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FOOD SELECTIVITY IN THE RED DEER TOWARDS TWIGS OF TREES, SHRUBS, AND DWARF-SHRUBS *

WYBIORCZOŚĆ POKARMOWA JELENIA SZLACHETNEGO W STOSUNKU DO PĘDÓW DRZEW, KRZEWÓW I KRZEWINEK

Food selectivity of the red deer towards twigs of 17 tree, shrub, and dwarf-shrub species was studied in the course of 551 tests. It was found that *Rubus idaeus* L., *Vaccinium vitis-idaea* L., *Quercus sessilis* Ehrh., *Salix caprea* L., *Sorbus aucuparia* L., *Corylus avellana* L., and *Rubus* sp. provide the first choice browse. *Acer platanoides* L., *Calluna vulgaris* (L.) Salisb., *Berberis vulgaris* L., *Carpinus betulus* L., *Padus serotina* (Ehrh.) Borkh., *Frangula alnus* Mill., *Vaccinium uliginosum* L., and *V. myrtillus* L. constitute the second choice food. *Pinus silvestris* L. and *Juniperus communis* L. are the starvation food. Analysis of variance substantiated the statistically significant variation in the number of twigs consumed by the deer in relation to plant species and the season of year.

The purpose of study was to determine the food selectivity in red deer towards plants given to him and to examine its seasonal variation. The study was conducted on one tamed individual of the red deer (*Cervus elaphus* L i n n a e u s, 1758). At the moment of the beginning of tests it was 2 months old male calf raised in pen.

Table 1.

Analysis of variance of the numbers of consumed twigs of plant species compared. Empirical data were expressed in percentage and later transformed according to the Bliss formula.

Source of variation	Degrees of freedom	Sums of squares	Variance	$F_{emp.}$
Seasons (S)	3	3213.78	1071.26	4.29*
Species (Sp)	15	93368.15	6224.54	24.90*
($S \times Sp$)	45	18247.03	405.49	1.62*
Error	458	114482.24	249.96	

*) Differences significant at the level of $\alpha = 0.99$.

Tests consisted in providing the deer with food sets. A total of 20 sets were handled during 18 months of study (July, 1967 — December, 1968). Each set consisted of 3 bundles of twigs of different plant species. Tests included 17 species of trees, shrubs, and dwarf-shrubs (Table 4). Tree and shrub samples contained 20 twigs, while dwarf-shrub samples — 50 twigs per bundle. Twigs were harvested immediately before a test. Care was taken to maintain a possibly equal size of twigs in each bundle. Uneaten remnants were collected, accurately counted, and the browsing

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degree was recorded. A four grade classification was used: (1) whole twigs, (2) those consumed in $^1/_4$, (3) consumed in $^1/_2$, and (4) consumed in $^3/_4$. Only one test was carried out, as a rule, per day. There was no other food in the pen during a test.

During the study period 551 observations were taken (3 bundles in each observation). Twigs of one plant species provided an object of testing at least on 14 occasions (*Padus serotina*) and at the most on 44 occasions (*Vaccinium myrtillus*).

In order to determine if the selectivity towards plants of definite species is not affected by the composition of the set there were compared means of twigs consumed for three species of browse plants with the aid of median test. This test was carried out for *Pinus silvestris* in a set with *Quercus sessilis* and *Salix caprea* and in a set with *Padus serotina* and *Quercus sessilis*; for *Corylus avellana* in a set with *Rubus idaeus* and *Frangula alnus* and with *Rubus* sp. and *Berberis vulgaris*; for *Vaccinium vitis-idaea* in the set with *V. myrtillus* and *V. uliginosum* and with *Calluna vulgaris* and *Vaccinium uliginosum*.

Table 2.

Detailed examination of transformed means of consumed twigs of plants compared.

Group	Species	Number of tests	Mean	»Multiple« interval
1	*Pinus silvestris*	35	6.072	
2	*Vaccinium myrtillus*	44	31.173	10.33
	Vaccinium uliginosum	40	38.127	
	Frangula alnus	27	39.088	
	Padus serotina	14	39.212	
3	*Carpinus betulus*	36	42 327	9.71
	Berberis vulgaris	27	43.055	
	Calluna vulgaris	44	46.568	
	Acer platanoides	18	49.620	
4	*Rubus* sp.	34	50.100	8.41
	Corylus avellana	40	50.744	
	Sorbus aucuparia	25	52.915	
	Salix caprea	28	54.453	
	Quercus sessilis	33	55.650	
5	*Vaccinium vitis-idaea*	40	59.611	7.07
	Rubus idaeus	37	60.336	

The following results were obtained from χ^2 test: 1.468 for *Pinus silvestris*, 0.876 for *Corylus avellana*, 0.670 for *Vaccinium vitis-idaea* which with one d.f. are lower than $\chi^2_{0.05}$. Therefore the composition of the set does not affect the intensity of the consumption of any of the three tested plant species. The conclusion is important since on its basis the decision was made to develop results of preference tests with neglect to the 20 sets in use, while directly comparing the 17 plant species tested.

RESULTS

As a result of analysis of variance (Table 1) the hypothesis pertaining to the homogeneity of individual effects (seasons of year and plant species) was rejected. It was found that differences in the number of consumed twigs of plant species under comparison are highly significant. As a result of t-Duncan's test (E l a n d t, 1964) 5 groups illustrating food preferences of the red deer were identified among the 16 plant species compared (Table 2). Common juniper which, due to a complete refusal by the red deer (out of 640 twigs offered the red deer consumed half of a twig) was not included in the statistical analysis of test results and obviously should be inserted in the first position in this sequence (in the zero group).

The analysis of variance (Table 1) also indicated a high significance of differences in the numbers of twigs consumed during certain seasons of the year. In this connection the detailed examination of differences among means for seasons (Table 3) was carried out with the aid of t-Student's test with $P = 0.05$ as a limit value. It was found that statistically significant differences occur exclusively between autumn and the remaining seasons.

Table 3.

Detailed examination of transformed means of twigs consumed during individual seasons of the year with the aid of t-Student's test.

Season versus season	Modulus of differences between means / smallest significant difference	Summer	Autumn	Winter
Spring	$(\bar{x}_i - \bar{x}_j)$ $t_o \cdot S_r$	2,503 3,263	6,824 * 3,100	3,239 3,315
Summer	$(\bar{x}_i - \bar{x}_j)$ $t_o \cdot S_r$		4,321 * 2,850	0,736 3,120
Autumn	$(\bar{x}_i - \bar{x}_j)$ $t_o \cdot S_r$			3,585 * 3,081

*) Means the significance at the level $\alpha = 0.05$.

Table 4 illustrates the sequence in food selectivity of the red deer towards plants of 16 species offered to it during individual seasons of year. It results from this table that, apart from plants willingly consumed during all seasons of the year (means > 50%), there is the group of plants willingly consumed only during definite seasons of year. Such plants in spring include: *Calluna vulgaris* and *Acer platanoides;* in summer — *Quercus sessilis*, *Acer platanoides*, and *Carpinus betulus;* while in winter — *Calluna vulgaris*. Hence, another group of plants preferred by the red deer only seasonally comprise four from among the 17 tested plant species. Of interest is that during autumn, apart from the four plants of the 1st choice, there were no plants particularly willingly consumed.

Table 4.

Comparison of the sequence in food selectivity towards plants tested during individuals seasons of year.

Spring (III-V)		Summer (VI-VIII)		Autumn (IX-XI)		Winter (XII-II)		Whole year (I-XII)	
Species	Mean	Species	Mean	Species	Mean	Species	Mean	Species	Mean
Vac. vitis-idaea	67.5	*Q. sessilis*	68.4	*R. idaeus*	60.6	*V. vitis-idaea*	70.1	*R. idaeus*	60.3
Rubus idaeus	65.3	*R. idaeus*	60.3	*S. caprea*	53.0	*C. vulgaris*	61.9	*V. vitis-idaea*	59.6
Salix caprea	60.7	*S. caprea*	60.0	*S. aucuparia*	50.2	*R. idaeus*	55.3	*Q. sessilis*	55.6
Sorbus aucuparia	58.2	*A. platanoides*	58.6	*V. vitis-idaea*	50.1	*S. idaeus*	50.5	*S. caprea*	55.4
Calluna vulgaris	56.7	*V. vitis-idaea*	55.3	*C. avellana*	48.4	*Q. sessilis*	49.9	*S. aucuparia*	52.9
Corylus avellana	54.6	*S. aucuparia*	54.4	*Rubus* sp.	48.2	*S. caprea*	48.4	*C. avellana*	50.7
Rubus sp.	51.3	*C. avellana*	52.7	*A. platanoides*	46.6	*Rubus* sp.	48.1	*Rubus* sp.	50.1
Acer platanoides	50.1	*Rubus* sp.	52.3	*Q. sessilis*	42.2	*C. avellana*	46.6	*A. platanoides*	49.6
Berberis vulgaris	47.2	*C. betulus*	51.9	*C. vulgaris*	41.2	*A. platanoides*	44.3	*C. vulgaris*	46.6
Quercus sessilis	46.4	*B. vulgaris*	45.7	*B. vulgaris*	38.1	*B. vulgaris*	43.8	*B. vulgaris*	43.0
Vac. uliginosum	46.4	*F. alnus*	42.5	*C. betulus*	37.6	*V. uliginosum*	41.6	*C. betulus*	42.3
Carpinus betulus	45.2	*P. serotina*	40.7	*F. alnus*	37.2	*P. serotina*	39.2	*P. serotina*	39.2
Padus serotina	42.8	*V. uliginosum*	33.2	*P. serotina*	36.5	*V. myrtillus*	35.8	*F. alnus*	39.1
Frangula alnus	42.0	*C. vulgaris*	30.1	*V. myrtillus*	34.6	*F. alnus*	35.4	*V. uliginosum*	38.1
Vac. myrtillus	31.6	*V. myrtillus*	18.4	*V. uliginosum*	33.6	*C. betulus*	29.3	*V. myrtillus*	31.2
Pinus silvestris	3.7	*P. silvestris*	8.4	*P. silvestris*	5.1	*P. silvestris*	6.1	*P. silvestris*	6.1

The seasonal selectivity for twigs of trees, shrubs, and dwarf-shrubs is indicated by the number of plant species which reach the mean of twigs consumed exceeding 50 during individual seasons of year. And so in spring there were 8 such species, in summer — 9, while in autumn and winter — only 4.

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PITYMYS MC MURTRIE, 1831, FROM THE BESKID ŻYWIECKI AND THE SUDETES

PITYMYS MC MURTRIE, 1831, BESKIDU ŻYWIECKIEGO I SUDETÓW

Differences were shown in the length of the tail, the hind foot and in particular the diastema between individuals from an isolated population of *Pitymys tatricus* from the Beskid Żywiecki area and *Pitymys tatricus* from the Tatra Mts. The mountain populations (Sudetes, Beskid Zywiecki) of *Pitymys subterraneus* exhibit far-reaching similarity of characters and on this account can be considered as morphologically identical. It is only tail length and length of the hind foot which are slightly greater in individuals from mountain populations than in those from lowland areas.

The subspecies taxonomy of the genus *Pitymys* McMurtrie, 1831, has not been fully elaborated and the differences found in the number of subspecies estimated for Europe would not appear to have been completely explained. In view off the fact that only small numbers of representatives of this genus occur the number of studies giving more comprehensive treatment of taxonomic and morphological problem in Central Europe is small (Langenstein-Issel, 1950; Kratochvil, 1952, 1964; Altner, 1958; Niethammer, 1960; König, 1962). In Polish literature one of the outstanding studies in this field is that by Wasilewski (1960) analysing the Białowieża population of *Pitymys subterraneus* (de Sélys Longchamps, 1835). Kowalski (1960) examined a small number of European pine voles from several places in the Carpathian Mountains. There is, however, a lack of information on the morphological characters of mountain populations.

After obtaining a larger number of common european pine voles from the Sudetes, Żywiecki Beskid mountain areas and Tatra pine voles from Pilsko (Żywiecki Beskid area) it proved possible to give some supplementary information on their morphology.