October (Fig. 2).

The trophic behaviour of the population studied is probably a consequence of the changed conditions of the biocenosis, originally founded on natural Beech stands (as the dominant species in the mixed forest or managed with the coppice method) and formed today by artificial pure stands of Norway Spruce.

The ecosystem simplification has caused a decrease in the quality and quantity of the food available, particularly of the vegetable one.

The Dormouse, which has a particular annual energy budget (Gebczynski et al., 1972), has been driven to a higher consumption of otherwise occasional foods (but highly energetics) on the ground of new food resources. This adaptability to an anomalous diet appears in a general and early way; it is shown, at least, by the diet difference between yearlings and mature individuals: the first maintain a strictly vegetarian diet, probably in consequence of physiological reasons not investigated, in spite of their need to store up quickly fat supplies during the period of low availability of plant food.

The simplification of the ecosystem influences also the variety of food consumption.

Among insects, Adelgids and, above all, Lachnids are almost constantly found (also the latter probably linked to the Spruce); they belong to one or few species and they are captured during their highest period of presence (May-September). From August I also found full-grown larvae of the sawfly *Cephalcia arvensis* that in this period of the Summer, are going to the ground, according to observations carried out in similar environments of the Cansiglio Plateau (Masutti, 1986).

By the end of September these few species of insects are not any more available, and animal food consumption has to turn to other sources; therefore chewed-fur, flesh remains and increasing quantities of bait are found in October, as already observed in other rodents by others (see Holisova & Obrtel, 1974).

Seeds of *Lonicera* (found in the biotope with *caerulea* L. or *alpigena* L. species) represent exclusively plant remains; bark and woody fiber are found during the peak period of trophic activity and that of greatest lack of green food-stuff, when the musk finding is probably not casual.

The predation of *Cephalcia arvensis* is particularly interesting: it suggests that this Dormouse population somehow interferes in the regulation of *Cephalcia* populations (which now are increasing in the Spruce stands near Asiago), and that its ground level predation is not so occasional, as stated for Dormice by others (see Von Storch, 1978); this latter observation is supported by the seedlings finding.

Concerning the utilization of Spruce vegetation, it is possible that Dormice occasionally eat needles, bark and sap, as stated by Zocchi (1957) and Santini (1983); little remains of Spruce needles and bark have been found in the stomachs. The utilization of spruce cones, as made by the Squirrel, seems to be **unusual**: reared Dormice of different ages refused always spruce cones even during starvation.

The general behavior of this Dormouse population, is with no doubt linked to learning behaviour, mostly for the prompt adaptation to the new biocenosis situation.

This, in its turn, seems to depend greatly on Dormouse sociability, probably undervalued till today, that is also present during the trophic action (Vietinghoff-Riesch, 1960; Santini, 1978, 1983; Pilastro, 1985; Franco, l.c.).

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