

Evolution of sexual dimorphism and Rensch's rule in the beetle genus *Limnebius* (Hydraenidae) - is sexual selection opportunistic?

Supporting information

Table S1. Studied species of *Limnebius*, with species groups, authors, and measures per species. lm, lf and lg, length of males, females and male genitalia respectively; Nm, Nf and Ng, number of measured males, females and male genitalia; stv.lm, stv.lf and stv.lg, standard deviation of measured males, females and male genitalia (for less than seven specimens the total range is given); per, perimeter of the male genitalia; fd, fractal dimension of the male genitalia.

Table S2. Specimens used in the molecular phylogeny, with country, voucher, species group according to Rudoy et al. (2016) and GenBank accession numbers (from Rudoy & Ribera, 2016).

Table S3. Reconstructed values of the measured variables in all branches of the phylogeny and estimated measurements of SSD. See Fig. S4 for the location of the branch numbers in the phylogeny. The raw values of male and female body size of the initial and final nodes of each branch are given, together with the amount of phenotypic change and the change measured in darwins ($\times 10^6$). In pink, composite branch after deleting terminals with missing males. In yellow, estimated values of *lf*.

Evolution of the sexual dimorphism in the beetle genus *Limnebius* (Hydraenidae) - is sexual selection opportunistic?

Andrey Rudoy & Ignacio Ribera

Table S1

Studied species of *Limnebius*, with species groups, authors, voucher of the specimens used in then molecular phylogeny, and measures per species.

lm, lf and lg, length of males, females and male genitalia respectively; Nm, Nf and Ng, number of measured males, females and male genitalia; stv.lm, stv.lf and stv.lg, standard deviation of measured males, females and male genitalia; per, perimeter of the male genitalia; fd, fractal dimension of the male genitalia; SSct, secondary sexual characters of the metatibiae (0 none, 1 with setae, 2 widened, 3 with distal part enlarged); SSCa, secondary sexual characters of the VI abdominal ventrite (0 none, 1 with setae, 2 with a protuberance).

No	genus	subgenus	species group	species	author and year	voucher (molecular phylog)	lm	lf	lg	Nm	Nf	Ng	stv.lm	stv.lf	stv.lg	per	fd	SSct	SSCa
1	<i>Laeliaena</i>			<i>sahlbergi</i>	Champion, 1920	MNCN-HI19	1.21	?	0.34	3	0	3	1.20-1.22	-	0.32-0.35	3.003	1.284	0	0
2	<i>Laeliaena</i>			<i>sichuanensis</i>	Jäch, 1995		1.42	1.43	0.39	7	46	7	0.065	0.055	0.0140	2.836	1.256	0	0
3	<i>Laeliaena</i>			<i>sparsa</i>	Sahlberg, 1900		1.11	?	0.38	2	0	2	1.10-1.11	-	0.36-0.39	2.344	1.232	0	0
4	<i>Limnebius</i>	<i>Bilimneus</i>		<i>acupunctus</i>	Perkins, 2004	MNCN-AI582	[0.85]	?	[0.21]	0	0	0	-	-	-	-	-	0	0
5	<i>Limnebius</i>	<i>Bilimneus</i>		<i>angustipennis</i>	d'Orchymont, 1932		0.84	?	0.29	1	0	1	-	-	-	2.262	1.176	0	0
6	<i>Limnebius</i>	<i>Bilimneus</i>		<i>arabicus</i>	Balfour-Browne, 1951		0.76	0.85	0.23	8	8	1	0.024	0.023	-	2.316	1.174	0	0
7	<i>Limnebius</i>	<i>Bilimneus</i>		<i>atomus</i>	(Duftschmid, 1805)	MNCN-AI1217	0.99	1.06	0.41	12	6	9	0.031	0.99-1.12	0.0154	2.340	1.176	0	0
8	<i>Limnebius</i>	<i>Bilimneus</i>		<i>boukali</i>	Jäch, 1993		0.94	1.06	0.25	14	5	4	0.041	1.03-1.1	0.24-0.25	2.438	1.186	0	0
9	<i>Limnebius</i>	<i>Bilimneus</i>		<i>clavatus</i>	Pu, 1951		0.81	?	0.21	2	0	2	0.80-0.81	-	0.20-0.21	2.457	1.164	0	0
10	<i>Limnebius</i>	<i>Bilimneus</i>		<i>cruzei</i>	Jäch, 1982		0.87	1.03	0.32	1	2	1	-	1-1.05	-	2.106	1.181	0	0
11	<i>Limnebius</i>	<i>Bilimneus</i>		<i>curidius</i>	d'Orchymont, 1941		0.98	1.07	0.33	9	7	2	0.030	0.035	0.32-0.34	2.392	1.172	0	0
12	<i>Limnebius</i>	<i>Bilimneus</i>		<i>dioscoridus</i>	Jäch & Delgado, 2012	IBE-RA728	0.84	0.98	0.23	4	4	1	0.74-0.77	0.83-0.86	0.22-0.24	2.310	1.175	0	0
13	<i>Limnebius</i>	<i>Bilimneus</i>		<i>endroedyi</i>	Perkins, 2015	IBE-AN78	0.86	1.08	0.41	1	1	1	-	-	-	2.177	1.173	0	0
14	<i>Limnebius</i>	<i>Bilimneus</i>		<i>evanescens</i>	Kiesenwetter, 1866	MNCN-AI915	0.88	1.01	0.32	36	14	32	0.040	0.039	0.0144	2.250	1.166	0	0
15	<i>Limnebius</i>	<i>Bilimneus</i>		<i>extraneus</i>	d'Orchymont, 1938	IBE-RA89	0.84	0.95	0.37	17	10	15	0.044	0.053	0.0150	2.347	1.174	0	0
16	<i>Limnebius</i>	<i>Bilimneus</i>		<i>feuerborni</i>	d'Orchymont, 1932	IBE-AR11	0.83	?	0.25	1	0	1	-	-	-	2.477	1.165	0	0
17	<i>Limnebius</i>	<i>Bilimneus</i>		<i>kelaniyae</i>	Jäch, 1982		0.82	?	0.36	1	0	1	-	-	-	2.456	1.184	0	0
18	<i>Limnebius</i>	<i>Bilimneus</i>		<i>kwangtungensis</i>	Pu, 1936		0.88	?	0.29	3	0	3	0.84-0.90	-	0.28-0.30	2.309	1.170	0	0
19	<i>Limnebius</i>	<i>Bilimneus</i>		<i>kweichowensis</i>	Pu, 1951		0.96	1.04	0.47	7	14	2	0.019	0.042	0.46-0.47	2.610	1.181	0	0
20	<i>Limnebius</i>	<i>Bilimneus</i>		<i>joeblorum</i>	Jäch, 1993		0.94	?	0.29	1	0	1	-	-	-	2.394	1.169	0	0
21	<i>Limnebius</i>	<i>Bilimneus</i>		<i>myrmidon</i>	Rey, 1883	MNCN-AI703	0.89	0.97	0.23	34	22	14	0.041	0.026	0.0072	2.522	1.165	0	0
22	<i>Limnebius</i>	<i>Bilimneus</i>		<i>nakanei nakanei</i>	Jäch & Matsui, 1994	MNCN-AC30	0.86	0.98	0.23	6	10	4	0.84-0.87	0.88-0.98	0.23-0.30	2.359	1.171	0	0
23	<i>Limnebius</i>	<i>Bilimneus</i>		<i>nanus</i>	Jäch, 1993		0.84	0.92	0.25	1	0	1	-	-	-	2.268	1.164	0	0
24	<i>Limnebius</i>	<i>Bilimneus</i>		<i>oblongus</i>	Rey, 1883	MNCN-AI942	1.01	1.08	0.43	13	1	11	0.042	0.023	0.0097	2.343	1.176	0	0
25	<i>Limnebius</i>	<i>Bilimneus</i>		<i>pararabicus</i>	Jäch & Delgado, 2013	IBE-RA761	0.82	1.00	0.26	9	1	8	0.035	-	0.0116	2.217	1.177	0	0
26	<i>Limnebius</i>	<i>Bilimneus</i>		<i>perparvulus</i>	Rey, 1884	MNCN-AI428	0.91	1.00	0.44	47	37	21	0.042	0.048	0.0230	2.246	1.180	0	0
27	<i>Limnebius</i>	<i>Bilimneus</i>		<i>pollex</i>	Jäch & Delgado, 2013	IBE-RA1019	0.93	?	0.44	1	0	1	-	-	-	2.263	1.159	0	0
28	<i>Limnebius</i>	<i>Bilimneus</i>		<i>rufipennis</i>	Régimbart, 1903		0.80	0.91	0.25	19	9	9	0.045	0.022	0.0137	2.316	1.167	0	0
29	<i>Limnebius</i>	<i>Bilimneus</i>		sp India1		IBE-AF193	0.83	1.38	0.31	2.00	4	3	1.26-1.31	1.34-1.4	0.49-0.51	2.200	1.168	0	0
30	<i>Limnebius</i>	<i>Bilimneus</i>		sp India2			0.99	?	0.39	1	0	1	-	-	-	-	-	0	0
31	<i>Limnebius</i>	<i>Bilimneus</i>		sp Bhutan		MNCN-AI1271	0.83	1.06	0.31	1	4	1	-	0.99-1.16	-	2.200	1.170	0	0
32	<i>Limnebius</i>	<i>Bilimneus</i>		<i>taiwanensis</i>	Jäch, 1993		0.83	1.00	0.22	18	12	9	0.048	0.042	0.0121	2.246	1.166	0	0
33	<i>Limnebius</i>	<i>Bilimneus</i>		<i>thienemanni</i>	d'Orchymont, 1932		0.98	1.15	0.24	4	6	3	0.93-1.04	1.06-1.18	0.23-0.26	2.148	1.175	0	0
34	<i>Limnebius</i>	<i>Bilimneus</i>		<i>wewalkai</i>	Jäch & Delgado, 2010	IBE-RA108	0.83	0.91	0.36	13	10	7	0.032	0.043	0.0086	2.277	1.184	0	0
35	<i>Limnebius</i>	<i>Limnebius</i>	<i>gracilipes</i>	<i>canariensis</i>	d'Orchymont, 1938		1.66	1.37	0.49	3	1	3	1.56-1.75	-	0.47-0.50	5.324	1.335	0	2
36	<i>Limnebius</i>	<i>Limnebius</i>	<i>gracilipes</i>	<i>cordobanus</i>	d'Orchymont, 1938	MNCN-AI1024/IBE-PA275	0.92	1.01	0.33	24	14	11	0.057	0.049	0.0100	3.850	1.252	0	0
37	<i>Limnebius</i>	<i>Limnebius</i>	<i>gracilipes</i>	<i>fallaciosus</i>	Ganglbauer, 1904	IBE-RA1121	1.31	1.40	0.42	22	28	4	0.035	0.041	0.41-0.45	7.254	1.335	0	2
38	<i>Limnebius</i>	<i>Limnebius</i>	<i>gracilipes</i>	<i>gracilipes</i>	Wollaston, 1864	MNCN-AI1094	1.32	1.50	0.40	15	0	5	0.054	0.032	0.37-0.42	5.130	1.323	0	2
39	<i>Limnebius</i>	<i>Limnebius</i>	<i>gracilipes</i>	<i>pagonettii</i>	Ganglbauer, 1904		1.77	1.41	0.50	27	9	10	0.073	0.058	0.0145	7.446	1.374	0	2
40	<i>Limnebius</i>	<i>Limnebius</i>	<i>nitidus-mundus</i>	<i>attalensis</i>	Jäch, 1993		1.04	?	0.28	2	0	2	1.04-1.09	-	0.28-0.32	2.878	1.201	0	0
41	<i>Limnebius</i>	<i>Limnebius</i>	<i>nitidus-mundus</i>	<i>distinguendus</i>	Ferro, 1989		1.15	?	0.30	2	0	2	1.10-1.20	-	0.29-0.32	2.436	1.161	0	0
42	<i>Limnebius</i>	<i>Limnebius</i>	<i>nitidus-mundus</i>	<i>ferroi</i>	Jäch, 1993		1.00	1.11	0.33	18	8	6	0.034	0.013	0.32-0.34	2.266	1.194	0	0
43	<i>Limnebius</i>	<i>Limnebius</i>	<i>nitidus-mundus</i>	<i>fontinalis</i>	Balfour-Browne, 1951		1.14	1.35	0.44	2	2	2	1.13-1.15	1.31-1.39	0.43-0.45	2.349	1.183	0	0
44	<i>Limnebius</i>	<i>Limnebius</i>	<i>nitidus-mundus</i>	<i>mundus</i>	Baudi di Selve, 1864		1.02	?	0.24	1	0	1	-	-	-	2.456	1.198	0	0
45	<i>Limnebius</i>	<i>Limnebius</i>	<i>nitidus-mundus</i>	<i>murcius</i>	d'Orchymont, 1945		0.95	1.06	0.33	1	1	1	-	-	-	2.380	1.190	0	0
46	<i>Limnebius</i>	<i>Limnebius</i>	<i>nitidus-mundus</i>	<i>murentius</i>	d'Orchymont, 1945	IBE-AN53	1.09	1.15	0.32	10	4	10	0.041	1.1-1.18	0.0106	2.379	1.187	0	0

102	<i>Limnebius</i>	<i>Limnebius</i>	parvulus-parvulus	<i>reuveortali</i>	Jäch, 1993	IBE-AN45	2.02	1.70	0.51	3	10	3	2.00-2.06	0.042	0.49-0.54	5.731	1.313	0	1
103	<i>Limnebius</i>	<i>Limnebius</i>	parvulus-parvulus	<i>rubropiceus</i>	Kuwert, 1890	IBE-AN32	1.93	1.63	0.65	13	74	9	0.073	0.072	0.0200	5.746	1.340	0	1
104	<i>Limnebius</i>	<i>Limnebius</i>	parvulus-parvulus	<i>shatrovskiyi</i>	Jäch, 1993		1.92	1.70	0.75	17	3	7	0.083	1.57-1.75	0.0295	4.229	1.301	0	1
105	<i>Limnebius</i>	<i>Limnebius</i>	parvulus-parvulus	<i>stagnalis</i>	Guillebeau, 1890	MNCN-AI824	1.87	1.63	0.55	78	7	46	0.090	0.061	0.0320	5.442	1.335	0	1
106	<i>Limnebius</i>	<i>Limnebius</i>	parvulus-setifer	<i>claviger</i>	Jäch, 1993		2.31	1.89	0.64	3	2	2	2.27-2.34	1.87-1.9	0.66-0.67	6.695	1.337	0	1
107	<i>Limnebius</i>	<i>Limnebius</i>	parvulus-setifer	<i>setifer</i>	lablokoff-Khznorian, 1962		2.13	?	0.71	1	0	1	-	-	-	7.876	1.331	0	1
108	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>alutaceus</i>	(Casey, 1886)		1.19	?	0.27	1	0	1	-	-	-	2.642	1.211	0	0
109	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>angustus</i>	(Casey, 1886)		1.12	?	0.29	1	0	1	-	-	-	2.316	1.176	0	0
110	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>arenicolus</i>	Perkins, 1980	MNCN-AI466	1.26	1.30	0.47	14	16	14	0.046	0.038	0.0150	2.822	1.216	0	0
111	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>borealis</i>	Perkins, 1980		1.18	?	0.53	1	0	1	-	-	-	2.708	1.213	0	0
112	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>discolor</i>	Casey, 1900		1.07	?	0.38	1	0	1	-	-	-	2.726	1.197	0	0
113	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>leechi</i>	Perkins, 1980		1.12	?	0.35	1	0	1	-	-	-	2.679	1.188	0	0
114	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>mexicanus</i>	Perkins, 1980		1.29	?	0.36	1	0	1	-	-	-	2.418	1.210	0	0
115	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>mitus</i>	Perkins, 1980		1.27	?	0.27	1	0	1	-	-	-	2.929	1.185	0	0
116	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>octolaevis</i>	Perkins, 1980		1.11	?	0.41	1	0	1	-	-	-	2.500	1.209	0	0
117	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>ozapalachicus</i>	Perkins, 1980		1.18	?	0.40	1	0	1	-	-	-	2.678	1.199	0	0
118	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>piceus</i>	(Horn, 1872)	IBE-RA1120	1.20	1.22	0.45	3	2	3	1.12-1.29	1.19-1.25	0.44-0.46	2.548	1.219	0	0
119	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>richmondi</i>	Perkins, 1980		1.30	?	0.53	1	0	1	-	-	-	2.780	1.249	0	0
120	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>sinuatus</i>	(Sharp, 1882)	IBE-AR9	1.22	1.29	0.36	1	2	1	-	1.19-1.38	-	2.772	1.195	0	0
121	<i>Limnebius</i>	<i>Limnebius</i>	piceus	<i>texanus</i>	Perkins, 1980		1.20	1.34	0.42	11	11	3	0.065	0.041	0.41-0.44	2.664	1.216	0	0

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Table S3

Reconstructed values of the measured variables in all branches of the phylogeny and estimated measurements of SSD.

See Figure S3 for the location of the branch numbers in the phylogeny. The raw values of male and female body size of the initial and final nodes of each branch are given, together with the amount of phenotypic change and the change measured in darwins (x10). In pink, composite branch after deleting terminals with missing males. In yellow, estimated values of lf.

branch	compound	terminal	subgenus	branch measures						SSD measures						qualitative measures						
				initial		final		phenotypic change		darwins x10 ⁶		rSSD		absolute dif SSD change		darwins cha>5% change		phenotypic cha>5% change				
				lfi	lff	lmi	lmf	p(lf)	p(lm)	d(lf)	d(lm)	lm/lf	ABS(p(lm))	ABS(lmf-lff d(lm)-d(lf))	lf	lm	lf	lm	SSD lf	SSD lm		
1	sahlbergi	Laeliaena	1.250	1.247	1.270	1.420	-0.003	0.150	0.000	0.003	1.139	0.147	0.154	0.003	0.997	1.118	-	+	+	=	+	+
2		stem Limnebius	1.250	1.251	1.270	1.249	0.001	-0.021	0.000	0.003	0.998	0.020	-0.017	0.003	1.001	0.984	+	-	-	=	=	-
3		stem Bilimneus	1.251	1.101	1.249	0.994	-0.150	-0.256	0.021	0.902	0.106	0.106	0.009	0.880	0.795	-	-	+	-	-	+	
4		stem s.str.	1.251	1.392	1.249	1.438	0.140	0.189	0.011	0.014	1.033	0.049	0.044	0.003	1.112	1.151	+	+	+	+	+	+
5		Bilimneus	1.101	1.096	0.994	0.968	-0.005	-0.026	0.002	0.013	0.883	0.021	0.021	0.011	0.996	0.974	-	-	+	=	-	+
6		Bilimneus	1.101	1.048	0.994	0.945	-0.053	-0.049	0.012	0.012	0.902	-0.005	-0.005	0.000	0.951	0.951	-	-	-	-	-	+
8		Bilimneus	1.096	1.093	0.968	0.947	-0.003	-0.021	0.001	0.011	0.866	0.018	0.018	0.010	0.997	0.979	-	-	+	=	=	+
10 7+10	pollex	Bilimneus	1.096	1.100	0.968	0.930	0.003	-0.038	0.000	0.002	0.846	0.034	0.041	0.002	1.003	0.961	+	-	+	=	-	+
11	sp India	Bilimneus	1.093	1.092	0.947	0.830	-0.001	-0.117	0.000	0.009	0.760	0.116	0.116	0.009	0.999	0.877	-	-	+	=	-	+
12		Bilimneus	1.093	1.084	0.947	0.937	-0.009	-0.010	0.002	0.003	0.864	0.001	0.001	0.001	0.991	0.989	-	-	+	=	=	+
13	feuerborni	Bilimneus	1.084	1.084	0.937	0.830	0.000	-0.107	0.000	0.011	0.766	0.106	0.107	0.011	1.000	0.886	+	-	+	=	=	+
15 14+15	atomus	Bilimneus	1.084	1.060	0.937	0.990	-0.024	0.053	0.002	0.005	0.934	0.029	-0.077	0.003	0.978	1.057	-	+	-	=	+	-
17		Bilimneus	1.048	1.035	0.945	0.904	-0.013	-0.041	0.002	0.008	0.873	0.028	0.028	0.006	0.988	0.956	-	-	+	=	-	+
18		Bilimneus	1.048	1.019	0.945	0.933	-0.028	-0.012	0.011	0.005	0.915	-0.016	-0.016	-0.006	0.973	0.987	-	-	-	-	=	=
19	endroedyi	Bilimneus	1.035	1.080	0.904	0.860	0.045	-0.044	0.005	0.006	0.796	-0.001	0.089	0.001	1.043	0.952	+	-	+	+	-	+
20		Bilimneus	1.035	1.022	0.904	0.902	-0.013	-0.002	0.007	0.001	0.882	-0.011	-0.011	-0.006	0.987	0.998	-	-	-	=	=	=
21	evanescens	Bilimneus	1.022	1.010	0.902	0.880	-0.012	-0.022	0.002	0.004	0.871	0.009	0.009	0.002	0.988	0.976	-	-	+	=	=	=
22		Bilimneus	1.022	1.007	0.902	0.904	-0.015	0.003	0.006	0.001	0.898	-0.012	-0.018	-0.005	0.986	1.003	-	+	-	=	=	-
23	extraneus	Bilimneus	1.007	0.950	0.904	0.840	-0.057	-0.064	0.014	0.018	0.884	0.007	0.007	0.004	0.943	0.929	-	-	+	-	-	=
24		Bilimneus	1.007	1.028	0.904	0.944	0.021	0.039	0.009	0.018	0.918	0.019	-0.019	0.009	1.021	1.044	+	+	-	=	+	-
25	perparvulus	Bilimneus	1.028	1.000	0.944	0.910	-0.028	-0.034	0.016	0.021	0.910	0.006	0.006	0.005	0.973	0.964	-	-	+	-	-	=
26	oblongus	Bilimneus	1.028	1.080	0.944	1.010	0.052	0.066	0.029	0.039	0.935	0.014	-0.014	0.011	1.051	1.070	+	+	-	+	+	=
27		Bilimneus	1.019	0.991	0.933	0.913	-0.028	-0.020	0.009	0.007	0.921	-0.008	-0.008	-0.002	0.972	0.978	-	-	-	-	=	=
28		Bilimneus	1.019	1.019	0.933	0.941	0.000	0.008	0.000	0.005	0.923	0.007	-0.008	0.005	1.000	1.008	-	+	-	=	=	=
29	myrmidon	Bilimneus	0.991	0.970	0.913	0.890	-0.021	-0.023	0.002	0.003	0.918	0.001	0.001	0.000	0.979	0.975	-	-	+	=	=	=
30		Bilimneus	0.991	0.977	0.913	0.906	-0.014	-0.007	0.006	0.003	0.927	-0.007	-0.007	-0.003	0.986	0.992	-	-	-	=	=	=
31	wewalkai	Bilimneus	0.977	0.910	0.906	0.830	-0.067	-0.076	0.011	0.014	0.912	0.009	0.009	0.003	0.931	0.916	-	-	+	-	-	=
32		Bilimneus	0.977	0.992	0.906	0.936	0.015	0.031	0.003	0.007	0.944	0.016	-0.016	0.004	1.015	1.034	+	+	-	=	+	=
33	pararabicus	Bilimneus	0.992	1.000	0.936	0.820	0.008	-0.116	0.004	0.069	0.820	0.108	0.124	0.065	1.008	0.876	+	-	+	=	-	+
34	dioscoridus	Bilimneus	0.992	0.993	0.936	1.070	0.001	0.134	0.000	0.069	1.078	0.133	0.022	0.069	1.001	1.143	+	+	+	=	+	+
37 35+37	sp Buthan	Bilimneus	1.019	1.060	0.941	1.040	0.041	0.099	0.004	0.010	0.981	0.058	-0.058	0.006	1.040	1.106	+	+	-	+	+	+
41 36+40+41	nakanei	Bilimneus	1.019	0.980	0.941	0.860	-0.039	-0.081	0.004	0.009	0.878	0.042	0.042	0.005	0.962	0.914	-	-	+	-	-	+
43		Limnebius s.str.	1.392	1.425	1.438	1.510	0.033	0.072	0.006	0.013	1.060	0.039	0.039	0.006	1.024	1.050	+	+	+	=	+	+
44		Limnebius s.str.	1.392	1.391	1.438	1.429	-0.001	-0.009	0.000	0.005	1.028	0.008	-0.008	0.004	0.999	0.994	-	-	-	=	=	=
45		Limnebius s.str.	1.425	1.278	1.510	1.280	-0.147	-0.229	0.018	0.027	1.001	0.083	-0.083	0.009	0.897	0.848	-	-	-	-	-	-
46		Limnebius s.str.	1.425	1.542	1.510	1.710	0.117	0.200	0.024	0.038	1.109	0.083	0.083	0.014	1.082	1.132	+	+	+	+	+	+
47	aluta	Limnebius s.str.	1.278	1.150	1.280	1.080	-0.128	-0.200	0.011	0.018	0.939	0.072	0.068	0.007	0.900	0.844	-	-	+	-	-	+
48	lusitanus	Limnebius s.str.	1.278	1.170	1.280	1.110	-0.108	-0.170	0.009	0.015	0.949	0.062	0.058	0.006	0.915	0.867	-	-	+	-	-	+
49		Limnebius s.str.	1.542	1.665	1.710	1.871	0.123	0.161	0.014	0.016	1.124	0.038	0.038	0.002	1.080	1.094	+	+	+	+	+	+
50		Limnebius s.str.	1.542	1.594	1.710	1.835	0.052	0.126	0.009	0.019	1.151	0.073	0.073	0.010	1.034	1.073	+	+	+	+	+	+
51	parvulus	Limnebius s.str.	1.665	1.700	1.871	1.930	0.035	0.059	0.003	0.005	1.135	0.024	0.024	0.002	1.021	1.032	+	+	+	=	+	+

106		Limnebius s.str.	1.522	1.332	1.600	1.316	-0.190	-0.284	0.029	0.043	0.987	0.094	-0.061	0.014	0.875	0.822	-	-	-	-	-	-
107	truncatellus	Limnebius s.str.	1.862	1.980	2.086	2.380	0.118	0.294	0.014	0.031	1.202	0.177	0.177	0.017	1.063	1.141	+	+	+	+	+	+
108	mesatlanticus	Limnebius s.str.	1.862	1.910	2.086	2.040	0.048	-0.046	0.006	0.005	1.068	-0.002	-0.093	-0.001	1.026	0.978	+	-	-	+	-	-
109		Limnebius s.str.	1.332	1.289	1.316	1.261	-0.044	-0.055	0.024	0.031	0.978	0.011	0.011	0.007	0.967	0.958	-	-	+	-	-	-
110		Limnebius s.str.	1.332	1.332	1.316	1.303	0.000	-0.013	0.000	0.011	0.978	0.013	0.013	0.011	1.000	0.990	-	-	+	=	=	=
111	murentius	Limnebius s.str.	1.332	1.150	1.261	1.090	-0.182	-0.171	0.026	0.026	0.948	-0.012	-0.012	0.000	0.863	0.865	-	-	-	-	-	-
112		Limnebius s.str.	1.332	1.288	1.261	1.261	-0.044	0.000	0.081	0.001	0.979	-0.044	-0.045	-0.080	0.967	1.000	-	+	-	-	-	-
113	hieronymi	Limnebius s.str.	1.288	1.280	1.261	1.280	-0.008	0.019	0.001	0.003	1.000	0.011	-0.027	0.002	0.994	1.015	-	+	-	=	=	-
114		Limnebius s.str.	1.288	1.245	1.261	1.220	-0.043	-0.041	0.021	0.021	0.980	-0.002	-0.002	0.000	0.967	0.967	-	-	-	-	-	=
115	corfidius	Limnebius s.str.	1.245	1.190	1.220	1.140	-0.055	-0.080	0.012	0.019	0.958	0.025	0.025	0.006	0.956	0.934	-	-	+	-	-	+
116	corybus	Limnebius s.str.	1.245	1.250	1.220	1.220	0.005	0.000	0.001	0.000	0.976	-0.005	0.005	-0.001	1.004	1.000	+	=	+	=	=	=
117	minoricensis	Limnebius s.str.	1.332	1.400	1.303	1.240	0.068	-0.063	0.008	0.008	0.886	-0.005	0.131	0.000	1.051	0.952	+	-	+	+	-	+
118		Limnebius s.str.	1.332	1.327	1.303	1.301	-0.005	-0.002	0.007	0.003	0.980	-0.003	-0.003	-0.004	0.996	0.999	-	-	-	=	=	=
119	bacchus	Limnebius s.str.	1.327	1.270	1.301	1.260	-0.057	-0.041	0.008	0.006	0.992	-0.017	-0.017	-0.002	0.957	0.969	-	-	-	-	-	-
120		Limnebius s.str.	1.327	1.331	1.301	1.312	0.004	0.012	0.005	0.017	0.986	0.008	-0.008	0.012	1.003	1.009	+	+	-	=	=	=
121	kocheri	Limnebius s.str.	1.331	1.350	1.312	1.330	0.019	0.018	0.003	0.003	0.985	-0.002	0.002	0.000	1.014	1.013	+	+	+	=	=	=
122		Limnebius s.str.	1.331	1.329	1.312	1.308	-0.002	-0.004	0.002	0.004	0.984	0.002	0.002	0.003	0.999	0.997	-	-	+	=	=	=
123	ibericus	Limnebius s.str.	1.329	1.260	1.308	1.210	-0.069	-0.098	0.012	0.018	0.960	0.029	0.029	0.006	0.948	0.925	-	-	+	-	-	+
124		Limnebius s.str.	1.329	1.376	1.308	1.385	0.047	0.076	0.011	0.018	1.006	0.029	-0.013	0.007	1.035	1.058	+	+	-	+	+	=
125		Limnebius s.str.	1.376	1.373	1.385	1.383	-0.003	-0.002	0.005	0.003	1.007	-0.001	0.001	-0.001	0.998	0.998	-	-	+	=	=	=
126		Limnebius s.str.	1.376	1.381	1.385	1.394	0.004	0.009	0.008	0.018	1.009	0.005	0.005	0.009	1.003	1.006	+	+	+	=	=	=
127	montanus	Limnebius s.str.	1.373	1.360	1.383	1.360	-0.013	-0.023	0.013	0.022	1.000	0.009	-0.009	0.009	0.990	0.984	-	-	-	=	=	=
128	nitidus	Limnebius s.str.	1.373	1.380	1.383	1.400	0.007	0.017	0.007	0.017	1.014	0.011	0.011	0.010	1.005	1.013	+	+	+	=	=	=
129	irmelae	Limnebius s.str.	1.381	1.410	1.394	1.430	0.029	0.036	0.023	0.028	1.014	0.007	0.007	0.005	1.021	1.026	+	+	+	=	+	=
130		Limnebius s.str.	1.381	1.381	1.394	1.390	0.001	-0.004	0.002	0.008	1.006	0.003	-0.004	0.006	1.001	0.997	+	-	-	=	=	=
131		Limnebius s.str.	1.381	1.372	1.390	1.389	-0.009	-0.001	0.034	0.004	1.012	-0.008	0.008	-0.029	0.993	0.999	-	-	+	=	=	=
132		Limnebius s.str.	1.381	1.385	1.390	1.390	0.003	0.000	0.024	0.002	1.004	-0.003	-0.004	-0.022	1.002	1.000	+	-	-	=	=	=
133	maurus	Limnebius s.str.	1.372	1.410	1.389	1.440	0.038	0.051	0.072	0.096	1.021	0.013	0.013	0.024	1.028	1.037	+	+	+	+	+	=
134		Limnebius s.str.	1.372	1.361	1.389	1.380	-0.012	-0.009	0.081	0.065	1.014	-0.002	0.002	-0.016	0.992	0.993	-	-	+	=	=	=
135	gerhardti	Limnebius s.str.	1.361	1.380	1.380	1.420	0.019	0.041	0.051	0.105	1.029	0.021	0.021	0.054	1.014	1.029	+	+	+	=	+	+
136	ordunyai	Limnebius s.str.	1.361	1.300	1.380	1.300	-0.061	-0.079	0.166	0.216	1.000	0.019	-0.019	0.050	0.955	0.942	-	-	-	-	-	-
137	monfortei	Limnebius s.str.	1.385	1.450	1.390	1.440	0.065	0.050	0.097	0.075	0.993	-0.015	0.005	-0.022	1.047	1.036	+	+	+	+	+	=
138		Limnebius s.str.	1.385	1.374	1.390	1.377	-0.011	-0.013	0.062	0.075	1.002	0.002	-0.002	0.012	0.992	0.991	-	-	-	=	=	=
139	hilaris	Limnebius s.str.	1.374	1.330	1.377	1.350	-0.044	-0.027	0.093	0.056	1.015	-0.017	0.017	-0.037	0.968	0.981	-	-	+	-	=	+
140		Limnebius s.str.	1.374	1.378	1.377	1.374	0.004	-0.003	0.034	0.022	0.997	-0.002	0.001	-0.012	1.003	0.998	+	-	+	=	=	=
141	millani	Limnebius s.str.	1.378	1.390	1.374	1.360	0.012	-0.014	0.033	0.039	0.978	0.002	0.026	0.006	1.009	0.990	+	-	+	=	=	+
142	aguilerai	Limnebius s.str.	1.378	1.370	1.374	1.380	-0.008	0.006	0.023	0.017	1.007	-0.002	0.006	-0.006	0.994	1.004	-	+	+	=	=	=

Figure S1. Aedeagus of *L. gerhardti*, with A) maximum length (lg); B) perimeter, outlined by hand and measured in ImageJ; and C) log-log plot of the regression between the scale of the box and the number of boxes necessary to cover the image, obtained with the Fractal Dimension Estimator (see Methods). The absolute value of the slope of the regression line is the fractal dimension of the image (in this case, the outline of the aedeagus).

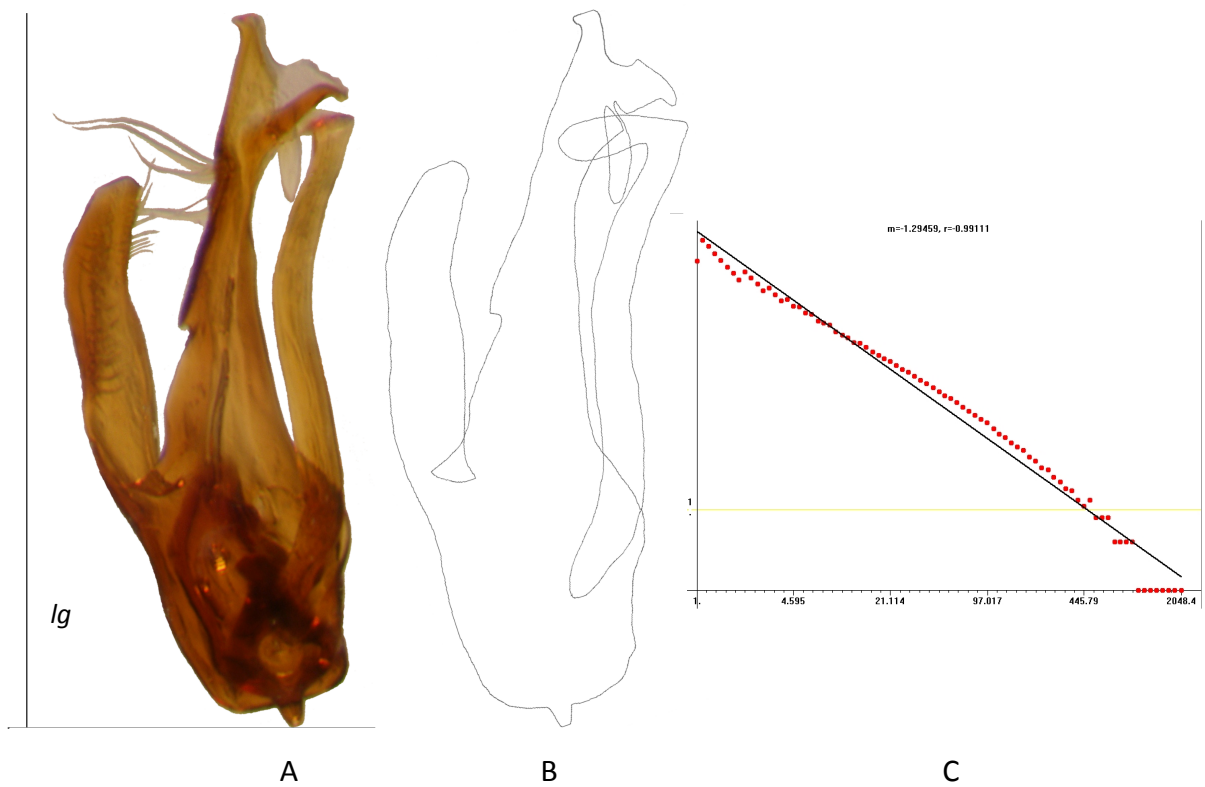


Figure S2. Male secondary sexual characters in the genus *Limnebius*. A & B) Abdominal modifications in ventral and lateral views (A, *L. fetalis*; B, *L. furcatus*); C to E) modification of the hind tibiae of C, *L. mesatlanticus*; D, *L. truncatellus*, the last two with a widening of the distal part; E, *L. fetalis*, with a row of strong setae; F) typical unmodified tibiae of female species of *Limnebius* (*L. fetalis*).



Figure S3. Estimated relationships of the species of *Limnebius* for which no molecular data were available (species without voucher numbers), based mostly on the general shape and structure of the male genitalia (from Rudoy et al., 2016).

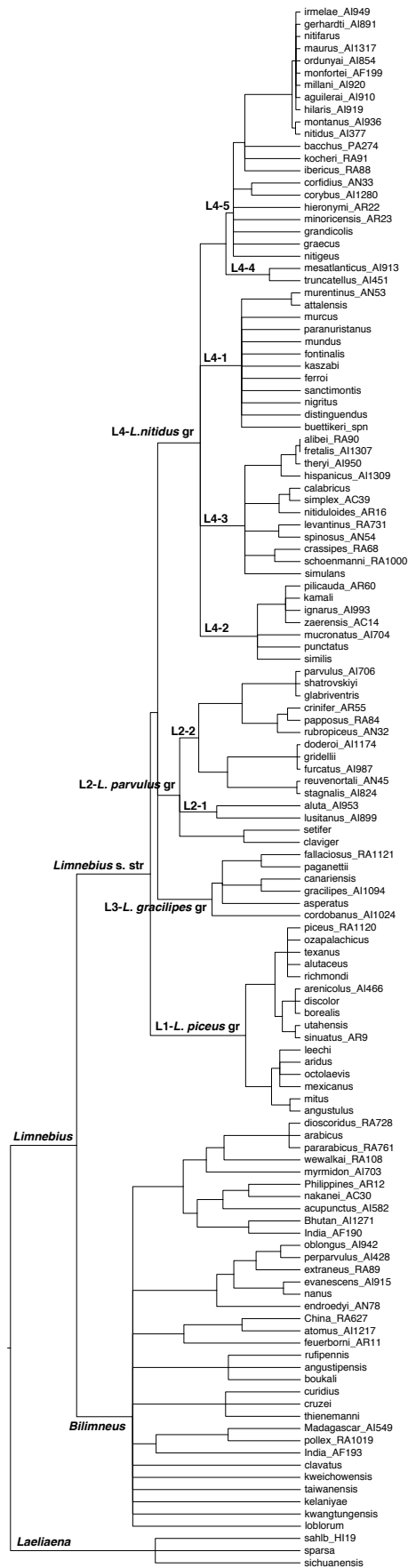


Figure S4. Phylogeny of *Limnebius*, with node support (posterior probability as estimated in BEAST) and the branch numbers used in Table S3 (from Rudoy & Ribera, 2016). See Tables S1 and S2 for details on the species.

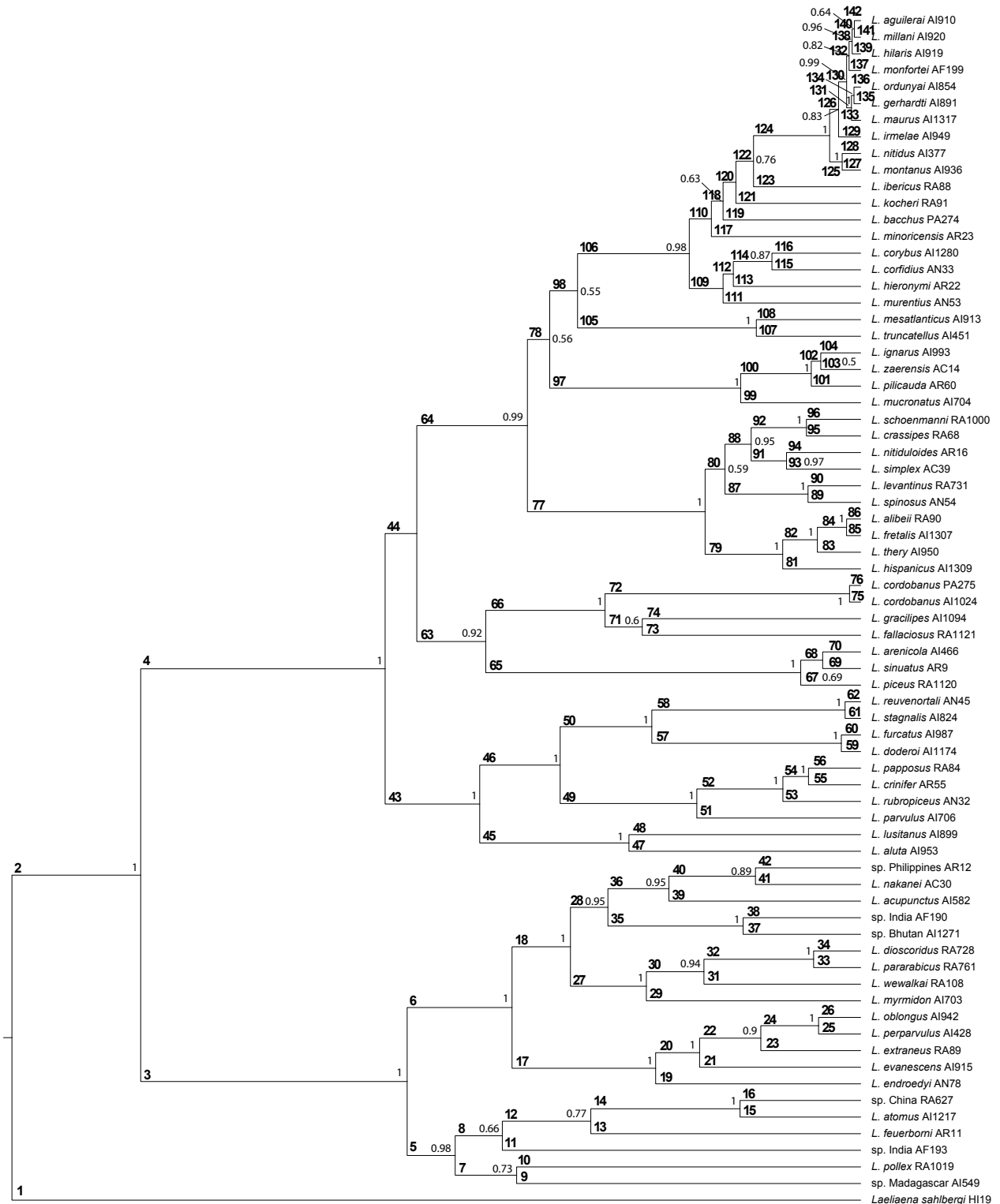
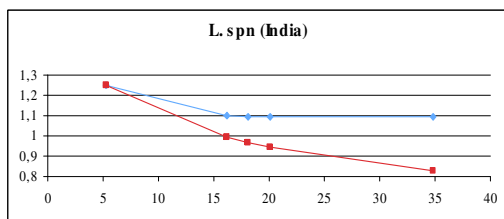
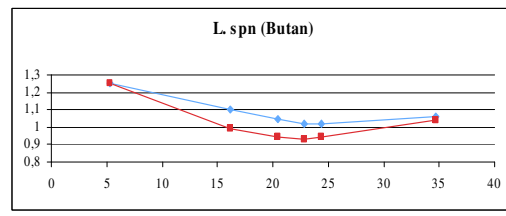
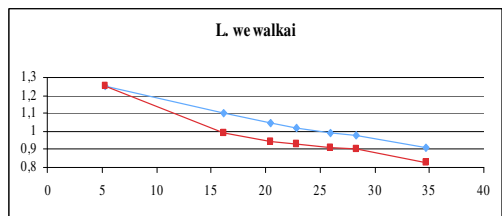
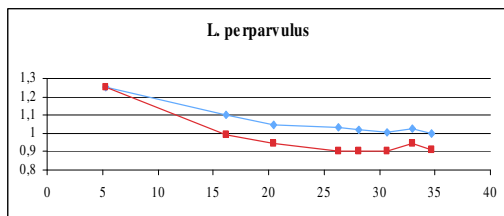
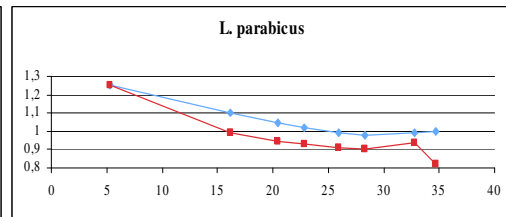
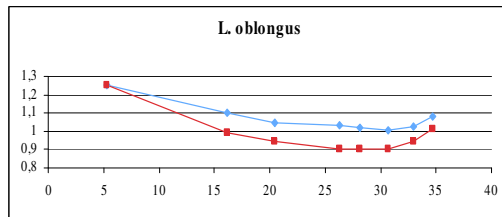
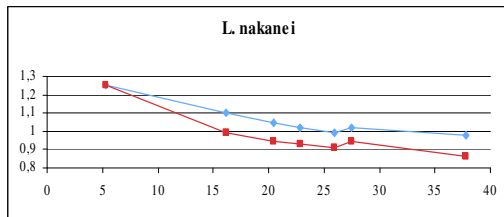
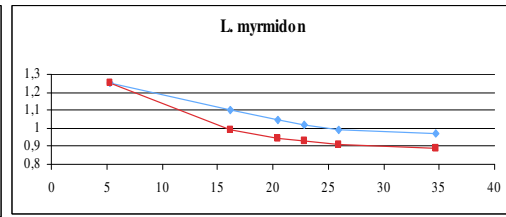
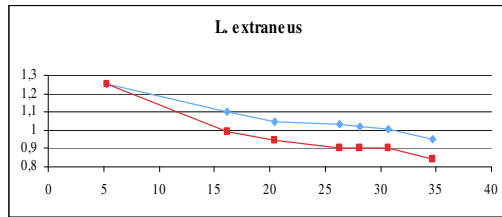
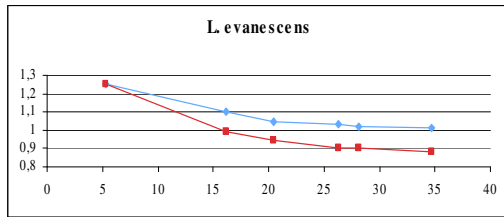
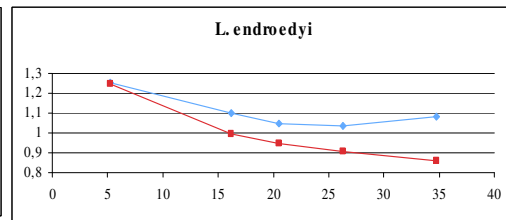
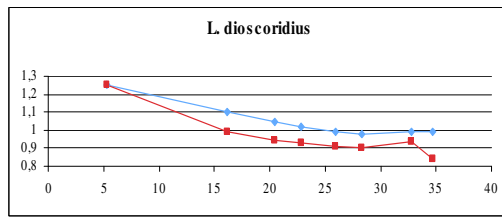
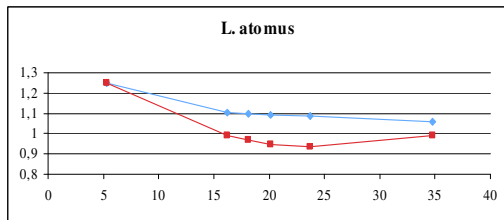


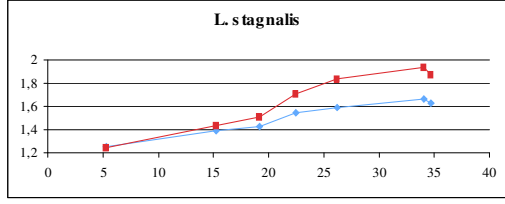
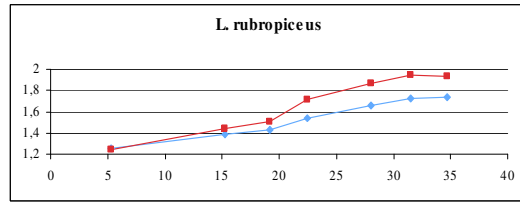
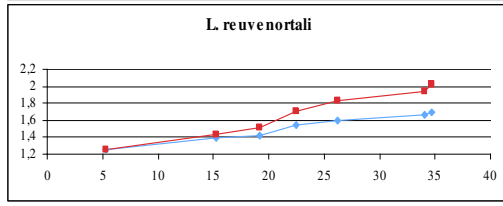
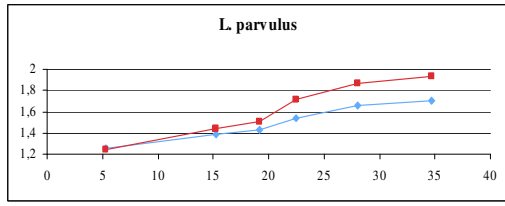
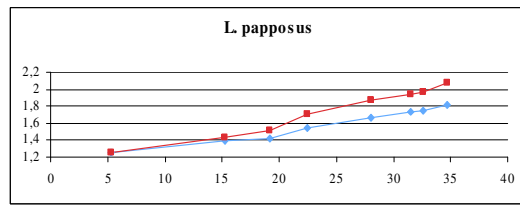
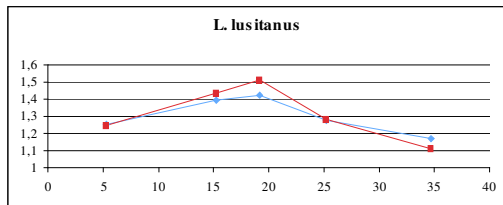
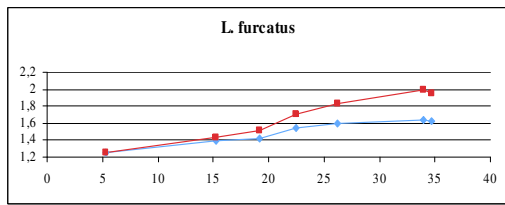
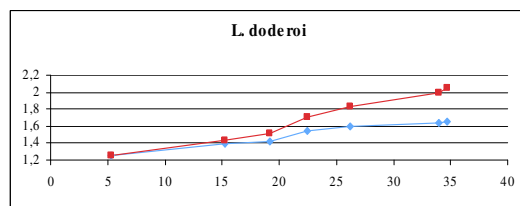
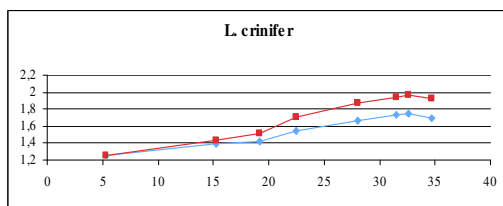
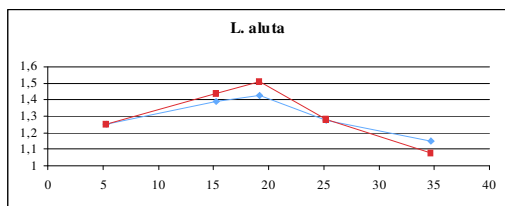
Figure S5. Evolutionary trajectories of de SSD in all the species of *Limnebius* included in the molecular phylogeny. In the y-axis, reconstructed values of male (red) and female (blue) body sizes (mm); in the x-axis, nodes in the reconstructed evolution of the species. Distances in the x-axis are proportional to time (MY, note that the scale is reversed, i.e. the root of the *Limnebiini* tree is dated with time 0). The trajectory represented in F (*L. nitidus* complex) is the same for all the species in this complex, due to the short terminal branches and the uncertain relationships among the species.

Bilimneus



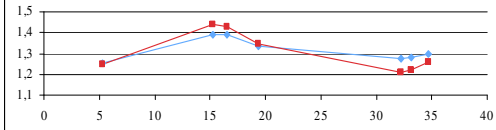
Limnebius sstr

L. parvulus group

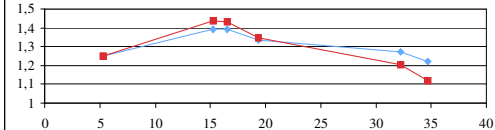


L. piceus group

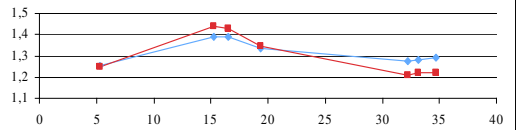
L. arenicolus



L. piceus

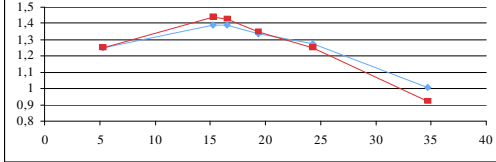


L. sinuatus

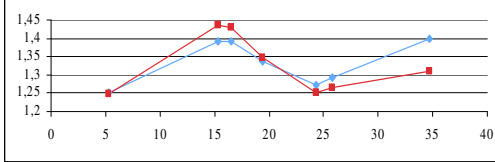


L. gracilipes group

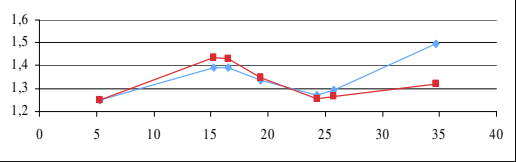
L. cordobanus



L. fallaciosus

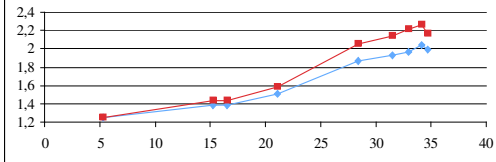


L. gracilipes

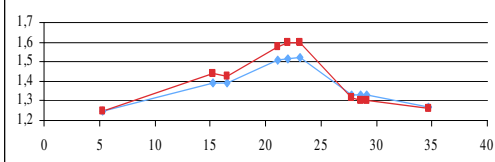


L. nitidus group

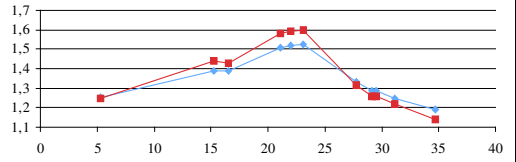
L. alibei



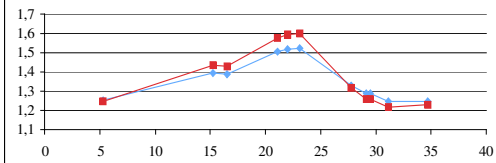
L. bacchus



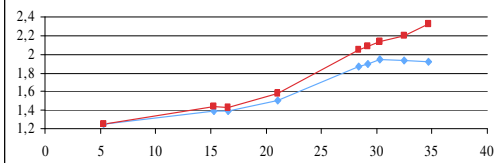
L. corfidius



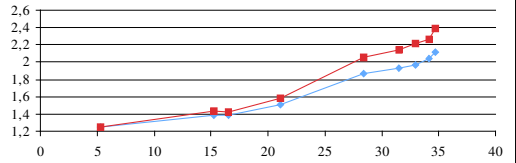
L. corybus



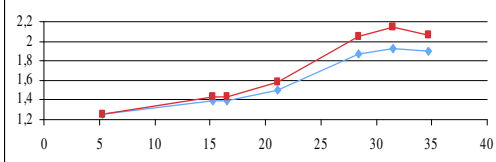
L. crasipes



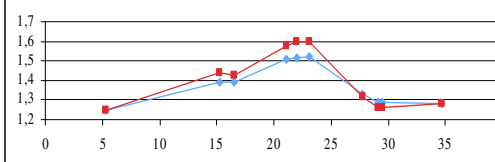
L. frentalis



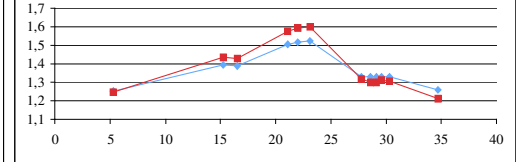
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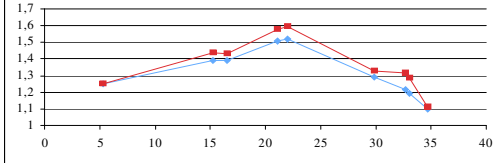
L. hieronimi



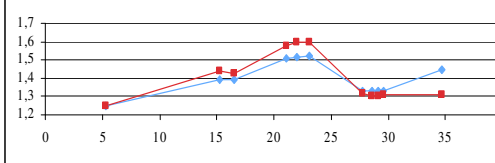
L. ibericus



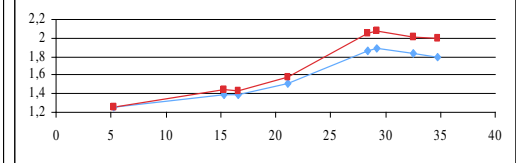
L. ignarus



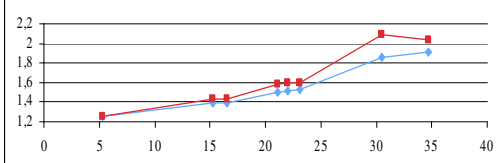
L. kocheri



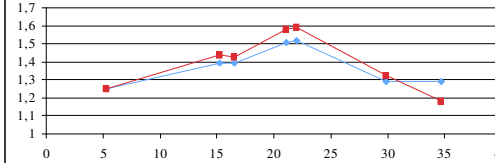
L. levantinus



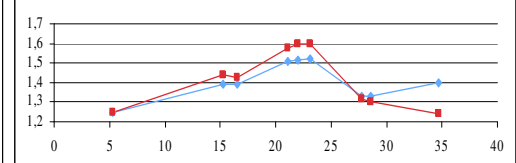
L. meatlanticus



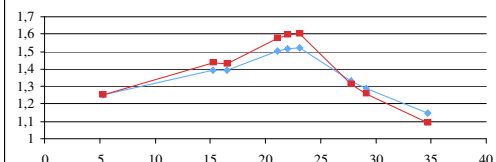
L. mucronatus



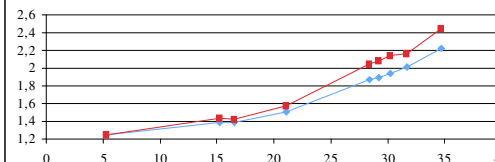
L. minorisensis



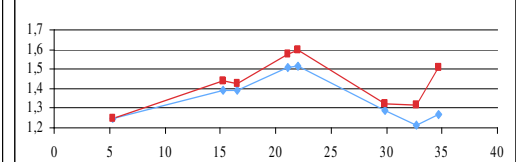
L. murentius



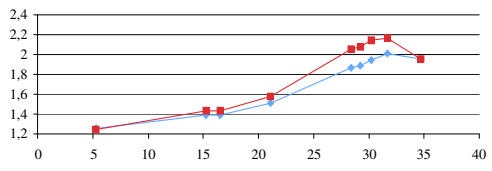
L. nitiduloides



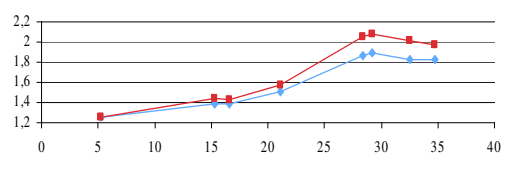
L. plicauda



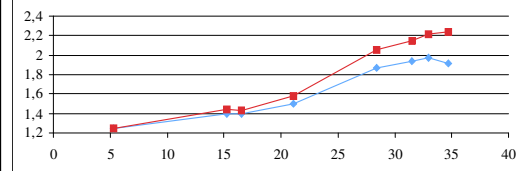
L. simplex



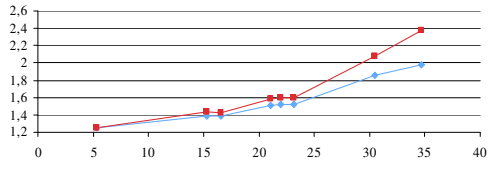
L. spinosus



L. thery



L. truncatellus



L. nitidus cplx

