Supplementary information

Diversity and Differentiation of Duckweed Species from Israel

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Supplementary Tables

Table S1. Duckweed plants collected in the present study - detailed location

Lab Code	Species	Region	loction	Grid Reference	Seasonality of the water source
32b	*Lemna gibba*	Golan Hights	"Orvim Reseroim"	33.137779, 35.725382	seasonal
58		HaSharon	Avihail straem	32.333731, 34.876507	perennial
56		Golan Hights	E'n Mokesh	33.09779, 35.81729	seasonal
7		Golan Hights	Natur	32.867917, 35.770194	seasonal
43b		Hulla Vally	Yesud HaMa'ala	33.060001, 35.615137	seasonal
43a		Hulla Vally	Yesud HaMa'ala	33.060002, 35.615138	seasonal
31a		Golan Heights	"Orvim Reseroim"	33.139682, 35.733806	perennial
31b		Golan Heights	"Orvim Reseroim"	33.139682, 35.733806	perennial
30		Golan Heights	"Orvim Reseroim"	33.138450, 35.734019	seasonal
45a	*Lemna minor*	Galille	E'n Korazim	32.912915, 35.569178	perennial
42		Hulla Vally	Jorden river	33.015434, 35.629857	seasonal
44		Hulla Vally	Yesud HaMa'ala	33.064187, 35.610817	seasonal
57		HaSharon	Alexander river	32.363913, 34.958369	perennial
45b		Galille	A E'n Korazim	32.912915, 35.569178	perennial
55a	*Lemna minuta*	Golan Heights	Nov stream	32.801403, 35.783032	seasonal
43		Hulla Vally	Yesud HaMa'ala	33.060002, 35.615138	seasonal
55b		Golan Hights	Nov stream	32.801403, 35.783032	seasonal
19	*Spirodela polyrhiza*	Golan Heights	Keshet	32.969559, 35.820036	seasonal
11b	*Wolffia arrhiza*	Golan Heights	Daliyot Junctionl	32.894030, 35.775695	seasonal
30a		Golan Heights	"Orvim Reseroim"	33.138450, 35.734019	seasonal
31b		Golan Heights	"Orvim Reseroim"	33.139682, 35.733806	perennial
55		Golan Heights	Nov stream	32.801403, 35.783032	seasonal
32b		Golan Heights	"Orvim Reseroim"	33.137779, 35.725382	seasonal
30b		Golan Heights	"Orvim Reseroim"	33.138451, 35.734018	seasonal
11a		Golan Heights	Daliyot Junctionl	32.895829, 35.776775	seasonal
58	*Wolffia globosa*	HaSharon	Avihail stream	32.333731, 34.876507	perennial

Table S2. *Water samples analysis:* estimated pH and electric conductivity (EC).

Lab Code	Species	PH	EC (S m^{-1})
32b	*Lemna gibba*	6	357
58		6	406
56		6	388
7		6	552
43b		6	323
43a		6	306
31a		6	346
31b		6	375
30b		6	349
45a	*Lemna minor*	6	502
42		5	148
44		6	693
57		6	416
45b		6	751
55a	*Lemna minuta*	6	970
43		6	397
55b		6	664
19	*Spirodela polyrhiza*	6	309
11b	*Wolffia arrhiza*	6	552
30a		6	349
31b		6	422
55		6	694
32b		6	359
30b		6	675
11a		6	554
58	*Wolffia globosa*	5	412

Table S3. Full table of fatty acid composition and content of duckweed plants isolates collected in the current study. The strain *W. arrhiza* 9528 was added to the analysis as a reference data continuance.

Clone	**Fatty acid (% of total fatty acids)**													**ω3/ω6 18:3/18:2**	**TFA (%DW)**
	16:0	**16:1**	**16:12**	**16:2**	**16:3**	**18:0**	**18:1n9**	**18:1n7**	**18:3n6 GLA**	**18:3n3 ALA**	**18:4n3 SDA**	**20:0**	**22:0**		
L. gibba 58	20.56±0.43	3.91±0.42	1.02±0.29	2.2±0.05	0.52±0.13	0.92±0.04	1.13±0.13	0.59±0.01	0.61±0.05	52.88±0.65	2.62±0.08	0.37±0.01	0.44±0.04	1.13±0.03	
L. gibba 30	19.72±0.46	4.88±0.03	0.89±0.01	3.27±0.05	0.75±0.04	1.01±0.16	1.07±0.09	0.94±0	0.89±0.05	50.32±0.36	3.81±0	0.45±0.01	0.39±0.02	4.77	5.25
L. gibba 31a	21.32±0.05	4.28±0.04	0.75±0.04	2.06±0.01	0.17±0.02	1.25±0.01	0.78±0	0.61±0.01	0.72±0	50.26±0	4.37±0.03	0.53±0	0.57±0.01	4.81	4.39
L. gibba 31b	21.61±0.17	5.46±0.31	0.87±0	2.18±0.02	0.23±0.07	1.07±0.04	1.11±0.01	0.56±0.01	0.39±0	48.98±0.01	1.96±0.03	0.39±0	0.41±0.01	4.46	3.63
L. gibba 32	20.01±0.42	4.65±1.09	0.55±0.04	2.11±0.03	0.35±0.21	1.36±0.05	0.94±0.01	0.57±0.01	0.8±0.01	48.09±0.21	3.21±0.01	0.55±0.02	0.51±0.05	3.52	3.88
L. gibba 43a	20.96±0.23	3.69±0.42	0.92±0.03	2.07±0.06	0.65±0.08	1.01±0.08	1.47±0.24	0.78±0.02	0.61±0.07	49.87±0.91	2.06±0.14	0.48±0.02	0.51±0.01	3.13	4.10
L. gibba 43b	21.4±0.31	4.56±0.77	1.01±0.14	1.96±0.03	0.43±0.13	0.97±0.01	1.3±0.02	0.71±0	0.47±0	49.92±0.24	2.02±0	0.39±0.01	0.41±0.02	3.60	4.36
L. gibba 56	21.75±2.27	5.39±1.1	0.97±0.11	2.62±0.02	0.23±0.11	1.08±0.31	1.08±0.19	0.85±0.06	0.52±0.11	47.77±3.37	2.35±0.34	0.42±0.14	0.45±0.15	3.65	4.12
L. gibba 7	21.49±0.04	4.23±0.22	0.69±0.05	2.24±0.06	0.4±0.03	1.24±0.03	0.94±0.01	0.72±0.02	0.44±0.05	47.78±0.51	2.1±0.03	0.53±0.01	0.5±0.01	3.49	4.09
L. minor 42	22.73±0.12	5.67±0.37	0.39±0.01	1.62±0.09	0.35±0.06	1.8±0.12	1.13±0.02	0.67±0	0.46±0.01	45.8±0.03	1.51±0.14	0.55±0	0.31±0	3.12	2.83
L. minor 44	19.85±0.06	5.5±0.01	0.33±0	2.01±0.01	0.2±0.01	1.28±0.02	1.45±0	0.58±0	0.5±0	46.75±0.13	1.75±0	0.31±0.01	0.29±0.01	2.86	3.35
L. minor 45a	19.97±0.33	2.89±0.05	0.31±0.01	2.03±0.02	0.75±0.02	1.4±0.04	1.69±0.01	0.7±0.03	0.6±0.01	47.37±0.39	1.88±0.08	0.47±0.01	0.36±0.15	2.54	6.34
L.minor 45b	22.49±0.9	4.1±0.79	0.51±0.03	2.54±0.43	0.68±0.37	1.4±0.16	1.57±0.03	1.11±0.13	0.71±0.05	42.74±0.63	2.68±0.21	0.45±0.01	0.34±0.14	2.51	3.77
L. minor 57	18.28±0.16	5.8±0.18	0.51±0.02	2.77±0.02	0.22±0.04	0.77±0.02	1.33±0.01	0.43±0	1.27±0.01	48.36±0.19	3.04±0.01	0.17±0.01	0.24±0	2.42	3.52
L. minuta 43	18.48±0.45	4.64±0.03	0.28±0	2.43±0.05	0.52±0.05	1.24±0.39	1.27±0.02	0.43±0.04	0.23±0.21	54.43±1.13	0.09±0.02	0.25±0.08	0.29±0.05	3.00	4.19
L. minuta 55a	19.92±0.2	4.97±0.52	0.37±0	1.62±0	0.31±0.13	0.93±0.03	1.08±0.02	0.32±0	0±0	53.35±0.23	0.12±0.11	0.15±0.02	0.19±0.03	3.87	4.78
L. minuta 55b	20.07±0.12	3.44±0.07	0.31±0.01	1.6±0	0.66±0.04	1.03±0.02	1.35±0.07	0.42±0.03	0±0	53.51±0.09	0.13±0.18	0.25±0	0.15±0	3.36	3.95
S. polyrhiza 19	23.15±0.24	5.43±0.37	0.45±0.01	6.11±0.06	0.35±0.04	2.35±0.07	1.17±0.04	1.03±0.06	0.04±0.05	50.9±0.48	0±0	0.58±0.04	0.62±0.01	3.36	4.19
W. arrhiza 11a	23.22±1.1	5.64±0.58	0.51±0	3.64±0.23	0.55±0.03	1.62±0	2.17±0.08	0.57±0.01	0.28±0.01	34.87±0.64	0.1±0.01	0.77±0.01	0.64±0.04	9.73	4.27
W. arrhiza 11b	21.63±0.26	5.36±0.53	0.49±0	3.45±0.12	0.59±0.11	1.48±0.07	1.87±0.03	0.52±0.03	0.15±0.01	37.32±0.56	0.1±0.01	0.73±0.01	0.53±0.01	1.38	4.38
W. arrhiza 30	20.4±0.01	5.32±0.2	0.48±0	3.46±0.02	0.48±0	1.17±0.02	1.73±0.01	0.49±0.01	0.14±0	42.29±0.14	0.08±0	0.58±0	0.47±0.01	1.45	4.55
W. arrhiza 31	24.28±0.14	3.11±0.22	0.49±0.01	3.19±0.14	1.03±0.14	1.35±0.04	1.64±0.04	0.72±0.1	0.11±0.1	38.74±0.33	0.14±0.02	0.69±0.02	0.4±0	1.86	4.70

W. arrhiza 55	21.85±0.43	3.65±0.25	0.44±0.03	3.33±0.04	0.75±0.04	1.37±0.11	1.73±0.04	0.53±0.01	0.03±0.01	38.97±0.44	0.1±0.01	0.6±0.02	0.51±0.04	1.63	3.18
W. arrhiza 9528	19.05±0.13	3.72±0.46	0.32±0.01	2.48±0.03	0.24±0.02	1.81±0.01	1.79±0.01	0.35±0.01	0.14±0.01	44.41±0.1	0.07±0	0.86±0.02	0.66±0.05	1.52	5.13
W. globosa 58	22.71±0.05	4.04±0.58	0.76±0.08	1.5±0.05	0.35±0.08	2.25±0	2.41±0.01	0.61±0.04	0.07±0.39	39.51±0.04	0.02±0.02	0.53±0.01	0.39±0.02	1.83	4.44
W. globossa Mankai	21.73±0.16	4.39±0.64	0.66±0	2.34±0.02	0.74±0.21	2.14±0.02	1.9±0.01	0.74±0.05	0.14±0	44.64±0.21	0.07±0	0.41±0.02	0.19±0.01	1.58	4.38

Supplementary figure

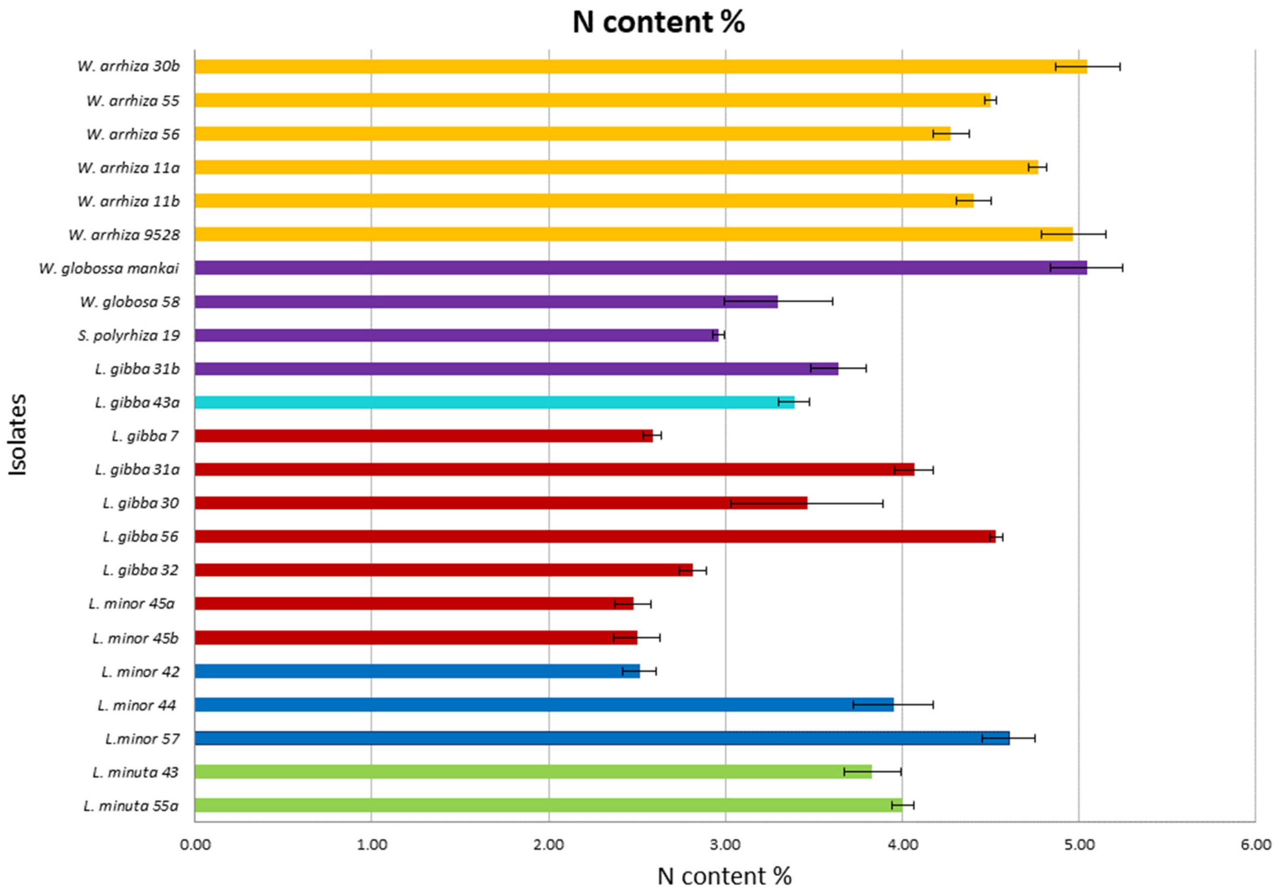

Figure S1. Nitrogen concentration measured by N content FT-MIT.

Supplementary File.

File S1.

FTIR spectra collection

The samples were all sieved to pass through a 210 μm mesh. Of each of the sample, three replicate subsamples of approximately 25 mg were scanned. Reference samples of an in-house standard *Lemna* sp. (Ma-STD), and blanks, were measured in each run for quality control. Analysis was conducted with a TENSOR II benchtop FT-IR (Fourier-Transform Infrared) spectrometer (Bruker, Berlin, Germany). This has a spectral range of 8000–340 cm−1, a KBr broadband beam-splitter and window, and an MCT (mercury cadmium telluride) mid-band detector cooled by liquid nitrogen. Diffuse Reflectance Infrared Fourier Transform (DRIFT) spectra were collected. A background spectrum was taken with a gold-plated reference cap. The high throughput screening accessory (HTS-XT), which scans 95 samples in one plate, was used. The spectral resolution was 4 cm−1 and scan time was 32 s per sample. Absorbance data in the spectral range 4000–600 cm−1 were obtained. All the data were obtained and processed using the Bruker OPUS-QUANT II software (Bruker, Berlin, Germany). Corrections of the raw data were made using the first derivative, with 8 smoothing points using the Savitsky–Golay algorithm and mean centred vector normalization. CO2peaks at 2361 and 2339 cm−1 were removed from the data.

Mid-infrared chemometric models were built using PLS (partial least-squares) modelling with OPUS-QUANT II software. A matrix is formed from the spectral data of the calibration samples of known composition. The matrix is transformed by the PLS algorithm into a result matrix consisting of eigenvectors (factors). The predictive reliability of the chemometric model strongly depends on the choice of the rank (the correct number of factors needed). In this case, a Cross Validation (leave one out) system is used to calculate the optimum rank by looking at the root mean square error of prediction (RMSE) with the minimum potential for over-fitting. Assessments of model predictive performance are made with calculations of the correlation coefficient (a measure of relative precision and closeness to the line of best fit), the coefficient of determination (R^2, gives the percentage of variance present in the true component values, which is reproduced in the prediction), the RMSECV (root mean squared errors of cross validation), the residual prediction deviation for the rank (RPD = SD/SECV), which allows comparison of model performance across different data sets, and the bias (mean value of deviation, also called "systematic error"). Additionally, the wavenumbers with the highest coefficient explaining the most variation in TN (VIP scores) were identified.