Analysis of synanthropic flora in the “Ayazmoto” landscape forest park (Stara Zagora, Bulgaria)

Sylvia Radanova

Tracian University - Stara Zagora, Faculty of Agriculture, Department of Biology and Aquacultures

E-mail: syl_rad@yahoo.com

Summary:

Nowadays there is no area practically unaffected by human activity. Synanthropization of flora occurs in utmost degree around major administrative centers with well developed industry and transport. The present study aims to analyze the strongly anthropogenized flora of cultigenic ecosystem – the “Ayazmoto” forest park near Stara Zagora, South Bulgaria. The investigation covers 2009 - 2012 time span. Standard floristic methods are used. 326 synanthropic species, distributed in 234 genera and 66 families are found on the territory of the forest park. Analysis comprises systematic structure, biomorforms, biological type (Raunkier), and phytogeographic belonging of aboriginal and adventive fraction.

Key words: higher flora - aboriginal and adventive fraction, cultigenic eco system, synanthropization,

Introduction:

Stara Zagora is the sixth largest town in Bulgaria with well developed industry. The local population uses various forms of livelihood, and in the area around the city agriculture and livestock are basically developed. The landscape around Stara Zagora has changed many times - from complete destruction of the vegetation cover and creating of cultural phytocenoses in the place of the natural vegetation to introduction of new species and increasing of phyto-variety (anthropogenic advention). These processes persist within the territory of the “Ayazmoto” forest park. Situated on the border between strongly anthropogenized urban landscape and the relatively natural environment of the Sarnena Sredna Gora Mountain, the forest park is a kind of border zone (ecoton) between two different types of flora (urbanized flora and natural flora). The lack of in-depth explorations regarding synanthropization degree of the flora in the region made this research quite necessary.

Objects and methods:

“Mitropolit Metodi Kusev” Forest Park is situated in the Northern part of the green shelter belt of Stara Zagora (see Map 1).

It takes an area of 1000 ha and includes several hills, parts of the Sarnena Sredna Gora Mountain. Two better-known of them - Ayazmoto and Kazlera are included in the constant

core of the forest park The altitude varies between 270-550 м. Soils are predominantly maroon - leached, less humus-carbonate. The climate is temperate continental with Mediterranean influence.

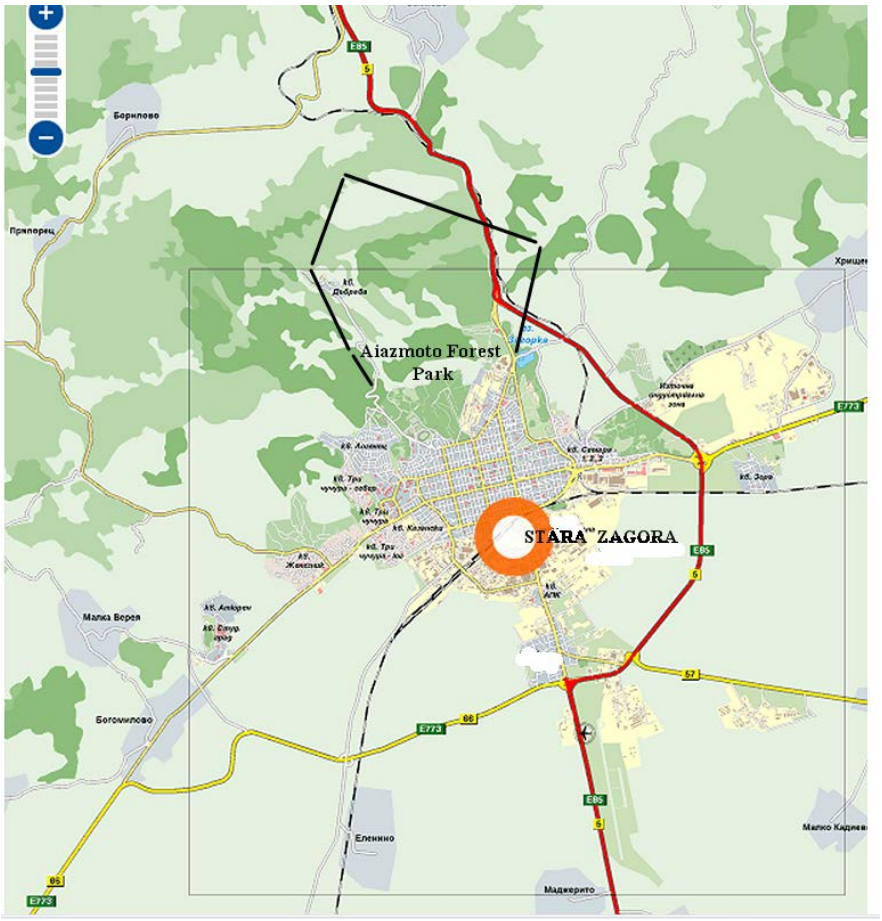
The examination covers the 2009- 2012 time span. To establish the species diversity routing method is used. The works of Yordanov (ed.) (1963-1989) and Kozhuharov (ed.) (1992) are used as a taxonomic basis for determining of species. Life forms are according to Raunkiaer (1934). The Conspectus of Asyov & al. (2002) is taken to determine phytogeographic belonging of taxa. Synanthropic belonging of species is based on the works of Pyšek & al. (2002); Baccheta & al. (2009).

Results and discussion:

326 synanthropic species, distributed in 234 families and 66 genera are established on the territory of the forest park as a result of the study. Synanthropic flora is made up mostly of angiosperms (96.9%), mainly Dicotyledons (89.4%), the presence of gymnosperms is weak (3.03%) (Table1). The group of Monocotyledons is significantly underrepresented (7.6%), due to the lack of suitable habitats.

A 

B 



C

Map1. Location of Stara Zagora town (A, B) and “Ajazmoto” forest park (C).

Taxon	**Number of families (%)**		**Number of genera (%)**		**Number of species (%)**	
Pinophyta	2	3, 03	5	2,14	8	2,4
Magnoliophyta:	64	96,9	229	97,9	318	97,5
Magnoliopsida	59	89,4	199	85,0	280	85,9
Liliopsida	5	7,6	30	12,8	38	11,6
Total:	**66**	**100**	**234**	**100**	**326**	**100**

Table. 1. Major groups of synanthropic plants

The relationship among the synanthropic flora fractions is shown in Figure 1. The share of local synanthropic species is relatively low (24.2%) at the expense of adventive elements (75.8%) - a fact fully explained taking into account the anthropogenic origin of the ecosystem.

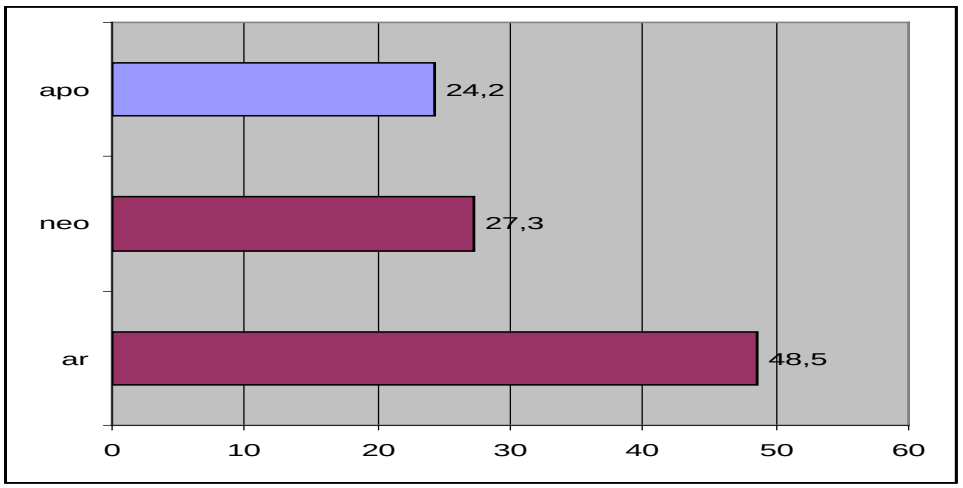


Fig.1 The relationship among the synanthropic flora fractions (%)

Rich of apophytic genera are Asteraceae family (15%), Poaceae family (15%), Rosaceae family (11.6%), Fabaceae family (10%), Lamiaceae family (8.3%), and Apiaceae family (5%) (Fig. 2). The presence of the Rosaceae family among the leading four families is due to the richness of stable perennial ligneous and frutescent types with various methods of reproduction.

The adventive genera are concentrated in the Fabaceae family (20.5%), the Asteraceae family (18.8 %), the Poaceae family (12.4%), the Brassicaceae family (11.8 %), and the Rosaceae family (10.6%). The reason for the presence of the Brassicaceae family in the top four families is in annual species domination in the family – by morphology and reproduction, adapted to the short life cycle.

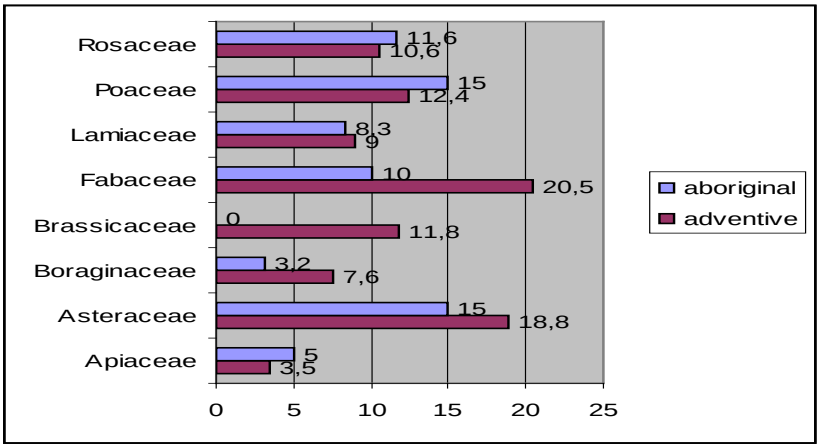


Fig2. Generic distribution of the synanthropic flora (%)

With respect to the species variety the leading families in the aboriginal flora are the Poaceae family (16%), the Asteraceae family (12.3%), and the Rosaceae family (8.6%) (Fig.3). The adventive species are best represented in the Fabaceae family (29%), the Asteraceae family (16.3%), and the Poaceae family (16%).

Smaller families predominate (1-2 genera, 1-2 species), which make up 23% of apophytic and 73% of adventive fraction correspondingly – a fact due to the varied abiotic conditions, a reason for saturation of the habitats.

Analysing Table 2 it is noteworthy that the leading in systematic terms families are represented by aboriginal and adventive species, that evolved from ancient times to the present day, unlike the small families in which emergence and development fit in one or two resident periods (Pysek & al, 2002).

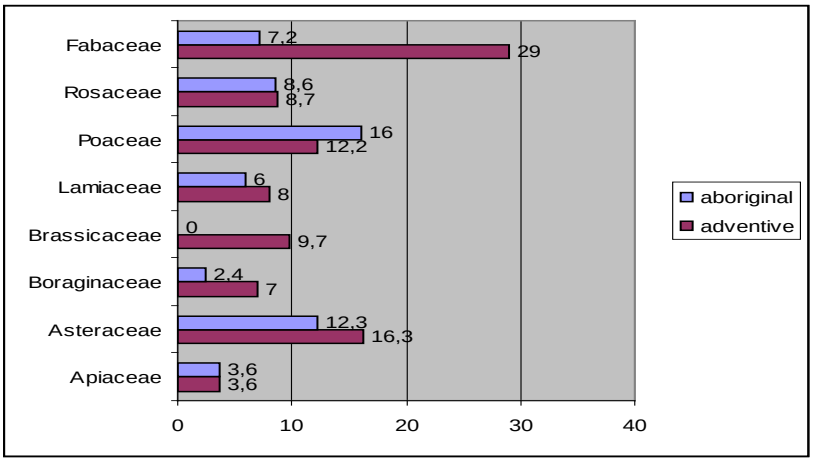


Fig.3 Species distribution of the synanthropic flora (%)

Table2. Distribution of synanthrops by families (leading in genera and species families are marked in red)

Family	**Resident status**											
	apophytes				**archeophytes**				**neophytes**			
	genera	**%**	**species**	**%**	**genera**	**%**	**species**	**%**	**genera**	**%**	**species**	**%**
Cupressaceae					2	1,4	6	3,6	2	2,4	2	2,04
PInaceae					2	1,4	3	1,8	2	2,4	2	2,04
Aceraceae					1	0,7	2	1,2	1	1,2	2	2,04
Anacardiaceae									1	1,2	1	1,02
Apiaceae	3	5,0	3	3,6	5	3,5	6	3,6				
Apocynaceae					1	0,7	2	1,2				
Araceae					1	0,7	1	0,6				
Araliaceae	1	1,6	1	1,2								
Aristolochiaceae	1	1,6	1	1,2								
Asteraceae	9	15,0	10	12,3	14	10,4	15	9,2	7	8,4	7	7,14
Berberidaceae									2	2,4	3	3,06
Betulaceae					1	0,7	1	0,6	1	1,2	1	1,02
Bignoniaceae									1	1,2	1	1,02
Boraginaceae	2	3,2	2	2,4	7	5,2	8	5,0	2	2,4	2	2,04
Brassicaceae					11	8,2	11	6,7	3	3,6	3	3,06
Buxaceae					1	0,7	1	0,6				
Cannabaceae					1	0,7	1	0,6				
Campanulaceae					1	0,7	2	1,2				
Caprifoliaceae	1	1,6	1	1,2	2	1,4	2	1,2				
Caryophyllaceae					2	1,4	3	1,8	2	2,4	2	2,04
Celastraceae	1	1,6	1	1,2					1	1,2	1	1,02
Chenopodiaceae					1	0,7	1	0,6				

Cistaceae					1	0,7	1	0,6				
Convolvulaceae					1	0,7	1	0,6				
Cornaceae					1	0,7	1	0,6				
Crassulaceae									1	1,2	1	1,02
Cyperaceae	1	1,6	2	2,4								
Dioscoreaceae	1	1,6	1	1,2								
Dipsacaceae	2	3,2	2	2,4								
Eleagnaceae									1	1,2	1	1,02
Euphorbiaceae					2	1,4	4	2,4	1	1,2	2	2,04
Fabaceae	6	10,0	6	7,2	8	6,0	14	8,6	12	14,5	20	20,4
Fagaceae					2	1,4	5	3,0				
Geraniaceae					2	1,4	2	1,2	2	2,4	4	4,08
Hippocastanaceae									1	1,2	1	1,02
Hypericaceae	1	1,6	1	1,2								
Juglandaceae					1	0,7	1	0,6	1	1,2	1	1,02
Lamiaceae	5	8,3	5	6,0	4	2,8	5	3,0	5	6,2	5	5,01
Liliaceae	2	3,2	2	2,4	4	2,8	4	2,4	2	2,4	2	2,04
Linaceae					1	0,7	1	0,6				
Malvaceae					1	0,7	1	0,6	1	1,2	1	1,02
Moraceae					2	1,4	3	1,8	2	2,4	2	2,04
Oleaceae					4	2,8	4	2,4	1	1,2	1	1,02
Onagraceae	1	1,6	1	1,2								
Orobanchaceae					1	0,7	1	0,6				
Oxalidaceae					1	0,7	1	0,6				
Papaveraceae					4	2,8	4	2,4	1	1,2	1	1,02
Plantaginaceae	1	1,6	2	2,4	1	0,7	1	0,6				
Poaceae	9	15,0	13	16,0	4	2,8	5	3,0	8	9,6	9	9,2
Polygonaceae					3	2,1	4	2,4	1	1,2	2	2,04
Portulacaceae					1	0,7	1	0,6				
Primulaceae					1	0,7	1	0,6	1	1,2	1	1,02
Ranunculaceae	2	3,2	3	3,6	3	2,1	5	3,0	4	4,8	4	4,08
Resedaceae									1	1,2	1	1,02
Rhamnaceae									1	1,2	1	1,02
Rosaceae	7	11,6	7	8,6	11	8,2	11	6,7	2	2,4	2	2,04
Rubiaceae	1	1,6	1	1,2	3	2,1	3	1,8	1	1,2	1	1,02
Salicaceae	1	1,6	1	1,2	2	1,4	2	1,2				
Scrophulariaceae	2	3,2	4	4,8	3	2,1	3	1,8	4	4,8	4	4,08
Simarubaceae									1	1,2	1	1,02
Solanaceae					2	1,4	2	1,2	3	3,6	3	3,06
Tiliaceae					1	0,7	2	1,2	1	1,2	1	1,02
Ulmaceae					1	0,7	1	0,6				
Urticaceae					2	1,4	2	1,2	1	1,2	1	1,02
Verbenaceae					1	0,7	1	0,6				
Violaceae					1	0,7	3	1,8				
Vitaceae					1	0,7	1	0,6				

The constant anthropogenic influence leaves an imprint on the distribution of biomorphotypes. It is perennial species (14.4%) that predominate in the aboriginal fraction, while annual species (24.2%) prevail in the adventive fraction. Wide distribution of annual plants is typical of urban floras and is associated with their high potential to naturalization through intensive reproduction by seeds and development in suitable ecotones. As far as alien

species are concerned, the groups of perennials (23.3%) and ligneous (15%) are well represented - the latter are connected with active anthropogenic induction (Fig.4).

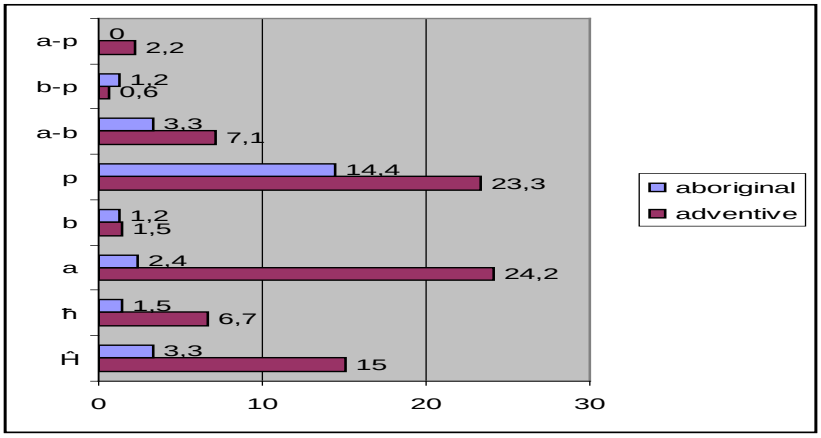


Fig.4. Distribution of synanthropic forms by life forms (%).

The specific character of abiotic environmental conditions is reflected in distribution of life forms by Raunkier. It is hemicryptophytes (16.6%) that prevail in aboriginal fraction, while in the adventive fraction the difference among the dominating hemicryptophytes (28%) and the groups of teropohytes (27%) and fanerophytes (20.2%) is minimal (Fig.5). Hemicryptophytes' dominance is explained by peculiarities in morphology and various methods of reproduction, and that of fanerophytes – with the active human intervention.

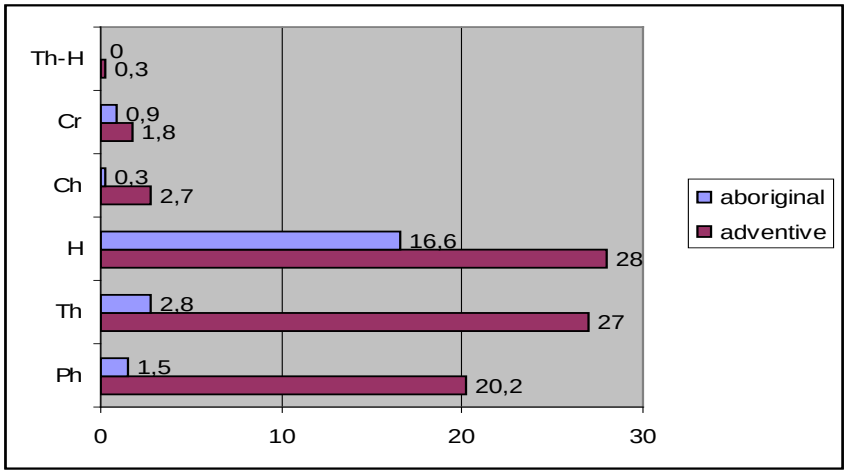


Fig.5 Distribution of synanthropic species according to Raunkier (%)

Synanthropic species belong to 28 phytogeographic areas. Analysis of dominating groups - EuroMed, EuroAs, subMed – reveals clearly expressed European character with a strong influence of the original area – ancient Mediterranean and Asian (Fig. 6). This trend is

emerging in both fractions of the flora. Underrepresented are the elements of Pontiac origin (3 species) and Ponto-Mediterranean origin (9species), as well as taxa originating from Asia (6 species). All representatives originating from China and Japan (2 species) and America (10 species) belong to adventive fraction. The presence of more cosmopolitans (4.6%) in the adventive fraction proves their high ecologic plasticity.

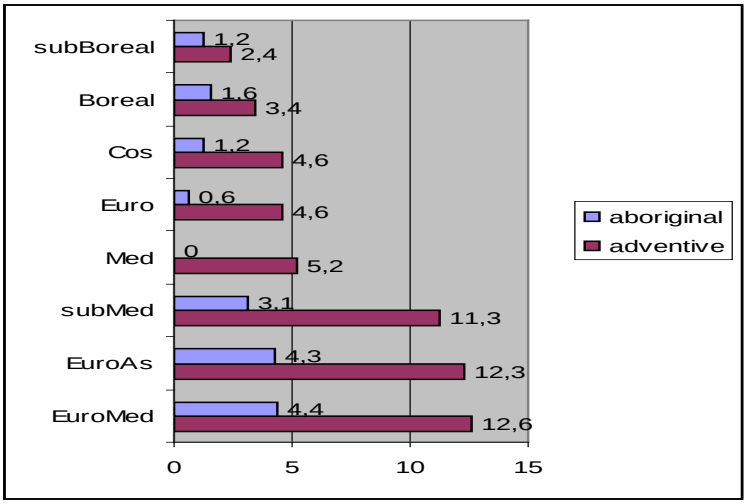


Fig.6. Distribution of dominant phytogeographic groups of synanthrops (%)

Conclusion:

Proximity of "Ajazmoto" forest park to a large administrative center defines the strong synanthropic character of the flora in the area. Distribution of synanthropic categories discloses that majority of species settled the territory during the period of XVIII-XX century.

In the floristic complex a number of trends typical for both natural and highly urbanized city floras are observed. Aboriginal and adventive fractions include similar set of leading families - Fa, As, Po, which although in a varying degree show strong southern character of flora, characteristic for almost all of Balkan states. Prevalence of angiosperms over gymnosperms and that of dicotyledons over monocotyledons are features of the floras of the temperate zone. In systematic terms the group of small families, composed of 1-2 species and 1-2 genera clearly outlines in both fractions – a pattern caused by the various ecologic conditions of semi-urban environment.

The distribution of floral elements is a direct reflection of the dominant climatic influences in the region.

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