SYNECOLOGICAL STUDY REGARDING SEVERAL PROTECTED SPECIES OF MAMMALIANS IN ROMANIA

Debora BALINT, Mădălina BORCA

Banat`s University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania", Faculty of Agriculture, Timişoara, Romania
Calea Aradului 119, 300645 Timişoara, Romania,
E-mail: mada_iordache@yahoo.com

Abstract: The purpose of the study was to synecologically characterize the protected species of mammalians from Romania using several ecological indices: analytic indices (abundance, dominance, constancy) and synthetic indices (Dzuba index of ecological significance, Jaccard index of coenotic affinity). These indices were calculated in order to synecologically describe the relations existing between several protected species of mammalians in the Romanian counties. The achieved values allowed to establishing the ecological significance of protected species of mammalians within their specific habitats located in the Romanian counties.
.

*Key words***:** *protected species, mammalians, synecological analytic indices, synecological synthetic indices, Romania.*

INTRODUCTION

To reach the goal and objectives of the study, we used data regarding mammalian species protected in Romania by Law 462/2001 for the application of the Government's Emergency Ordinance 236/2000 regarding the regime of protected natural areas, conservation of natural habitats, of wild flora and fauna (Annex 3) [5].

We calculated analytical ecological indices (starting from raw data from the field or from sampling providing information on the structure of biocoenoses) and synthesis ecological indices (providing a general view of the interrelations between the species of a biocoenosis or allow the comparison of several biocoenoses based on these interrelations).

MATERIAL AND METHODS

To reach the goal and objectives of this study, we used biocoenotic synecological analysis that supposes the calculus of some analytic ecological indices (abundance, dominance, constancy) and synthetic indices (Dzuba index of ecological significance, Jaccard index of coenotic affinity) through quantitative biocoenoses research methods [DUMITRESCU, 2003; GOMOIU & SKOLKA, 2001; IORDACHE & BORZA, 2008]:

- *Abundance (A)* – the total number of a species individuals;

- *Dominance (D)* (the so-called relative abundance) – the ratio between the number of specimens of a species and the sum total of the number of specimens of other species in a studied area, calculated with the formula: $D_{sp.\ A}$ = (Number of individuals of species A / Total number of individuals) x 100.

Depending on the percentage, the studied species were grouped into the following dominance class: D_1 – subrecedent species (below 1.1%); D_2 – recedent species (1.1-2%); D_3 – subdominant species (2.1-5%); D_4 – dominant species (5.1-10%); D_5 – eudominant species (above 10.1%).

- *Constancy (Frequency) (C, K, F)* – an indicator showing the continuity of a species on a certain territory, calculated with the formula: $C_{sp.\ A}$ = (Number of samples of species A / Total number of samples) x 100.

Depending on the percentage, the studied species were grouped into the following Constance classes: C_1 – accidental species (present in 1-25% of the samples); C_2 – accessory species (present in 25.1-50%); C_3 – constant (present in 50.1-75%); C_4 – euconstant species (present in 75.1-100%).

- *Ecological significance index: Dzuba Index (W).* It reflects the relationship between structural (constancy, C) and productive (dominance, D) indices, showing the position of a species in a biocoenosis; it is calculated with the formula: $W = (C \times D)/100$, where C = constancy; D = dominance.

According to the values of this index, studied species were grouped into the following categories/classes [DUMITRESCU, 2003; GOMOIU & SKOLKA, 2001; IORDACHE & BORZA, 2008]: W_1 – for values < 0,1% (subrecedent species); W_2 – for values between 0.1-1% (recedent species); W_3 – for values between 1.1-5% (subdominant species); W_4 – for values between 5.1-10% (dominant species); W_5 – for values > 10% (eudominant species). The category W_1 includes accidental species. The categories W_2 and W_3 include accessory species. The categories W_4 and W_5 include characteristic species.

- *Coenotic affinity Index: Jaccard Index (q).* It estimates the affinity between species existing in a biocoenosis. Coenotic affinity can be between species in the same biota as well as between species belonging to different biota. It is calculated with the formula: $q_{A,B}$ = {number of samples containing the species A and B/[(number of samples containing the species A + number of samples containing the species B) - number of samples containing the species A and B]} x 100.

Depending on the values of this index, one can identify with accuracy the characteristic species that have the highest affinities.

Data regarding mammalian species protected in Romania are supplied for each county by the Biodiversity Compartment of the Ministry for Environment [4].

RESULTS AND DISCUSSION

The results of the calculus of ecological indices aimed at in reaching the objectives of this study are shown in Tables 1 and 2 below.

Table 1

Values of abundance, dominance, constany and Dzuba index of the protected species of mammalians

Nr. crt.	Species	Value of the index Abundance (A)	Value of the index Dominance (D)	Class of the index Dominance (D)	Value of the index Constancy (C)	Class of the index Constancy (C)	Value of Dzuba Index (W)	Class of the Dzuba Index (W)
1	*Ursus arctos* L. 1758 (brown bear)	9.220	0,56%	D_2 = recedent species	65%	C_3= constant species	0,36%	W_2= sub recedent species
2	*Canis lupus* L. 1758 (grey wolf)	5.580	0,34%	D_2= recedent species	67,5%	C_3= constant species	0,22%	W_2= recedent species
3	*Lynx lynx* L. 1758 (Eurasian lynx)	2.506	0,15%	D_2= recedent species	62,5%	C_3= constant species	0,09%	W_1= sub recedent species
4	*Felis silvestris* Schreber 1777 (wildcat)	8.603	0,52%	D_2= recedent species	87,5%	C_4= euconstant species	0,45%	W_2= recedent species
5	*Cervus elaphus* L. 1758 (red deer)	46.697	2,86%	D_3= subdominant species	95%	C_4= euconstant species	2,71%	W_3= subdominant species
6	*Capreolus capreolus*	202.396	12,42%	D_5= eudominant species	100%	C_4= euconstant species	12,42%	W_5= eudominant

	L. 1758 (European roe deer)						species
7	*Dama dama* L. 1758 (fallow deer)	6.507	0,39%	D_2= recedent species	65%	C_3= constant species	0,25%	W_2= recedent species
8	*Rupicapra rupicapra carpatica* L. 1758 (chamois)	7.693	0,47%	D_2= recedent species	47,5%	C_2= accessory species	0,22%	W_2= recedent species
9	*Sus scrofa* L. 1758 (wild boar)	96.246	5,90%	D_4= dominant species	100%	C_4= euconstant species	5,90%	W_4= dominant species
10	*Lepus europaeus* Pallas 1778 (European hare)	1.077.389	66,14%	D_5= eudominant species	100%	C_4= euconstant species	66,14%	W_5= eudominant species
11	*Marmota marmot* L. 1758 (Alpine marmot)	756	0,04%	D_1= subrecedent species	15%	C_1= accidental species	0,006%	W_1= sub recedent species
12	*Oryctolagus cuniculus* L. 1758 (European rabbit)	70	0,004%	D_1= subrecedent species	5%	C_1= accidental species	0,0002%	W_1= sub recedent species
13	*Meles meles* L. 1758 (European badger)	21.199	1,30%	D_2= recedent species	100%	C_4= euconstant species	1,30%	W_3= subdominant species
14	*Vulpes vulpes* L. 1758 (red fox)	65.307	4,00%	D_3= subdominant species	100%	C_4= euconstant species	4,00%	W_3= subdominant species
15	*Nyctereutes procyonoides* Gray 1834 (raccoon dog)	381	0,02%	D_1= subrecedent species	5%	C_1= accidental species	0,001%	W_1= sub recedent species
16	*Canis aureus* L. 1758 (golden jackal)	10.348	0,63%	D_2= recedent species	85%	C_4= euconstant species	0,53%	W_2= recedent species
17	*Martes martes* L. 1758 (European pine marten)	14.225	0,87%	D_2= recedent species	92,5%	C_4= euconstant species	0,80%	W_2= recedent species
18	*Martes foina* Erxleben 1777 (beech marten)	6.326	0,38%	D_2= recedent species	65%	C_3= constant species	0,24%	W_2= recedent species
19	*Mustela putorius* L. 1758 (European polecat)	21.762	1,33%	D_2= recedent species	100%	C_4= euconstant species	1,33%	W_3= subdominant species
20	*Mustela nivalis* L. 1766 (least weasel)	20.345	1,24%	D_2= recedent species	100%	C_4= euconstant species	1,24%	W_3= subdominant species
21	*Mustela ermine* L. 1758 (ermine)	5.347	0,32%	D_2= recedent species	42,5%	C_2= accessory species	0,13%	W_2= recedent species

Table 2

Coenotic affinity of protected mammalians species in Romania per species pairs according to the Jaccard coenotic affinity index (q)

Species	Ursus arctos	Canis lupus	Lynx lynx	Felis silvestris	Cervus elaphus	Capreolus capreolus	Dama dama	Rupicapra rupicapra carpatica	Sus scrofa	Lepus europaeus	Marmota marmota	Oryctolagus cuniculus	Meles meles	Vulpes vulpes	Nyctereutes procyonoides	Canis aureus	Martes martes	Martes foina	Mustela putorius	Mustela nivalis	Mustela ermine
Ursus arctos		96.29%	96.15%	74.28%	68.42%	65%	48.57%	73.07%	65%	65%	23.07%	7.69%	65%	65%	0%	57.89%	70.27%	79.31%	65%	65%	43.33%
Canis lupus			92.59%	77.14%	66.66%	67.5%	51.42%	70.37%	67.50%	67.5%	22.22%	7.40%	67.50%	67.50%	0%	56.41%	72.97%	70.66%	67.5%	67.5%	46.67%
Lynx lynx				71.42%	65.78%	71.05%	45.71%	76%	62.5%	71.05%	24%	8%	71.05%	71.05%	0%	55.20%	67.56%	70%	71.05%	71.05%	44.82%
Felis silvestris					87.15%	87.50%	60.52%	54.28%	82.92%	97.36%	17.14%	5.71%	87.50%	87.50%	5.71%	72.50%	84.61%	76.47%	87.50%	87.50%	48.57%
Cervus elaphus						95%	64.10%	50%	95%	95%	15.78%	5.26%	95%	95%	2.56%	80%	92.30%	68.42%	95%	95%	44.73%
Capreolus capreolus							65%	47.50%	100%	100%	15%	5%	100%	100%	5%	85%	92.5%	65%	100%	100%	42.50%
Dama dama								32.35%	65%	65%	6.66%	3.70%	65%	65%	3.70%	57.89%	65.78%	57.57%	65%	65%	34.37%
Rupicapra rupicapra carpatica									47.50%	47.50%	31.57%	10.52%	47.50%	47.50%	0%	39.47%	51.35%	55.17%	47.50%	47.50%	33.33%
Sus scrofa										100%	15%	5%	100%	100%	5%	85%	92.5%	65%	95.12%	95.12%	39.02%
Lepus europaeus											15%	5%	95.12%	95.12%	5%	100%	92.5%	65%	100%	100%	42.50%
Marmota marmota												14.28%	15%	15%	0%	14.28%	16.21%	18.51%	15%	15%	21.05%
Oryctolagus cuniculus													5%	5%	0%	5.88%	5.40%	7.69%	5%	5%	0%
Meles meles														95.12%	5%	85%	92.5%	65%	100%	100%	42.5%
Vulpes vulpes															5%	85%	92.5%	65%	100%	100%	42.5%
Nyctereutes procyonoides																5.88%	2.63%	4%	5%	5%	6.25%
Canis aureus																	77.5%	50%	85%	85%	27.5%
Martes martes																		70.27%	92.50%	92.50%	45.94%
Martes foina																			65%	65%	65.38%
Mustela putorius																				100%	42.50%
Mustela nivalis																					42.50%
Mustela ermine																					

CONCLUSIONS

The following conclusions have been established through this study:

- From the point of view of abundance, the best represented protected mammalian species in Romania are *Lepus europaeus* (European hare), *Capreolus capreolus* (European row deer), *Sus scrofa* (wild boar);

- The least represented protected mammalian species in Romania are *Marmota marmota* (Alpine marmot), *Oryctolagus cuniculus* (European rabbit), *Nyctereutes procyonoides* (raccoon dog):

- The most dominant (in number) are the species *Capreolus capreolus* (European row deer) and *Lepus europaeus* (European hare) that were grouped into the D_5 class of ecological dominance (as eudominant species), followed by *Sus scrofa* (wild boar), that was grouped into the D_4 class of ecological dominance (dominant species).

- The least dominant (in number) are the species *Marmota marmota* (Alpine marmot), *Oryctolagus cuniculus* (European rabbit) and *Nyctereutes procyonoides* (raccoon dog), that was grouped into the D_1 class of ecological dominance (sub recedent species).

- The most abundant species of protected mammalians in Romania (*Capreolus capreolus, Lepus europaeus, Sus scrofa*) are not the single constant ones on the analysed territories; there are also 8 species grouped into the C_4 class of Constance (euconstant species), though not always dominant: *Felis silvestris* (wildcat), *Cervus elaphus* (red deer), *Meles meles* (European badger), *Vulpes vulpes* (red fox), *Canis aureus* (golden jackal), *Martes martes* (European pine marten), *Mustela putorius* (European polecat), *Mustela nivalis* (least weasel).

- The species *Marmota marmota* (Alpine marmot), *Oryctolagus cuniculus* (European rabbit) and *Nyctereutes procyonoides* (raccoon dog) are accidental species (Constance class C_1).

- The most significant ecologically species according to the Dzuba Index are *Capreolus capreolus* (European row deer) and *Lepus europaeus* (European rabbit) (class W_5, eudominant species), followed by *Sus scrofa* (wild boar) (class W_4, dominant species).

- The species *Lynx lynx* (Eurasian lynx), *Marmota marmota* (Alpine marmot), *Oryctolagus cuniculus* (European rabbit) and *Nyctereutes procyonoides* (raccoon dog) are sub recedent species (class W_1) according to the Dzuba Index of ecological significance (W).

- There was 100% coenotic affinity between 17 pairs of species (*Capreolus capreolus-Sus scrofa, Capreolus capreolus-Lepus europaeus, Capreolus capreolus-Meles meles, Capreolus capreolus-Vulpes vulpes, Capreolus capreolus-Mustela putorius, Capreolus capreolus-Mustela nivalis, Sus scrofa-Lepus europaeus, Sus scrofa-Meles meles, Sus scrofa-Vulpes vulpes, Lepus europaeus-Canis aureus, Lepus europaeus-Mustela putorius, Lepus europaeus-Mustela nivalis, Meles meles-Mustela putorius, Meles meles-Mustela nivalis, Vulpes vulpes-Mustela putorius, Vulpes vulpes-Mustela nivalis, Mustela putorius-Mustela nivalus*), while the species *Nyctereutes procyonoides* is the only one with no coenotic affinity with other species.

BIBLIOGRAFY

1. DUMITRESCU, I., 2003 - Ecologie generală. Editura Universitas, Petroşani.
2. GOMOIU, T. M., SKOLKA, M., 2001 - Ecologie. Metodologii pentru studii ecologice, Universitatea „Ovidius", Constanţa.
3. IORDACHE, MĂDĂLINA, BORZA, I., 2008 - Ecologie şi protecţia mediului. Tematici aplicative. Editura Eurobit, Timişoara.
4. ***www.mmediu.ro.
5. ***Law 462/2001 for the application of the Government's Emergency Ordinance 236/2000 regarding the regime of protected natural areas, conservation of natural habitats, of wild flora and fauna (Annex 3).