

**BIOMASS AND THE AERIAL PRODUCTIVITY OF THE  
ARBORESCENT LAYER OF THE *ARO ORIENTALIS* -  
*CARPINETUM* (DOBRESCU ET KOVACS 1973) TÄUBER 1991-1992  
ASSOCIATION FROM THE VASLUI RIVER BASIN**

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**Abstract:** The hornbeam groves forming the *Aro orientalis* – *Carpinetum* (Dobrescu et Kovacs 1973) Täuber 1991-1992 association are analyzed both phytocoenologically and from the viewpoint of the biomass and aerial productivity of the arborescent layer it develops. This association achieve a density of 670 trees/ha, a biomass of 340967,47 kg/ha and a productivity of 10470 kg/ha/year.

**Key words:** phytocoenology, vegetation of forests, biomass, productivity.

The Vaslui river, springing from the Păun Hill, covers part of the Iassy and Vaslui countries from north to south, and flows into the Bârlad river, southward the Vaslui town. The hydrographic basin has a surface of about 646 km<sup>2</sup>.

The methods applied for calculating the biomass and aerial productivity of the arborescent layer had been taken over from the studies elaborated by different Romanian and foreign investigators [1,2,5,7,9-11].

The *Aro orientalis* – *Carpinetum* (Dobrescu et Kovacs 1973) Täuber 1991-1992 association is part of the *Aro orientalis* – *Carpinionion* (Dobrescu et Kovacs 1973) Täuber 1991-1992 suballiance, the *Lathyro hallersteinii* – *Carpinion* Boşcaiu 1974 alliance, *Fagetalia sylvaticae* Pawlowski in Pawlowski et al. 1928 order, *Querco* – *Fagetea* Br.-Bl. et Vlieger in Vlieger 1937 class (Table 1).

The woods formed by *Carpinus betulus*, *Quercus robur* and *Tilia tomentosa*, united in this association, are spreading over, at an average altitude of 300 m, on plateaus, terraces and low-sloping sides (with an average sloping of 6 degrees), with mainly-northern exposition.

The floristic composition, including 103 species, has an average number on the relevee of 27 species, of which about 80% belong to the *Querco-Fagetea* class.

The average coverage of the arborescent layer, of 80%, is usually formed of *Quercus robur*, *Carpinus betulus* and *Tilia tomentosa*, the average density being of 670 trees/ha, with *Carpinus betulus* predominant - 230 trees/ha -, followed by *Quercus robur*, with 227 trees/ha and *Tilia tomentosa*, with 92 trees/ha. The average diameter is of 25.08 cm – which means that the phytocoenosis may be considered as belonging to the small-wood stage (with diameter between 21-36 cm).

The largest diameters are recorded for *Quercus robur* (33.80 cm), *Fraxinus excelsior* (29.85 cm), *Carpinus betulus* (25.16 cm) and *Tilia tomentosa* (22.89).

The woody species belonging to this association realize an average aerial biomass of 340967.47 kg/ha, of which trunks' biomass is of 246959.32 kg/ha (representing

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72.44%), branches' biomass – 89906.41 kg/ha (26.36%) – where branches of the 2<sup>nd</sup> and 3<sup>rd</sup> order are prevailing – and finally, leaves' biomass – 4101.76 kg/ha (1.20%).

The most significant part to the formation of biomass is brought by *Quercus robur* – 153445.26 kg/ha, *Carpinus betulus* – 123081.51 kg/ha and *Tilia tomentosa* with 36847.98 kg/ha (Table 2).

Calculation of the aerial productivity of the arborescent layer gives an average amount per association of 10470 kg/ha/year, this value being influenced by the age, density and diameter of the species forming the phytocoenosis (Table 2).

The bushy layer covers, on the average, 7% of the surface, while the herbaceous one – abundant and varied – has an average coverage of 35%, the species with high constancy being: *Viola reichenbachiana*, *Geranium robertianum*, *Melica uniflora*, *Geum urbanum*, *Asarum europaeum*.

The bioforms' spectrum evidences the predominance of hemipterophytes (Figure 1), while the analysis of the phytogeographical elements illustrates the occurrence, in approximately equal ration, of the Euro-asian (38.7%) and European (37.73%) elements (Figure 2). The values of the ecological indices demonstrate that the species forming the association under study – which are mesophyllic, mesothermal and mesohydrophylic – are developing on neutral soils with a moderate content of mineral nitrogen (Figure 3).

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**Table 1**  
***Aro orientalis - Carpinetum* (Dobrescu et Kovacs 1973) Täuber 1991-1992**

Number of relevés	1	2	3	4	5	6	7	8	9	10	11	
Altitude(m)	330	330	310	230	250	230	360	350	350	393	230	
Exposition	NE	NV	NE	NV	SV	NV	NE	NV	NE	SV	V	
Slope (degrees)	-	20	3	5	10	10	5	8	-	8	5	
Coverage of the arborescent layer (%)	75	80	70	60	60	85	90	80	90	85	75	K
Coverage of the bushy and juvenile layer (%)	2	-	20	1	5	1	5	35	2	1	3	
Coverage of the herbaceous layer (%)	45	30	5	30	50	55	30	25	35	30	45	
Surface (m <sup>2</sup> )	1000											
Number of species	49	33	22	20	29	18	31	21	31	23	21	
<b><i>Association's characteristics</i></b>												
Arum orientale	+	-	+	-	-	-	-	-	-	-	-	I
<b><i>Aro orientalis-Carpinenion</i></b>												
Carpinus betulus	2	2	2	1	1	2	4	3	4	4	3	V
Carpinus betulus juv.	-	-	-	+	+	+	-	2	+	+	+	IV
Tilia tomentosa	+	2	+	+	+	+	+	-	+	+	+	V
Tilia tomentosa juv.	-	-	-	-	-	-	-	-	-	+	-	I
Lathyrus venetus	-	-	-	-	-	-	+	-	-	-	-	I
<b><i>Galio schultesii-Carpinenion</i></b>												
Cerasus avium	1	+	-	-	+	+	1	-	+	+	-	IV
Stellaria holostea	-	-	-	+	+	+	-	-	+	-	1	III
Campanula trachelium	+	+	+	-	-	-	-	-	-	-	-	II
Lathyrus vernus	-	-	-	-	+	-	+	-	-	+	-	II
Tilia cordata	-	-	+	-	-	-	+	-	+	1	-	II
Tilia cordata juv.	-	-	+	-	-	-	+	-	-	-	-	I
Carex pilosa	-	-	-	-	-	-	+	-	+	-	-	I
Galium schultesii	-	-	+	-	-	-	-	-	+	-	-	I
Dactylis polygama	+	+	-	-	-	-	-	-	-	-	-	I
Glechoma hirsuta	-	-	-	+	-	-	1	-	-	-	-	I
<b><i>Tilio platyphyllae-Acerion pseudoplatani</i></b>												
Acer pseudoplatanus juv.	-	-	-	-	-	-	-	+	-	-	-	I
<b><i>Symphyto cordati-Fagion</i></b>												
Epipactis helleborine	-	-	+	-	-	-	-	-	-	-	-	I
<b><i>Alnion incanae</i></b>												
Lamium maculatum	+	+	-	-	-	-	+	-	+	-	2	III
Urtica dioica	2	1	+	-	+	-	+	-	+	-	-	III
Alliaria petiolata	-	-	-	+	2	2	-	-	-	-	2	II
Geranium phaeum	+	-	-	-	-	-	-	-	+	+	-	II
Stellaria nemorum	-	-	2	2	2	-	-	-	-	-	-	II
Anthriscus sylvestris	-	-	-	-	+	-	+	-	-	+	+	II
Fraxinus angustifolia	+	-	-	-	-	-	-	-	-	-	-	I
Aegopodium podagraria	-	-	-	+	-	-	-	-	+	-	-	I
Circaea lutetiana	+	-	-	-	-	-	-	-	-	-	-	I
Sambucus nigra	+	-	-	-	-	-	-	+	-	-	-	I
Ulmus minor	+	-	-	-	-	-	-	+	-	-	-	I
Ulmus minor juv.	-	-	-	-	+	-	-	-	-	-	-	I
Glechoma hederacea	-	-	-	-	-	-	+	-	-	+	-	I
Cruciata glabra	+	+	-	-	-	-	-	-	-	-	-	I
Carex remota	+	-	-	-	-	-	-	-	-	-	-	I
<b><i>Fagetalia</i></b>												
Geranium robertianum	+	+	-	+	+	2	-	-	+	+	-	IV
Asarum europaeum	+	-	-	+	-	-	+	-	1	1	-	III
Sanicula europaea	-	+	-	-	-	-	+	+	+	2	-	III
Acer platanooides	+	-	-	-	-	-	+	+	-	+	-	II

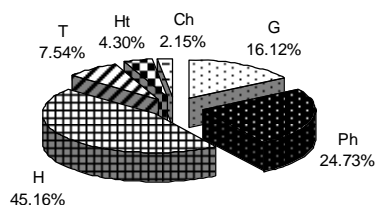
Acer platanoides juv.	-	-	-	-	-	-	1	1	-	+	-	II
Chaerophyllum temulum	+	+	-	+	-	-	-	+	-	-	-	II
Galium odoratum	-	-	+	+	+	-	+	-	+	1	1	II
Lamium galeobdolon	+	-	-	-	+	-	+	+	-	-	-	II
Lapsana communis	+	+	+	-	-	-	-	-	-	-	-	II
Salvia glutinosa	-	-	-	-	-	-	+	-	+	+	-	II
Allium ursinum												
ssp. ucrainicum	+	-	-	+	1	+	-	-	-	-	-	II
Euphorbia amygdaloides	-	-	+	-	+	-	-	-	+	-	-	II
Campanula rapunculoides	+	+	-	-	-	-	-	-	-	-	-	I
Carex sylvatica	-	-	-	-	-	-	-	+	-	-	-	I
Dentaria bulbifera	-	-	-	-	+	+	-	-	-	-	-	I
Pulmonaria obscura	-	-	-	-	-	-	+	-	-	-	-	I
Stachys sylvatica	+	-	-	-	-	-	-	-	-	-	-	I
Luzula luzuloides	-	-	-	-	-	-	-	-	-	+	-	I
Rubus hirtus	-	-	-	-	-	-	-	1	-	-	-	I
<b><i>Quercus-Fagetea</i></b>												
Quercus robur	1	1	2	2	2	3	1	+	1	1	1	V
Quercus robur juv.	-	-	+	+	+	-	+	-	+	-	-	III
Acer campestre	1	+	+	+	+	+	+	-	+	+	+	V
Acer campestre juv.	-	-	-	+	1	+	-	-	+	-	-	II
Viola reichenbachiana	+	+	+	-	+	+	1	+	+	-	-	IV
Evonymus verrucosus	+	-	1	-	-	-	-	+	+	-	+	III
Crataegus monogyna	+	-	1	-	-	-	-	+	+	-	+	III
Melica uniflora	1	2	-	-	+	-	+	-	+	+	-	III
Fraxinus excelsior	1	+	-	-	-	-	-	1	+	-	+	III
Fraxinus excelsior juv.	-	-	-	-	-	-	-	+	-	-	-	I
Geum urbanum	+	+	-	-	+	-	+	1	-	+	-	III
Mycelis muralis	+	+	+	-	-	-	-	-	-	-	-	II
Moehringia trinervia	+	+	-	-	-	2	-	-	-	-	-	II
Ranunculus ficaria	-	-	-	1	1	+	-	-	-	-	-	II
Brachypodium												
sylvaticum	-	-	-	-	-	-	-	-	2	-	-	I
Evonymus europaeus	+	-	-	-	-	-	-	-	-	-	-	I
Ulmus procera	+	-	-	-	-	-	-	-	-	-	-	I
Clematis vitalba	+	-	-	-	-	-	-	-	-	-	-	I
Poa nemoralis	-	+	-	-	-	-	-	-	-	-	-	I
Dryopteris filix-mas	-	+	-	-	-	-	-	-	-	-	-	I
Rosa canina	-	-	-	-	-	-	-	-	-	-	+	I
Viola odorata	-	-	-	-	-	-	+	-	-	-	-	I
Viola alba	-	-	-	-	-	-	-	-	-	+	-	I
Ranunculus auricomus	+	-	-	-	-	-	-	-	-	-	-	I
Lathyrus niger	+	-	-	-	-	-	-	-	-	-	-	I
Polygonatum latifolium	-	-	-	-	-	-	-	-	2	-	-	I
Anemone ranunculoides	-	-	-	-	-	-	-	-	-	-	+	I
Platanthera bifolia	-	-	-	-	-	-	+	-	-	-	-	I
Anemone nemorosa	-	-	-	-	-	-	-	-	-	-	+	I
<b><i>Quercetea pubescentis</i></b>												
Fragaria vesca	-	-	-	1	1	+	-	-	-	-	-	II
Polygonatum odoratum	-	-	-	-	-	-	+	+	-	-	+	II
Cornus sanguinea	+	-	-	-	-	-	-	-	-	-	+	I
Clinopodium vulgare	-	+	-	-	-	-	-	-	-	-	-	I
Agrimonia eupatoria	+	+	-	-	-	-	-	-	-	-	-	I
Acer tataricum	-	-	-	-	-	-	-	-	+	-	-	I
Cornus mas	-	-	1	-	-	-	-	-	-	-	-	I
Prunus spinosa	-	-	-	-	-	-	-	-	-	-	+	I
Viola hirta	+	+	-	-	-	-	-	-	-	-	-	I
<b><i>Companion</i></b>												
Galium aparine	+	+	-	-	-	+	+	-	-	-	-	II
Lysimachia nummularia	+	+	-	-	-	-	-	-	+	-	-	II

<i>Ajuga reptans</i>	+	-	-	+	+	-	-	-	-	-	-	II
<i>Veronica chamaedrys</i>	-	+	-	-	+	-	-	-	-	-	+	II
<i>Taraxacum officinale</i>	-	+	-	-	+	+	-	-	-	-	-	II
<i>Capsella bursa-pastoris</i>	-	-	-	-	-	-	-	-	-	-	+	I
<i>Acinos arvensis</i>	-	-	-	-	-	-	-	+	-	-	-	I
<i>Arctium tomentosum</i>	-	-	+	-	-	-	-	-	-	-	-	I
<i>Hypericum perforatum</i>	+	+	-	-	-	-	-	-	-	-	-	I
<i>Prunella vulgaris</i>	+	-	-	-	-	-	-	-	-	-	-	I
<i>Parietaria officinalis</i>	+	+	-	-	-	-	-	-	-	-	-	I
<i>Leonurus cardiaca</i> ssp. <i>villosus</i>	+	-	-	-	-	-	-	-	-	-	-	I
<i>Polygonum convolvulus</i>	-	+	-	-	-	-	-	-	-	-	-	I

Place and date of the releves:

1,2. dl. Movila, 11.06.2003; 3. dl. Prisăcii, 07.2001; 4-6,11. pd. Buda, 6.05.2002; 7,8. Poiana cu Cetate, 08.2001; 9. dl. Vărăriei, 23.08.2003; 10. Bârnova, 09.2002

Fig.1. The bioforms spectrum



Ph - phanerophytes, G - geophytes  
H - hemicryptophytes, T - therophytes  
Ht - hemitherophytes, Ch - chamephytes

Fig.2. The phytogeographical spectrum

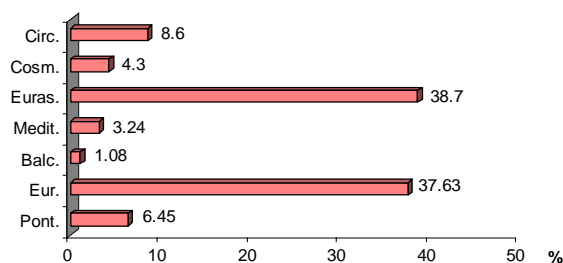
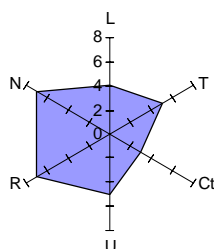


Fig.3. The ecological indices spectrum



L - light, T - temperature, Ct - continentality,  
U - humidity, R - pH, N - soil trophicity, based on  
mineral nitrogen contents

**Table 2**  
**Biomass (Kg/ha) and productivity (Kg/ha/year) of arborescent layer**

Species	Density (trees/ha)	Average diameter (cm)	Biomass (kg/ha)									Productivity (Kg/ha/year)
			Trunks	Branches					Leaves	Total		
				Total	5	4	3	2			1	
<b>dl. Movila - Tăcuta</b>												
Quercus robur	69	35.08	43700	13837.94	599.15	3397.56	5298.85	3802.24	740.14	745.2	58283.14	1720
Carpinus betulus	200	29.58	98056.92	31602.65	2109	6445.8	10720.71	9961.62	2365.52	1663.45	131323.02	3410
Tilia tomentosa	123	29.18	43085.8	14537.72	369.54	3781.11	5256.17	4696.42	434.07	442.5	58066.03	2410
Fraxinus excelsior	57	29.85	31304.8	11676.74	597.48	3676.26	3728.54	3382.18	292.28	279.58	43261.12	1596
Cerasus avium	60	27.86	18366.56	6190.22	-	1460.39	2409.85	2149.23	170.75	176.08	24732.86	466
Acer campestre	33	25.38	8823.95	2683.43	-	65.46	1305.29	1137.76	174.92	153.63	11661.01	378
<b>Total</b>	<b>542</b>	<b>29.86</b>	<b>243338.03</b>	<b>80528.7</b>	<b>3675.58</b>	<b>18826.58</b>	<b>28719.41</b>	<b>25129.45</b>	<b>4177.68</b>	<b>3460.44</b>	<b>327327.18</b>	<b>9980</b>
<b>Focșeasca</b>												
Quercus robur	350	24.96	102058.92	32855.06	956.36	6518.97	13083.99	10132.19	2163.55	2041.18	136955.16	4620
Carpinus betulus	150	23.11	44875.96	42601.33	-	2683.36	32854.88	6115.12	947.97	759.9	88237.19	2897
Tilia tomentosa	165	18.92	24247.64	8298.17	-	436.45	2567.53	4952.72	341.47	390.97	32936.78	2215
Cerasus avium	30	24.93	7474.65	2520.57	-	441.33	957.47	1047.89	73.88	82.32	10077.53	278
Acer campestre	40	23.11	8501.96	2579.99	-	88.76	1098.54	1197.54	195.15	169.21	11251.16	464
<b>Total</b>	<b>735</b>	<b>23.25</b>	<b>187159.13</b>	<b>88855.12</b>	<b>956.36</b>	<b>10168.87</b>	<b>50562.41</b>	<b>23445.46</b>	<b>3722.02</b>	<b>3443.58</b>	<b>279457.82</b>	<b>10474</b>
<b>pd. Buda</b>												
Quercus robur	355	29.73	142557.15	43178.64	-	4761.69	20324.69	15637.6	2454.66	2363.55	188099.34	5530
Carpinus betulus	250	19.07	25717.35	18751.96	-	394.32	8734.50	8599.08	1024.06	757.89	45227.2	3260

Cerasus avium	60	28.64	19301.64	6550.56	-	1588.56	2554.2	2232.48	175.32	179.4	26031.6	582
Acer campestre	105	10.00	2871	798	-	-	-	675	123	111	3780	370
Ulmus minor	20	19.07	2914.55	767.3	-	-	260.95	450.07	56.28	51.51	3733.36	220
<b>Total</b>	<b>790</b>	<b>24.40</b>	<b>193361.69</b>	<b>70046.46</b>	<b>-</b>	<b>6744.57</b>	<b>31874.34</b>	<b>27594.23</b>	<b>3833.32</b>	<b>3463.35</b>	<b>266871.5</b>	<b>10006</b>
<b>Bårnova</b>												
Quercus robur	132	45.46	171612.77	55913.25	5144.61	20024.07	16772.74	11192.43	2779.4	2917.4	230443.42	6452
Carpinus betulus	320	28.91	168077.51	56722.28	2284.71	10755.31	21279.18	18767.48	3635.6	2738.84	227538.63	3920
Tilia tomentosa	80	20.57	13736.03	4710.73	-	589.11	1559.72	2386.59	175.31	194.37	18641.13	620
Cerasus avium	8	22	1585.2	530.2	-	46.8	196.8	268.4	18.2	20.6	2136.00	57
Acer campestre	72	18.18	8966.92	2318.91	-	-	680	1454.54	184.37	168.47	11454.30	370
<b>Total</b>	<b>612</b>	<b>31.34</b>	<b>363978.43</b>	<b>120195.37</b>	<b>7429.32</b>	<b>31415.29</b>	<b>40488.44</b>	<b>34069.44</b>	<b>6792.88</b>	<b>6039.68</b>	<b>490213.48</b>	<b>11419</b>
<b>Average of the association</b>	<b>670</b>	<b>25.08</b>	<b>246959.32</b>	<b>89906.41</b>	<b>3015.31</b>	<b>16788.82</b>	<b>37911.15</b>	<b>27559.64</b>	<b>4631.47</b>	<b>4101.76</b>	<b>340967.47</b>	<b>10470</b>
<b>%</b>			<b>72.44</b>	<b>26.36</b>	<b>0.88</b>	<b>4.93</b>	<b>11.12</b>	<b>8.08</b>	<b>1.35</b>	<b>1.20</b>	<b>100.00</b>	