PANAYIOTIS TRIGAS, KONSTANTINOS KOUGIOUMOUTZIS, AIKATERINI ERMIDOU & ELEFTHERIOS KALPOUTZAKIS

Multivariate morphometric analysis of *Petrorhagia* subsect. *Saxifragae* (*Caryophyllaceae*) in Greece, with a new species from SE Peloponnisos: *P. laconica*

Appendix 1. Supplementary tables

Table S1. Specimens used in the morphometric analyses of the members of *Petrorhagia* sect. *Petrorhagia* subsect. *Saxifragae* in Greece.

Species	Region	Voucher (number of specimens)
Petrorhagia fasciculata	Ionian Islands	Kefallinia Is., 1992, *Georgiou 2786*, UPA (1)
	Ionian Islands	Kefallinia Is., 1968, *Phitos 8271*, UPA (1)
	Ionian Islands	Lefkada Is., 1991, *Georgiou 1885*, UPA (1)
	Ionian Islands	Kefallinia Is., 1967, *Phitos 5875*, UPA (1)
	Ionian Islands	Kefallinia Is., 1992, *Georgiou 2787*, UPA (1)
	Ionian Islands	Kefallinia Is., 1991, *Georgiou 156*, UPA (1)
	Sterea Ellas	Aetolia-Akarnania, 1971, *Phitos 11285*, UPA (1)
Petrorhagia graminea	Peloponnisos	Achaia, 1970, *Phitos 11474*, UPA (2)
	Peloponnisos	Achaia, 1980, *Iatrou 933*, UPA (2)
	Peloponnisos	Achaia, 1992, *Georgiou 6625*, UPA (2)
	Peloponnisos	Achaia, 1997, *Maroulis s.n.*, UPA (1)
	North Central	Florina, 2010, *Strid 57240*, ATH (1)
	Southern Pindos	Ioannina, 2006, *Strid 56142*, ATH (1)
	Southern Pindos	Thesprotia, 2006, *Strid 56153*, ATH (1)
Petrorhagia laconica	Peloponnisos	Lakonia, 2017, *Trigas 6311*, ACA (20)
	Peloponnisos	Lakonia, 2017, *Trigas 6312*, ACA (24)
Petrorhagia phthiotica	Sterea Ellas	Phthiotis, 1982, *Georgiou 1813*, UPA (2)
	Sterea Ellas	Fokida, 1999, *Constantinidis 8605*, UPA (1)
	Sterea Ellas	Phthiotis, 1982, *Georgiou 1812*, UPA (1)
	Sterea Ellas	Phthiotis, 1995, *Georgiou 8148*, UPA (2)
	Sterea Ellas	Phthiotis, 1982, *Georgiou 1813*, UPA (3)
Petrorhagia saxifraga	Peloponnisos	Achaia, 1994, *Chronopoulos 1818*, UPA (1)
	North Central	Pella, 2002, *Constantinidis 10409*, UPA (1)
	Ionian Islands	Paxoi Is., 1976, *Georgiadis & Papanikolaou 2282*, UPA (2)
	Ionian Islands	Paxoi Is., 1974, *Georgiadis & Papanikolaou 488*, UPA (1)
	Ionian Islands	Paxoi Is., 1974, *Georgiadis & Papanikolaou 198*, UPA (2)

Species	Region	Voucher (number of specimens)
Petrorhagia saxifraga	North Central	Pella, 1976, *Stamatiadou 19521*, ATH (1)
	North Central	Florina, 1972, *Stamatiadou 15881*, ATH (1)
	Southern Pindos	Ioannina, 1971, *Stamatiadou 13384*, ATH (1)
	North Central	Kastoria, 1972, *Stamatiadou 15685*, ATH (1)
	North Central	Kozani, 1972, *Stamatiadou 15637*, ATH (1)
	North Central	Florina, 1971, *Stamatiadou 13604*, ATH (1)
	Southern Pindos	Thesprotia, 1971, *Stamatiadou 12512*, ATH (1)
	Southern Pindos	Ioannina, 1979, *Stamatiadou 21191*, ATH (1)
	Southern Pindos	Ioannina, 1979, *Stamatiadou 21177*, ATH (1)
	North Central	Makedonia, 1973, *Greuter 11506*, ATH (1)
	North Central	Kastoria, 1977, *Hartvig & al. 6609*, ATH (1)
	Southern Pindos	Ioannina, 1981, *Andersson & Franzen 699*, ATH (1)
	Southern Pindos	Ioannina, 1979, *Hartvig & Christiansen 7888*, ATH (1)
	Ionian Islands	Kefallinia Is., 1981, *Strid & al. 18072*, ATH (1)
	Southern Pindos	Ioannina, 1979, *Strid 15575*, ATH (1)
	North Central	Kozani, 1970, *Strid 515*, ATH (1)
	Southern Pindos	Ioannina, 1979, *Hartving & Christiansen 7960*, ATH (1)
	Southern Pindos	Ioannina, 1979, *Hartving & Christiansen 7821*, ATH (1)
	North East	Xanthi, 2002, *Strid & al. 54325*, ATH (1)
	North East	Xanthi, 2002, *Strid & al. 54294*, ATH (1)

Table S2. Basic statistical parameters (minimum and maximum values, mean values, standard deviations, 5th and 95th percentiles) resulting from the morphometric analyses of our dataset. Character abbreviations follow Table 1. All measurements are in mm. St.Dev = Standard deviation. A, B, C, D and E indicate *Petrorhagia fasciculata*, *P. graminea*, *P. phthiotica*, *P. saxifraga* and *P. laconica*, respectively.

Parameter		A	B	C	D	E
a1	min-max	4.0–45.0	2.0–32.0	6.0–78.0	4.0–100.0	4.0–25.0
	Mean	14.7	10.1	36.0	24.6	11.6
	St.Dev	14.3	8.9	30.7	20.2	6.4
	5%–95%	6.5–15.5	3.8–12.5	8.5–61.0	14.0–25.0	7.0–15.0
a2	min-max	13.5–28.0	19.0–40.0	7.3–18.0	8.0–40.0	14.0–40.0
	Mean	20.6	27.0	14.8	22.7	25.1
	St.Dev	6.0	7.2	4.0	8.7	6.7
	5%–95%	15.5–26.0	21.5–32.8	13.5–17.5	16.0–29.6	20.8–29.0
a3	min-max	5.0–13.0	3.0–26.0	2.0–10.0	3.0–28.5	8.0–37.0
	Mean	8.4	13.7	5.3	9.8	17.9
	St.Dev	2.9	7.2	2.8	6.0	5.2
	5%–95%	6.3–10.0	8.5–17.5	3.5–7.0	5.0–12.5	15.0–20.0
a4	min-max	1.5–3.0	1.5–3.3	2.0–4.0	1.5–4.5	0.6–1.0
	Mean	2.3	2.2	3.0	2.1	0.8
	St.Dev	0.7	0.6	0.7	0.7	0.1
	5%–95%	1.8–2.9	1.8–2.5	2.7–3.5	1.5–2.5	0.8–0.9

Parameter		A	B	C	D	E
a5	min-max	1.0–1.0	0.0–1.0	0.0–1.0	0.0–0.0	0.0–0.0
	Mean	1.0	0.1	0.9	0.0	0.0
	St.Dev	0.0	0.3	0.4	0.0	0.0
	5%–95%	1.0–1.0	0.0–0.0	0.0–1.0	0.0–0.0	0.0–0.0
a6	min-max	0.0–1.0	0.0–1.0	0.0–1.0	0.0–0.0	0.0–0.0
	Mean	0.6	0.1	0.9	0.0	0.0
	St.Dev	0.5	0.4	0.3	0.0	0.0
	5%–95%	0.0–1.0	0.0–0.0	0.0–1.0	0.0–0.0	0.0–0.0
a7	min-max	0.0–1.0	0.0–1.0	0.0–1.0	0.0–0.0	0.0–0.0
	Mean	0.6	0.1	0.9	0.0	0.0
	St.Dev	0.5	0.3	0.4	0.0	0.0
	5%–95%	0.0–1.0	0.0–0.0	0.0–1.0	0.0–0.0	0.0–0.0
a8	min-max	0.0–0.0	0.0–1.0	0.0–0.0	0.0–0.0	1.0–1.0
	Mean	0.0	0.1	0.0	0.0	1.0
	St.Dev	0.0	0.5	0.0	0.0	0.0
	5%–95%	0.0–0.0	0.0–1.0	0.0–0.0	0.0–0.0	1.0–1.0
a9	min-max	0.0–0.0	0.0–1.0	0.0–0.0	0.0–0.0	1.0–1.0
	Mean	0.0	0.1	0.0	0.0	1.0
	St.Dev	0.0	0.3	0.0	0.0	0.0
	5%–95%	0.0–0.0	0.0–1.0	0.0–0.0	0.0–0.0	1.0–1.0
a10	min-max	0.0–0.0	0.0–0.0	0.0–0.0	0.0–0.0	1.0–1.0
	Mean	0.0	0.0	0.0	0.0	1.0
	St.Dev	0.0	0.0	0.0	0.0	0.0
	5%–95%	0.0–0.0	0.0–0.0	0.0–0.0	0.0–0.0	1.0–1.0
a11	min-max	3.0–80.0	2.0–37.0	15.0–115.0	2.0–59.0	1.0–10.0
	Mean	18.4	15.7	57.9	17.5	2.7
	St.Dev	27.4	12.6	43.4	15.9	2.0
	5%–95%	6.5–12.4	7.3–23.0	18.0–92.5	6.0–28.5	1.0–3.0
a12	min-max	2.0–9.0	2.0–7.0	4.0–10.0	1.0–10.0	0.0–9.0
	Mean	6.1	4.6	6.9	5.3	1.7
	St.Dev	2.8	2.0	2.3	2.1	2.0
	5%–95%	4.0–8.0	3.0–6.0	5.0–8.5	4.0–7.0	0.0–2.0
a13	min-max	3.5–8.5	2.5–10.0	3.2.–5.7	3.0–15.0	0.6–13.0
	Mean	5.4	5.7	4.4	5.9	3.6
	St.Dev	1.9	2.5	0.9	3.0	2.5
	5%–95%	4.0–6.8	4.1–6.8	3.8–5.0	4.0–7.0	1.9–4.5
a14	min-max	2.0–11.0	1.0–11.0	5.0–13.0	2.0–13.0	1.0–1.0
	Mean	4.3	4.4	8.9	4.0	1.0
	St.Dev	3.0	3.0	3.6	2.5	0.0
	5%–95%	3.0–4.0	3.0–6.3	6.0–12.5	2.0–6.0	1.0–1.0
a15	min-max	1.0–10.0	1.0–2.0	2.0–2.0	1.0–2.0	1.0–1.0
	Mean	3.9	1.4	2.0	1.1	1.0
	St.Dev	2.9	0.5	0.0	0.3	0.0
	5%–95%	3.0–3.5	1.0–2.0	2.0–2.0	1.0–1.0	1.0–1.0
a16	min-max	10.0–16.0	10.0–20.0	8.0–17.0	8.0–17.0	7.0–19.0
	Mean	12.6	13.7	10.6	11.4	12.9
	St.Dev	2.6	3.7	3.2	2.5	3.0
	5%–95%	10.5–15.0	11.0–16.3	8.5–11.0	9.8–13.0	11.0–15.0

Parameter		A	B	C	D	E
a17	min-max	1.5–2.0	1.5–2.0	1.5–2.0	0.5–1.5	0.5–1.0
	Mean	1.6	1.6	1.8	1.4	0.9
	St.Dev	0.2	0.2	0.3	0.4	0.2
	5%–95%	1.5–1.8	1.5–1.5	1.5–2.0	1.5–1.5	0.5–1.0
a18	min-max	5.0–12.0	1.0–14.0	4.0–15.0	5.0–18.0	6.0–16.0
	Mean	8.1	8.5	8.7	8.3	9.9
	St.Dev	2.8	3.5	3.6	3.0	2.6
	5%–95%	6.0–10.5	7.5–10.0	6.5–10.0	6.0–10.0	8.0–12.0
a19	min-max	0.5–0.5	0.5–0.5	0.5–1.0	0.5–0.5	0.5–1.0
	Mean	0.5	0.5	0.8	0.5	0.9
	St.Dev	0.0	0.0	0.3	0.0	0.2
	5%–95%	0.5–0.5	0.5–0.5	0.5–1.0	0.5–0.5	0.5–1.0
a20	min-max	12.0–21.0	19.1–34.0	14.0–22.0	9.0–28.0	8.0–21.0
	Mean	16.7	23.9	18.0	19.8	15.9
	St.Dev	3.3	5.1	2.9	4.9	3.8
	5%–95%	15.0–19.5	20.0–26.8	16.0–19.5	17.8–24.0	13.4–19.3
a21	min-max	6.0–10.0	6.0–8.0	4.0–8.0	6.0–12.0	6.0–12.0
	Mean	6.9	7.0	5.4	7.6	8.6
	St.Dev	1.6	1.1	1.5	1.8	1.4
	5%–95%	6.0–7.0	6.0–8.0	4.0–6.0	6.0–8.0	8.0–10.0
a22	min-max	0.3–0.7	0.2–0.4	0.2–0.4	0.2–0.7	0.4–0.8
	Mean	0.4	0.3	0.3	0.4	0.6
	St.Dev	0.1	0.1	0.1	0.1	0.1
	5%–95%	0.3–0.5	0.3–0.3	0.3–0.4	0.3–0.5	0.5–0.6
a23	min-max	1.0–1.0	1.0–1.0	3.0–3.0	1.0–1.0	1.0–1.0
	Mean	1.0	1.0	3.0	1.0	1.0
	St.Dev	0.0	0.0	0.0	0.0	0.0
	5%–95%	1.0–1.0	1.0–1.0	3.0–3.0	1.0–1.0	1.0–1.0
a24	min-max	4.0–5.0	6.0–9.0	5.0–6.0	4.0–10.0	4.0–8.0
	Mean	4.2	7.8	5.5	7.5	6.1
	St.Dev	0.4	1.2	0.4	1.6	0.9
	5%–95%	4.0–4.3	7.0–9.0	5.3–5.8	6.0–8.6	5.5–7.0
a25	min-max	1.5–3.0	3.0–6.0	2.0–3.0	2.0–8.0	1.5–3.0
	Mean	2.4	4.6	2.6	4.1	2.1
	St.Dev	0.6	0.9	0.4	1.3	0.4
	5%–95%	2.0–2.8	4.0–5.0	2.5–3.0	3.0–5.0	2.0–2.5
a26	min-max	2.5–4.0	4.0–6.0	3.5–5.0	3.0–7.0	3.0–6.0
	Mean	3.3	5.0	4.3	5.3	4.6
	St.Dev	0.5	0.7	0.5	1.1	0.7
	5%–95%	3.0–3.5	4.5–5.4	4.0–4.5	5.0–6.0	4.0–5.0
a27	min-max	1.0–1.5	1.0–1.5	0.5–2.0	0.5–2.0	0.5–1.0
	Mean	1.1	1.2	0.9	1.3	0.7
	St.Dev	0.2	0.2	0.6	0.4	0.3
	5%–95%	1.0–1.3	1.0–1.4	0.5–1.0	1.0–1.5	0.5–1.0
a28	min-max	0.5–0.5	0.5–1.0	0.5–0.5	0.5–1.0	0.5–0.5
	Mean	0.5	0.9	0.5	0.8	0.5
	St.Dev	0.0	0.2	0.0	0.2	0.0
	5%–95%	0.5–0.5	1.0–1.0	0.5	0.5–1.0	0.5–0.5

Parameter		A	B	C	D	E
a29	min-max	1.0–6.0	2.0–10.0	5.5–13.0	3.0–20.0	1.0–3.5
	Mean	2.9	3.7	7.6	8.7	2.0
	St.Dev	1.7	2.4	2.5	4.6	0.6
	5%–95%	2.0–3.5	2.1–4.0	6.3–7.5	5.0–11.0	1.5–2.0
a30	min-max	2.0–4.0	1.5–4.0	2.0–3.0	1.0–5.0	2.5–5.0
	Mean	3.3	2.7	2.6	3.0	3.4
	St.Dev	0.8	0.7	0.4	1.1	0.7
	5%–95%	3.0–4.0	2.1–3.0	2.5–3.0	2.0–4.0	3.0–3.5
a31	min-max	0.3–1.7	0.3–2.2	1.3–3.7	0.8–3.3	1.0–7.0
	Mean	0.9	0.8	1.8	1.6	3.0
	St.Dev	0.4	0.5	0.8	0.7	1.5
	5%–95%	0.6–0.9	0.4–0.8	1.4–1.7	1.0–1.9	2.0–4.0
a32	min-max	1.1–1.6	1.2–2.0	1.1–1.4	1.2–2.0	1.1–2.0
	Mean	1.3	1.6	1.3	1.4	1.3
	St.Dev	0.2	0.3	0.1	0.2	0.2
	5%–95%	1.2–1.3	1.4–1.8	1.2–1.4	1.3–1.5	1.2–1.4
a33	min-max	1.0–1.0	3.0–3.0	1.0–1.0	3.0–3.0	1.0–1.0
	Mean	1.0	3.0	1.0	3.0	1.0
	St.Dev	0.0	0.0	0.0	0.0	0.0
	5%–95%	1.0–1.0	3.0–3.0	1.0–1.0	3.0–3.0	1.0–1.0
a34	min-max	0.0–0.0	0.0–1.0	0.0–0.0	0.0–0.0	1.0–1.0
	Mean	0.0	0.2	0.0	0.0	1.0
	St.Dev	0.0	0.4	0.0	0.0	0.0
	5%–95%	0.0–0.0	0.0–0.0	0.0–0.0	0.0–0.0	1.0–1.0
a35	min-max	1.0–1.0	0.0–1.0	0.0–0.0	0.0–0.0	0.0–0.0
	Mean	1.0	0.6	0.0	0.0	0.0
	St.Dev	0.0	0.5	0.0	0.0	0.0
	5%–95%	1.0–1.0	0.0–1.0	0.0–0.0	0.0–0.0	0.0–0.0
a36	min-max	0.0–0.0	0.0–0.0	0.0–0.0	1.0–1.0	1.0–1.0
	Mean	0.0	0.0	0.0	1.0	1.0
	St.Dev	0.0	0.0	0.0	0.0	0.0
	5%–95%	0.0–0.0	0.0–0.0	0.0–0.0	1.0–1.0	1.0–1.0

Table S3. Correct Leave-One-Out (LOO) cross-validation classification from the stepwise discriminant analysis. A, B, C, D and E indicate *Petrorhagia fasciculata*, *P. graminea*, *P. phtiothica*, *P. saxifraga* and *P. laconica*, respectively. PCC and MCC indicate the Proportional Chance Criterion and the Maximum Chance Criterion, respectively.

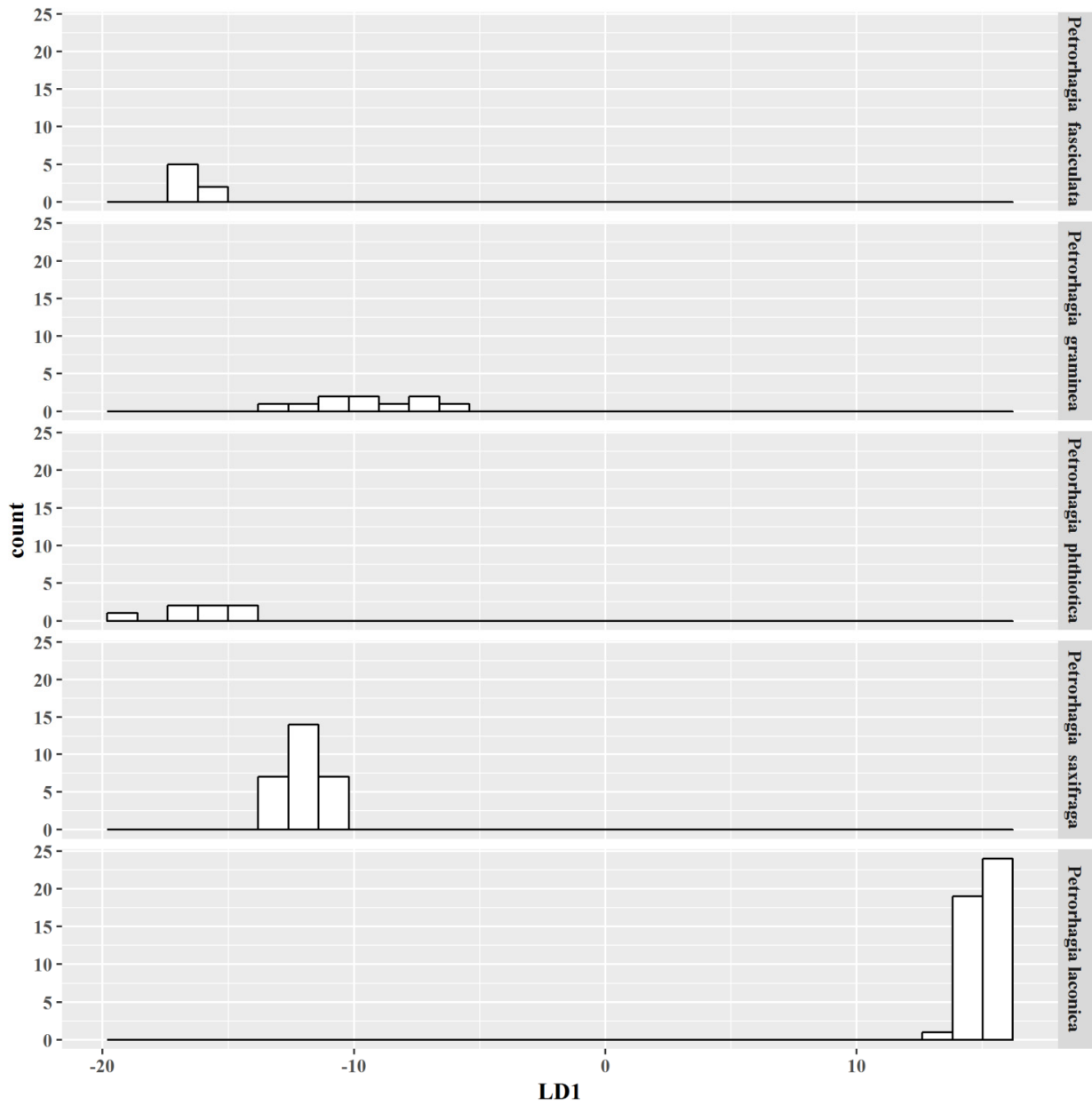| Taxon	A	B	C	D	E	% Correct Classification
A	100.0	0.0	0.0	0.0	0.0	100.0
B	0.0	100.0	0.0	0.0	0.0	100.0
C	0.0	0.0	100.0	0.0	0.0	100.0
D	0.0	0.0	0.0	100.0	0.0	100.0
E	0.0	0.0	0.0	0.0	100.0	100.0
PCC	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
MCC	–	–	–	–	–	< 0.001
Total	–	–	–	–	–	100.0

Appendix 2. Supplementary figures

Fig. S1 (part 1). Frequency distribution of discriminant scores for the first (LD1) discriminant function. The numbers on the *x* axis represent the discriminant function values.
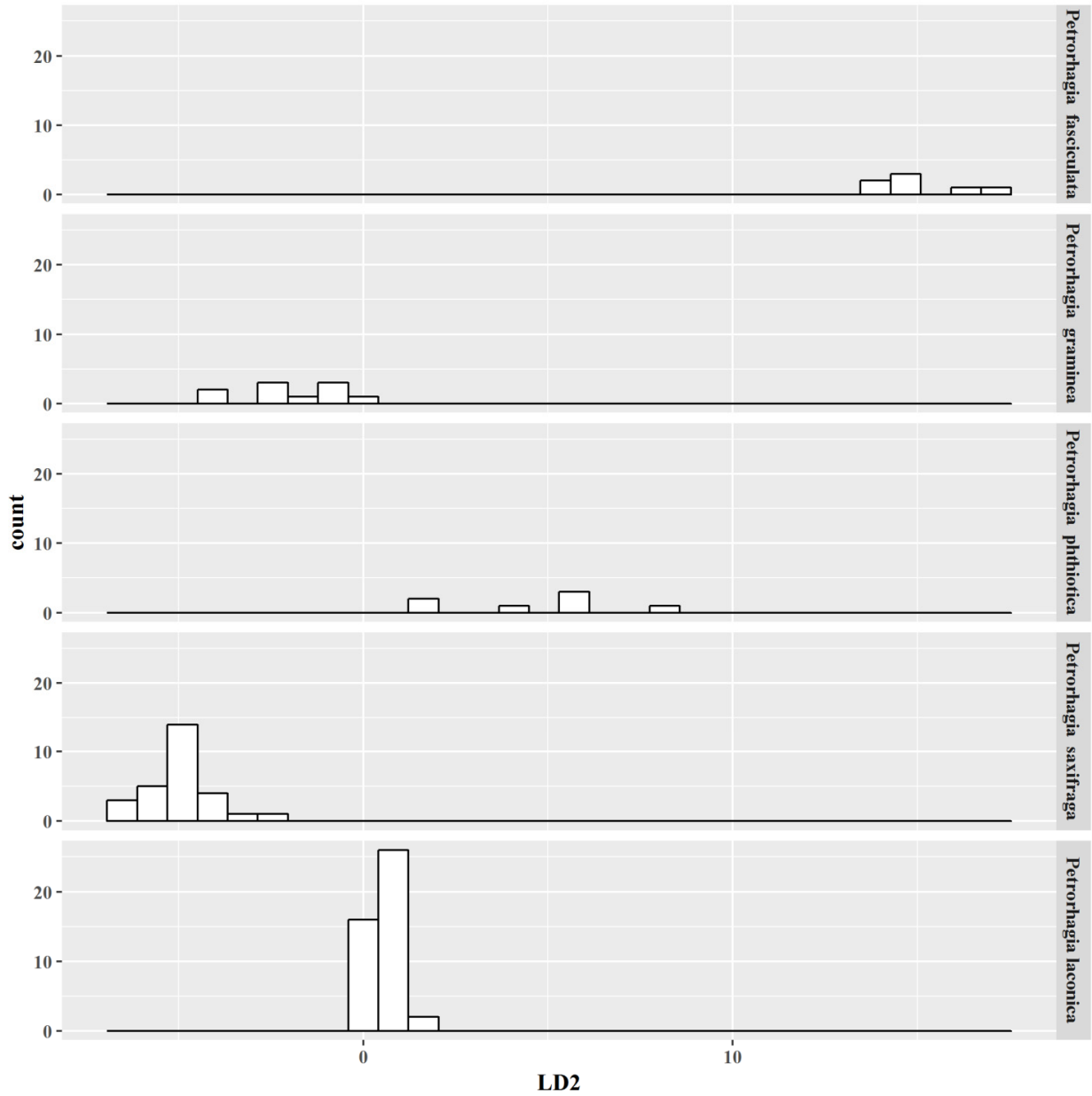
Fig. S1 (part 2). Frequency distribution of discriminant scores for the second (LD2) discriminant function. The numbers on the *x* axis represent the discriminant function values.
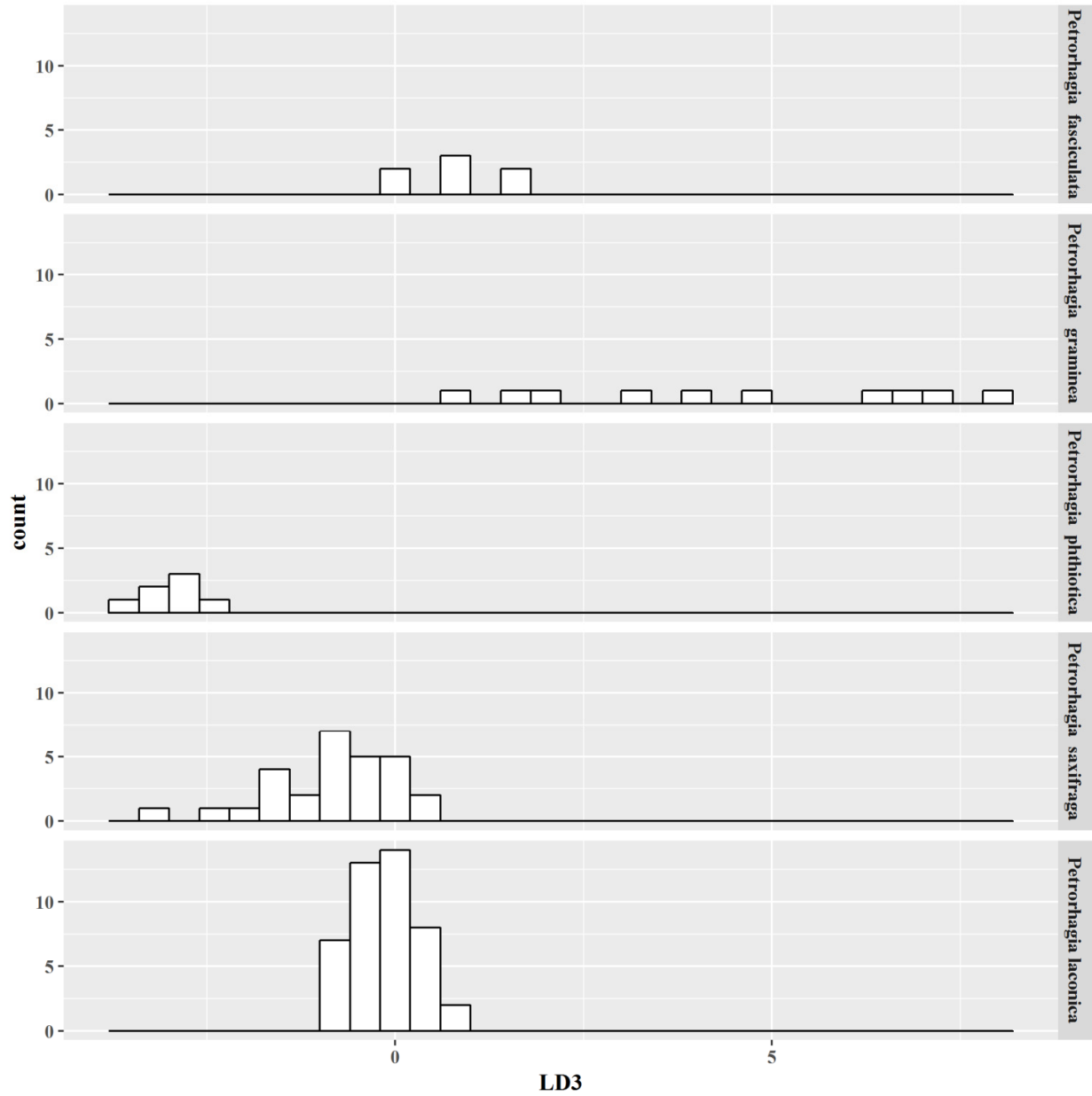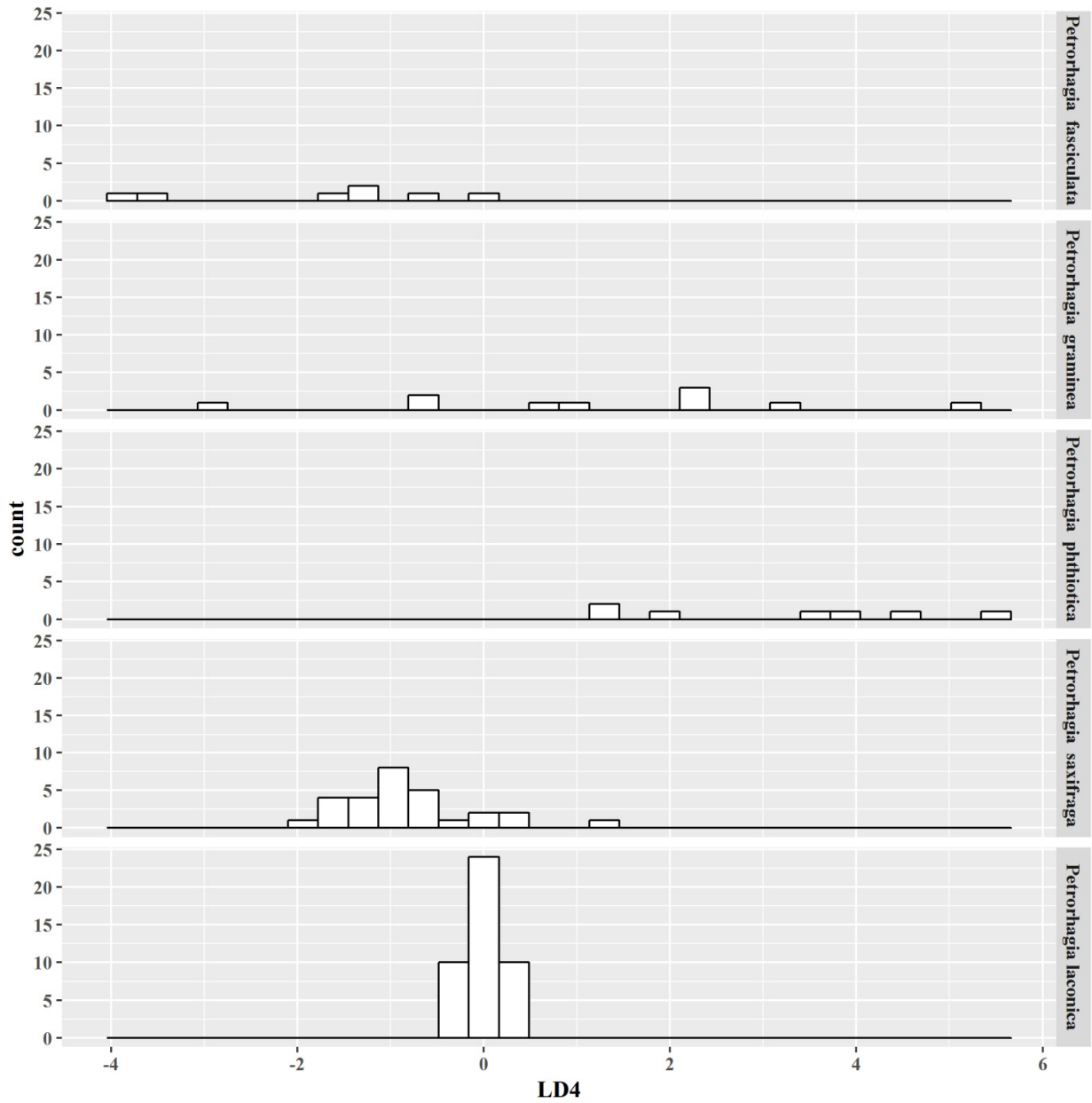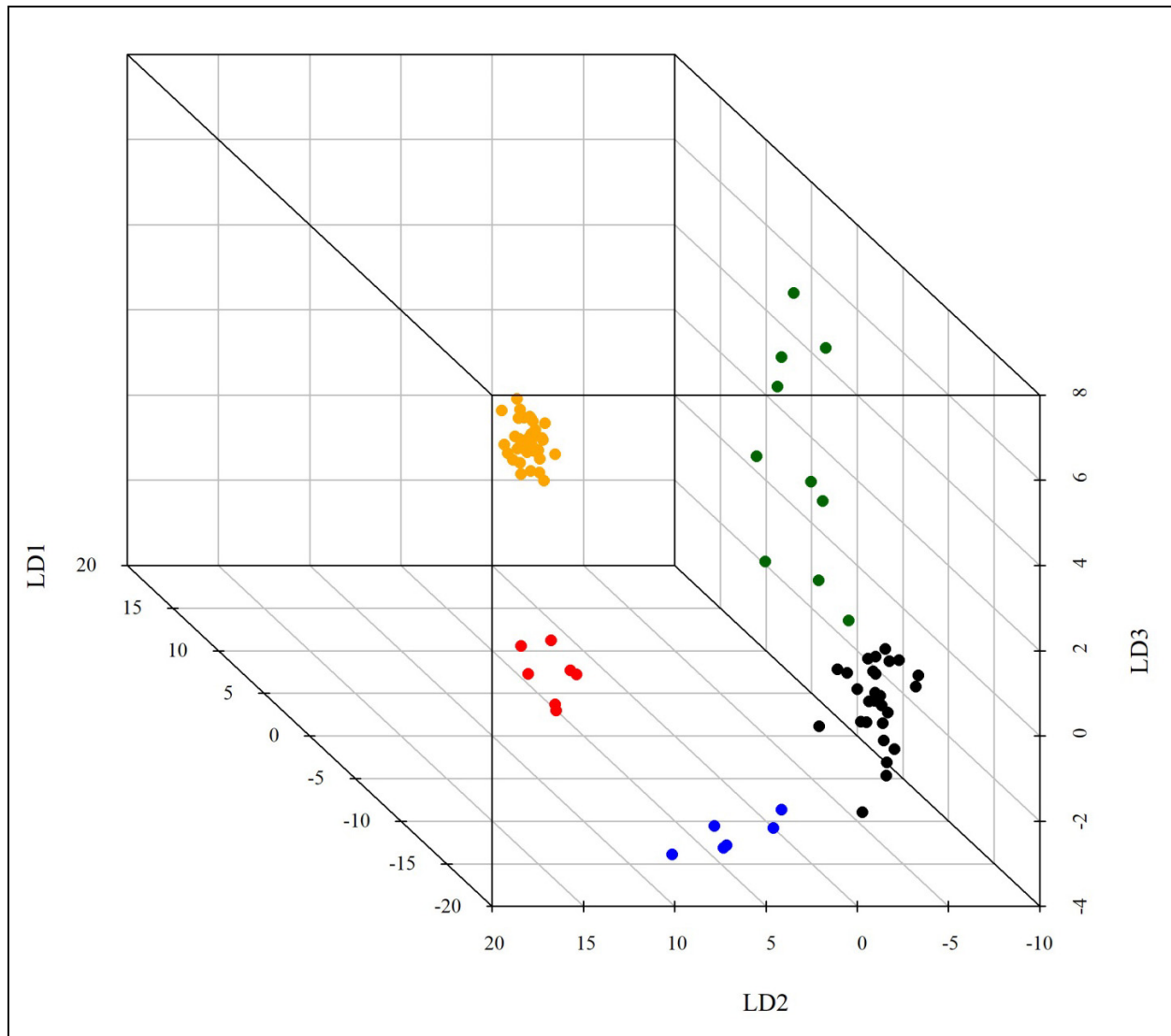
Fig. S1 (part 3). Frequency distribution of discriminant scores for the third (LD3) discriminant function. The numbers on the *x* axis represent the discriminant function values.

Fig. S1 (part 4). Frequency distribution of discriminant scores for the fourth (LD4) discriminant function. The numbers on the *x* axis represent the discriminant function values.

Fig. S2. 3D stepwise discriminant analysis plot for the five *Petrorhagia* species: *P. fasciculata* (red dots), *P. graminea* (green dots), *P. phthiotica* (blue dots), *P. saxifraga* (black dots) and *P. laconica* (orange dots).