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Food Habits of the Bank Vole and Phenological Phases of Plants in an Oak Hornbeam Forest *

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The contents of 139 stomachs of the bank vole trapped in a *Tilio-Carpinetum* community were subjected to microscopic analysis. It was found that in spring voles consume mainly green vegetative parts of plants (68%), insects (21%) and seeds (5%). Similar proportions are maintained in summer but the share of seeds increases to 11%. Hence in these two seasons the bank vole belongs to herbivorous-insectivorous animals. In autumn green food fills the stomachs in 38% and tree and herb seeds constitute jointly 40% of food mass. The amount of animal food decreases to 15%. In winter the proportion of green food is identical as in autumn but the share of seeds increases to 56% at the expense of animal food which constitutes barely 6%. It was observed that some herb species are preferred in the period of full development (*A. nemorosa*) while other are mainly consumed in the phase of slow vegetation. Comparison of the amount of consumed food with its availability indicates that some types of food are specially preferred (*e.g.* acorns). It was calculated that in the autumn-winter period population of voles including 30—40 individuals/ha may destroy from 1.2 to 1.5% of seed crop. In that period such population consumes under the form of seeds from 27,300 to 36,400 kcal, *i.e.* approximately 3.9% of total calories present in tree seeds available in 1 ha of *Tilio-Carpinetum* forest.

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1. INTRODUCTION

The bank vole *Clethrionomys glareolus* (Schreber, 1780) is widely distributed over a great geographic range and through a great variety of plant communities. Thus its food preference varies depending on geographic latitude (Koshkina, 1957; Smyth, 1966; Ashby, 1967; Bashenina, 1968; Hansson, 1971) and on biotope (Sviridenko, 1940; Pivovarova, 1956; Koshkina, 1957; Drożdż, 1966; Bandomir, 1973 msc). Also seasonal variations of plant vegetation, characteristic for temperate zone, cause significant differences in the food composition (Miller, 1954; Górecki & Gębczyńska, 1962;

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Watts, 1968; Zemanek, 1972). Moreover, food conditions of this species depend on rodent density on a given plot, as well as on the sex of examined animals (Holišova, 1966; 1971).

The present study was aimed at finding out the composition of natural food of the bank vole in the oak hornbeam Białowieża Forest in different seasons. Moreover, it was intended to ascertain whether food preference is influenced by the stage of plant development, as well as by its amount and availability in a given area. Only in this way it is possible to establish to what extent variable food preference of the bank vole really depends on food abundance of the forest.

2. MATERIAL AND METHODS

Trappings of voles were carried out in Białowieża Forest in plant association belonging to *Tilio-Carpinetum*, where multi-year studies were continued on herb layer productivity, as well as on phytosociology and phytocenology (Faliński, 1966). The investigated plot included three communities of *Tilio-Carpinetum:* north, western and southern part of the area can be classified as *Tilio-Carpinetum typicum;* the middle and eastern part — community of low oak hornbeam, *Tilio-*

Table 1

Number of analyzed stomachs in the bank voles in four seasons.

Sex	Spring (April, May)	Summer (July)	Autumn (Oct.)	Winter (Dec.)
Males	11	12	24	25
Females	6	22	17	22

-Carpinetum stachyetosum; a small part belongs to high oak hornbeam, *Tilio-Carpinetum calamagrostietum*. The general scheme of differentiation of the oak hornbeam Białowieża Forest is related to floristic-ecological features of neighbouring plant associations. The low oak hornbeam forest shows some similarities with flood plain forest, while high oak hornbeam forest has some features of thermophilic oak and plain oak mixed forest (Matuszkiewicz & Matuszkiewicz, 1954).

On the ground of floristic-ecological analysis of the examined forest associations, and studies of the home range of *C. glareolus* (Mazurkiewicz, 1971) it can be concluded that food supply for bank voles included plant species common for oak hornbeam forest and neighbouring areas (narrow zone of flood plain forest and plain oak mixed forest).

Microscopic analysis of 139 stomachs contents (Table 1) of voles captured in snap-traps was employed in the investigations of natural food. The excised stomachs were fixed in 4% formalin and then rinsed with water. Stomach content was placed on a watch-glass containing a few drops of water and Gramma II reagent for starch staining. After careful mixing 4 microscopic glycerin slides were prepared in each case. Microscopic ocular was fitted with a net consisting of 100 squares. Taking into account the number of squares occupied by a given food type its relative abundance was calculated. Each slide was analyzed in 10

non-overlapping fields. The obtained results were added up and the mean relative proportion of a given food component was calculated. A similar method was employed by Holišova (1966).

Histological preparations, drawing of epidermis and test slides prepared from stomach content of voles fed in the laboratory for 2—3 days with one type of food were used for identification of plant species. This number of days of feeding was found to be sufficient since according to Myrcha & Myrcha (1964) green vegetative parts of plants pass through the intestinal tract of rodents within 17—18 hours.

Animal food was identified on the ground of undigested remnants such as chitin covers of insects, parts of extremities, single complete specimens and squama of butterfly wings.

3. SEASONAL FOOD CHANGES

The following types of food were identified in the analyzed material: green vegetative parts of plants and flowers, tree leaves, animal food, seeds and fruits of herbs, tree seeds, fungi, mosses, roots and non-chlorophyllous tissues of underground parts of herbs. Moreover, some impurities in the form of sand and fur were observed, and negligible part remained not identified. During four seasons 42 plant species were distinguished.

The area of investigations was covered with 6 tree species and 61 herb and shrub species (Falińska, 1971). Out of these numbers in vole stomachs were found 4 and 32 species, respectively, as well as some mosses and fungi. The remaining 4 species of green plants were consumed probably outside the studied area. One of these species belonged to plain oak mixed forest, one to flood plain forest, and the remaining two belonged to oak hornbeam forest.

In spring (April-May) 18 plant species along with some animal food were identified in the stomachs of voles. Among herb plants the most common were: *Oxalis acetosella* (41%), *Anemone nemorosa* (65%) and *Geum urbanum* (35% of stomachs). Moss was found in 30% and invertebrates in 59% of stomachs (Fig. 1). It should be mentioned, however, that invertebrates occurred in 67% of female stomachs but only in 59% of male stomachs (Table 3). Vegetative parts of herb layer plants constituting 68% of the total amount of food, were the principal component of vole food in that season. Among plants dominated the species mentioned above. Invertebrates were also an important component of food since they constituted 21.5% of food mass. The remaining part included seeds and fruits of herbs and trees, as well as fungi, various roots, mosses and contaminants (Fig. 2).

In summer (July) the number of plant species consumed by voles is almost doubled in comparison with the spring and amounts to 30 species. *O. acetosella*, *A. nemorosa* and *G. urbanum* were found in over 50% of

stomach. Considerable number of stomachs contained also *Majanthemum bifolium, Hepatica nobilis, Isophyrum thalictroides,* and moss. The number of stomachs containing animal food increased rather considerably, up to 89%; this type of food was found in all stomachs of fe-

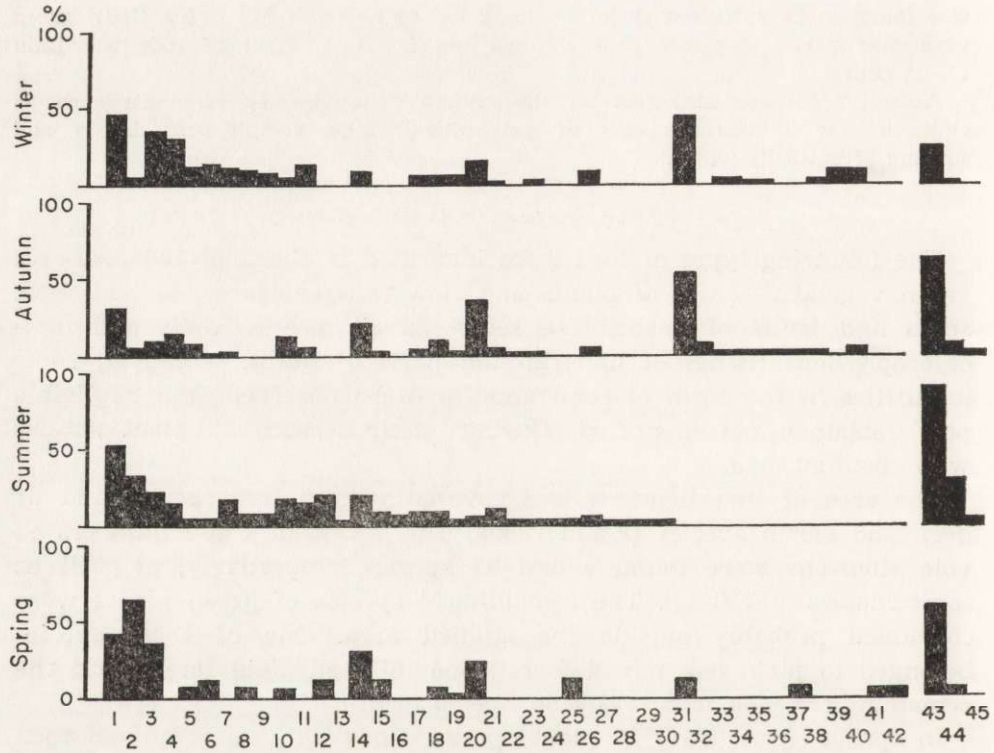

Fig. 1. Frequency of occurrence of plant species and other types of food in the stomachs of *C. glareolus.*

1. *Oxalis acetosella,* 2. *Anemone nemorosa,* 3. *Geum urbanum,* 4. *Lathyrus vernus,* 5. *Galeobdolon luteum,* 6. *Ranunculus lanuginosus,* 7. *Majanthemum bifolium,* 8. *Mycelis muralis,* 9. *Ficaria verna,* 10. *Hepatica nobilis,* 11. *Poligonatum multiflorum,* 12. *Isopyrum thalictroides,* 13. *Luzula* sp., 14. Mosses, 15. *Dentaria bulbifera,* 16. *Festuca* sp., 17. *Asperula odorata,* 18. *Sanicula europaea,* 19. Fungi, 20. *Stachys silvatica,* 21. *Aegopodium podagraria,* 22. *Milium effusum,* 23. *Ajuga reptans,* 24. *Dryopteris filix-mas,* 25. *Impatiens noli-tangere,* 26. *Viola silvestris,* 27. *Fragaria vesca,* 28. *Polygonum persicaria,* 29. *Athyrium filix-femina,* 30. *Veronica chamoedrys,* 31. *Quercus robur,* 32. *Urtica dioica,* 33. *Tilia cordata,* 34. *Acer platanoides,* 35. *Geranium robertianum,* 36. *Circaea lutetiana,* 37. *Rubus idaeus,* 38. *Stellaria nemorum,* 39. *Carpinus betulus,* 40. *Pulmonaria obscura,* 41. *Stellaria holostea,* 42. *Carex pilosa,* 43. Invertebrata, 44. Unidentified, 45. Contaminants.

males trapped in that period (Fig. 1, Table 3). The proportion of vegetative parts of herb plants decreased to 54% (Fig. 2). Majority of it, *i.e.,* 62%, constitute the same species which occur most commonly in stomachs (Table 2). Some increase was observed in the amount of

consumed seeds and fruits of herbs (11%) and roots (7%). The amount of animal food was similar to that found in spring (Fig. 2).

In autumn (October) voles utilize similar number of herb plant species as in summer — 28. Dominate the stomachs in which *O. acetosella* and *Stachys sylvatica* were found (32 and 37%, respectively). Tree

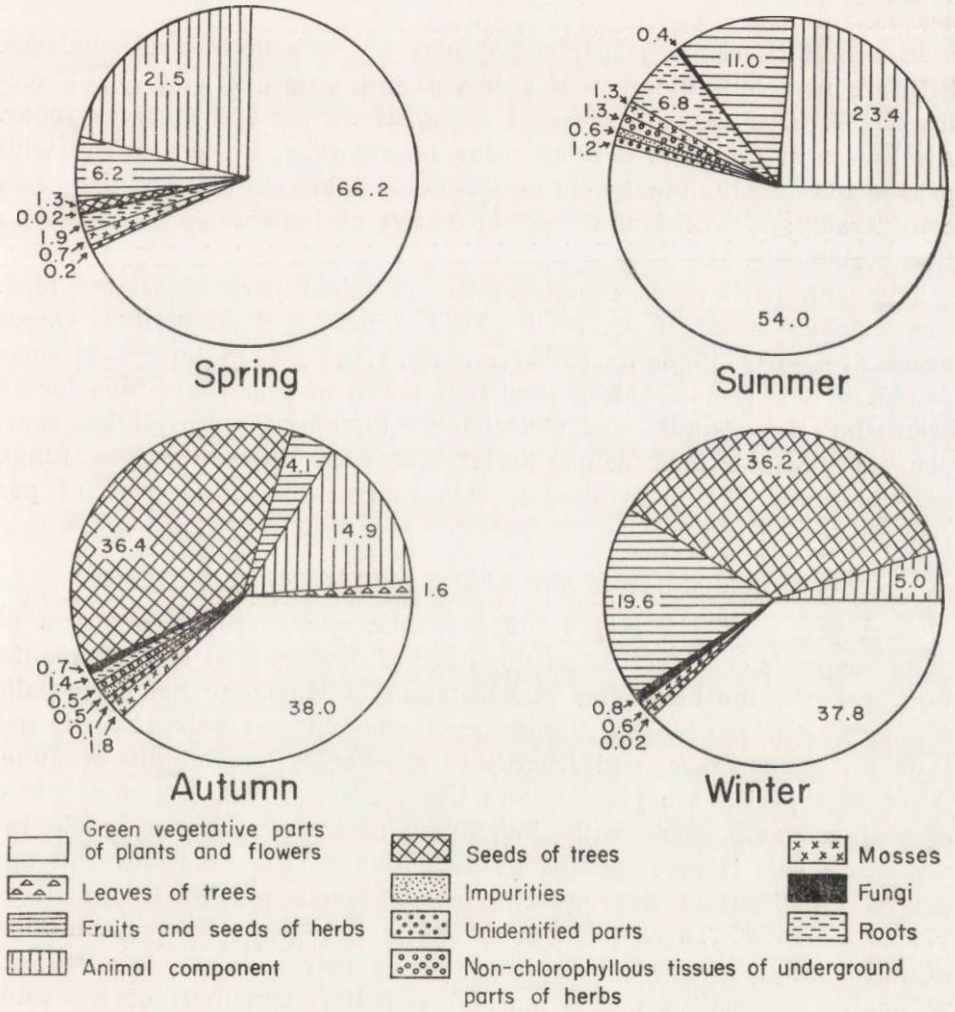

Fig. 2. Relative proportions of various components in the food of *C. glareolus*.

seeds, and especially of oak, occur in 50% of stomachs. Invertebrates are still consumed by voles and are found in 63% of stomachs (Fig. 1). The degree of filling of stomachs with green food decreases to 38%. Apart from the two above mentioned species prevail *Urtica dioica* and

Galeobdolon luteum, consumed less frequently but in higher amounts. These species jointly constitute 62% of green food. The proportion of tree seeds (acorns only) increases to 36% (Fig. 2), while the share of animal food decreases to 15%, hence is 10% lower than in summer. The proportion of seeds and fruits of herbs also decreases, nearly twice (Fig. 2). Tree and herb seeds constitute jointly 40% of food in that season.

In winter (December) 26 plant species were found in vole stomachs. Still a considerable number of animals consume green parts of *O. acetosella*, *G. urbanum* and seeds of *Lathyrus vernus* and *Quercus robur*. Also seeds of *Carpinus betulus* occur in stomachs. In comparison with previous season the number of samples containing animal food decreases considerably: it was found only in 25.5% of individuals examined in that period (Fig. 1).

Tree and herb seeds constitute the principal part of winter food. They include seeds of *Q. robur*, *Tilia cordata* and *L. vernus*. Green vegetative parts of plants (38%) represent the second important component of winter food. More than half (59%) of this value falls for *O. acetosella*, *G. urbanum* and *Galeobdolon luteum*. The remaining components of winter food include invertebrates (ca 5%) and mosses, fungi, non-chlorophyllous plant tissues, *etc.*, representing a fraction of per cent (Fig. 2).

4. FOOD COMPOSITION AND STAGE DEVELOPMENT OF PLANTS

Food preference in respect of particular plant species or parts of plants depends considerably on the stage of development of these plants. For example, the beginning of vegetation of *Anemone nemorosa* falls for the first days of April, florescence starts in the middle of April and lasts for ca 2 weeks, and fructification ends in the middle of June. After that period the plant enters the period of rest, *i.e.*, appearance of yellow leaves, their withering, dying of some stems or whole individuals. This is accompanied by reduction of life processes and apparent inhibition of development in non-favourable conditions (Falińska, 1973). These phenomena are reflected in the consumption of this species by voles. In spring and summer anemone is consumed willingly: it constitutes 38% (spring) and 10% (summer) of the total food mass. In autumn and winter anemone is encountered only seldom in stomach content and it constitutes barely 0.7 and 0.6% (Table 2).

Geum urbanum is consumed willingly in winter, spring and summer, when it constitutes respectively 5, 7 and 5% of food mass (Table 2). The maximum development of this species falls for the period from the end of April till the middle of August. This coincides with maximum

utilization of this species by voles. Later withering of stems occurs and *Geum urbanum* is almost totally lacking in the food. In winter, under snow, survive only some leaves and seeds, but they are very attractive for voles.

Table 2

Proportion of particular plant species in the food of *C. glareolus* in various seasons.

Species	Spring	Summer	Autumn	Winter
Oxalis acetosella L.	7.2	15.5	7.0	15.4
Anemone nemorosa L.	38.4	9.8	0.7	0.6
Geum urbanum L.	6.8	4.9	1.3	4.9
Lathyrus vernus Bernh.	—	6.6	1.6	14.9
Galeobdolon luteum Huds.	1.3	1.7	2.6	3.9
Ranunculus lanuginosus L.	4.0	0.7	0.4	1.5
Majanthemum bifolium Schm.	—	3.8	1.1	1.6
Mycelis muralis (L.)	0.9	1.2	—	1.0
Ficaria verna Huds.	1.6	6.1	—	0.5
Hepatica nobilis Garsault	—	3.4	1.9	0.5
Polygonatum multiflorum All.	—	2.3	1.3	3.0
Isophyrum thalictroides L.	2.8	2.7	—	—
Luzula sp.	—	0.5	—	—
Dentaria bulbifera L.	1.8	1.9	0.6	—
Festuca sp.	—	0.5	—	—
Asperula odorata L.	—	1.6	1.6	1.2
Sanicula europaea L.	1.6	0.9	1.7	0.7
Stachys silvatica L.	1.1	1.3	11.1	2.8
Aegopodium podagraria L.	—	2.1	0.5	0.4
Milium effusum L.	—	0.2	1.2	—
Ajuga reptans L.	—	0.1	0.2	0.2
Dryopteris filix-mas (L.)	—	0.4	—	—
Impatiens noli-tangere L.	4.4	0.3	—	—
Viola silvestris Rchb.	—	1.5	1.1	2.1
Fragaria vesca L.	—	0.3	—	—
Polygonum persicaria L.	—	0.1	—	—
Athyrium filix-femina Roth.	—	0.1	—	—
Veronica chamaedrys L.	—	0.1	—	—
Quercus robur L.	1.3	—	36.3	31.6
Urtica dioica L.	—	—	3.2	—
Geranium robertianum L.	—	—	0.9	0.4
Circea lutetiana L.	—	—	0.3	—
Pulmonaria obscura Dum.	—	—	0.6	0.8
Stellaria holostea L.	1.6	—	—	—
Stellaria nemorum L.	—	—	0.4	1.1
Carex pilosa Scop.	1.5	—	—	—
Tilia cordata Mill.	—	—	0.7	3.4
Acer platanoides L.	—	—	1.0	0.5
Rubus idaeus L.	1.35	—	0.1	—
Mosses	0.7	1.2	1.7	0.6
Fungi	0.1	0.1	0.6	0.8
Carpinus betulus L.	—	—	—	0.9

O. acetosella is one of the main food components in all seasons (7, 16, 7 and 15% of food mass in particular seasons) (Table 2). Almost exclusively leaves are consumed. The maximum consumption of this species falls for the stage of fructification and normal vegetation.

Lathyrus vernus is consumed only under the form of seeds in summer and winter (6 and 15% of food mass). In spring it is totally lacking in food and in autumn it constitutes a negligible per cent (Table 2). Probably its attractivity decreases with the appearance of acorns. Also *Quercus robur* and *Carpinus betulus* are consumed exclusively in the form of seeds, and nearly exclusively *Acer platanoides* and *Tilia cordata*. They constitute in autumn and winter 36% of food mass (Table 2). The period of their appearance in food is in agreement with seeds falling (July — November) (Faliński, 1971).

Stachys sylvatica occurs as a significant food component of voles also only in autumn and winter, hence in the period of seed falling and rest of vegetation. Many plant species in the oak hornbeam forest become attractive for voles only in the periods of fructification and seeds falling, *i. e.*, June — October. After that period their consumption ceases completely or is significantly reduced.

5. FOOD COMPOSITION AND COVERING OF THE GROUND BY HERB LAYER PLANTS

The share of particular components in the structure of a given phytocenosis is not uniform, as indicated among others by the degree of ground covering by herb layer plants (Faliński, 1966). An attempt was made to compare in a *Tilio-Carpinetum* forest the degree of ground covering and density per square meter of plant species estimated by approximate and quantitative methods (Faliński, 1971; 1974) with the frequency of their occurrence in vole stomachs and proportion in the consumed food mass.

In the period of maximum development (May-June) *Anemone nemorosa* is a species covering 50% of the area with the density of 99.0 individuals/m² (Falińska, 1974). At such abundance and density the frequency of its occurrence and proportion in the total food are also high in that period (Fig. 1, Table 2). *Galeobdolon luteum*, the species of similar density and belonging to wintergreen plants, is important as food component, especially in autumn-winter period. In distinction to these species, *Equisetum pratense* although covers the area to a considerable extent is not consumed by voles. Also *Urtica dioica*, for which the density amounts to 26 individuals/m², is not consumed in spring aud summer. On the other hand, *O. acetosella* showing the highest density (225 individuals/m²) is utilized by voles all the year round.

The above examples indicate that some species occurring in abundance in the herb layer are consumed willingly by voles, but other are consumed to a similar extent although the degree of area covering by them

is low. The latter must be especially sought for by voles. To such species belong the following: *Geum urbanum* (8 individuals/m²) being one of the principal food components in spring, summer and winter (Table 2), *Ranunculus lanuginosus* (8 individuals/m²) consumed willingly in spring, and *Q. robur* occurring in a rather low number in the area of investigations (Faliński, 1966; Falińska, 1974) while in the period of fructification and seed falling its seeds constitute the main component of vole food (Table 2).

6. ANIMAL FOOD OF VOLES

In the stomachs of voles living in oak hornbeam forest of Białowieża region animal food is encountered during all seasons, but it is most abounding in spring and summer (Fig. 2). It is interesting that more

Table 3

Frequency of occurrence (A) and proportion (B) of animal food in vole stomachs (in percentage).

Sex	Spring		Summer		Autumn		Winter	
	A	B	A	B	A	B	A	B
Males	55.5	15.5	66.6	8.8	66.6	9.2	24.0	1.5
Females	66.6	5.9	100.0	14.6	58.8	5.6	27.3	3.5

females than males consume this food (Table 3). In the total food mass this type of food is important only in summer. The animal food includes *Daphnia, Lepidoptera* and other invertebrates.

7. DISCUSSION

Food composition of voles inhabiting different biotopes is of course different. Less understandable are differences in the diet of voles living in the habitats of closely similar floristic composition. Ascertainment of food relationships of voles in the oak hornbeam Białowieża Forest enables to compare them with the data for other *Tilio-Carpinetum* of this region (Pivovarova, 1956), as well as with this type of forest in geographically distant areas: Wolski Forest and Niepołomicka Forest near Kraków (Górecki & Gębczyńska, 1962; Zemanek, 1972) and southern Moravian (Holišova, 1966; 1971).

The results of Pivovarova (1956) indicate that in spring the food of bank vole in the Russian part of Białowieża Forest consists in half with green parts of plants, and in nearly half with seeds (part of the food was not identified by the author). On the other hand, the data from

the present study indicate that in spring bank vole consumes mainly green parts of plants while insects and seeds constitute only 6% of food. Similar proportions persist in summer. Hence the data of Pivovarova (1956) suggest that bank vole is herbivorous-seed consuming animal, while from the present data it arises that it can be classified as herbivorous-insectivorous animal. In autumn and winter the differences in food composition between these two sites of investigations are smaller and indicate a significant proportion of seeds in the food, although detailed figures are not identical.

Such considerable differences in the vole diet observed in very similar biotopes belonging to the same forest complex may depend on variable seed crop and numbers of insects in particular years. Some differences may also arise from the employed methods of investigations. Pivovarova (1956) took into account only main food groups without reporting percentage proportion of particular plant species. When analyzing own results the author emphasized exceptionally high, in comparison with earlier data, proportion of seeds in food composition.

There is no doubt, however, that bank vole is characterized by a very high plasticity of food preference. For example these rodents inhabiting oak hornbeam Niepołomicka Forest near Kraków (Zemanek, 1972) consume in spring 38—65% of green parts of plants and 19—55% of seeds. In summer seeds and fruits become the principal food (43%) while the amount of green parts of plants is considerably reduced. In autumn the proportion of green parts again increases to 50% of stomach volume, and seeds decreases to 26—37%. Similar proportions were observed in winter.

Despite considerable variability in the composition of diet seeds are particularly important as winter food; this fact was ascertained with various methods (Pivovarova, 1956; Górecki & Gębczyńska, 1962; Holišova, 1971; this study). Nevertheless, even in that season some data indicate on the prevalence of green parts of plants over seeds (Zemanek, 1972), while other show their almost completely lack in diet (Holišova, 1966).

Some controversy concerns the importance of green food in the vole diet. Nesterov & Nikso-Nikočio (1950, after Pivovarova, 1956) hold the opinion that this food is only supplementary and cannot exert any significant effect on the reproduction of these rodents. On the other hand, Pivovarova (1956) claims that green food provides basic vitamins and is important for reproduction. This was fully confirmed by the studies of Pinter & Negus (1965), Negus & Pinter (1966) and Pinter (1968) on the effect of food composition on the reproduction of *Microtus montanus*. After supplementing the food with seedlings and

stems of wheat the voles produced during the experiment a higher number, and more numerous, litters than those devoid of green food. The former group contained also a smaller number of adult, sexually inactive females. The hypothesis concerning the relationship between food quality and reproduction was confirmed by the investigations of Holišova (1966) who draw attention to marked differences in food composition of bank voles during the reproduction period and outside it. During reproduction (April-July) the females consumed more animal food. Outside the reproduction period, a significant difference was observed in winter, when females utilized large quantities of green matter, compared to the males.

Some types of plant food are especially sought for by voles. This conclusion is supported by comparing tests of choice with the indices of occurrence of given plant species (Zemanek, 1972). Also the analysis of the stomachs content demonstrated that bank voles inhabiting oak hornbeam Białowieża Forest consume large amounts of some rarely occurring plants, *e. g.*, oak seeds. It was also shown that preference of a given food depends on its development stage: some plants are most willingly consumed in the full development, other during quiet vegetation. Thus there is no doubt that plant food satisfies in such way various requirements of bank voles.

The data on a considerable proportion of animal food in vole diet in spring, and especially in summer, suggest its importance for reproduction. The fact that the females consume more invertebrates provides also a convincing proof.

On the ground of calculations from the trappings carried out during several years in Białowieża Forest (Pucek, unpubl. data), and from the dynamics number of voles in autumn-winter period in a multi-year cycle in this area (Pucek & Pucek, 1974) it was assumed that in the autumn-winter period the number of voles per 1 ha of *Tilio-Carpinetum* forest ranges, depending of year, from 30 to 40 individuals. Employing these data, and the results of Sviridenko (1940) on the quantity of seeds of various tree species which can be destroyed by one vole, the damages caused by this rodent species were calculated. For the calculations seed crop in the year 1968 was employed (after Falińska, 1971) assuming that it represents the mean value between the preceding and following year. On the studied area the population of voles (30—40 individuals/ha) may destroy in autumn from 1,700 to 2,200 acorns, and in winter 17,000 to 23,100 lime-tree seeds, 1,500 to 2,000 maple-tree seeds and 1,400 to 1,900 acorns. To this list should be added hornbeam seeds, constituting in winter 2.6% of total consumed seeds (present study), although the exact amount of these seeds consumed by voles is not known. Neglecting in further calculations the seeds of hornbeam and

birch (the latter were not found in stomachs) it was assumed that the vole population may destroy in autumn-winter period approximately 1.2—1.5% of tree seeds crop.

By means of other calculations it was attempted to estimate the quantity of calories consumed by voles as tree seeds on the examined area. The following data are known: the amount of tree seeds of particular species per 1 ha of *Tilio-Carpinetum* (Falińska, 1971), their dry weight and caloric value of 1 g of seeds without cover (Grodziński & Sawicka-Kapusta, 1970). On this basis it was calculated that during 1 year 1 ha of the forest provides 691,000 kcal in the form of seeds of the following trees: hornbeam, oak, lime and maple. Birch seeds are omitted from the calculations on account of their absence in vole stomachs and complete crop failure of birch seeds in 1968. The tree seeds constitute approximately 1/3 (36%) of the vole food in autumn-winter period (present study). Since daily energy requirement of 1 vole amounts to 13—15 kcal (Drożdż, 1968) the seeds provide ca 5 kcal daily. Assuming that the number of voles per 1 ha of *Tilio-Carpinetum* amounts in autumn and winter to 30—40 individuals (Pucek & Pucek, 1974) it can be easily computed that such population consumes in this period in the form of seeds from 27,300 to 36,400 kcal, or 3,9% of the total amount of calories available as seeds in 1 ha of oak hornbeam forest.

The presented results confirm the fact of existence of significant seasonal differences in the diet of bank vole, depending on phenological stages of plant development. *C. glareolus* shows definite food preference as indicated by search for some plant species. It should be also emphasized that population of voles can destroy approximately 1.2—1.5% of fallen tree seeds; this value is below any practical significance. On the other hand, these rodents, by consuming many invertebrate species (up to 23% of their diet) may play some role in the control of occurrence of these animals.

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SKŁAD NATURALNY POKARMU NORNICY RUDEJ A FAZY FENOLOGICZNE ROŚLIN W GRĄDZIE PUSZCZY BIAŁOWIESKIEJ

Streszczenie

Analizie mikroskopowej poddano zawartość 139 żołądków nornic (Tabela 1) odłowionych w *Tilio-Carpinetum*. Wiosną w treści żołądkowej nornic wyróżniono 18 gatunków roślin (Tabela 2) i pokarm pochodzenia zwierzęcego (Ryc. 1, 2). Głównymi składnikami ich pokarmu są wegetatywne części roślin zielnych (68%), bezkręgowce (21.5%) oraz nasiona (5%) (Ryc. 2). Podobne proporcje utrzymują się latem z tym, że udział nasion wzrasta do 11% (Ryc. 1; 2). W tych dwóch sezonach jest więc nornica zwierzęciem roślino-owadożernym. Jesienią nornice wykorzystują 28 gatunków roślin (Tabela 2). Udział roślin zielnych zmniejsza się do 38%, nasiona drzew i ziół stanowią łącznie 40%, a pokarm pochodzenia zwierzęcego 15% (Ryc. 2). Zimą ilość paszy zielonej w pokarmie nornicy jest taka sama jak jesienią, natomiast udział nasion wzrasta do 56%, a pokarmu zwierzęcego obniża się do 6%, (Ryc. 2).

Wykazano, że niektóre gatunki runa są preferowane w okresie swego pełnego rozwoju (*A. nemorosa*). Inne zjadane są w fazie spokojnej wegetacji. Porównanie ilości zjadanego pokarmu z jego zasobnością wskazuje, że niektóre rodzaje pokarmów są specjalnie wyszukiwane (np. nasiona dębu). Znaczny udział pokarmu zwierzęcego w diecie nornic wiosną, a szczególnie latem, wskazuje na istotny związek z rozrodem. Dowodem na to jest wyszukiwanie i zjadanie większej ilości bezkręgowców przez samice, niż przez samce (Tabela 3).

Obliczono również, że w sezonach jesiennym i zimowym populacja nornic o liczebności 30—40 osobników/ha może zniszczyć od 1.2 do 1.5% nasion opadłych z drzew. Populacja taka konsumuje w tym okresie w nasionach od 27300 do 36400 kcal, co stanowi 3.9% ogólnej ilości kalorii zawartych w nasionach opadłych z drzew dostępnych na 1 ha lasu grądowego.