

ON-LINE SUPPLEMENTARY MATERIAL

Tzonev R., Mastrogianni A., Tsiripidis I., Dimitrov M., Gussev C., Mandžukovski D., Pachedjieva K.: Forest communities of the relict Balkan endemic *Aesculus hippocastanum*. Acta Bot Croat, DOI: 10.37427/botcro-2024-010

On-line Suppl. Tab 1. Header data of relevés used in the study. Latitude and longitude are given in decimal degrees (coordinate system WGS84).

Relevé	Altitude (m)	Aspect (°)	Slope (%)	Latitude	Longitude	Cover tree layer (%)	Cover shrub layer (%)	Cover herb layer (%)	Cover total (%)	Releve area (m ²)	Authors/Citation
B1	314	45	15	43.15266	26.75476	70	40	20		400	R. Tzonev, M. Dimitrov, Ch. Gussev
B2	330	315	20	43.15214	26.75359	90	50	15		400	R. Tzonev, M. Dimitrov, Ch. Gussev
B3	342	45	30	43.1519	26.75326	60	70	5		400	R. Tzonev, M. Dimitrov, Ch. Gussev
B4	357	45	30	43.14997	26.74987	80	30	50		400	R. Tzonev, M. Dimitrov, Ch. Gussev
B5	406	315	25	43.14997	26.74992	70	30	10		400	R. Tzonev, M. Dimitrov, Ch. Gussev
B6	416	45	35	43.14579	26.74724	70	50	40		400	R. Tzonev, M. Dimitrov, Ch. Gussev
B7	436	45	20	43.14491	26.74665	80	15	20		400	R. Tzonev, M. Dimitrov, Ch. Gussev
B8	320	315	20	43.15324	26.75724	80	30	60		400	R. Tzonev, M. Dimitrov, Ch. Gussev
B9	304	45	15	43.15304	26.76119	60	40	20		400	R. Tzonev, M. Dimitrov, Ch. Gussev
M1	680	90	2	41.541833	20.630498						Matvejeva and Nikolovski (1976)
M2	780	135	2	41.532118	20.655357						Matvejeva and Nikolovski (1976)
M3	1200	360	60	40.950691	20.805032						Matvejeva and Nikolovski (1976)
M4	1280	180	60	40.950852	20.807077						Matvejeva and Nikolovski (1976)
M5	810	45	30	41.481452	20.794431						Matvejeva and Nikolovski (1976)
M6	960	360	45	41.487764	20.785661						Matvejeva and Nikolovski (1976)
M7	1020	360	30	41.491376	20.779414						Matvejeva and Nikolovski (1976)
M8	900	360	70	41.486632	20.787872				60		Rizovski and Džekov (1990)
M9	950	90	60	41.48767	20.786039				80		Rizovski and Džekov (1990)
M10	1070	270	45	41.492194	20.775632				60		Rizovski and Džekov (1990)
G1	700	360	20	39.99	22.49	55	0	70		150	Bergmeier (1990)
G2	850	45	25	39.99	22.49	60	0	20		800	Bergmeier (1990)
G3	650	315	15	39.99	22.49	85	5	25		250	Bergmeier (1990)
G4	530	360	15	39.99	22.49	60	0	30		800	Bergmeier (1990)
G5	560	270	25	39.99	22.49	75	0	35		400	Bergmeier (1990)

On-line Suppl. Tab. 1. continued

G6	520	45	20	39.99	22.49	70	5	45	300	Bergmeier (1990)
G7	887	195	52	39.858185	20.831892	70	60	80	400	Mastrogianni (2020)
G8	1462	131	20	40.336424	21.093058	50	50	70	400	Mastrogianni (2020)
G9	1035	52	50	39.744814	20.877674	85	40	60	400	Mastrogianni (2020)
G10	1071	15	42	39.74928	20.86919	0	0	0	400	Mastrogianni (2020)
G11	976	345	40	40.027857	21.220045	75	60	60	400	Mastrogianni (2020)
G12	1020	360	85	40.03098	21.238106	0	0	0	400	Mastrogianni (2020)
G13	986	4	60	39.521505	21.424043	40	65	80	400	Mastrogianni (2020)
G14	982	351	80	39.421805	21.433276	90	35	50	400	Mastrogianni (2020)
G15	972	18	65	39.423333	21.431315	75	50	60	400	Mastrogianni (2020)
G16	925	21	75	39.431536	21.424254	80	40	70	400	Mastrogianni (2020)
G17	880	4	80	39.838598	22.709355	60	45	65	400	Mastrogianni (2020)
G18	663	342	70	39.849106	22.723148	65	35	40	400	Mastrogianni (2020)
G19	321	40	65	39.854017	22.708647	65	35	30	400	Mastrogianni (2020)
G20	340	3	55	39.859806	22.693633	75	20	40	400	Mastrogianni (2020)
G21	365	38	80	39.867563	22.670421	65	40	50	400	Mastrogianni (2020)
G22	595	97	70	39.998855	22.497125	75	15	45	400	Mastrogianni (2020)
G23	703	41	10	39.996668	22.492283	80	15	50	400	Mastrogianni (2020)
G24	657	349	60	39.997541	22.493606	70	10	70	400	Mastrogianni (2020)
G25	1175	172	70	39.214153	21.70955	85	35	60	400	Mastrogianni (2020)
G26	1047	25	45	39.214564	21.714492	90	35	65	400	Mastrogianni (2020)
G27	1032	31	75	39.214153	21.715049	95	20	50	400	Mastrogianni (2020)
G28	800	45	20	39.84	22.76	70	40	50	1500	Raus (1980)
G29	740	45	25	39.84	22.76	99	50	60	1500	Raus (1980)
G30	1500	180	20	39.53	21.51			90	100	Barbéro and Quézel (1976)
G31	1550	135	40	39.53	21.45			90	100	Barbéro and Quézel (1976)
G32	1400	180	15	39.52	21.42			90	100	Barbéro and Quézel (1976)
G33	1400	270	15	39.52	21.42			95	100	Barbéro and Quézel (1976)
G34	1300	360	25	39.61	21.33			80	100	Barbéro and Quézel (1976)
G35	1300	180	30	39.48	21.51			90	100	Barbéro and Quézel (1976)
G36	1400	135	25	39.52	21.42			95	100	Barbéro and Quézel (1976)

On-line Suppl. Tab. 2. continued

Df	<i>Arabis alpina</i> L.				r . . + r . . r r		
Df	<i>Lathyrus vernus</i> (L.) Bernh.				. . . . . r + r . . r r . . a a		
Df	<i>Viola odorata</i> L.				r l a l r r r r l . . . r r r .		
Df	<i>Rosa canina</i> L.				r r . r . . . r r		
Association Juglando regiae-Aesculetum hippocastani							
Ch	<i>Chaerophyllum hirsutum</i> L.						l . . + + l l + + l .
Ch	<i>Fraxinus excelsior</i> L.						+ + l . + l + . + l
Ch	<i>Rhamnus alpina</i> L. subsp. <i>fallax</i> (Boiss.) Maire & Petitm.						. + + . . + + l + l
Ch	<i>Juglans regia</i> L.	+ + +					l . . + + + l a l l l
Ch	<i>Lunaria rediviva</i> L.						. . . + l . + l + l
Ch	<i>Umbilicus rupestris</i> (Salisb.) Dandy				r . . . . .		. . . . a a a 3 l
Ch	<i>Asperula taurina</i> L.						+ + +
Ch	<i>Mercurialis ovata</i> Sternb. & Hoppe		l			l . r . r .	. . . . + l l l l
Ch	<i>Saxifraga rotundifolia</i> L.		. l l + + . + . r . + .		+ l r . a a r + l l		l . + l + l + + + l . l +
Ch	<i>Geranium macrorrhizum</i> L.		. a . . + . l . . r +		3 r r . . . l + . . . . .		. . . + l . + + l l
Ch	<i>Acer hyrcanum</i> Fisch. & C. A. Mey.		. . . . . l + + . r .		. . . . a . . r a . . . r r . .		+
Ch	<i>Frangula rupestris</i> (Scop.) Schur		. +				+ . +
Ch	<i>Asarum europaeum</i> L.						. +
Ch	<i>Dryopteris carthusiana</i> (Vill.) H. P. Fuchs						+
Ch	<i>Galium pseudaristatum</i> Schur						. +
Df	<i>Euonymus verrucosus</i> Scop.					r r r r	l l l + + + + + l
Df	<i>Lapsana communis</i> L.					. + . r . . . . .	. + + l l l + + + +
Df	<i>Clinopodium nepeta</i> (L.) Kuntze						. . . + l + l + + +
Df	<i>Lonicera xylosteum</i> L.						. . . + + + + + l .
Df	<i>Rhamnus cathartica</i> L.						. . . . + + l l l +
Df	<i>Solanum dulcamara</i> L.						+ . . . l + + + + .
Df	<i>Dactylis glomerata</i> L.					r . r . . . r r . . r . . r	+ + + + + l . + l +
Df	<i>Digitalis laevigata</i> Waldst. & Kit.					. . . . . r . r r	+ . . . + + + + + l
Df	<i>Hylotelephium maximum</i> (L.) Holub						+ + l . . . +
Df	<i>Knautia drymeia</i> Heuff.					r r	. . . + + + . + + l
Df	<i>Polygonatum odoratum</i> (Mill.) Druce		+ l r		. . . r . r r r r r . . . r .		l + + + . + + + + l
Df	<i>Geranium sylvaticum</i> L.						. . . l l + . . + .
Df	<i>Silene coronaria</i> (L.) Clairv.					 + + + + .
Df	<i>Salix eleagnos</i> Scop.						. . . l l . . + + .
Df	<i>Daphne mezereum</i> L.					 + . + + +
Df	<i>Veronica chamaedrys</i> L.					r . r r . . r . . . r r	l + + + + + . + + l . . l l . . .
Df	<i>Chelidonium majus</i> L.		. + + +				+ l + + + l
Df	<i>Geranium phaeum</i> L.						l + +

On-line Suppl. Tab. 2. continued

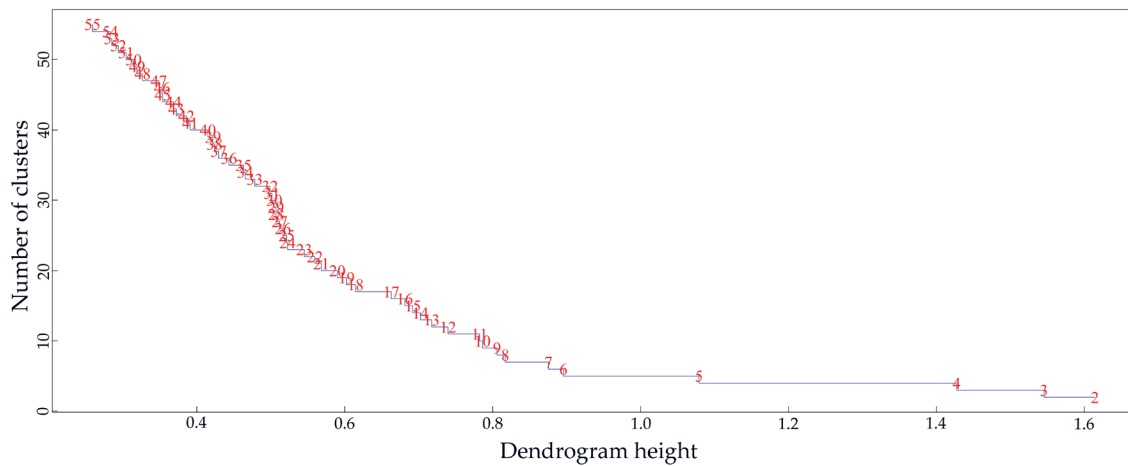
Df	<i>Geranium robertianum</i> L.	. . . + + +	+ + 1 1 1 1 1 1 1 1 r r r a a	r a l l a + + 1 1 1 . r r r . .	+ + + 1 1 1 1 1 1 1 1	. . . . . . . . . . .
Df	<i>Campanula trachelium</i> L.	. . . . . . . . . . .	. . . . + + + + . . . r .	. r r + r r r r r r r r +	+ + + 1 1 1 1 1 1 . .	. . . . . . . . . . .
Df	<i>Cicerbita muralis</i> (L.) Wallr.	. + . . . + + + + +	1 + 1 1 1 + 1 1 1 + + + +	1 1 1 1 1 + + r + 1 + + r + r r	+ + + + 1 + + 1 1 1 1	. a . . . 1
Df	<i>Polypodium vulgare</i> L.	+ . . . . . . . . . .	. + + . . . . 1 1 1 + r +	r r + r . r + r . .	. + + 1 + + + 1 + 1	. . . . . . . . . . .
Df	<i>Primula acaulis</i> (L.) L.	. . . . . . . . . . .	. + 1 + + 1 . .	r r r l + r . . . r + . r l	1 . + + + 1 1	1
Df	<i>Aremonia agrimonoides</i> (L.) DC.	. r . . . . . . . . . .	. + 1 . . + + + + . . r r .	r r r + l r + r r r r l	+ + + . . . . . . . .	. 1 1 1 + a 1
Df	<i>Corylus avellana</i> L.	. . . . + . . . . +	. . . . . . . . . . . . . . .	. 1 . . . 1 b a + 1 3 a a . 1 1	1 a a 1 + + + + . 1	. . . . . . . . . . .
Df	<i>Lamium maculatum</i> (L.) L.	. . . . . + . . . . .	. . . . . . . . . . . r . . . . .	. r r . + . r r + r + + . r . .	+ . . . + . + + + + .	. . . . . . . . . . .
Df	<i>Sedum cepaea</i> L.	. . . . . . . . . . .	. . . . . . . . . . + . r	+ r r r r . r . . . . . . . . . .	. + . . . 1 + 1 1 1 1	. . . . . . . . . . .
Df	<i>Daphne laureola</i> L.	. . . . . . . . . . .	+ . . . . . . . 1 r r . . . . .	. r + r r . . r r r . . . . + .	. . . . . . . . . . .	. + a a . 1 1
Df	<i>Physospermum cornubiense</i> (L.) DC.	. . . . . . . . . . .	. . . . . . . . . . . . . . .	. r . r . . . r r . r	. . . . . . . . . . .	+ + . . . . . . . . . .
Df	<i>Ostrya carpinifolia</i> Scop.	. . . . . . . . . . .	. a a + + . + + . . r a b	a a a 1 3 3 . a a a r .	4 1 1 + + 1 + +	1 1 . . + 3 4
Df	<i>Helleborus odorus</i> Willd. subsp. <i>cyclophyllus</i> (A. Braun) Maire & Petitm.	. . . . . . . . . . .	. . . . . . . . . . . . . . .	. . . r . . r r r . r r	+ + + + + . +	1 1 . 1 + . 1
Df	<i>Clinopodium vulgare</i> L.	. . . . . . . . . . .	. . . . . . . . . . . r . . . . .	. . . . . . . . . . . . . . .	+ . . . 1 . . + + . . .	. 1 + . . 1
	Other vascular species					
	<i>Clematis vitalba</i> L.	. r + . + . + + .	+ . 1 1 + . a a r r . . . . .	. r . a + . + 1 r . . r r l r l	1 + . + 1 + + 1 + . . . .	. 1 . . + + 1
	<i>Brachypodium sylvaticum</i> (Huds.) P. Beauv.	. + a + r . + . . .	. . + . 1 1 . 1 . . + r r	r r a a r . r +	+ . . . + + + + . 1	1 a a a + . 1
	<i>Acer pseudoplatanus</i> L.	. . . . . 1 1 a +	a 1 . . . . . . . . . . . . . .	. 3 4 r r a l l a . . r a . r .	. . . + 1 . . . + +	1 + + . . . +
	<i>Poa nemoralis</i> L.	+ r . . . . . . . . .	. 1 . + 1 + 1 1 . r r r . r	+ . r . + . r r r	1 1 . + . + + . . . . .	. 1 . . + +
	<i>Dioscorea communis</i> (L.) Caddick & Wilkin	. . +	a . + 1 + + 1 . r . r r . . . . .	. r + a . . r r . . r	+ + + . + + . . . . . . . .	. . . . . . . . . . .
	<i>Sanicula europaea</i> L.	. + . . . . + . + . .	. . 1 + . a 1 1 . r l r . . . . .	. . r . r . r r . . . . . . . . .	. . + + . . + . + . . . . .	. 1 a . . +
	<i>Ulmus glabra</i> Huds.	. . . + + + + . . . . .	. . 1 1 + . 1 . . . . . . . . .	. a 1 + . r . r b . r .	. . + . . + . + + . . . . .	. . . . . . . . . . .
	<i>Viola riviniana</i> Rchb.	. . . . . . . . . . .	. . . . . . . . 1 + + + r	. . . . + r + r r . . r r . . +	. . . . . . . . . . .	. . + . . 1
	<i>Pseudoturritis turrita</i> (L.) Al-Shehbaz	. + . . . . . . . . . .	. + . . . + + + . . . . . . . . .	. r r . r . . r . + . . . r r r	+ + . . . . . . . . . . . . . .	. . . . . . . . . . .
	<i>Cornus mas</i> L.	+ + + + . . . . . . . . .	. . . . . . . . . . . . . . .	. . 1 . r + r r a	+ + 1	1 . +
	<i>Dryopteris filix-mas</i> (L.) Schott	. . . . . . . . . . .	a 1 . . 1 + a 1 r r	r . . . r . r . . . . . . . . . .	. . + . . + . . . + . . . . .	. . . . . . . . . . .
	<i>Urtica dioica</i> L.	. + +	+ + . + 1 . . 1 . r . r . . . . . . .	. a r . r . . . r . . . r . . . . .	. . . . . . . . . . . . . . .	. . . . . . . . . . .
	<i>Euphorbia amygdaloides</i> L.	. . . . . + . . . . . . . . . .	. . . . . . . . . . . r r	r r + . . r . . r r . . . . . . . .	+ . + . + . + . . . . . + . . . . .	. . . . . . . . . . .
	<i>Acer obtusatum</i> Willd.	. . . . . . . . . . . . . . . . . .	. . . . . . . . . . . . . . . a	a r b . . . 1 . . . b 1	1 1 1 . . + + +
	<i>Cardamine bulbifera</i> (L.) Crantz	. . . . . . . . . . . . . . . . . .	. . . . . . . . . . . + . . . 1 a	. + + r . r r . . . . . . . . . . .	. . + 1 . + . . + 1 . . . . . . . . . .	. . . . . . . . . . . . . . . . . .
	<i>Geum urbanum</i> L.	. . . + . . + . . . . . . . . . . . . . .	. . . . . + + . . . . . . . . . . . . . .	. . r . . . . . . . . . . . . . . . . . .	. . . 1 1 . 1 + 1 . . . . . . . . . .	. 1 1 1

On-line Suppl. Tab. 2. continued

<i>Bubon macedonicum</i> L.				r					
<i>Campanula patula</i> L.						r			
<i>Campanula persicifolia</i> L.									+
<i>Cardamine impatiens</i> L.							l		
<i>Carex digitata</i> L.							l		
<i>Carex remota</i> L.		+							
<i>Cephalanthera damasonium</i> (Mill.) Druce				r					
<i>Chaerophyllum aureum</i> L.				r					
<i>Colutea arborescens</i> L.							+		
<i>Cyclamen repandum</i> Sibth. & Sm.									+
<i>Cytisus hirsutus</i> L.				r					
<i>Dorycnium pentaphyllum</i> Scop. subsp. <i>herbaceum</i> (Vill.) Bonnier & Layens				r					
<i>Epilobium angustifolium</i> L.			l						
<i>Epipactis atrorubens</i> (Hoffm.) Besser				r					
<i>Epipactis exilis</i> P. Delforge				r					
<i>Equisetum ramosissimum</i> Desf.				r					
<i>Eryngium palmatum</i> Pančić & Vis.							+		
<i>Eupatorium cannabinum</i> L.		+							
<i>Fraxinus angustifolia</i> Vahl							+		
<i>Fritillaria pontica</i> Wahlenb.		+							
<i>Galium lucidum</i> All.							l		
<i>Gentiana asclepiadea</i> L.			l						
<i>Geranium asphodeloides</i> Burm. f.			+						
<i>Geranium sanguineum</i> L.									+
<i>Hesperis sylvestris</i> Crantz							+		
<i>Hieracium lachenalii</i> Suter				r					
<i>Hypopitys monotropa</i> Crantz						r			
<i>Juniperus foetidissima</i> Willd.					r				
<i>Lathyrus alpestris</i> (Waldst. & Kit.) Čelak.		+							
<i>Ligustrum vulgare</i> L.							+		
<i>Lonicera caprifolium</i> L.							+		
<i>Lonicera etrusca</i> Santi			+						
<i>Lysimachia punctata</i> L.				r					
<i>Melica ciliata</i> L.					r				
<i>Melissa officinalis</i> L.			+						
<i>Neottia ovata</i> (L.) Bluff & Fingerh.						r			
<i>Origanum vulgare</i> L.					r				
<i>Oxalis acetosella</i> L.			+						

On-line Suppl. Tab 3. Conditional term effects of explanatory variables calculated by CCA analysis. Statistical significance was tested by applying 999 unrestricted permutations. Abbreviations as in Fig. 3 in the article text. Furthermore, Sl: slope, Bio19: Precipitation of Coldest Quarter, Bio13: Precipitation of Wettest Month, Bio18: Precipitation of Warmest Quarter, Bio8: Mean Temperature of Driest Quarter, Bio5: Min Temperature of Coldest Month, Bio10: Mean Temperature of Warmest Quarter, Bio11: Mean Temperature of Coldest Quarter, Bio9: Mean Temperature of Driest Quarter, Bio1: Annual Mean Temperature, Bio2: Mean Diurnal Range, and Bio16: Precipitation of Wettest Quarter.

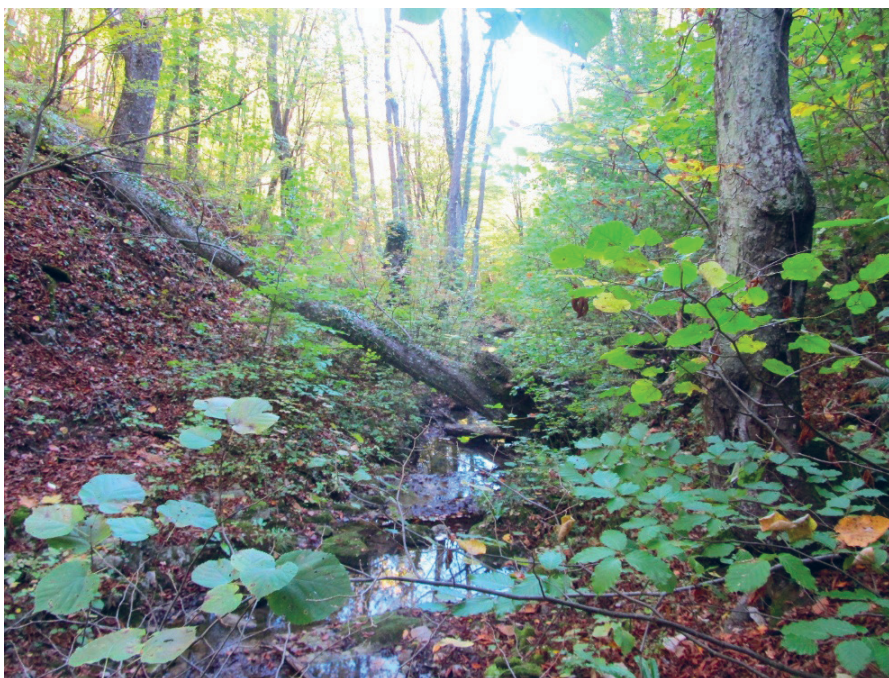
Variable's Name	Unique percentage of explained variation (%)	pseudo-F test statistic	P-value
Alt	7.8	4.5	0.001
Lat	7.4	4.6	0.001
Lon	7.2	4.7	0.001
Bio4	4.3	2.9	0.001
Bio15	3.2	2.3	0.001
Bio3	3.1	2.2	0.001
Bio7	2.4	1.7	0.002
Bio17	2.2	1.6	0.006
Bio14	2.8	2.1	0.001
Bio12	1.9	1.5	0.002
Sl	1.7	1.3	0.03
Bio19	1.7	1.3	0.025
Bio13	1.8	1.4	0.007
Bio18	1.5	1.2	0.068
Bio8	1.5	1.2	0.056
Bio5	1.6	1.3	0.037
Bio10	1.5	1.2	0.054
Bio11	1.4	1.2	0.125
Bio9	1.4	1.1	0.191
Bio1	1.4	1.1	0.2
Bio2	1.1	0.9	0.636
Bio16	1	0.8	0.93



On-line Suppl. Fig. 1. Fusion level values plot, indicating that the distinction of four up to six clusters is reasonable.



On-line Suppl. Fig. 2. *Ass. Staphyleo-Aesculetum* in Dervisha Reserve, Shumen district, NE Bulgaria, old Horse-chestnut tree (Photo: R. Tzonev).



On-line Suppl. Fig. 3. *Ass. Staphyleo-Aesculetum* in Dervisha Reserve, Shumen district, NE Bulgaria, the small valley of Dervishka River (Photo: R. Tzonev).



On-line Suppl. Fig. 4. Ass. *Staphyleo-Aesculetum* in Dervisha Reserve, Shumen district, NE Bulgaria, typical appearance (Photo: R. Tzonev).



On-line Suppl. Fig. 5. Ass. *Rusco hypoglossi-Aesculetum hippocastani* in Mt. Kato Olympos, Greece (Photo: I. Tsiripidis).



On-line Suppl. Fig. 6. *Ass. Rusco hypoglossi-Aesculetum hippocastani* in Mt. Ossa, Greece (Photo: A. Mastrogianni).



On-line Suppl. Fig. 7. *Aesculus hippocastanum-Tilia platyphyllos* community, 1 km southern from village Vrachos, at the locality "Ontria" (Photo: I. Tsiripidis).



On-line Suppl. Fig. 8. *Aesculus hippocastanum*-*Tilia platyphyllos* community, southwest of Lake Plastiras (Photo: A. Mastrogianni).



On-line Suppl. Fig. 9. Ass. *Juglando-Aesculetum* – locality “Garska Reka”, Debar district, NW Macedonia (Photo: J. Acevski)



On-line Suppl. Fig. 10. *Ass. Juglando-Aesculetum* – locality “Garska Reka”, Debar district, NW Macedonia (Photo: J. Acevski).



On-line Suppl. Fig. 11. *Aesculus hippocastanum-Abies borisii-regis* community, 3 km after the village Pyrra, towards the village Neraidochori (Photo: A. Mastrogiani).



On-line Suppl. Fig. 12. *Aesculus hippocastanum*-*Abies borisii-regis* community, 3 km after the village Pyrra, towards the village Neraidochori (Photo: A. Mastrogianni).