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Distribution of gastropod character species in some vegetation succession lines of the Great Hungarian Plain

K. Bába

Abstract: The distribution of terrestrial gastropods was investigated in details in 16 plant communities from four major vegetation succession lines of the Great Hungarian Plain. Collections were made in 226 sampling sites via utilization of the classic quadrate method (10×25×25). The regional species constancy index was determined in relation to the plant communities, namely constant between 50–100%, subconstant between 30–50% and accessory below 30%. The number of constant and subconstant species was between 2 and 8 in the starting communities and 7–10 in the final or closing communities (except the degraded loess succession lines). Dominance values for the constant species in the starting communities were between 67–99 %. Meanwhile values of 60–81 % could have been determined in the final communities for the same species types. Consequently the constant and subconstant species types were the most frequently occurring species considering species richness in the plant communities under investigation.
Key words: *succession lines, constant and subconstant species, variance of their dominance values*

Introduction

The structure of gastropod assemblages in relation to plant communities is highly dependent on the following factors both locally and regionally: the number of constant, subconstant and accessory species and their dominance values.

Materials and method

Regional species constancy index and dominance values were determined for sampling sites in individual plant communities following collections via the classical quadrate method (10×25×25 cm) (Table 1.2.). The four vegetation succession lines under investigation were divided into two groups regarding humidity values: 1.organogenic series and mineralogenic series, 2. Sand series and loess series. The former ones are characterized by gradual decrease and thus drying while the latter ones by a gradual increase in humidity in the path leading to the development of the closing communities.

The following plant communities were investigated in details with the number of collection sites (N) marked after Soó (1964): Organogenic series: *Calamagrostio-Salicetum cinereae* (Soó et Zólyomi 1955) (N=4); *Salici pentandrae- Betuletum pubescensis* (Soó 1934, 1955) (N=1); *Fraxino pannonicae- Alnetum hungaricum* (Soó et Komlódi 1960) (N=23); Mineralogenic series: *Salicetum triandrae* (Malcuit 1929, Kárpáti I. 1970) (N=37), *Salicetum albae-fragilis tibiscense and danubialis* (Soó 1971) (N=16), *Fraxino panonicae-Ulmetum* (Soó 1960) (N=71), *Querco robori- Carpinetum hungaricum* (Soó 1940, 1967) (N=16). Succession lines experiencing increasing humidity with forestation: Sand series: *Brometum tectorum* (Soó 1925, 1939) (N=3); *Festucetum vaginatae danubiale* (Soó 1929) (N=6); *Junipero populetum albae* (Zólyomi

Table 1. The distribution of constant and subconstant species in the organogenic and mineralogenic series with the number of accessorial elements indicated. The following habitat types are marked for these species: HF, B, RU, St

ORGANOGENIC SERIE				MINERALOGENIC SERIES				HT		K%	D%
HT	**1. Calamagrosi-Salicetum**	**K%**	**D%**	**HT**	**4. Salicetum triandrae**	**K%**	**D%**	B	Cochlicopa lubrica (O.F.Müller 1774)	30,9	2,73
RU	Succinea oblonga Draparnaud 1801	75	23,7	RU	Perforatella rubiginosa (A. Schmidt 1853)	86,5	21,1	B	Vitrina pellucida (O.F.Müller 1774)	29,5	3,12
RU	Zonitoides nitidus (O.F.Müller 1774)	75	10,9	RU	Zonitoides nitidus (O.F.Müller 1774)	75,6	16,0	B	Nesovitrea hammonis (Störm 1795)	29,5	2,19
RU	Carichium minimum O.F.Müller 1774	75	15,3	RU	Succinea oblonga Draparnaud 1801	70,2	19,9	Σ	**C+SC+D%**	**5+5**	**44,03**
B	Cepaea vindobonensis (Ferrusac 1821)	55	6,5	B	Cochlicopa lubrica (O.F.Müller 1774)	39,7	8,6	Σ	**accessorial**	**47**	
St	Vallonia costata (O.F.Müller 1774)	50	4,3	St	Vallonia pulchella (O.F.Müller 1774)	37,8	11,9				
St	Monacha carthusiana (O.F.Müller 1774)	50	3,29	RU	Olyloma elegans (Risso 1826)	35,1	3,65		**7. Querco robori-Carpinetum**		
Σ	**C+SC+D%**	**3+3**	**67,99**	RU	Deroceras agreste/reticulatum	34,0	2,75	B	Aegopinella minor (Stabile 1864)	62,5	30,0
Σ	**accessorial**	**12**		RU	Succinea putris (Linné 1758	32,4	9,89	HF	Perforatella vicina (Rossmässler 1842)	43,7	8,42
				Σ	**C+SC+D%**	**3+5**	**93,79**	HF	Brandybaena fruticum (O.F.Müller 1774)	43,7	7,89
	2. Salici-Betuletum			Σ	**accessorial**	**13**		B	Helix pomatia Linné 1758	37,5	3,68
RU	Zonitoides nitidus (O.F.Müller 1774)	80	22,6					HF	Perforatella incarnata (O.F.Müller 1774)	31,3	4,73
HF	Vitrea crystallina (O.F.Müller 1774)	70	22,4		**5. Salicetum albae-fragilis**			HF	Arion subfuscus (Draparnaud 1805)	31,3	3,42
RU	Perforatella rubiginosa (A. Schmidt 1853)	60	21,4	RU	Perforatella rubiginosa (A. Schmidt 1853)	94,1	15,2	B	Nesovitrea hammonis (Störm 1795)	31,3	2,63
B	Cochlicopa lubrica (O.F.Müller 1774)	50	11,9	RU	Zonitoides nitidus (O.F.Müller 1774)	82,3	9,8	Σ	**C+SC+D%**	**3+4**	**60,77**
RU	Carichium tridentatum (Risso 1826)	50	7,1	RU	Succinea oblonga Draparnaud 1801	72,5	4,7	Σ	**accessorial**	**23**	
RU	Succinea oblonga Draparnaud 1801	40	7,1	RU	Succinea putris (Linné 1758)	52,9	4,7				
Σ	**C+SC+D%**	**3+3**	**92,5**	B	Cochlicopa lubrica (O.F.Müller 1774)	47,1	9,45				
Σ	**accessorial**	**4**		St	Vallonia pulchella (O.F.Müller 1774)	41,2	5,06				
				HF	Vitrea crystallina (O.F.Müller 1774)	35,2	16,36				
	3. Fraxino-Alnetum			HF	Bradybaena fruticum (O.F.Müller 1774)	35,2	5,49				
B	Cepaea vindobonensis (Ferrusac 1821)	95,6	7,3	RU	Deroceras agreste/reticulatum	35,2	0,68				
RU	Succinea oblonga Draparnaud 1801	86,9	23,5	Σ	**K+SK+D%**	**4+5**	**71,4**				
HF	Bradybaena fruticum (O.F.Müller 1774)	78,3	16,3	Σ	**accessorial**	**25**					
St	Vallonia pulchella (O.F.Müller 1774)	60,0	11,6								
B	Cochlicopa lubrica (O.F.Müller 1774)	43,5	1,9		**6. Fraxino-Ulmetum**						
St	Vallonia costata (O.F.Müller 1774)	39,1	4,9	HF	Bradybaena fruticum (O.F.Müller 1774)	54,02	6,5				
B	Nesovitrea hammonis (Störm 1795)	34,8	9,9	B	Cepaea vindobonensis (Ferrusac 1821)	50,7	1,58				
RU	Carychium minimum O.F.Müller 1774	34,8	4,7	HF	Perforatella vicina (Rossmässler 1842)	47,88	12,7				
St	Monacha carthusiana (O.F.Müller 1774)	30,4	1,0	RU	Succinea oblonga Draparnaud 1801	47,07	4,47				
B	Euconulus fulvus (O.F.Müller 1774)	30,4	0,6	B	Aegopinella minor (Stabile 1864)	43,66	8,45				
Σ	**C+SC+D%**	**4+6**	**81,7**	B	Helix pomatia Linné 1758	32,8	1,49				
Σ	**accessorial**	**17**		HF	Arion subfucus (Draparnaud 1805)	33,8	0,8				

Table 2. The distribution of dominant constant species within the sand and loess series along with the number of accessorial elements. The following habitat types are marked for these species: HF, B, RU, St

	SAND SERIE			**HT**	**4. Convallario-Quercetum**	**K%**	**D%**				
HT	**1. Brometum tectorum**	**K%**	**D%**	B	Vitrina pellucida (O.F.Müller 1774)	87	22,52	**HT**		**K%**	**D%**
St	Helicopsis striata (O.F.Müller 1774)	100	36,11	B	Euconulus fulvus (O.F.Müller 1774)	66	5,38		**7. Amygdaletum nanae**		
B	Cepaea vindobonensis (Ferrusac 1821)	100	31,9	B	Cepaea vindobonensis (Ferrusac 1821)	60	1,71	St	Vallonia costata (O.F.Müller 1774)	100	40,42
B	Helix pomatia Linné 1758	66	5,55	St	Vallonia costata (O.F.Müller 1774)	53	26,07	St	Vallonia pulchella (O.F.Müller 1774)	70	24,46
Σ	C+SC+D%	2+1	73,56	St	Cochlicopa lubricella (Porro 1838)	40	3,05	St	Granaria frumentum (Draparnaud 1801)	50	27,65
Σ	accessorial	2		St	Truncatellina cylindrica (Ferrusac 1807)	40	1,95	B	Vitrina pellucida (O.F.Müller 1774)	30	3,19
				B	Aegopinella minor (Stabile 1864)	33	5,5	**Σ**	**C+SC+D%**	**3+1**	**95,72**
	2. Festucetum vaginatae			RU	Deroceras agreste (Linné 1758)	33	1,22	**Σ**	**accessorial**	**6**	
St	Helicopsis striata (O.F.Müller 1774)	100	40,52	B	Euoruphalia strigella (Draparnaud 1801)	33	0,73				
B	Cepaea vindobonensis (Ferrusac 1821)	100	8,42	**Σ**	**C+SC+D%**	**4+5**	**68,13**		**8. Aceri tatarico-Quercetum**		
St	Pupilla muscorum (Linné 1758)	83	8,42	**Σ**	**accessorial**	**20**		B	Aegopinella minor (Stabile 1864)	56,25	46,27
B	Chondrula tridens (O.F.Müller 1774)	66	15,78					**Σ**	**C+D%**	**1**	**46,27**
B	Vitrina pellucida (O.F.Müller 1774)	33	1,77		**LOESS SERIE**			**Σ**	**accessorial**	**12**	
Σ	**C+SC+D%**	**4+1**	**74,91**		**5. Agropyro-Kochietum**						
Σ	**accessorial**	**5**		St	Helicella obvia (Mercke 1828)	100	74,07				
				St	Granaria frumentum (Draparnaud 1801)	100	25,18				
	3. Junipero-Populetum			**Σ**	**C+ D%**	**2**	**99,95**				
St	Truncatellina cylindrica (Ferrusac 1807)	93	18,93	**Σ**	**accessorial**	**2**					
St	Vallonia costata (O.F.Müller 1774)	87	42,18								
B	Vitrina pellucida (O.F.Müller 1774)	87	14,18		6. Salvio-Festucetum rupicolae						
St	Granaria frumentum (Draparnaud 1801)	75	14,82	St	Cochlicopa lubricella (Porro 1838)	50	10,6				
B	Cepaea vindobonensis (Ferrusac 1821)	56	3,56	St	Vallonia pulchella (O.F.Müller 1774)	50	28,79				
St	Cochlicopa lubricella (Porro 1838)	56	2,11	St	Granaria frumentum (Draparnaud 1801)	40	8,24				
St	Pupilla muscorum (Linné 1758)	44	1,0	B	Chondrula tridens (O.F.Müller 1774)	38	7,59				
St	Helicopsis striata (O.F.Müller 1774)	44	0,65	St	Vallonia costata (O.F.Müller 1774)	35	18,19				
B	Euconulus fulvus (O.F.Müller 1774)	37	1,25	**Σ**	**C+SC+D%**	**2+3**	**73,41**				
B	Chondrula tridens (O.F.Müller 1774)	31	0,85	**Σ**	**accessorial**	**12**					
Σ	**C+SC+D%**	**6+4**	**98,53**								
Σ	**accessorial**	**7**									

1950, SZODFRIEDT 1969) (N=16); *Convallario–Quercetum roboris* DANUBEALE (SOÓ 1934, 1957) (N=16); Loess series: *Agropyro–Kochietum prostratae* (Zólyomi 1959, SOÓ 1962) (N=1); Salvio-*Festucetum rupicolae* (Zólyomi 1957, SOÓ 1962) (N=6), *Amygdaletum nanae* (SOÓ 1927, TALLÓS 1960) (N=2); *Aceri tatrico-Quercetum submatricum* (ZÓLYOMI–FEKETE 1957, SOÓ 1962) (N=8). 226 sampling sites have been assigned to the 16 plant communities.

The character species types for the individual communities -Constant (C), Subconstant (SC) Acessorial (A)- are listed in Table 1–2. with reference to their percentage values of constancy and dominance as well as the number of the species. The main plant community types have also been marked. The following habitat type distributions has been set up for the character and accessorial species based on works of Ložek (1964): HF hygrophilous forest dweller, B bush forest dweller, RU riparian ubiquist, St steppe dweller (Fig.1–2.).

Results

From the two succession lines experiencing gradual humidity decrease during their development towards the final stage in the organogenic series starting off with still water conditions (Table 1.) a gradual increase for the constant and subconstant species could be noticed in the final stage of suc-

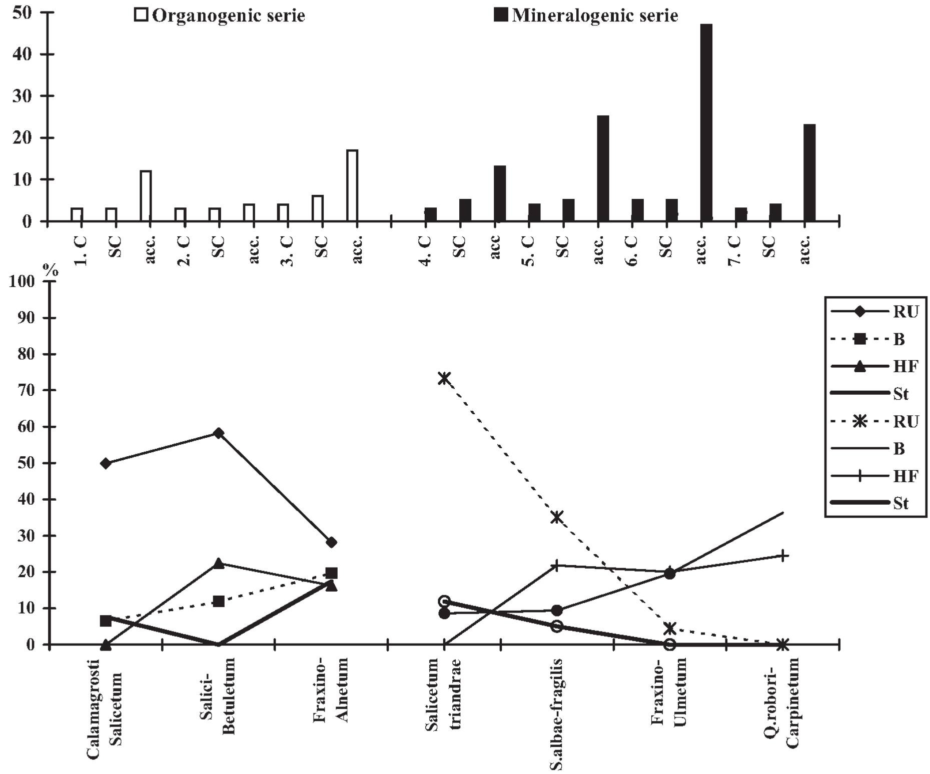

Fig.1. The distribution of character species and habitat types for the organogenic and mineralogenic series.

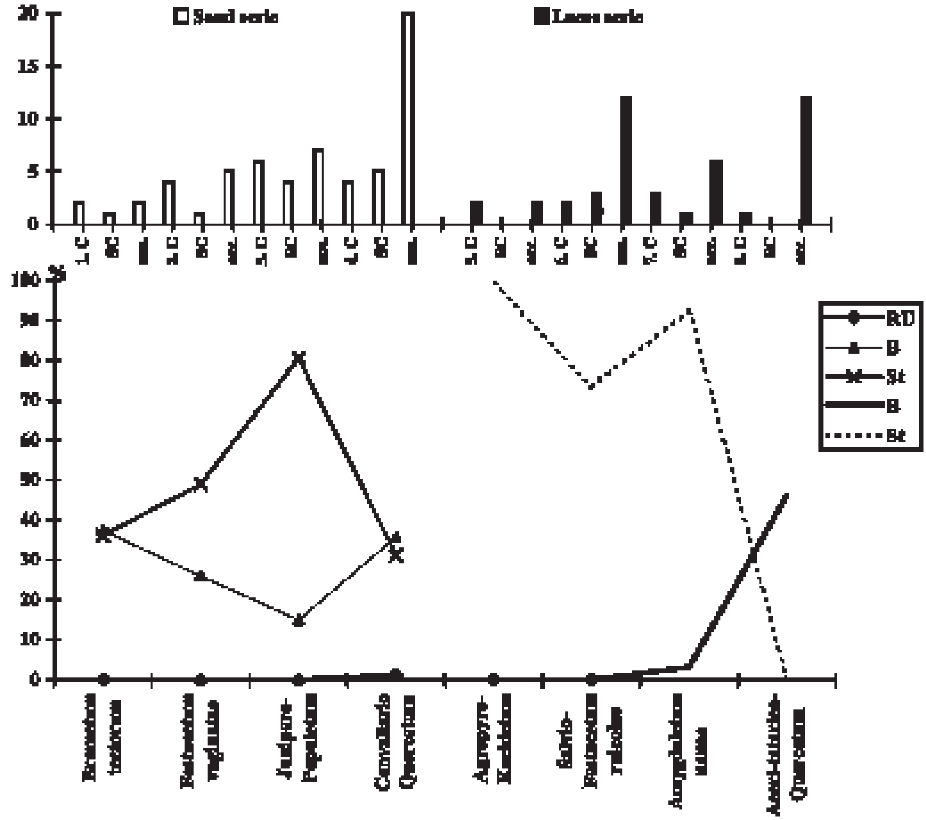

Fig.2. The distribution of character species and habitat types for the sand and loess series.

cession development following the first two associations. There is a parallel increase for the accessorial species in the final developmental stage as well. In the second and third succesional stage dominance for the constant and subconstant species tend to reach higher values referring to a decrease in the area of water-coverage and humid habitats. This trend is clearly observable on the distribution of habitat types with a steady decrease of RU in the final stage accompanied by an increase in bush forest dwellers (B). In the *Salici-Betuletum* association there is a higher number of hygrophilous forest dweller species partly thanks to the regular human forest treating activities. On the other hand the higher ground water levels and draining of the *Alnetum* areas might have had a positive role in the increase of HF species on the previously mentioned area (Bába 1973) (Fig.1).

In the mineralogenic series the number of constant and subconstant species is higher in the first three stages compared to the previous organogenic series. The number of accessorial species is higher as well in this series. Only in the final stage could one experience a decrease in these values (*Querco r.–Carpinetum*) (Table 1.). Dominance values are similar to the ones of the previous organogenic series. In the first two stages the dominance values are high for the constant and subconstant species. There is a decrease in the third stage followed by an increase in the final stage due to increasing aridity. Forests belonging to the mineralogenic series are mainly situated on the flood plain. Only the *Querco r.–Carpinetum* forests are protected within this flood plain area. This succession line experiences occasional flooding greatly varying in time and strength as well as a fluvial faunatransport of the tributing rivers (Bába, K. 1970, 1982). These factors may greatly modify the number and distribution of character species in the area. The species *Chilostoma banaticum* and *Vitrea crystallina* may become constant-dominant in some places in certain forests of the Upper–Tisza area and the *Fraxino-Ulmetum* complexes of the Körös and Maros rivers. Similar tendencies could be observed for the species of *Hygromia kovácsi* in the forests on the banks of the river Körös (Bába, K. 2000). Regarding habitat types the sharp decrease of Riparian ubiquist (RU) accompanied with a moderate increase in the bush forest dweller (B)- hygrophilous forest dweller (HF) complementer refer to gradual increase in aridity (Fig.1).

The picture is totally different for the Sand (Bába, K. 1977) and Loess succession series (Bába 2000 b) occupying the more arid regions of the Great Hungarian Plains and displaying an increase of humidity in the final stage of succession development. The numbers of constant, subconstant and accessorial species show an increase for the individual associations in the sand series (Table 2., Fig.2). In the final developmental stage a sharp increase could be observed for the accessorial species. In the sand series occupying mainly dry areas under the influence of more arid climate conditions higher values could be observed for the steppe dweller species as a consequence for the first three communities. The only exception is the *Convallario-Quercetum* coenosis where the number of steppe dweller species decreases heavily with a complementary increase of the bush forest dweller species. The appearance of Riparian ubiquists (RU) in this latter community refers to a development of more humid conditions in these successions.

A far more different trend could be observed in the various stages of the loess succession series. All the communities of *Salvio-Festucetum, Amygdaletum and Aceri tatarico-Quercetum* are under strong human influence except for the first one not mentioned here. The meadows and forests, which had developed on the loessy soils, have been utilized for agricultural production since the 19th century. We managed to collect only from a couple of sites, where the original natural conditions had been preserved. On these places the number of character species increased in the first three stages of the succession line development. In the initial *Agropyro-Kochietum* stage the number of accessorial elements was low as expected. Their increase tends to slow down in the second and third stages. In the oak forests developed on the loess the decrease of the constant and accessorial elements is extremely strong. (Table 2.) (Fig.2). The dominance values of character and acessorial species are extremely low for this latter association.

When we take the different species types into consideration the following conclusions may be drawn: in the first two stages of development the number of the constant species for the organogenic series is 1–1, while for the mineralogic series this value is 3–3. The number of constant species in the final stage is 3–3 for both associations and a more intensive exchange of subconstant species could be observed. In the sand series 2–2 species remain constant throughout the first two stages. In the loess series the species *Granaria* and *Vallonia pulchella* appear as constant and subconstant in the first three stages (Table 1–2).

Summary

The distribution of terrestrial gastropods was investigated in details in 16 plant communities from four major vegetation succession lines of the Great Hungarian Plain. Collections were made in 226 sampling sites via utilization of the classic quadrate method. The ratio of constant and subconstant species along with their dominances and the number of accessorial ele-

ments were analyzed. The four major succession lines or series could be divided into two series experiencing developing aridity and two other series representing developing humidity during its developmental stages such as organogenic, mineralogenic, sand and loess series. The dominance values for the constant and subconstant species are the highest (67–99%) in the first two developmental stages for all the major succession series. The same values are between 60–81% in the final stages except for the degraded oak forests. Considering the dominances of the accesorial elements they have a subordinate role in the populations of the succession lines showing increasing tendency only towards and in the final stages. In the first two stages the number of shared constant species is between 1–3. There is a greater exchange of subconstant species in the succession series. Within the mineralogenic series faunal exchange may affect 3–4 constant species as well as a result of the fluviotransport of the nearby rivers.

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BÁBA, Károly
SZEGED
Vár u.6.
H–6720