

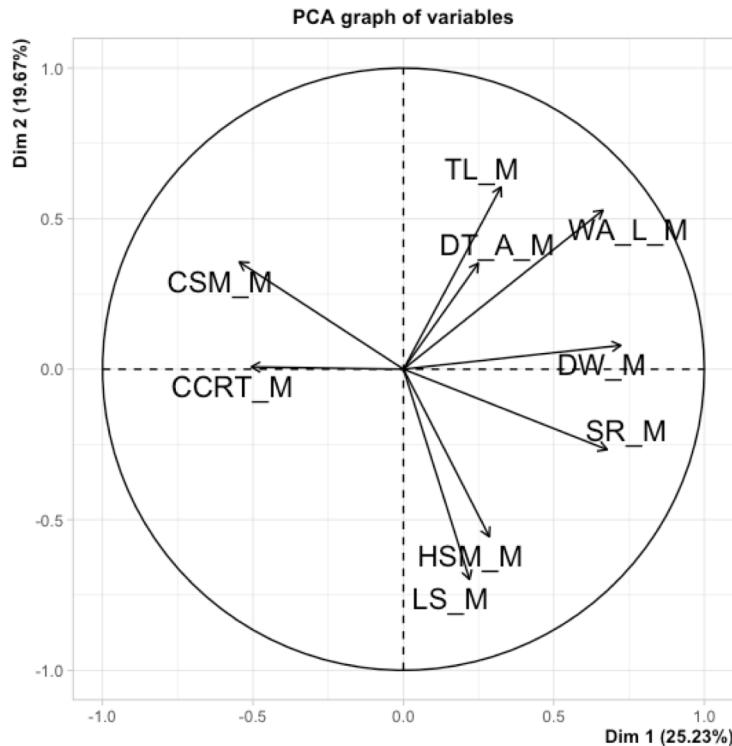
Seperate sex PCAs with model estimates

28/09/2022

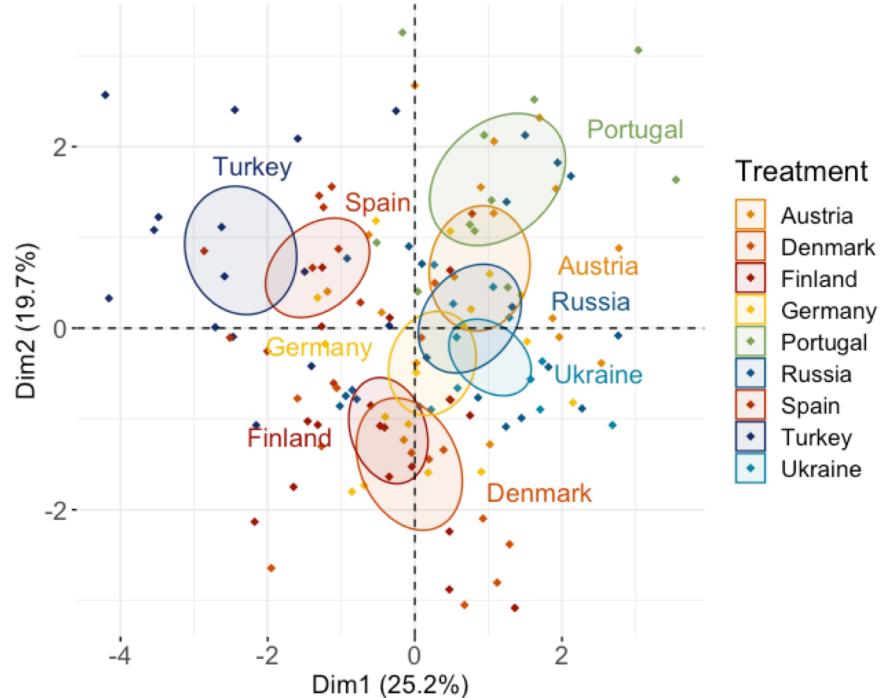
Notes

- Using model estimates for line rather than raw data (scaled to unit variance).
- Sexes dealt with separately
- PCA1 (M9) – male PCA with 9 traits
- PCA2 (F9) – female PCA with 9 traits equivalent to males
- PCA3 (Fmax) – female PCA with all 12 female traits
- PCA4 (FmaxPlus) – female PCA with 13 traits (12 female traits + viability)
- Loadings of traits on to PCs are considered of interest if greater than > 0.4 (or < -0.4).
 - Loadings > 0.6 are in **bold red**
 - Loadings from $0.4 - 0.59$ are in dark red

1: Male PCA - 9 traits (M9)



Male PCA - 9 traits (M9) PC1 vs PC2



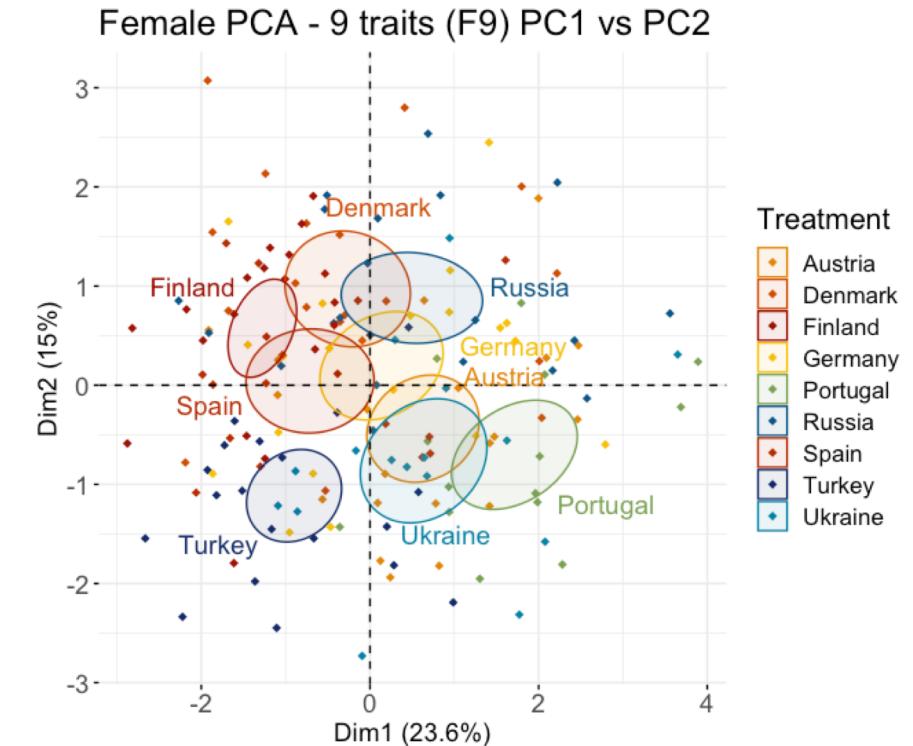
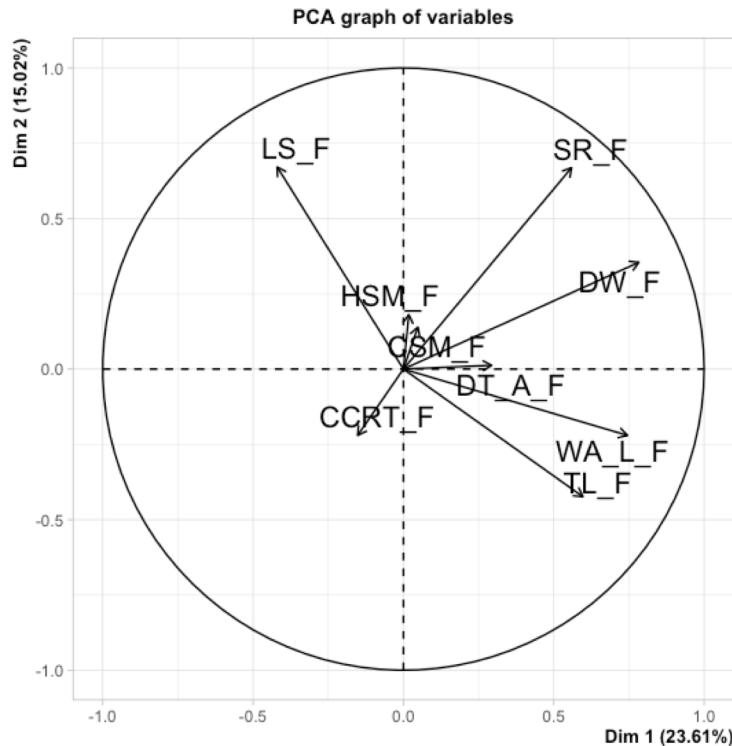
	eigenval	% var	cum % var
comp 1	2.271	25.231	25.231
comp 2	1.770	19.670	44.902
comp 3	1.211	13.452	58.353
comp 4	1.055	11.723	70.076
comp 5	0.818	9.084	79.160
comp 6	0.680	7.551	86.710
comp 7	0.462	5.139	91.849
comp 8	0.387	4.297	96.146
comp 9	0.347	3.854	100.000

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
CCRT_M	-0.505	0.007	0.598	0.295	-0.318
CSM_M	-0.545	0.356	0.367	0.080	0.510
DT_A_M	0.249	0.352	0.038	0.812	-0.148
DW_M	0.722	0.079	0.380	-0.260	-0.033
HSM_M	0.286	-0.556	-0.412	0.345	-0.100
LS_M	0.220	-0.699	0.171	0.181	0.505
SR_M	0.677	-0.267	0.517	0.105	0.050
TL_M	0.324	0.605	-0.316	0.219	0.395
WA_L_M	0.664	0.528	0.077	-0.154	-0.101

PCA 1 results

- PC1 accounts for 25.23% of the variance
- PC1: high trait loading values (>0.5):
 - WA, DW, SR = +ve PC1
 - CCRT, CSM = -ve PC1.
 - Por/Aus/Ukr/Rus = +ve PC1 (large, resistant to starvation & cold)
 - Tur/Spa = -ve PC1 (small, susceptible to starvation & cold)
- PC2: high trait loading values (>0.5):
 - TL, WA +ve PC2,
 - LS, HSM -ve PC2
 - Por/Tur/Spa = +ve PC2 (large, short-lived, resistant to heat)
 - Den/Fin. = -ve PC2 (small, long-lived, susceptible to heat)

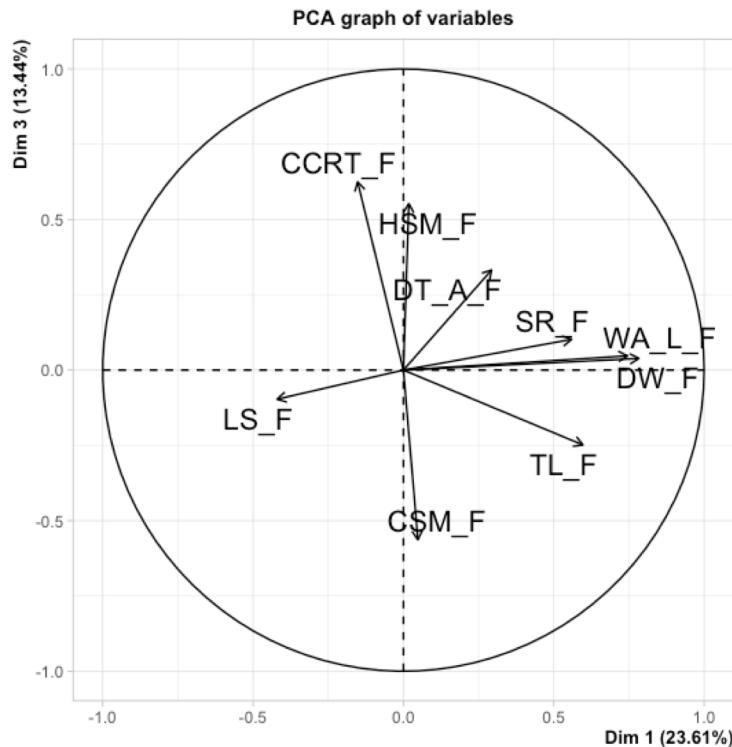
2: Female PCA – 9 traits (F9)



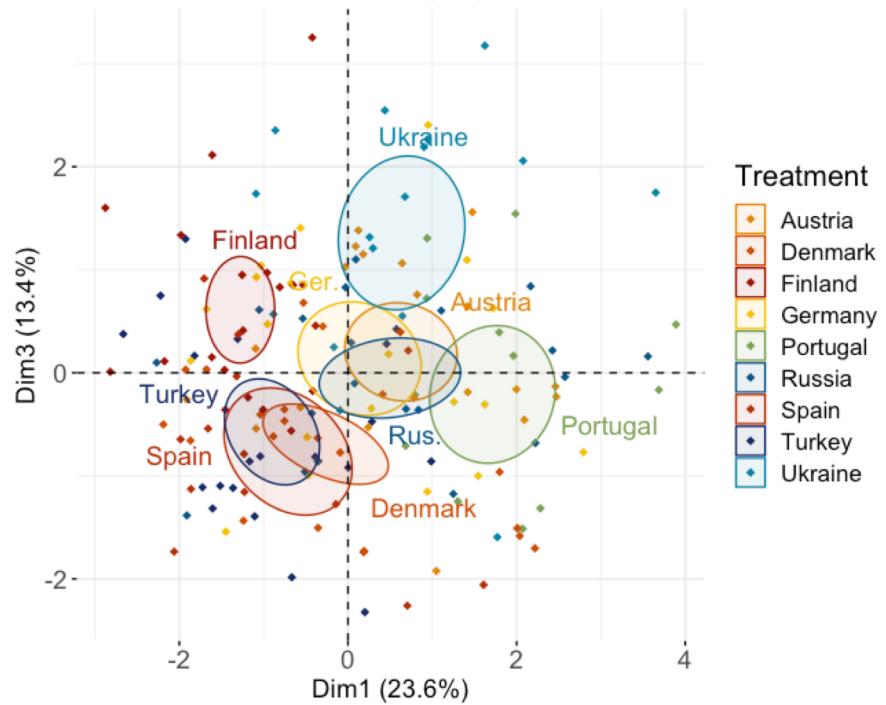
	eigenval	% var	cum % var
comp 1	2.125	23.612	23.612
comp 2	1.352	15.022	38.634
comp 3	1.210	13.441	52.075
comp 4	0.993	11.033	63.108
comp 5	0.950	10.554	73.662
comp 6	0.891	9.903	83.565
comp 7	0.659	7.327	90.892
comp 8	0.505	5.609	96.502
comp 9	0.315	3.498	100.000

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
CCRT_F	-0.152	-0.220	0.625	0.396	0.330
CSM_F	0.048	0.139	-0.564	0.357	0.698
DT_A_F	0.293	0.013	0.333	0.673	-0.258
DW_F	0.783	0.355	0.039	-0.100	-0.051
HSM_F	0.018	0.181	0.553	-0.416	0.510
LS_F	-0.420	0.671	-0.097	0.108	-0.122
SR_F	0.559	0.669	0.102	0.105	0.037
TL_F	0.597	-0.424	-0.249	0.109	0.091
WA_L_F	0.745	-0.220	0.047	-0.197	-0.004

2: Female PCA – 9 traits (F9)



Female PCA - 9 traits (F9) PC1 vs PC3



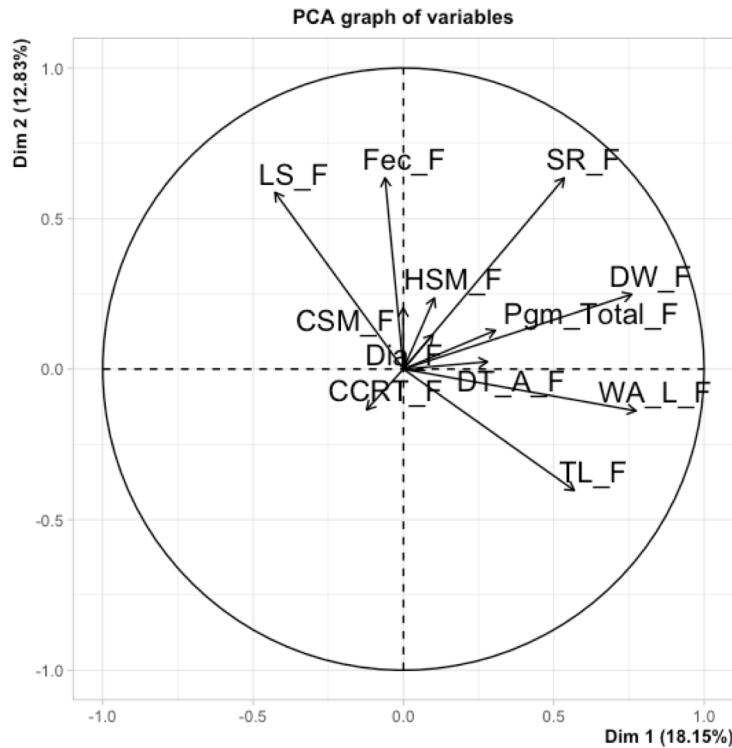
	eigenval	% var	cum % var
comp 1	2.125	23.612	23.612
comp 2	1.352	15.022	38.634
comp 3	1.210	13.441	52.075
comp 4	0.993	11.033	63.108
comp 5	0.950	10.554	73.662
comp 6	0.891	9.903	83.565
comp 7	0.659	7.327	90.892
comp 8	0.505	5.609	96.502
comp 9	0.315	3.498	100.000

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
CCRT_F	-0.152	-0.220	0.625	0.396	0.330
CSM_F	0.048	0.139	-0.564	0.357	0.698
DT_A_F	0.293	0.013	0.333	0.673	-0.258
DW_F	0.783	0.355	0.039	-0.100	-0.051
HSM_F	0.018	0.181	0.553	-0.416	0.510
LS_F	-0.420	0.671	-0.097	0.108	-0.122
SR_F	0.559	0.669	0.102	0.105	0.037
TL_F	0.597	-0.424	-0.249	0.109	0.091
WA_L_F	0.745	-0.220	0.047	-0.197	-0.004

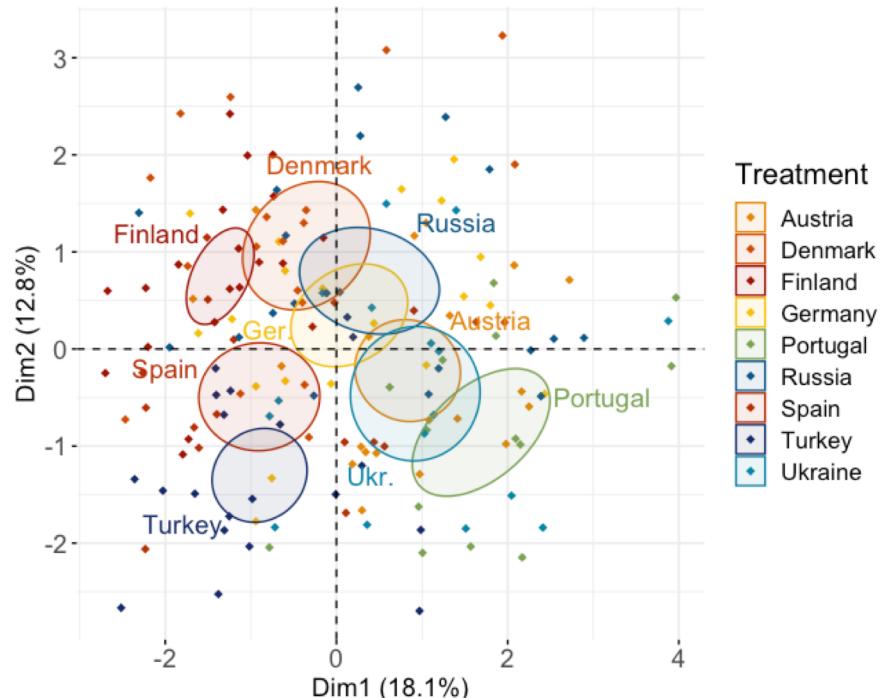
PCA 2 results

- PC1 accounts for 23.61% of the variance
- PC1: high trait loading values (>0.4):
 - DW, WA, TL, SR = +ve PC1
 - LS = -ve PC1.
 - Por/Aus = +ve PC1 (large, resistant to starvation)
 - Tur/Fin/Spa = -ve PC1 (small, susceptible to starvation)
- PC2: high trait loading values (>0.4):
 - LS, SR +ve PC2,
 - TL -ve PC2
 - Den/Rus/Fin = +ve PC2 (small, long-lived, resistant to starvation)
 - Tur/Ukr/Por = -ve PC2 (large, short-lived, susceptible to starvation)
- PC3: high trait loading values (>0.5):
 - CCRT, HSM +ve PC3,
 - CSM -ve PC3
 - Ukr/Fin = +ve PC3 (resistance to cold, susceptible to heat)
 - Tur/Spa/Den = -ve PC3 (susceptible to cold, resistant to heat)

3: Female PCA – 12 traits (Fmax)



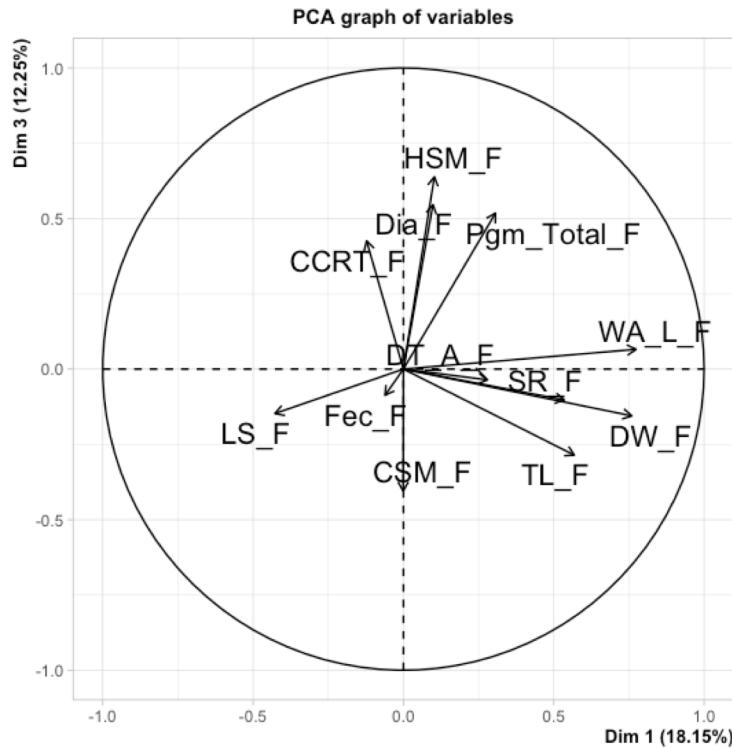
Female PCA - 12 traits (Fmax) PC1 vs PC2



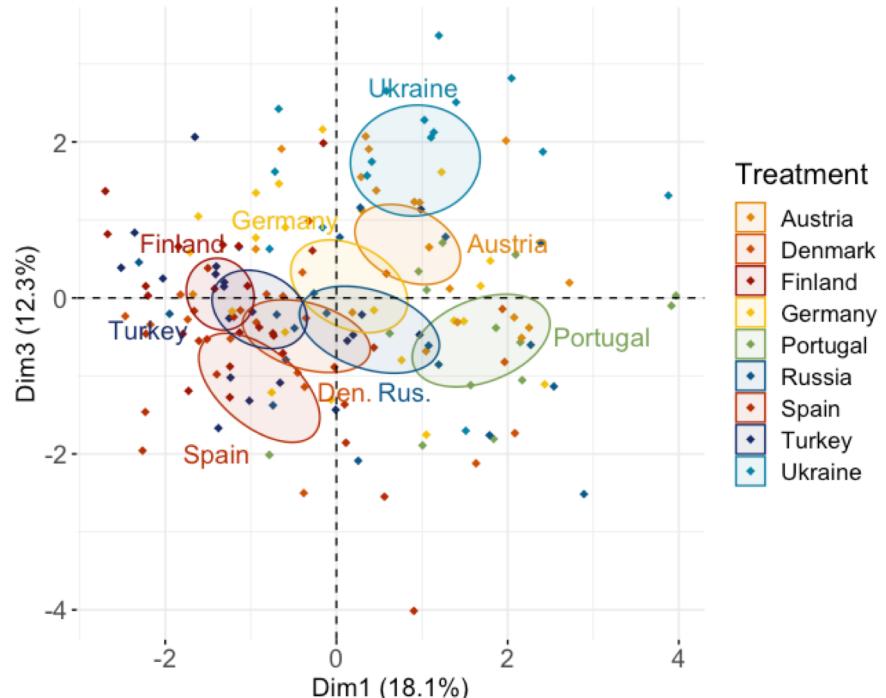
	eigenval	% var	cum % var
comp 1	2.178	18.149	18.149
comp 2	1.540	12.834	30.983
comp 3	1.470	12.250	43.233
comp 4	1.116	9.300	52.534
comp 5	1.072	8.931	61.465
comp 6	1.000	8.332	69.797
comp 7	0.829	6.906	76.704
comp 8	0.787	6.557	83.260
comp 9	0.664	5.537	88.797
comp 10	0.605	5.044	93.842
comp 11	0.438	3.647	97.488
comp 12	0.301	2.512	100.000

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
CCRT_F	-0.122	-0.135	0.426	0.591	-0.179
CSM_F	-0.001	0.203	-0.405	0.099	0.564
DT_A_F	0.280	0.024	-0.036	0.232	-0.645
Dia_F	0.098	0.114	0.546	0.383	0.444
DW_F	0.759	0.248	-0.155	0.131	-0.064
Fec_F	-0.061	0.635	-0.087	-0.022	0.113
HSM_F	0.103	0.236	0.639	-0.190	0.042
LS_F	-0.427	0.587	-0.148	-0.245	-0.276
Pgm_Total_F	0.306	0.129	0.518	-0.541	-0.020
SR_F	0.535	0.635	-0.103	0.305	-0.052
TL_F	0.568	-0.403	-0.286	-0.063	0.091
WA_L_F	0.774	-0.139	0.066	-0.229	0.039

3: Female PCA – 12 traits (Fmax)



Female PCA - 12 traits (Fmax) PC1 vs PC3



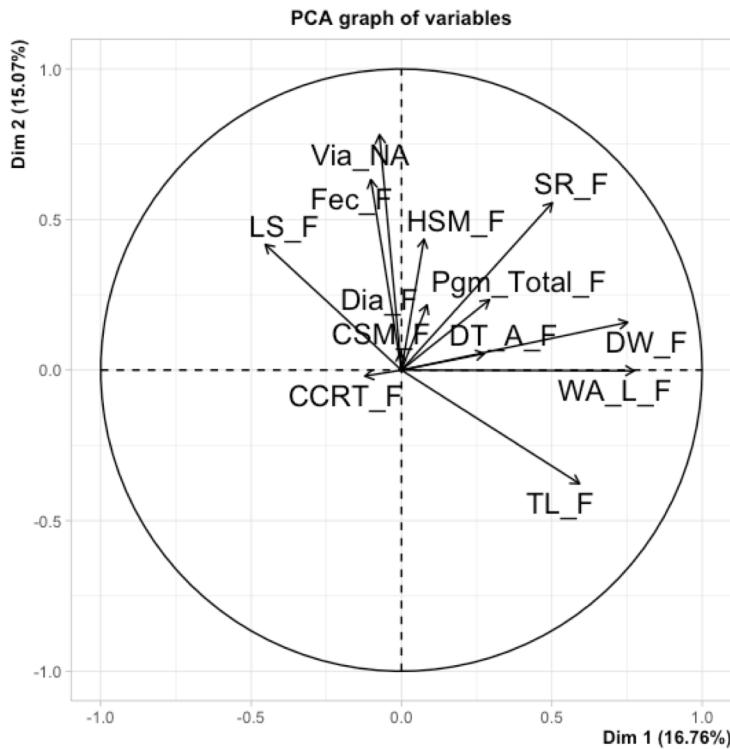
	eigenval	% var	cum % var
comp 1	2.178	18.149	18.149
comp 2	1.540	12.834	30.983
comp 3	1.470	12.250	43.233
comp 4	1.116	9.300	52.534
comp 5	1.072	8.931	61.465
comp 6	1.000	8.332	69.797
comp 7	0.829	6.906	76.704
comp 8	0.787	6.557	83.260
comp 9	0.664	5.537	88.797
comp 10	0.605	5.044	93.842
comp 11	0.438	3.647	97.488
comp 12	0.301	2.512	100.000

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
CCRT_F	-0.122	-0.135	0.426	0.591	-0.179
CSM_F	-0.001	0.203	-0.405	0.099	0.564
DT_A_F	0.280	0.024	-0.036	0.232	-0.645
Dia_F	0.098	0.114	0.546	0.383	0.444
DW_F	0.759	0.248	-0.155	0.131	-0.064
Fec_F	-0.061	0.635	-0.087	-0.022	0.113
HSM_F	0.103	0.236	0.639	-0.190	0.042
LS_F	-0.427	0.587	-0.148	-0.245	-0.276
Pgm_Total_F	0.306	0.129	0.518	-0.541	-0.020
SR_F	0.535	0.635	-0.103	0.305	-0.052
TL_F	0.568	-0.403	-0.286	-0.063	0.091
WA_L_F	0.774	-0.139	0.066	-0.229	0.039

PCA 3 results

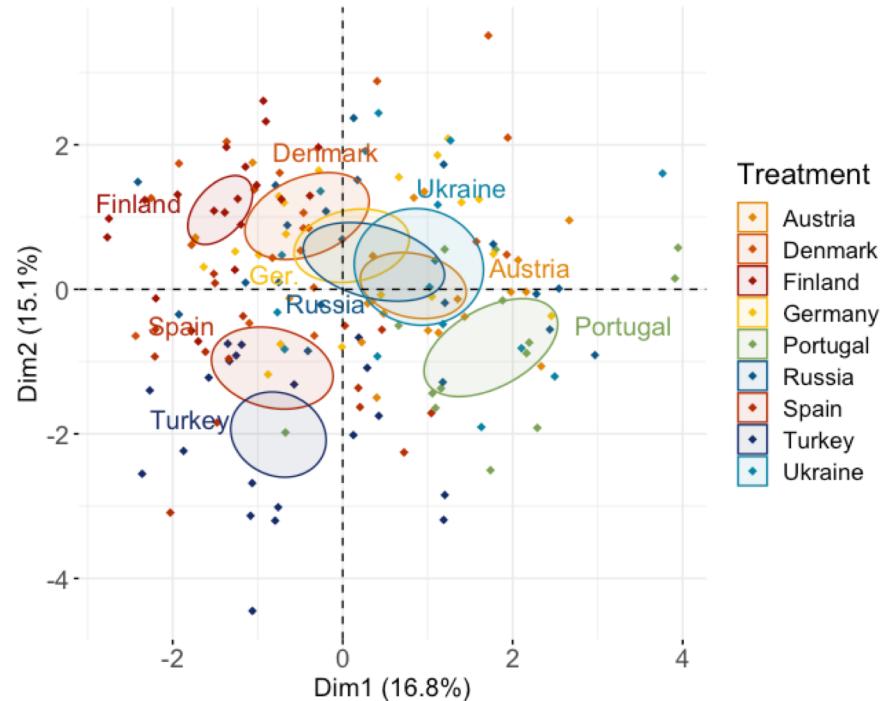
- PC1 accounts for 18.61% of the variance
- PC1: high trait loading values (>0.4):
 - DW, WA, TL, SR = +ve PC1
 - LS = -ve PC1.
 - Por/Aus/Ukr = +ve PC1 (large, resistant to starvation)
 - Tur/Fin/Spa = -ve PC1 (small, susceptible to starvation)
- PC2: high trait loading values (>0.4):
 - Fec, SR, LS +ve PC2,
 - TL -ve PC2
 - Den/Rus/Fin = +ve PC2 (small, long-lived, resistant to starvation)
 - Tur/Ukr/Por = -ve PC2 (large, short-lived, susceptible to starvation)
- PC3: high trait loading values (>0.4):
 - HSM, Pigm, dia, CCRT +ve PC3,
 - CSM -ve PC3
 - Ukr/Aus = +ve PC3 (resist cold, suspect heat, higher diap, more pigm)
 - Spa/Den/Por = -ve PC3 (suspect cold, resist heat, lower diap, less pigm)

4: Female PCA – 13 traits (Fmax Plus)



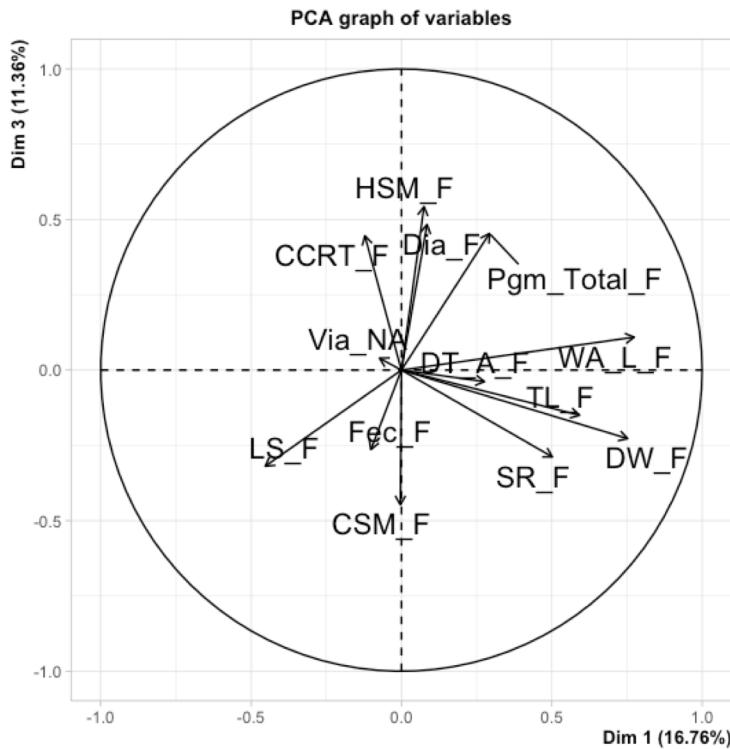
	eigenval	% var	cum % var
comp 1	2.179	16.763	16.763
comp 2	1.959	15.069	31.832
comp 3	1.477	11.361	43.194
comp 4	1.117	8.589	51.783
comp 5	1.072	8.245	60.028
comp 6	1.016	7.817	67.844
comp 7	0.847	6.512	74.356
comp 8	0.789	6.066	80.421
comp 9	0.761	5.855	86.276
comp 10	0.606	4.664	90.940
comp 11	0.487	3.743	94.684
comp 12	0.413	3.173	97.857
comp 13	0.279	2.143	100.000

Female PCA - 13 traits (Fmax Plus) PC1 vs PC2

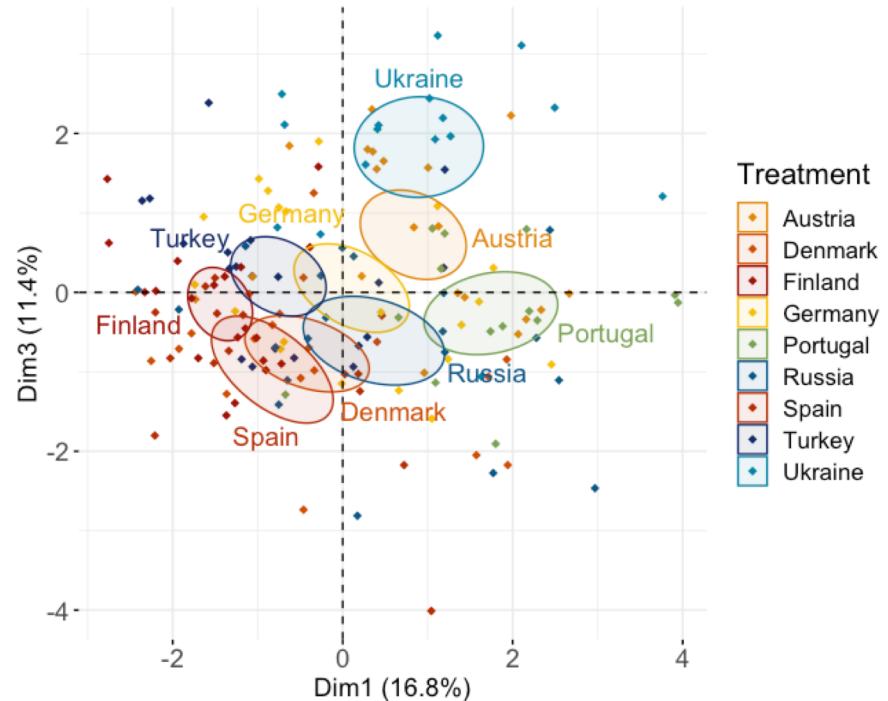


	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
CCRT_F	-0.122	-0.020	0.446	0.587	-0.185
CSM_F	-0.004	0.059	-0.447	0.096	0.559
DT_A_F	0.276	0.055	-0.038	0.219	-0.652
Dia_F	0.085	0.216	0.483	0.399	0.448
DW_F	0.753	0.159	-0.228	0.147	-0.056
Fec_F	-0.102	0.633	-0.264	-0.020	0.111
HSM_F	0.075	0.435	0.543	-0.180	0.046
LS_F	-0.453	0.417	-0.319	-0.225	-0.267
Pgm_Total_F	0.293	0.233	0.454	-0.529	-0.014
SR_F	0.502	0.556	-0.288	0.327	-0.044
TL_F	0.592	-0.377	-0.150	-0.084	0.083
WA_L_F	0.774	-0.002	0.109	-0.239	0.036
Via_NA	-0.073	0.782	0.040	-0.027	-0.010

4: Female PCA – 13 traits (Fmax Plus)



Female PCA - 13 traits (Fmax Plus) PC1 vs PC3



	eigenval	% var	cum % var
comp 1	2.179	16.763	16.763
comp 2	1.959	15.069	31.832
comp 3	1.477	11.361	43.194
comp 4	1.117	8.589	51.783
comp 5	1.072	8.245	60.028
comp 6	1.016	7.817	67.844
comp 7	0.847	6.512	74.356
comp 8	0.789	6.066	80.421
comp 9	0.761	5.855	86.276
comp 10	0.606	4.664	90.940
comp 11	0.487	3.743	94.684
comp 12	0.413	3.173	97.857
comp 13	0.279	2.143	100.000

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
CCRT_F	-0.122	-0.020	0.446	0.587	-0.185
CSM_F	-0.004	0.059	-0.447	0.096	0.559
DT_A_F	0.276	0.055	-0.038	0.219	-0.652
Dia_F	0.085	0.216	0.483	0.399	0.448
DW_F	0.753	0.159	-0.228	0.147	-0.056
Fec_F	-0.102	0.633	-0.264	-0.020	0.111
HSM_F	0.075	0.435	0.543	-0.180	0.046
LS_F	-0.453	0.417	-0.319	-0.225	-0.267
Pgm_Total_F	0.293	0.233	0.454	-0.529	-0.014
SR_F	0.502	0.556	-0.288	0.327	-0.044
TL_F	0.592	-0.377	-0.150	-0.084	0.083
WA_L_F	0.774	-0.002	0.109	-0.239	0.036
Via_NA	-0.073	0.782	0.040	-0.027	-0.010

PCA 4 results

- PC1 accounts for 16.73% of the variance
- PC1: high trait loading values (>0.4):
 - WA, DW, TL, SR = +ve PC1
 - LS = -ve PC1.
 - Por/Aus/Ukr = +ve PC1 (large, resistant to starvation)
 - Fin/Spa/Tur = -ve PC1 (small, susceptible to starvation)
- PC2: high trait loading values (>0.4):
 - Via, Fec, SR, HSM, LS +ve PC2,
 - O traits -ve PC2
 - Fin/Den/Ger = +ve PC2 (High via & fec, long-lived, resist starve, suscept. heat)
 - Tur/Spa/Por = -ve PC2 (Low via & fec, short-lived, suscept. starve, resist heat)
- PC3: high trait loading values (>0.4):
 - HSM, dia, Pigm, CCRT +ve PC3,
 - CSM -ve PC3
 - Ukr/Aus = +ve PC3 (resist cold, suspect heat, higher diapause, more pigm)
 - Spa/Den/Rus = -ve PC3 (suscept cold, resist heat, lower diapause, less pigm)

Summary

- PC1 always includes positive correlation of dry weight, wing area and starvation resistance as well as....
 - ... negative corr. with CSM in males
 - ... negative corr. with life span in females
 - Por/Aus (+ Ukr/Rus) are positive
 - Tur/Spa (+ Fin) are negative
- PC2 differs somewhat between males and females (note '+' and '-' switch)
 - In males:
 - +ve correlation with thorax length and wing area
 - -ve correlation with HSM and lifespan
 - Por/Tur/Spa are positive
 - Den/Fin are negative
 - In females:
 - -ve correlation with thorax length
 - +ve correlation with lifespan and starvation resistance (+ fecundity and viability)
 - Tur/Por (+ Ukr/Spa) are negative
 - Den/Fin (+ Rus/Ger) are positive
- PC3 potentially interesting in females...
 - Positive correlation between HSM and CCRT (+ diapause and pigmentation)
 - Negative correlation with CSM
 - Ukr (+Aus/Fin) are positive
 - Spa/Den (+Tur/Rus/Por) are negative
 - *Interestingly, in males HSM and CCRT negatively correlate with one another on PC3....*