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Typology and distribution regularities of oriental hornbeam shrubberies (Carpineta orientalis) in Tbilisi environs

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A B S T R A C T

Oriental hornbeam formation (Carpineta orientalis) of Tbilisi environs is studied for the first time. Oriental hornbeam shrubbery is one of the characteristic and prevalent formations of Tbilisi environs. Tbilisi environs area of oriental hornbeam formation mostly include foothills and lower mountain belt at about 600 to 1000(1100) m above s.l., rarely is in middle mountain belt (1100-1300 m above s.l.). Its plant communities with different plots area are fragmentary spread mostly on Saguramo-Ialno ridge and east endings of Trialeti ridge; they also meet on Skhaltba low range. Plant communities are developed on slopes with various exposure and inclination, on the cinnamonic and brown forest soils. Sometimes soil is thin and skeleton, rarely with bare mother rocks. Formation is characterised by rich typological composition. 8 plant communities were identified by us: (1) Querceto-Carpinetum graminoso-mixtoherbosum, (2) Carpinetum graminoso-mixtoherbosum, (3) Carpinetum mixtoherbosum, (4) Carpinetum poosum nemoralis, (5) Carpinetum poo-so-caricosum, (6) Carpinetum caricosum humilis, (7) Carpinetum caricosum digitatae, (8) Carpinetum ruscosum. Their phytocoeno) logical characteristics are presented. Geo-botanical descriptions are represented for each community in the form of consolidated table, in which are given general geo-botanical characteristics (general projective coverage, sodding degree, density, projective coverage, distribution and average height of each layer, floristic composition, coenetic role of each species - projective coverage, and etc.). Physical-geographical conditions (altitude, relief, exposure, inclination) are also given. In Tbilisi environs oriental hornbeam plant communities are secondary origin and derived as a result of digressive successions of oak forest (Querceta iberici).

Keywords: *Carpinus orientalis*, Plant community, Typology, Geo-botanical characteristics, Xeromesophilous shrubberies, Tbilisi environs.

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Introduction

Oriental hornbeam formation (Carpineta orientalis) relates to xeromesophilous shrubberies. Oriental hornbeam shrubbery is one of the characteristic and prevalent formations of Tbilisi environs [1, 2]. They mostly are secondary origins and derived as a result of digressive successions of oak forest (Querceta iberici). They relate to I stage of post-forest vegetation succession [3, 4]. At the same time, oriental hornbeam formation distributed in the other regions of South Caucasus [5-7, and etc.]. In spite of this, literary data is very scanty – only typological composition is given in Lachashvili et al. [1].

Objectives and Methods

The object of research is oriental hornbeam formation (Carpineta orientalis) of Tbilisi environs. The aim of our research was to establish typological composition and distributed regularities of oriental hornbeam formation in Tbilisi environs; determine phytosociological structure for each distinguished plant communities which would be reflected in the consolidated geo-botanical tables.

Phytosociological data was obtained by the route method in long period (2008-2015). 70 geo-botanical surveys (releve) were made. Geo-botanical

surveys were carrying out on 25 m² plots. During the geo-botanical surveys, studying the structure of phytocoenoses and identification of syntaxa, we were guided by the traditional geo-botanical methods [8-14]. Instead of the term "association" that is observed in soviet literature, we use the term "plant community" that is recognized through the Europe.

Life forms of the plants are separated on the basis of C. Raunkiaer [15] and I. Serebriakov classifications [16].

Soil types are founded on the modern classifications [17-19].

Results and Analysis

1. Areal and short physical-geographical characteristics

This formation is one of the characteristic for vegetation cover of Tbilisi surroundings. In Tbilisi environs oriental hornbeam communities are distributed on Saguramo-Ialno ridge and east endings of Trialeti ridge. Their altitudinal range is from 500 to 1200 (1300) m above s.l., however, the main area is in foothills and lower mountain belt, approximately 600-1000 m above s.l..

Oriental hornbeam communities in Tbilisi environs mainly are spread in moderately humid climate with moderately warm long summer and moderately cold snowy winter. In the distribution area of oriental hornbeam formation average annual temperature is 7.4°-11°C; mean annual precipitation is 550-800 (900) mm; precipitation-evaporation ratio is within the range 1 [20, 21].

Oriental hornbeam communities are developed on the cinnamonic and brown forest soils. Sometimes soil is thin and skeleton, rarely with bare mother rocks.

2. Typological composition and geo-botanical characteristic

Oriental hornbeam shrubberies are distinguished by typological variety. In Tbilisi environs within formation 8 plant communities were identified by us. They are: (1) Querceto-Carpinetum graminoso-mixtoherbosum, (2) Carpinetum graminoso-mixtoherbosum, (3) Carpinetum mixtoherbosum, (4) Carpinetum poosum nemoralis, (5) Carpinetum pooso-caricosum, (6) Carpinetum caricosum humilis, (7) Carpinetum caricosum digitatae, (8) Carpinetum ruscosum.

The distribution area in the environs of Tbilisi and consolidated geo-botanical tables for each distinguished plant communities are given below.

Abbreviations:

m – meter cm – centimeter s. – specimen

N – North S – South W – West

Th – Therophyte H – Hemicryptophyte
G – Geophyte Ch – Chamaephyte
Ph – Phanerophyte

1. Querceto-Carpinetum graminoso-mixtoherbosum

This plant community belongs to first stage of digressive successive of oak forests. They are characterized by the participation of oaks in the arborescent stratum. Oaks density is within 0,1-0,2. In the composition of both shrubs and grasses are good preserved forests species which make the core of floristic composition. However, floristic composition is enriched with non-characteristic species of forests.

Distribution in Tbilisi environs: Teleti, Mamadaviti and Mskhaldidi ridges; Altitude (m): 950-1050; Topography: slopes; Exposure (macro): N-E, S, W; Exposure (micro): N-E, N-W, E; Inclination: 27°-35°, rarely 13°-15°; Soil: cinnamonic and brown forest;

Table 1. *Querceto-Carpinetum graminoso-mixtoherbosum*

Cotoneaster morulus	-	-	-	-	+	-	-	-
Crataegus kyrtosyla	2-3	+	-	-	-	-	-	1
Euonymus leiophloeus	+	-	-	-	+	-	+	-
Euonymus verrucosus	2-3	+	-	-	-	-	+	-

Juniperus communis subsp. oblonga	-	-	-	-	+	-	-	-
Ligustrum vulgare	+ 1c.	-	-	-	-	-	-	+
Lonicera caprifolium	+	-	-	+	+	-	+	-
Lonicera caucasica	1-2	+	+	-	-	-	-	+
Swida australis	+	+	+	-	-	-	+	-
Semishrubs & dwarf semishrubs (Ch)								
Teucrium nuchense (*T. chamaedrys* subsp. *nuchense*)	-	-	+	-	-	-	-	-
Perennial herbs (H)								
Achillea bisserrata	-	-	-	+	+	-	+	-
Aegonychon purpurea-coeruleum	-	-	+	-	-	-	+	-
Albovia tripartita	-	-	-	-	+	+	-	+
Alliaria petiolata	-	+	-	-	-	-	+	-
Alyssum murale	-	-	-	+	+	-	-	-
Anthriscus nemorosa	-	+	-	-	-	-	-	+
Asplenium adiantum-nigrum	-	-	-	-	+	-	-	-
Asplenium trichomanes	-	-	-	-	+	-	-	-
Brachypodium sylvaticum	+	-	-	-	-	-	+	-
Campanula alliariifolia	-	-	-	-	-	+	-	-
Campanula rapunculoides	+	+	0.5	2	+	1	2	+
Carex digitata	-	-	6-7	12	+	6-7	-	4-5
Carex pallescens	6	4	+	-	-	+	2	-
Clinopodium vulgare	-	-	4-5	4	+	-	1-2	-
Cruciata laevipes	+	-	-	-	-	-	-	-
Dactylis glomerata	-	-	+	+	+	+	-	+
Dictamnus albus	-	+	-	-	-	-	-	-
Galium album	-	-	1-2	5	+	+	1	-
Galium spurium (*G. vaillantii*)	-	-	+	5	+	-	1	-
Galium tricornutum	-	-	+	+	+	-	-	+
Hieracium auriculatum	-	-	-	2	+	1-2	-	+
Hypericum perforatum	-	-	+	-	-	-	-	-
Lapsana grandiflora (*L. communis* subsp. *grandiflora*)	-	-	-	-	-	+	+	-
Lathyrus laxiflorus (*Orobus hirsutus*)	+	-	-	-	-	-	+	-
Lathyrus roseus	-	+	-	-	+	-	-	+
Myosotis sylvatica	-	-	+	+	+	+	+	-
Physospermum cornubiense	1-2	0.5	+	-	-	-	-	+
Poa nemoralis	3-4	+	9-10	7	+	5-6	3-4	4-5
Polypodium vulgare	5	-	1	2	+	6-7	+	2-3

Primula veris subsp. *macrocalyx*	1	+	3	2	-	-	-	2
Silene italica	+	-	2-3	1	-	1	2-3	2
Thalictrum collinum	+	-	-	-	-	-	-	-
Trifolium pratense	-	-	+	-	-	+	-	-
Turritis glabra	-	-	+	+	+	+	+	-
Veronica peduncularis	-	0.5	3-4	4	+	1-2	3	2
Vicia truncatula	+	+	+	+	+	-	+	+
Viola alba	+	7-8	1	-	+	1	3-4	2
Viola odorata	-	1	-	-	-	-	-	-
Viola reichenbachiana	-	-	-	+	-	-	-	-
Perennial herbs (G)								
Allium pseudoflavum	-	-	-	+	+	-	-	-
Epipactis helleborine	-	-	+	-	-	+	-	-
Orchis purpurea subsp. *caucasica*	-	-	-	+	-	-	-	-
Platanthera chlorantha	-	-	-	+	+	-	-	+
Polygonatum glaberrimum	2	-	-	-	+	-	+	-
Sedum maximum subsp. *ruprechtii* (*S. caucasicum*)	-	-	-	-	+	-	-	-
Annual plants (Th)								
Alyssum alyssoides	-	-	+	-	-	-	-	-
Arabis nova (*A. auriculata*)	-	-	-	-	+	-	+	-
Asperula arvensis	-	-	+	+	-	-	-	+
Lapsana communis	-	-	3	-	-	-	-	+
Moehringia trinervia	-	-	+	+	-	-	+	-
Sedum hispanicum	-	-	+	-	+	-	-	-
Thlaspi orbiculatum	-	-	+	+	+	+	+	+
Torilis japonica	-	-	+	+	+	-	-	+
Trifolium aureum	-	-	-	-	-	+	-	-

2. Carpinetum graminoso-mixtoherbosum

Plant community is represented by two ecological variant. First variant subsequently of digressive succession of forests were formed early case and now mostly is created with low height (2,5-3,5 m) oriental hornbeams. 4-4,5 m height plant communities are rare. Structural characteristics of forests in their structure are noticeably decreased – floristic composition both shrubs and grasses are much reduced. Floristic composition is enriched with non-characteristic species of forests.

The second variant was formed relatively recently and therein forest structure is good preserved. Average height of their arborescent stratum is considerably high – mostly within 6-7(8) m. Characteristic species of forests make the basis of floristic composition. These plant communities are one of first stage of digressive successive of oak forests [3, 4]. Because of such important structural differences, their geo-botanical tables are given severally. First variant is met relatively frequently.

First variant

Distribution in Tbilisi environs: foothills of Armazi, Skhaltba and Saguramo ridges; Altitude (m): 500-800; Topography: slopes; Exposure (macro): S, N, W; Exposure (micro): S-W, N, W, N-W; Inclination: 1°-2° to 35°-37°, rarely 1°-7°; Soil: cinnamonic and brown forest;

Table 2. *Carpinetum graminoso-mixtoherbosum (first variant)*

Surveys	1	2	3	4	5	6	7	8	9	10
Date	14.07.10.	03.07.11.	06.07.11.	06.07.11.	06.07.11.	15.07.11.	15.07.11.	15.07.11.	17.07.13.	10.07.14.
Altitude (m)	560	765	528	546	562	685	683	680	655	705
Exposure (macro)	S	S	W	W	W	N	N	N	N	W
Exposure (micro)	S-W	W	W	N-W	W	N	N	N	N	W
Inclination	30°-33°	7°	35°	35°-37°	35°-36°	2°	1°-2°	2°	20°-22°	10°-12°
I layer (Arborescent stratum)										
Density of canopy	0,75-0,8	0.8-0.9	0.8	0.75-0.8	0.75-0.8	90	75-80	80-85	0,8-0,9	0,9
Average height (m)	2,5	4-4,5	2.2	3	2.5	2.5-3	2.5-3	2,7-3	2,5	2,8-3
Maximum height (m)	3	5	3	3.5	3.3	4	3.5	4	3,5	3,5
II layer (Grass cover)										
Projective coverage (%)	9-10	3-5	7-8	9-10	8-10	15-17	20	15-17	6-7	5-6
Average height (cm)	15-17	12-15	20	17-20	17-20	15	22-25	20	18-20	16-18
III layer (Moss cover)										
Projective coverage (%)	+	-	-	+	+	+	+	+	-	+
Litter										
Projective coverage (%)	92-95	95	85-90	90-95	90-95	90-95	90	90-95	87-90	90-95
Depth (cm)	2-3	1-5	2-3	2-3	3-5	5	4-5	5	3-4	3
Floristic composition										
Trees (Ph)										
Quercus iberica	+1 s.	-	-	+1 s.	+1 s.	-	+ 2 s.	+1 s.	-	+1 s.
Shrubs (Ph)										
Carpinus orientalis	75-80	80-90	80	75-80	75-80	90	75	75-80	80-90	90
Cotoneaster morulus	+	-	+	+	-	-	-	-	-	-
Prunus divaricata	-	+	-	-	-	-	-	-	-	-
Rosa canina	-	-	-	-	-	+	-	-	-	+
Swida australis	-	+	-	-	-	-	-	-	+	-
Perennial herbs (H)										
Aegonychon purpurea-coeruleum	2	+	-	-	-	1-2	+	1-2	1	+
Carex digitata	-	-	-	-	-	1	2-3	-	-	-
Carex halleriana	-	-	+	+	+	-	-	-	-	-
Carex humilis	-	+	-	-		-	-	-	-	+
Clinopodium vulgare	+	-	-	-	-	-	-	-	+	-
Dactylis glomerata		-	4	4	4-5	-	-	+		
Dictamnus albus		+	-	-	-	-	-	-		
Filipendula vulgaris	-	-	-	-	-	-	-	-	+	-
Galium album	+	-	+	+	+	-	-	-	+	-
Klasea quinquefolia	-	+	-	-	-	-	-	-	-	-
Melica uniflora	1	-	-	-	-	7	7-8	5	-	-
Myosotis sylvatica	+	-	+	-	+	-	-	-	-	-
Poa nemoralis	-	0,5	-	-	-	-	6-7	+		2
Psephellus carthalinicus	-	-	+	-	-	-	-	-	-	+

Pyrethrum corymbosum	-	+	-	-	-	-	-	-	+	-
Silene italica	4-5	-	4	6-7	5-6	2	+	3	3-4	2-3
Vincetoxicum amplifolium (*V. scandens*)	+	-	-	-	-	-	+	+	-	-
Viola alba	2	1	+	+	+	6-7	5	6	2-3	1
Perennial herbs (G)										
Cephalanthera damasonium	-	+ 1 s.	-	-	-	-	-	-	-	-
Muscari szovitsianum	+	-	-	-	-	+	-	+	-	-
Biannual plants (H)										
Campanula sibirica subsp. *hohenackeri*	+ 1 s.	-	-	-	-	-	-	-	-	-
Annual plants (Th)										
Asperula arvensis	-	-	-	+ 1-2 s.	+ 2 s.	-	-	-	-	+
Bromus japonicus	-	-	+	+	+	-	-	-	-	-

Second variant

Distribution in Tbilisi environs: Mamadaviti, Saguramo ridge (surroundings of vil. Tsitsamuri) and Mskhaldidi-Lisi ridges (surroundings of vil. Tsodoreti); Altitude (m): 600-1020; Topography: slopes, rarely plane place; Exposure (macro): N, E, S-W; Exposure (micro): N-E, N-W, N, S-W; Inclination: 13°-15° to 20°-35°, rarely 3°-4°; Soil: cinnamonic and brown forest;

Table 3. *Carpinetum graminoso-mixtoherbosum (second variant)*

Surveys	1	2	3	4	5	6	7
Date	12.07.08.	15.07.08.	15.07.08.	07.07.09.	07.07.09.	16.07.11.	11.07.15.
Altitude (m)	810	888	928	996	1007	620	780
Exposure (macro)	N	N	N	E	N	S-W	N
Exposure (micro)	N-W	N	N	N-E	N-E	S-W	N-W
Inclination	25°	13°-15°	15°-17°	20°	32°-35°	3°-4°	18°-20°
I layer (Arborescent stratum)							
Density of canopy	0.7-0.75	0.7	0.75	0.6	0.5-0.6	0.7	0,6-0,7
Average height (m)	6	6	4-5	6-7	4,5-5	8	6-7
Maximum height (m)	7	7	6	8	6,5	9	8
II layer (Grass cover)							
Projective coverage (%)	3-5	2-3	3-5	45	18-20	20	14-16
Average height (cm)	17-20	20	15	30	32-37	20	20-22
III layer (Moss cover)							
Projective coverage (%)	+	-	2-3	-	-	+	+
Moss							
Projective coverage (%)	+	-	2-3	-	-	-	+
Lichen							
Projective coverage (%)	+	-	+	-	-	-	-
Litter							
Projective coverage (%)	95-96	95-97	75	92-93	90-92	90	88-90
Depth (cm)	2-4	2-6	1-3	2-4	2-4	2-3	1-3

Floristic composition							
Trees (Ph)							
Acer cappadocicum	-	-	-	-	+ 1s.	-	-
Fraxinus excelsior	-	-	-	+	+ 1s.	-	+ 1s.
Quercus iberica	-	+	-	-	+	-	+ 1s.
Sorbus torminalis	-	-	-	+	-	-	-
Shrubs (Ph)							
Carpinus orientalis	70-75	70	70	60	50-60	70	60-70
Cornus mas	+	-	-	+	-	+	+
Cotoneaster morulus	+ 1 s.	-	+ 1 s.	-	-	-	-
Crataegus kyrtostyla	+	+	+	+	-	+	+
Euonymus leiophloeus	-	-	-	-	+	-	-
Euonymus verrucosus	-	15-16	7-8	+	-	+	+
Hedera helix	-	-	-	-	-	+	-
Ligustrum vulgare	3	+	-	-	-	+	+
Lonicera caprifolium	2	15-16	1	2	3	20	3-4
Lonicera caucasica	-	-	-	+	-	+	+
Prunus divaricata	+ 1 s.	-	-	-	-	-	+ 1 s.
Rhamnus cathartica	-	-	+	-	-	-	-
Swida australis	-	+	-	+	-	+	-
Viburnum lantana	-	-	-	-	+	-	-
Perennial herbs (H)							
Achillea biserrata	-	-	-	-	-	1-2	-
Aegonychon purpurea-coeruleum	-	+	-	-	-	+	-
Albovia tripartita	-	-	-	1-2	7-8	-	3-4
Alliaria petiolata	+	+	+	+	6-7	-	2-3
Asplenium adiantum-nigrum	-	-	-	+	-	-	+
Asplenium trichomanes	-	-	-	+	-	-	-
Brachypodium sylvaticum	-	-	-	-	-	2	-
Campanula rapunculoides	-	+	+	4	+	+	1-2
Carex humilis	1	-	+	-	-	-	-
Carex pallescens	+	+	+	-	-	-	+
Clinopodium vulgare	+	-	-	+	-	+	-
Cruciata laevipes	-	-	+	-	-	-	-
Festuca drymaja	-	-	-	+	-	+	-
Filipendula vulgaris	+ 1 s.	-	-	-	-	-	-
Galium spurium (*G. vaillantii*)	-	-	-	-	5	-	-
Geum urbanum	-	+	+	+	-	+	+
Helleborus caucasicus	-	-	-	1	+	-	-
Hypericum perforatum	-	-	-	+	-	-	-
Klasea quinquefolia	-	-	-	+	-	2-3	1-2
Laser trilobum	-	-	-	+	-	+	+
Lathyrus laxiflorus (*Orobus hirsutus*)	-	-	-	+	-	8-9	-
Luzula multiflora	-	-	-	-	+	-	-
Melica picta	-	-	-	-	-	+	+
Melica uniflora	-	-	-	4	-	8	-

Physospermum cornubiense	-	-	-	16	-	+	1
Poa nemoralis	1	+	+	17	3-4	-	-
Polypodium vulgare	+	-	+	+	+	-	+
Primula veris subsp. macrocalyx	-	+	+	6	-	+	2-3
Primula woronowii	-	-	-	+	-	-	+
Pyrethrum corymbosum	-	+	-	+	-	-	-
Seseli peucedanoides	-	-	-	+	-	-	-
Solidago virgaurea	-	-	-	+	-	+	-
Thalictrum collinum	**+ 1 s.**	+	+	-	-	-	-
Valeriana officinalis	-	-	-	+	-	-	-
Veronica peduncularis	-	-	-	**1**	+	-	+
Vicia truncatula	-	+	-	+	+	-	-
***Vincetoxicum amplifolium* (*V. scandens*)**	-	-	-	-	-	+	-
Viola alba	**1-2**	+	**1**	**2-3**	+	+	**3**
Viola odorata	-	+	+	-	-	-	+
Viola reichenbachiana	-	-	-	-	+	+	-
Perennial herbs (G)							
Cephalanthera rubra	-	-	-	-	-	+	-
***Dioscorea communis* (*Tamus communis*)**	**+ 1 s.**	-	-	-	-	-	+
Platanthera chlorantha	-	-	-	-	+	-	+
Polygonatum glaberrimum	-	-	+	**2**	**2-3**	+	**1**
Biennial plants (H)							
Campanula sibirica* subsp. *hohenackeri	**+ 1 s.**	-	-	-	-	-	-
Lactuca quercina* subsp. *wilhelmsiana	-	-	-	-	+	-	-
Annual plants (Th)							
Thlaspi orbiculatum	-	-	+	+	+	-	+
Geranium lucidum	-	-	+	+	**3-4**	-	-
Geranium robertianum	-	-	+	-	-	-	-

3. Carpinetum mixtoherbosum

Plant community is very rare and has limited distribution area.

Distribution in Tbilisi environs: foothills of Saguramo ridge (surroundings of vil. Tsitsamuri); Altitude (m): 600-700; Topography: slopes, rarely plane place; Exposure (macro): N; Exposure (micro): N, N-W; Inclination: 20°-30°, rarely 1°-2° to 8°; Soil: cinnamonic and brown forest;

Table 4. *Carpinetum mixtoherbosum*

Surveys	1	2	3	4	5
Date	16.07.11.	16.07.11.	16.07.11.	16.07.11.	16.07.11.
Altitude (m)	615	649	657	667	633
Exposure (macro)	N	N	N	N	N
Exposure (micro)	N	N-W	N	N	N-W
Inclination	30°	18°-20°	1°-2°	20°-25°	25°-27°
I layer (Arborescent stratum)					
Density of canopy	0.6-0.7	0.7-0.75	0.7-0.75	0.7	0,7
Average height (m)	6	5-7	5-6	7	6-7
Maximum height (m)	9	8	7	8	8
II layer (Grass cover)					
Projective coverage (%)	20	22-25	12	6-7	15-17
Average height (cm)	17-20	22-25	17-20	20	18-20
III layer (Moss cover))					
Projective coverage (%)	2-3	+	-	-	+
Litter					
Projective coverage (%)	75-80	80	90	95	85
Depth (cm)	2-3	3-4	3-5	3-5	3-5
floristuli Semadgenloba					
Trees (Ph)					
Quercus iberica	-	-	+ 1 s.	-	+ 1 s.
Sorbus torminalis	1	-	-	-	-
Shrubs (Ph)					
Carpinus orientalis	60-70	70-75	70-75	70	70
Citysus caucasicus	+	-	-	-	-
Cornus mas	+	15	1	+	+
Crataegus kyrtostyla	+	-	+	-	+
Euonymus europaeus	+	+	-	-	-
Euonymus verrucosus	-	+	-	-	+
Hedera helix	-	+	-	-	-
Ligustrum vulgaris	-	-	+	-	+
Lonicera caprifolium	4-5	15	+	+	+
Lonicera caucasica	-	+	-	-	+
Mespilus germanica	+	-	-	-	-
Ruscus aculeatus	+	-	-	-	-
Swida australis	-	-	5	3-5	-
Perennial herbs (H)					
Achillea biserrata	+	+	+	+	+
Campanula rapunculoides	3	2	+	+	2-3
Carex digitata	+	+	+	+	+
Carex humilis	3-4	-	-	-	-
Klasea quinquefolia	-	12-15	7	+	4-5
Laser trilobum	1-2	+	-	-	1-2
Lathyrus laxiflorus (*Orobus hirsutus*)	1-2	-	+	-	-
Lathyrus roseus	1-2	-	-	-	1
Melica uniflora	+	+	+	+	+
Physospermum cornubiense	+	+	+	3	1-2
Primula veris subsp. *macrocalyx*	6-7	+	1	1	2-3
Pyrethrum corymbosum	-	-	-	+	-
Vicia truncatula	-	+	+	-	+
Vincetoxicum amplifolium (V. *scandens*)	-	+	+	+	+
Viola alba	2	4-5	+	2	4
Viola reichenbachiana	-	3-5	5-6	3	-
Perennial herbs (G)					
Cephalanthera rubra	-	-	-	+	-
Helleborus caucasicus	-	+	-	-	-
Polygonatum glaberrimum	3	-	-	-	+

4. Carpinetum poosum nemoralis

This plant community is one of more widely distributed.

Distribution in Tbilisi environs: TeleTi ridge (surroundings of vil. Tabakhmela), Mamadaviti ridge (surroundings of Lake Kustba and vil. Tsavkisi), Mskhaldidi ridge (surroundings of vil. Tsodoreti) and etc.; Altitude (m): 800-1400; Topography: slopes; Exposure (macro): N, S, S-E, W; Exposure (micro): N, N-E, S-E, E, W; Inclination: 13°-15° to 30°-35°; Soil: cinnamonic and brown forest;

Table 5. *Carpinetum poosum nemoralis*

Surveys	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Date	12.07.08.	13.07.08.	13.07.08.	16.07.08.	16.07.08.	16.07.08.	19.07.08.	19.07.08.	19.07.08.	08.07.09.	08.07.09.	08.07.09.	06.07.09.	06.07.09.
Altitude (m)	808	810	877	1360	1236	1233	1038	1035	1022	959	967	970	995	1005
Exposure (macro)	N	N	N	S-E	S-E	S-E	S	S	S	N	N	N	W	W
Exposure (micro)	N	N-E	N	S-E	S-E	S-E	E	E	E	N	N	N	W	W
Inclination	30-32°	20-22°	25-27°	18°-20°	14°-15°	13°-15°	16°-18°	15°-16°	15°	25°	20-22°	18°-20°	28-30°	25°
I layer (Arborescent stratum)														
Density of canopy	0.7-0.75	0.6	0.7	0.7	0.6	0.75-0.8	0.8	0.8	0.8	0.5	0.5-0.6	0.45-0.5	0.7-0.8	0.7-0.8
Average height (m)	6	5-6	5	7-8	5-6	5-6	3-4	3-4	4-5	3-4	4-5	4-5	5	5-6
Maximum height (m)	7	8	6	10	7	7-8	5	6	6,5	4,5	6,5	5,5	6	7
II layer (Grass cover)														
Projective coverage (%)	20	5-6	7-8	60	52-55	38-40	10	48-50	40	50-52	35-38	33-35	37-40	25-28
Average height (cm)	23-28	23-28	23-28	25-30	22-25	25-30	20	30-35	32-37	35-40	40-45	45-50	42-47	42-47
III layer (Moss cover)														
Projective coverage (%)	+	+	-	-	+	-	-	-	-	1-2	-	-	3-5	5-6
Moss														
Projective coverage (%)	+	+	-	-	+	-	-	-	-	1-2	-	-	3-5	5-6
Lichen														
Projective coverage (%)	+	+	-	-	-	-	-	-	-	-	-	-	+	-
Litter														
Projective coverage (%)	70	95-96	95-96	90-95	80-85	92-93	75-80	80	80-85	92-95	85-90	90	75-80	80-85
Depth (cm)	1-2	2-3-5	2-4-6	2-4-5	2-3-5	2-4	1-3	1-3	1-3	5-8	3-5	3-5	1-3	3-4
Floristic composition														
Trees (Ph)														
Carpinus caucasica	-	-	-	+ 1 s.	+ 1 s.	-	-	-	-	+	-	-	-	-
Fraxinus excelsior	-	-	-	-	-	-	-	-	-	+ 1 s.	-	+	-	-
Pyrus caucasica	-	-	-	-	-	-	+ 1 s.	-	10 1 s.	-	-	-	-	-
Quercus iberica	-	-	+	-	+	-	+ 1 s.	-	15	+	+ 1 s.	-	0.2	0.2
Shrubs (Ph)														

Carpinus orientalis	70-75	50	70	70	60	75-80	65-70	65-70	45-50	40-50	50-60	40-50	05.-06.	70
Cornus mas	-	+	-	-	-	+	+	8	5	-	-	-	-	-
Cotoneaster morulus	-	-	+	-	-	-	+	-	-	-	-	-	-	-
Crataegus kyrtostila	-	+	-	-	+	+ 1 s.	5-7	4-5	5	-	+	-	-	-
Euonymus leiophloa	+	-	-	-	-	-	-	-	-	+	+	-	-	+
Euonymus verrucosus	-	+	+	-	-	-	-	+	-	+	-	-	-	-
Juniperus oblonga	-	-	-	-	-	-	-		-	+	+	-	-	-
Ligustrum vulgare	-	-	+	-	-	-	-	+	-	+	-	-	-	-
Lonicera caprifolia	-	13-15	-	+	+	-	2-3	+	-	15-20	+	9-10	-	+
Lonicera caucasica	-	-	30-32	+	-	-	+	-	+	-	-	-	-	+
Mespilus germanica	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Prunus divaricata	-	+	-	-	+	-	-	-	-	-	-	-	-	-
Rhamnus cathartica	-	-	+ 1 s.	-	-	-	-	-	-	-	-	-	-	-
Rosa canina	-	-	-	-	+	-	-	-	+	-	-	-	-	-
Swida australis	-	10	-	-	-	-	5-7	-	+	-	-	-	-	+
Viburnum lantana	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Perennial herbs (H)														
Achillea biserrata	-	-	-	3	-	-	-	-	-	+	+	+	+	+
Aegonychon purpurea-coeruleum	-	+	-	-	-	-	-	-	-	-	+	-	-	-
Albovia tripartita	-	-	-	4	-	-	-	-	-	-	1	+	+	3-5
Alliaria petiolata	2-3	-	1	+	-		+	+	-	+	-	-	-	-
Anthriscus nemorosa	-	-	-	+	-	-	+	-	-	-	-	-	-	-
Asplenium adiantum-nigrum	-	-	-	-	-	-	-	-	-	-	+	-	-	+
Asplenium trichomanes	-	-	-	-	-	-	-	-	-	-	+	-	+	+
Brachypodium sylvaticum	-	+	-	6-7	-	-	+	-	-	-	-	-	-	-
Campanula rapunculoides	1	-	+	+	+	0.5	+	3-4	1	+	1-2	4	3	4-5
Carex digitata	-	-	-	-	-	-	-	-	-	+	-	-	2-3	+
Carex humilis	2-3	-	0.5	-	-	1	-	-	-	-	-	-	-	-
Carex pallescens	-	+	-	-	1-2	+	0.5	5	1	+	1	+	2	+
Clinopodium vulgare	-	-	-	+	-	+	0.5	-	-	-	+	-	1	1
Cruciata laevipes	-	+	-	+	+	-	-	-	-	-	-	-	-	-
Dactylis glomerata	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Dictamnus albus	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Fragaria vesca	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Galium album	-	-	-	-	-	-	-	-	-	+	-	-	1-2	-
Galium humifusum	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Galium rivale	-	-	-	+	-	-	-	-	-	-		-	-	-
Galium tricornutum	-	-	-	-	-	-	-	-	-	8-9	1	-	+	1
Geum urbanum	+ 1 s.	+	-	+	-	-	-	+	-	-	-	-	-	-
Lapsana grandiflora (*L. communis* subsp. *grandiflora*)	-	-	-	+	-	-	-	-	-	-		-	-	-
Laser trilobum	-	-	-	-	-	-	-	-	-	-	-	+	-	+
Lathyrus laxiflorus (Orobus hirsutus)	-	-	-	1	-	-	-	-	-	-		-		+

Lathyrus roseus	-	-	-	-	-	-	+	3-4	18-20	-	+	-	-	+
Melica picta	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Melica uniflora	-	-	-	-	-	-	-	-	-	+	2	+	-	-
Physospermum cornubiense	-	+	-	-	+	1	+	+	+	6-7	6	5	-	+
Poa nemoralis	12-13	4	5	40	50-52	33-35	6-7	40	17-18	25	22-24	20-22	22-25	12-15
Polypodium vulgare	1	-	2	-	-	-	-	-	-	5	2	-	1	+
Primula veris subsp. *macrocalyx*	1	-	+	1	-	-	1	+	1-2	+	1	+	1-2	+
Pyrethrum corymbosum	-	+	+	-	-	-	-	-	-	+	+	-	-	-
Silene italica	-	-	-	-	+	-	1	+	-	1-2	+	+	-	-
Stachys iberica	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Thalictrum collinum	+ 1c.	-	-	-	-	-	-	-	-	-	-	-	-	-
Turritis glabra	-	-	-	-	-	-	-	-	-	+	+	+	-	-
Valeriana officinalis	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Veronica peduncularis	-	-	-	3	+	3	3-4	+	0.5	+	-	-	7-8	3-5
Vicia truncatula	-	-	+	-	+	+	+	+	+	+	+	+	-	+
Vincetoxicum amplifolium (*V. scandens*)	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Viola alba	+	-	0.5	4-5	+	4	+	+	0.5	+	-	1	-	-
Viola odorata	-	+	-	-	-	-	+	+	-	+	+	-	2	+
Viola reichenbachiana	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Perennial herbs (G)														
Helleborus caucasicus	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Polygonatum glaberrimum	-	-	-	2	2-3	-	-	-	+ 1 s.	7	1	7-8	1	4-5
Sedum maximum subsp. ruprechtii (*S. caucasicum*)	+	-	-	-	-	-	-	-	-	-	+	-	-	-
Biennial plants (H)														
Lactuca quercina subsp. *wilhelmsiana*	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Annual plants (Th)														
Arabis nova (*A. auriculata*)	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Geranium lucidum	+	+	-	-	-	-	-	-	-	1	-	-	-	-
Thlaspi orbiculatum	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Torilis japonica	-	-	-	+	-	-	-	-	-	-	-	-	+	+

5. Carpinetum pooso-caricosum

This plant community has relatively limited distribution area.

Distribution in Tbilisi environs: Mamadaviti and TeleTi ridges; Altitude (m): 800-1050; Topography: slopes; Exposure (macro): N, rarely S; Exposure (micro): N, N-W, N-E, E, rarely S-E; Inclination: 13°-15° to 30°-32°; Soil: cinnamonic and brown forest;

Table 6. *Carpinetum mixtoherbosum*

Surveys	1	2	3	4	5	6	7	8
Date	12.07.08.	12.07.08.	12.07.08.	13.07.08.	13.07.08.	13.07.08.	19.07.08.	15.07.14.
Altitude (m)	810	816	813	810	822	848	1040	840
Exposure (macro)	N	N	N	N	N	N	S	N
Exposure (micro)	N-W	N	N	N-E	E	N-E	S-E	N
Inclination	°25°	22°-25°	30°-32°	17°-18°	13°-15°	25°-27°	22°-25°	20°-22°
I layer (Arborescent stratum)								
Density of canopy	0,6	0.6-0.7	0.7-0.75	0.7-0.75	0.6	0.7-0.75	0.6-0.7	0,7
Average height (m)	6	5-6	6-7	6	6-6.5	4-5	5-6	5-6
Maximum height (m)	7	8	7.5-8	8	8-9	6	7	7
II layer (Grass cover)								
Projective coverage (%)	45	20-22	28-30	8-10	33-35	36-38	10-12	23-25
Average height (cm)	20	22-25	25-30	17-20	25-28	22-25	25	20-22
III layer (Moss & lichen cover)								
Projective coverage (%)	+	-	+	-	+	-	-	+
Moss								
Projective coverage (%)	+	-	+	-	+	-	-	+
Lichen								
Projective coverage (%)	-	-	+	-	-	-	-	+
Litter								
Projective coverage (%)	80-85	85-90	85-90	90	90-92	85-90	90	85-88
Depth (cm)	1-3	1-2	2-3	2-4	1-3	3-5	2-3	1-2
Floristic composition								
Trees (Ph)								
Quercus iberica	-	+ 1 s.	+ 1 s.	+ 1 s.	-	+ 2 s.	-	+ 1 s.
Shrubs (Ph)								
Carpinus orientalis	60	60-70	70-75	70-75	60	70-75	60-65	70
Cornus mas	-	-	-	+	-	-	+	+
Cotoneaster morulus	+	+	+.	-	+	-	+	-
Crataegus kyrtostyla	+	-	-	+	+	-	5-6	+
Euonymus leiophloeus	-	+	-	-	-	-	-	-
Euonymus verrucosus	+	-	-	-	+	+	-	+
Jasminum fruticans	-	-	+	-	+	-	+	-
Ligustrum vulgare	-	+	4-5	+	+ 1 s.	+	-	+
Lonicera caprifolium	+	-	5-6	4-5	+	+	-	+
Rosa canina	+ 1 s.	-	-	-	-	-	-	-
Spiraea hypericifolia	+ 1 s.	-	+	-	-	-	-	-
Perennial herbs (H)								
Aegonychon purpurea-coeruleum	-	+	-	+	+	-	-	+
Albovia tripartita	-	-	-	-	-	+	-	-
Alliaria petiolata	+	4	1-2	-	-	+	-	-
Anthriscus nemorosa	-	-	-	-	-	-	+	-

Campanula rapunculoides	-	-	+	-	-	+	1	+
Carex humilis	10	2-3	10-12	-	3-4	4	+	4-5
Carex pallescens	30	7-8	7-8	4-5	10-12	5	3-4	5-6
Clinopodium vulgare	2-3	-	-	-	-	-	0.5	-
Cruciata laevipes	-	-	-	-	+	+	-	-
Dactylis glomerata	-	-	-	-	+	-	+	-
Dictamnus albus	-	-	-	-	-	-	+	-
Fragaria vesca	-	-	-	-	-	-	+	-
Galium spurium (*G. vaillantii*)	-	-	-	-	-	-	+	-
Geum urbanum	+	-	+	-	+	+	+	-
Klasea quinquefolia	-	-	-	+	-	-	-	+
Melica picta	-	-	-	-	+	-	-	-
Melica uniflora	-	+ 1 s.	-	-	-	6-7	-	-
Physospermum cornubiense	-	-	-	+	-	-	-	+
Poa nemoralis	5	5	8-9	4-5	22-25	18-19	7-8	10-12
Polypodium vulgare	-	-	+	-	-	-	-	-
Primula veris subsp. *macrocalyx*	+	-	+	-	-	2-3	+	1
Silene italica	+	+	+	+	+	-	-	+
Thalictrum collinum	+	-	+	-	-	+	-	-
Valeriana officinalis	-	+	+	-	-	-	-	-
Vicia truncatula	-	-	-	+	-	-	-	-
Vinca herbacea	-	-	-	-	-	-	+	-
Viola alba	1-2	1	+	+	+	4	0.5	3
Viola odorata	-	-	-	+	+	+	+	-
Perennial herbs (G)								
Polygonatum glaberrimum	-	-	-	-	-	+	-	-
Sedum maximum subsp. *ruprechtii* (*S. caucasicum*)	+	-	-	-	-	+	-	-
Annual plants (Th)								
Geranium lucidum	-	2-3	2	-	+	+	-	+

6. Carpinetum caricosum humilis

Distribution in Tbilisi environs: Saguramo-Ialno and Mskhaldidi-Lisi ridges; Altitude (m): 600-1100; Topography: slopes; Exposure (macro): S, N, E; Exposure (micro): S-W, N-W, E; Inclination: 15°-35°, rarely 8°-10°; Soil: cinnamonic and brown forest;

Table 6. *Carpinetum caricosum humilis*

Surveys	1	6	2	3	4	5	7
Date	16.07.11.	12.07.12.	16.07.12.	16.07.12.	16.07.12.	16.07.12.	14.07.14.
Altitude (m)	615	1096	850	868	875	878	1060
Exposure (macro)	N	E	S	S	S	S	S
Exposure (micro)	N-W	E	S-W	S-W	S-W	S	S-W
Inclination	15°-18°	8°-10°	25°	15°	30°-32°	25°-27°	20°-22°
I layer (Arborescent stratum)							
Density of canopy	0.7-0.8	0,5-0,6	0.6-0.7	0.7-0.75	0.7-0.75	0,5-0,6	0,7
Average height (m)	7	3,5-4	5-6	7-8	6	5	5-6
Maximum height (m)	9	5	7	9	7.5	6	7,5
II layer (Grass cover)							
Projective coverage (%)	30	35-40	35-40	45	40-42	37-40	35-38
Average height (cm)	17-20	22-25	22-25	17-22	22-25	25	20-23

III layer (Moss cover)							
Projective coverage (%)	+	-	1-2	-	-	-	+
Litter							
Projective coverage (%)	50	80	95	95	95	95-96	90
Depth (cm)	2-4	1-3	1-4	2-5	3-5	1-6	2-3
Floristic composition							
Trees (Ph)							
Fraxinus excelsior	+ 1 s.	-	+ 1 s.	+ 1 s.	0.1	0,1	+ 1 s.
Quercus iberica	-	-	0.1	-	+ 1 s.	-	-
Sorbus torminalis	+	-	-	-	-	-	+
Ulmus minor	-	-	-	-	+	-	-
Shrubs (Ph)							
Carpinus orientalis	70-80	50-60	60	70-75	70-75	50-60	70
Berberis vulgaris	-	-	+	+	+	-	-
Cornus mas	+	+	20	+	+	5	+
Cotoneaster meyeri	-	-	-	-	+	-	-
Cotoneaster morulus	+	+	-	-	-	-	-
Crataeugus kyrtostyla	-	+	-	-	-	-	+
Cytisus caucasicus	-	-	-	+	-	-	-
Euonymus europaeus	-	-	+	-	-	-	-
Euonymus verrucosus	-	-	-	-	+	+	+
Juniperus communis subsp. oblonga	+	-	1-2	+	6	3	-
Ligustrum vulgare	-	-	3-4	+	+	5-6	+
Lonicera caprifolium	+	-	-	-	-	+	+
Lonicera caucasica	-	-	+	-	+	-	-
Paliurus spina-christi	-	-	-	+ 1 s.	+ 1 s.	-	-
Viburnum lantana	-	-	+	+	+	2-3	+.
Semishrubs & dwarf semishrubs (Ch)							
Teucrium nuchense (*T. chamaedrys* subsp. *nuchense*)	-	+	-	-	-		-
Perennial herbs (H)							
Achillea biserrata	+	-	-	-	-		-
Aegonychon purpurea-coeruleum	+	+	4	3	1-2	+	1
Albovia tripartita	-	+	+	-	-	-	-
Asplenium adiantum-nigrum	+	-	-	-	-	-	-
Brachypodium sylvaticum	-	-	+	8	2	5	-
Briza media	-	+	-	-	-	-	-
Campanula rapunculoides	+	+	3-4	2	1	+	2-3
Carex digitata	+	-	-	1	-	1-2	-
Carex flacca subsp. *erythrostachys* (*C. cuspidata*)	-	-	+	+	1	-	+
Carex humilis	20	35	25	20-22	30	25-27	25-28
Dactylis glomerata	-	+	-	-	-	-	-
Falcaria vulgaris	-	+	-	-	-	-	-
Fragaria vesca	-	+	-	-	-	-	-
Galium album	-	-	+ 1 s.	+	-	-	+ 1 s.
Galium humifusum	+	+	-	-	-	+	-
Klasea quinquefolia	-	-	-	1	-	+	+
Laser trilobum	-	-	4-5	+	8	5-6	1-2
Lathyrus laxiflorus (*Orobus hirsutus*)	+	+	-	-	-	-	-
Lathyrus roseus	6	-	-	-	-	-	+
Melica uniflora	1	-	-	-	-	-	-

Physospermum cornubiense	+	-	+	6	+	+	2
Poa nemoralis	-	+	-	-	-	-	-
Potentilla recta	-	+	-	-	-	-	-
Primula veris subsp. macrocalyx	+	-	-	-	-	-	+
Primula woronowii	-	-	-	-	-	+	-
Vincetoxicum amplifolium (*V. scandens*)	-	-	-	+	+	+	+
Viola alba	-	+	2-3	5-6	1-2	7-8	3-4
Perennial herbs (G)							
Cephalanthera damasonium	-	+	+	1	-	-	-
Cephalanthera rubra	+	-	-	-	-	-	-
Dioscorea communis (*Tamus communis*)	-	-	+	+	-	-	-
Limodorum abortivum	-	-	+	-	-	-	-
Polygonatum glaberrimum	4	-	+	-	-	-	+

7. Carpinetum caricosum digitatae

This plant community is rare and has limited distribution area.

Distribution in Tbilisi environs: Skhaltba low range and east foothills of Armazi ridge; Altitude (m): 650-800; Topography: slopes; Exposure (macro): W, N-W, N; Exposure (micro): W, N-W, N; Inclination: 5-15°; Soil: cinnamonic and brown forest;

Table 7. *Carpinetum caricosum digitatae*

Surveys	1	2	3	4
Date	03.07.11.	03.07.11.	03.07.11.	15.07.11.
Altitude (m)	756	762	764	684
Exposure (macro)	W	W	W, N-W	N
Exposure (micro)	W	W	N-W	N
Inclination	10°	7°	10°-12°	6°-7°
I layer (Arborescent stratum)				
Density of canopy	0,8	0,8-0,9	0,75-0,8	0,75
Average height (m)	4	5	4.5-5	2,5
Maximum height (m)	5	6	6	3
II layer (Grass cover)				
Projective coverage (%)	37-40	20	23-25	60-63
Average height (cm)	17-20	17-20	25	35
III layer (Moss & lichen cover)				
Projective coverage (%)	-	-	-	
Litter				
Projective coverage (%)	80	95	80	80
Depth (cm)	0,5-1,5	1-5	1-5	3,5
Floristic composition				
Trees (Ph)				
Quercus iberica	-	-	-	+
Shrubs (Ph)				
Carpinus orientalis	35-40	80-90	75-80	75
Euonymus verrucosus	-	-	+	-
Juniperus foetidissima	+	+	+	-
Juniperus oxycedrus	+	-	+	
Lonicera caprifolium	-	-	+	-
Prunus divaricata	-	+	-	-
Ruscus aculeatus	-	-	+	-

Spiraea hypericifolia	-	-	+	-
Swida australis	2	+	+	-
Perennial herbs (H)				
Aegonychon purpurea-coeruleum	2	+	-	-
Campanula rapunculoides	+	-	+	+
Carex digitata	32	16-18	20-22	42-45
Clinopodium vulgare	+	-	-	-
Dictamnus albus	-	+	-	-
Falcaria vulgaris	+	-	-	-
Fragaria vesca	1	-	+	-
Klasea quinquefolia	-	+	-	-
Melica uniflora	5	1-2	2-3	15-16
Poa nemoralis	-	-	-	2
Psephellus carthalinicus	+	-	-	-
Pyrethrum corymbosum	-	+	+	-
Silene italica	+	-	+	+
Viola alba	2	1	0,5	1
Perennial herbs (G)				
Asparagus verticillatus	-	-	+	-
Cephalanthera damasonium	+	+	+	-
Muscari szovitsianum	+	-	-	+
Sedum maximum subsp. *ruprechtii* (*S. caucasicum*)	-	-	-	+

8. Carpinetum ruscosum

This plant community has relatively limited distribution area.

Distribution in Tbilisi environs: Saguramo ridge; Altitude (m): 600-800; Topography: slopes; Exposure (macro): E, W, S; Exposure (micro): E, W, rarely S-W, N-E and S; Inclination: 5°-10° to 30°-40°(45°); Soil: cinnamonic and brown forest, thin or middle depth, often with stones, sometimes denuded bedrocks are observed;

Table 8. *Carpinetum ruscosum*

Surveys	1	2	3	4	5	6	7
Date	06.10.12.	10.09.15.	20.07.15.	28.07.16	28.07.16	19.07.17.	24.07.17.
Altitude (m)	638	725	715	780	626	795	630
Exposure (macro)	E	E	W	S	E	W	W
Exposure (micro)	E	N-E	S-W	S-E	E	W	W
Inclination	12°-15°	5°-8°	8°-10°	10°-12°	30°-32°	15°-17°	30°-35°
I layer (Arborescent stratum)							
Density of canopy	0,55-0,6	0,6	0,6-0,65	0,55-0,6	0,5-0,6	0,65-0,7	0,7-0,8
Average height (m)	4,5-5	4-5	3-3,5	4-4,5	3,5	4-5	3-3,5
Maximum height (m)	6	5,5	5	5,5	5	6	4
II layer (Ruscus ponticus)							
Projective coverage (%)	55-60	75-80	45-50	20-23	65	85-90	35-40
Average height (cm)	90-100	45-50	50-55	40-45	55-65	60-70	40-50
III layer (Grass cover)							
Projective coverage (%)	20-22	7-8	21-23	32-34	15-17	6-8	18-20
Average height (cm)	22-25	20-22	25	25-27	10-12	12-15	20
IV layer (Moss)							
Projective coverage (%)	4-5	+	-	+	-	+	6
Litter							
Projective coverage (%)	20-22	12-15	35-40	70-72	27-30	10	50-52
Depth (cm)	0,5-1	1	1-1,5	0,5-1	0,5-1	1-2	1-2
Floristic composition							
Trees (Ph)							

Quercus iberica	+ 1 s..	+	+	-	-	+ 1 s..	-
Shrubs (Ph)							
Carpinus orientalis	55-60	60	60-65	50-55	50-60	65-70	70-80
Cornus mas	-	+	-	-	-	-	-
Cotoneaster morulus	+	-	-	-	+	-	+
Cotoneaster saxatilis	-	+	-	+	-	+	-
Crateagus kyrtostyla	+	+	-	+	-	+	-
Cytisus caucasicus	-	-	-	-	+	-	+
Euonymus leiophloeus	-	+	-	-	-	-	-
Euonymus verrucosus	+	+	-	-	-	-	-
Jasminum fruticans	-	-	-	+	+	-	-
Juniperus oxycedrus	-	-	-	+	-	-	+
Ligustrum vulgare	+	-	+	-	+	+	-
Lonicera caprifolium	-	+	-	-	-	-	-
Paliurus spina-christi	-	-	-	+	-	-	-
Prunus divaricata	+	-	-	-	-	-	-
Rosa canina	+	-	-	-	-	-	-
Spiraea hypericifolia	-	-	-	-	+	-	+
Swida australis	+	-	+	-	-	+	-
Perennial herbs (H)							
Aegonychon purpurea-coeruleum	4	2-3	2	3-4	3	-	2-3
Albovia tripartita	-	+	-	-	-	-	-
Alliaria petiolata	-	1	0,5	-	-	+	-
Anthriscus nemorosa	3-4	-	-	-	-	2	-
Brachypodium pinnatum	-	-	2	-	-	-	-
Brachypodium sylvaticum	-	1	-	-	-	2	-
Campanula rapunculoides	1	+	-	-	-	+	+
Carex humilis	+	-	-	-	-	-	1
Clinopodium vulgare	-	-	1-2	2-3	3	-	2-3
Cynosurus echinatus	-	-	-	-	+	-	+
Dactylis glomerata	-	-	-	4-5	3	-	3-4
Fragaria vesca	-	-	-	3-4	3-4	-	4-5
Galium spurium (*G. vaillantii*)	+	-	-	+	1-2	-	-
Geum urbanum	-	+	-	-	-	+	-
Klasea quinquefolia	-	+	-	-	-	-	-
Laser trilobum	+	-	-	-	-	-	-
Melica uniflora	2-3	1-2	-	-	-	1-2	-
Physospermum cornubiense	-	-	+	-	-	-	-
Poa nemoralis	+	-	3-4	-	-	-	1-2
Polypodium vulgare	-	+	-	-	-	-	-
Primula veris subsp. *macrocalyx*	-	+	-	-	-	-	-
Silene italica	3-4	-	3-4	6-7	-	1-2	-
Thalictrum collinum	-	-	-	+	+	-	-
Vicia truncatula	+	-	-	-	-	-	-
Vincetoxicum amplifolium (*V. scandens*)	-	-	+	-	-	-	-
Viola alba	5	-	6-7	8-9	5	2-3	5-6
Viola odorata	-	1-2	-	-	-	-	-
Perennial herbs (H)							
Asparagus verticillatus	-	-	-	+	-	-	-
Cyclamen vernum (*C. coum* subsp. *caucasicum*)	2	-	1-2	-	-	+	-
Helleborus caucasicus	-	-	-	3-4	-	-	-
Muscari szovitsianum	-	-	-	+	-	-	-

Scilla siberica	-	+	-	-	-	-	-
Annual plants (Th)							
Geranium lucidum	0,5	-	1	-	-	+	-
Thlaspi orbiculatum	-	+	-	-	-	-	-
Torilis japonica	-	-	-	-	-	0,5	-

Renewal of plant communities

Seedlings (5-15 cm height) of oriental hornbeam with various numbers are in the all described plots. Participation of seedlings of main dominants of forest vegetation – *Quercus iberica* and *Fraxinus excelsior* are important. Their seedlings and young individuals (5-30 cm height) were recorded almost in the all plots. In the several plots also are seedlings and young individuals of characteristic woody plants of forests. They are: *Acer campestre*, *Acer cappadocicum*, *Sorbus torminalis*, *Tilia begoniifolia*.

Wide participation of seedlings and young individuals of characteristic woody plants of forests indicate that oriental hornbeam formation of Tbilisi environs is related with forests of foothills and lower mountain belt.

Conclusion

Main area of oriental hornbeam formation (Carpineta orientalis) in Tbilisi environs is in foothills and lower mountain belt, approximately 600-1000 (1100) m above s.l.. It is rare in middle mountain belt (1100-1300 m above s.l.). Plant communities of formation are fragmentary distributed. They are developed on slopes with various exposure and inclination, on the cinnamonic and brown forest soils. Often soils are skeletal. In Tbilisi environs oriental hornbeam plant communities are secondary origin and derived as a result of digressive successions of oak forest (Querceta iberici).

Formation is characterised by rich typological composition. 8 plant communities were identified in Tbilisi environs by us: (1) Querceto-Carpinetum graminoso-mixtoherbosum, (2) Carpinetum graminoso-mixtoherbosum, (3) Carpinetum mixtoherbosum, (4) Carpinetum poosum nemoralis, (5) Carpinetum pooso-caricosum, (6) Carpinetum caricosum humilis, (7) Carpinetum caricosum digitatae, (8) Carpinetum ruscosum. From them Carpinetum poosum nemoralis and Carpinetum graminoso-mixtoherbosum are comparatively widespread and others are relatively rare.

In the phytocenological structure of plant communities 2 layer are sharply expressed: I layer - arborescent stratum, II layer – grass cover. Moss and lichen cover is not always developed. Average height of arborescent stratum vary in (3,5)4-5(7) m and density of canopy from 0,4-05 to 0,6-0,7(0,8-0,9) [40-50% to 60-70%(80-90%)].

Floristic composition is complex. Participation of main dominants of forests (*Quercus iberica*, *Fraxinus excelsior*) is not rare, but they in most cases are presented with 1-2 specimens. Majority of woody plants are characteristic species of forests and elements of shibliak and xerophytic forests are rare. Core of grass cover composition in the same way is created by forest components. Part of them is dominants of grass cover. Composition of herbs is enriched with characteristic plants of different types of shrubberies and, partially, of dry meadows and steppe-meadows, but they are not appertained to constant species.

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