THE IMPORTANCE OF THE LONG-EARED OWL ASIO OTUS OTUS (L.) IN RODENT CONTROL

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Key words: Long-eared owl, rodents, common vole, trophic spectrum, rodent control.

Abstract
The trophic spectrum of the long-eared owl was studied in two localities of Someshul Mic basin: Cluj-Napoca city and Cojocna village. 2131 pellets were collected: 1403 pellets from Cluj-Napoca Botanical Garden and 728 from Cojocna. 6161 micromammal and bird skulls and bones were separated: 4238 from the pellets collected in Cluj-Napoca and 1923 from those collected in Cojocna. The rodents percent was 84,52% in Cluj-Napoca and 99,12% Cojocna pellets. 4 insectivore species, 12 rodent species and 10 bird species were found in pellets. The most abundant and the dominant species is the common vole (Microtus arvalis) with 64,08% in Cluj-Napoca and with 79,43% in Cojocna. Among birds the most abundant are the house sparrow and the tree sparrow, which constitute almost 70% from all the birds.

INTRODUCTION

The long-eared owl (Asio otus otus L.) is a typical specialized myophagous species, it is one of the most important rodent predators. In our country the long-eared owl is a sedentary bird and one of the most wide spread bird of prey. In the winter period the long-eared owl density increases because of the migrating from the northern regions individuals. During this period the owls live in colonies of 20-40 individuals and inhabit different types of forest habitats.

The long-eared owl looks for food in open type habitats and go to hunt after the sunrise. The vision and hearing senses of this predator are very good, so it can locate a rodent under the half meter snow cover (Zubkov, 1981). The long-eared owl is a high specialized predator, it capture animals only of 15-20g weight (Goszczynski, 1977).

During the digestion process the owl regurgitate as pellets the undigerable rests of eaten animals (birds and micromammals). The study of the pellets can offer important data concerning the diet of this predator, the micromammal fauna in certain zone, the density of small mammals and their seasonal dynamics, the rodent spreading etc.

MATERIAL AND METHODS

Within the micromammal study accomplished in Someshul Mic basin in 1994-1996 pellets of Asio otus were collected in two zones: Cluj-Napoca city (Botanical Garden) and Cojocna village. The collected material was processed in laboratory; the animal species found in pellets were identified. Several ecological indexes were calculated, such as the relative abundance, the dominance. The importance of the long-eared owl was revealed.

RESULTS AND DISCUSSIONS
In both localities 2131 pellets were collected: 1403 pellets from Cluj-Napoca Botanical Garden and 728 from Cojocna. After pellets processing 6161 micromammal and bird skulls and bones were separated: 4238 from the pellets collected in Cluj-Napoca and 1923 from those collected in Cojocna.

After the quantitative and qualitative analysis of the pellet content we established that in those from Cluj-Napoca the birds, all Passeriformes representatives, constitute 9,01%, while the micromammals constitute 90,99% from all the identified in pellets animals. In Cojocna pellets the passerine birds constitute only 0,88%, while the small mammals – 99,07%. In both zones there were identified from pellets 399 passerine birds (6,48%) 274 insectivores (4,45%) and 5488 rodents (89,07%). The rodents recorded the highest abundance with 84,52% in Cluj-Napoca pellets and with 99,12% Cojocna pellets.

The species composition of the identified micromammals is different in the two studied zones (table 1). The rodents are represented by 12 species in Cluj-Napoca and by 9 species in Cojocna pellets. The species Sorex minutus (Insectivora), Clethrionomys glareolus, A. terrestris, Micromys minutus, R. norvegicus and M. avellanarius (Rodentia) in Cluj-Napoca and the species Pitymys subterraneus, C. glareolus, A. flavicollis, A. agrarius and M. minutus (Rodentia) in Cojocna have less than 1% in the pellets (table 1). The low abundance of the mentioned above species suggest the fact that they are hunted only occasionally by the long-eared owl.

In both areas the most abundant species in pellets is the common vole (Microtus arvalis), which constitute more than half of identified micromammals, with 64,08% in Cluj-
Napoca and with 79.43% in Cojocna, and more than half of all the identified animals with 58.31% in Cluj-Napoca and with 78.73% in Cojocna. It was also the dominant species with the dominant index of 0.685 from all the animals and of 0.753 from all the micromammals in Cluj-Napoca, and in Cojocna this index had the value of 0.909 from all the animals and 0.917 from all the micromammals. This fact indicates that the common vole had optimal development conditions, which lead to its excessive reproduction in both studied areas. After analyzing the relative abundance of the prey species it can be seen that in Cluj-Napoca M. arvalis belong to the ecological group of very abundant and constant species, while in Cojocna the common vole is a mass and euconstant species.

The long-eared owl prefers the common vole due to several factors. First of all the common vole inhabit the open type biotopes such as steppes, fields, meadows, cultivated lands and avoid the forest ecosystems. Thus, the spreading areas of this vole coincide with the hunting sectors of the long-eared owl. The common vole prefers the microhabitats with low herbaceous vegetation which expose the species to the predator attack. M. arvalis have a gregarious behavior and form colonies during the cold period of the year and the activity periods alternates with the resting periods during the day as well as in the night. We have also to mention the high prolificacy of this species that can reproduce in winter as well in our country. All these factors make the common vole an available and abundant prey.

The Microtus genus species are, in general, the preferred prey of many owls in different regions of Europe: in Italy (Aloise et Scaravelli, 1995), Poland (Cabon-Roczynska et Ruprech, 1977; Goszczynski, 1977), Scandinavian countries (Hanski et al., 1991; Korpimaki, 1987; 1988), Moldova (Zubkov, 1981) etc. The proportion of Microtus genus in the predator diet is varying accordingly to their density in the field (Goszczynski, 1977; Korpimaki et Norrdahl, 1989). The preference of the owls for the species Microtus arvalis in Romania is mentioned in the studies of several researchers, where this species recorded the highest percent in the owl trophic spectrum (Barbu, 1966; Barbu et Barbu, 1972; Barbu et Korodi, 1972; Cătuneanu et al., 1970; Hamar et Schnapp, 1971; Homei et Popescu, 1969; Kohl, 1980; Schnapp, 1971).

Apodemus sylvaticus is the second abundant species after the common vole in Cluj-Napoca pellets with 11.23%, and the third in Cojocna pellets with 4.51% from all the identified micromammals. Nevertheless, this species abundance is much lower comparing with the common vole abundance. The wood mice has more nocturnal activity and prefer the habitats at the forest edge, especially those limiting with fields and cultivated lands, being thus an easy prey for the long-eared owl.

Usually, the highest density of the forest rodents, especially of the Apodemus genus species, occurs in the same period with the field rodent density peak, especially of M. arvalis, which is the preferred prey. In such cases the percent of forest rodent in pellets decreases, although their number registers a considerable growth (Goszczinski, 1977). On the contrary, in the periods with low common vole density, the importance of the forest ones increases in the Asio otus diet.

Microtus agrestis is situated on the third place after its abundance in Cluj-Napoca pellets with 3.97% and in the second place in Cojocna pellets with 12.28%. This species is rather frequent in the avian predator pellets from the northern zones (Andersson et Erlinge, 1977; Hanski et al., 1991; Korpimaki, 1987; 1988; Korpimaki et Norr Dahl, 1989; Martinsson, et al., 1993), because it is a north and central European zoogeographic element and has a high density in the mentioned areas. In our country M. agrestis was found rather seldom in pellets and, in the most of the cases, in the north-western region of the country: in Crișana region.
with 0.8% (Barbu, 1966), near Cluj city with 1.4% (Barbu et Korodi, 1972), in Tisa Plain with 0.08% and in Transilvana with 0.29% (Cătuneanu et al., 1970), more rarely it was recorded in the south of Romania with 0.02% (Murariu et al., 1982) and in flooded Danube area with 1.04% (Homei et Popescu, 1969). The high number of this species in Cojocna pellets is due to the hilly and stony relief, as well as to the favorable humidity conditions in the zone.

*Mus musculus* was on the fourth place after its abundance in both zones with 3.89% in Cluj-Napoca pellets and with 1.57% in Cojocna pellets. It is more frequent in Cluj surroundings due to larger areas influenced by anthropogenic factors. In several areas this species had the highest abundance in pellets: in Romania Plain with 40.93% and in Dobrogea plateau with 34.07% (Cătuneanu et al., 1970), in south of Romania with 45.46% (Murariu et al., 1982), or it was among the most abundant species with 14.3% in Crishana region (Barbu, 1966), with 37.0% in Dobrogea region (Barbu et Popescu, 1965), with 7.17% in north – east of Bucharest (Murariu et al., 1991), with 26.4% at Valul-lui-Traian (Schnapp, 1971).

*Pitymys subterraneus* was found in both studied regions with 3.11% Cluj-Napoca and with only 0.47% in Cojocna pellets. This species was recorded in the long-eared owls diet in many regions, but it never had a high abundance (it is a forest species), usually between 0 and 5% (Barbu et Korodi, 1972; Cătuneanu et al., 1970; Homei et Popescu, 1969; Murariu et al., 1982; 1991).

*Apodemus agrarius* was registered with the abundance of 1.89% Cluj-Napoca and of 0.05% in Cojocna pellets. Although it is an open land species, it is more rarely hunted by the prey birds because of its much lower density comparing to the common vole, as well as due to its predilection to the microhabitats with high herbaceous vegetation. In other researchers studies this species had a low percent (Barbu, 1966; Barbu et Korodi, 1972; Barbu et Popescu, 1965; Cătuneanu et al., 1970; Homei et Popescu, 1969).

*A. flavicollis* had the relative abundance of 3.35% in Cluj-Napoca and of 0.79% in Cojocna pellets. It is a forest species; therefore it is seldom hunted by the long-eared owl. The forest species *Clethrionomys glareolus* also had a low percent in the long-eared owls diet with 0.18% in Cluj-Napoca and with 0.68% in Cojocna pellets. These species avoid the open land habitats, thus they represent rare trophic objects for the long-eared owl, but in the tawny owl (*Strix aluco*) diet, which is a forest nocturnal avian predator, these rodents are the most abundant (Jedrzejewski et al., 1996).

The low percent of *Micromys minutus, Rattus norvegicus, Arvicola terrestris, Muscardinus avellanarius* in the long-eared owl diet was mentioned by other researchers (Barbu, 1966; Barbu et Korodi, 1972; Barbu et Popescu, 1965; Cătuneanu et al., 1970; Homei et Popescu, 1969; Murariu et al., 1982; Schnapp, 1968).

Among other animals found in pellets were the insectivores represented by 4 species, all from the family *Soricidae*, only in Cluj-Napoca pellets. The lowest abundance was recorded in *Sorex minutus* – 0.39, which has the lowest density among this species. A rather high percent registered the species *S. araneus* with 2.26%, and *Crocidura leucodon* with 3.06%, which have the highest density among shrews. The insectivores represent an alternative prey type for the owl. It hunts shrews only when the abundance of common vole is low.

In Cluj-Napoca pellets the shrews constitute 6.47% from all the animals and 7.11% from all the micromammals. In other regions of the country the proportion of the shrews varied between 0 and 10% (Barbu, 1966; Barbu et Barbu, 1972; Barbu et Korodi, 1972; Barbu et Popescu, 1965; Cătuneanu et al., 1970; Homei et Popescu, 1969; Murariu et al., 1982; Murariu et al., 1991; Popescu et Barbu, 1979; Schnapp, 1971; Schnapp et Hellwing, 1968; Zubkov, 1981).
In the studied material the bird percent is of 9.01% in Cluj Napoca and of 0.93% in Cojocna pellets. The very low abundance of birds as well of the absence of the shrews in Cojocna pellets can be explained by the extremely high density of the common vole, which is the preferred food type of the long-eared owl. The proportion of the birds in this owl diet from Cluj-Napoca and Cojocna zones is close to that mentioned by other Romanian researchers, where the bird abundance in pellets varied between 0.1% and 15.4% (Barbu, 1966; Barbu et Barbu, 1972; Barbu et Korodi, 1972; Barbu et Popescu, 1965; Cătuneanu et al., 1970; Homei et Popescu, 1969; Murariu et al., 1982; Murariu et al., 1991; Popescu et Barbu, 1979; Schnapp, 1971; Schnapp et Hellwing, 1968; Zubkov, 1981).

10 bird species were identified from pellets, all of them belonging to Passeriformes order. In Cluj-Napoca were registered 10 species and in Cojocna pellets only 4 species (tab. 2).

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>CLUJ-NAPOCA</th>
<th>COJOCNA</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>1. Passer domesticus</td>
<td>177</td>
<td>46.34</td>
<td>8</td>
</tr>
<tr>
<td>2. P. montanus</td>
<td>83</td>
<td>21.73</td>
<td>-</td>
</tr>
<tr>
<td>3. Fringilla coelebs</td>
<td>36</td>
<td>9.42</td>
<td>6</td>
</tr>
<tr>
<td>4. Carduelis carduelis</td>
<td>24</td>
<td>6.28</td>
<td>-</td>
</tr>
<tr>
<td>5. C. chloris</td>
<td>22</td>
<td>5.76</td>
<td>2</td>
</tr>
<tr>
<td>6. C. cannabina</td>
<td>18</td>
<td>4.71</td>
<td>-</td>
</tr>
<tr>
<td>7. Pyrrhula pyrrhula</td>
<td>4</td>
<td>1.05</td>
<td>-</td>
</tr>
<tr>
<td>8. Emberiza citrinella</td>
<td>8</td>
<td>2.09</td>
<td>1</td>
</tr>
<tr>
<td>9. Parus major</td>
<td>6</td>
<td>1.57</td>
<td>-</td>
</tr>
<tr>
<td>10. Turdus pilaris</td>
<td>4</td>
<td>1.05</td>
<td>-</td>
</tr>
</tbody>
</table>

The most abundant in the pellets species in both zones is *Passer domesticus* with 46.34% in Cluj-Napoca and with 47.86% in Cojocna. In Cluj-Napoca pellets the house sparrow together with the tree sparrow represent almost 70% from all the birds. The high abundance of the sparrows can be explained by the high density in some types of ecosystems, especially in the anthropogenic ones. The dominance in the long-eared owl diet of sparrows and fringilline that have a high density in anthropogenic biotopes and produces many damages in gardens, orchards and cultivated lands, prove the role of this owl even in the case of bird consumption.

The presence of the long-eared owl in certain area is indispensably connected to the presence of the rodents, especially of the common vole. Even in the years when the common vole density is low, such specialized predator as the long-eared owl changes its diet only slightly, being capable to catch the voles from the solitary isolated colonies.

In the years of high common vole density the owls reduce a little the prey number. But when the vole density is low the decreasing of the rodent number by the long-eared owl can reach 50% from the entire rodent population and the contribution of this predator to the rodent mortality can achieve 75% of the population (Andersson et Erlinge, 1977; Goszczynski, 1977). Also, in the case of not excessively high density of the rodent population, the predatory birds can increase the periods between two successive demographic (Ryszkowski et al., 1973), thus disturbing the cyclic rhythm and the dynamics of rodent population.
CONCLUSIONS

The trophic spectrum of the long-eared owl is rather various and consists of 26 bird and mammal species. The common vole with 58.31% in Cluj-Napoca and with 78.73% in Cojocna pellets is the main trophic object in this owl diet. The wood mouse was on the second place in Cluj-Napoca with 11.23% and the field vole was on the second place in Cojocna with 12.28%. Among the birds the harvest and the tree sparrows are the most abundant and constitute almost 70% from all the birds. The high proportion of rodents, especially of the common vole, in the long-eared owl diet reveals its importance in rodent control in open land habitats.

BIBLIOGRAPHY