

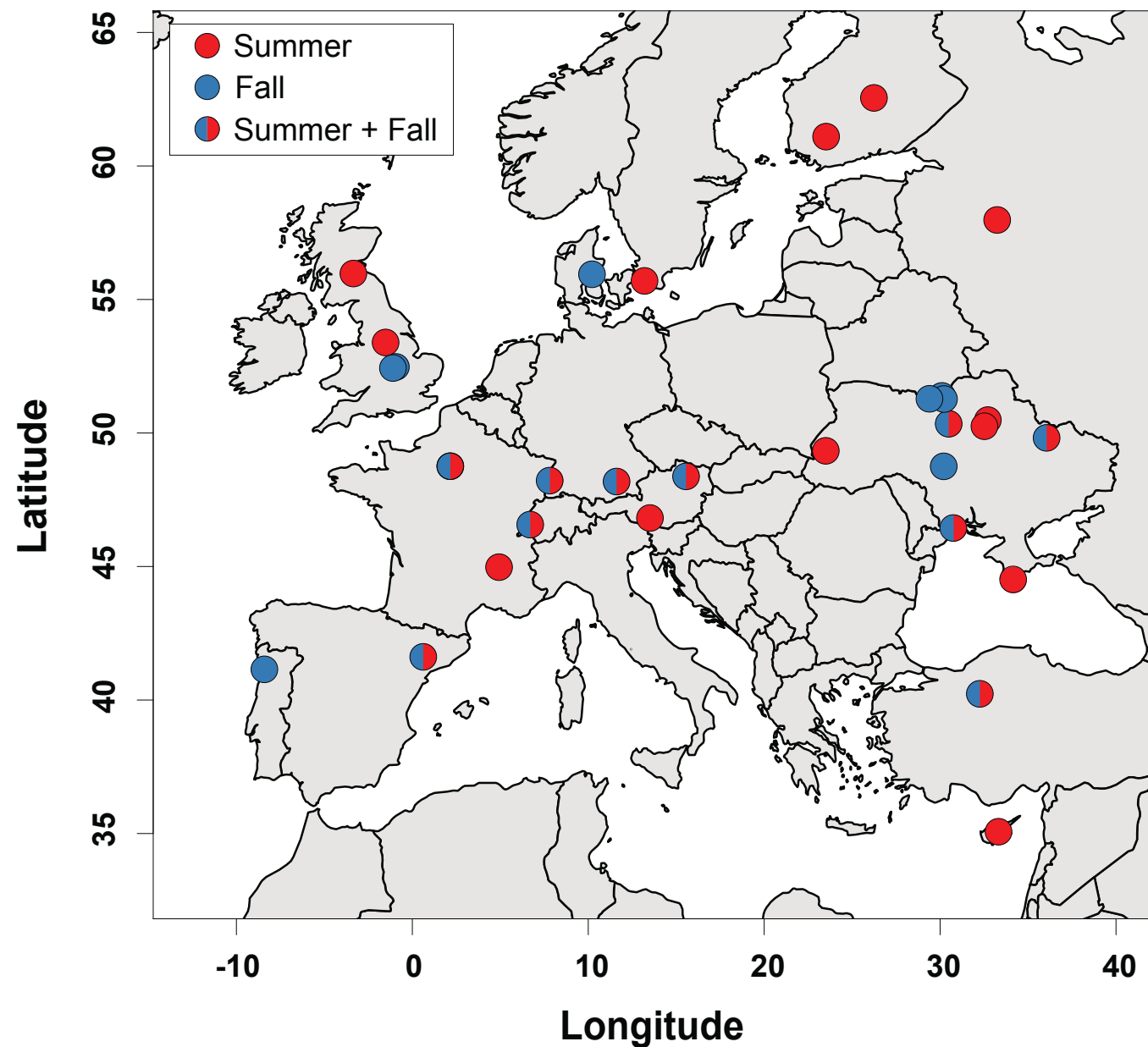
DrosEU

Phenotyping Effort

Updates

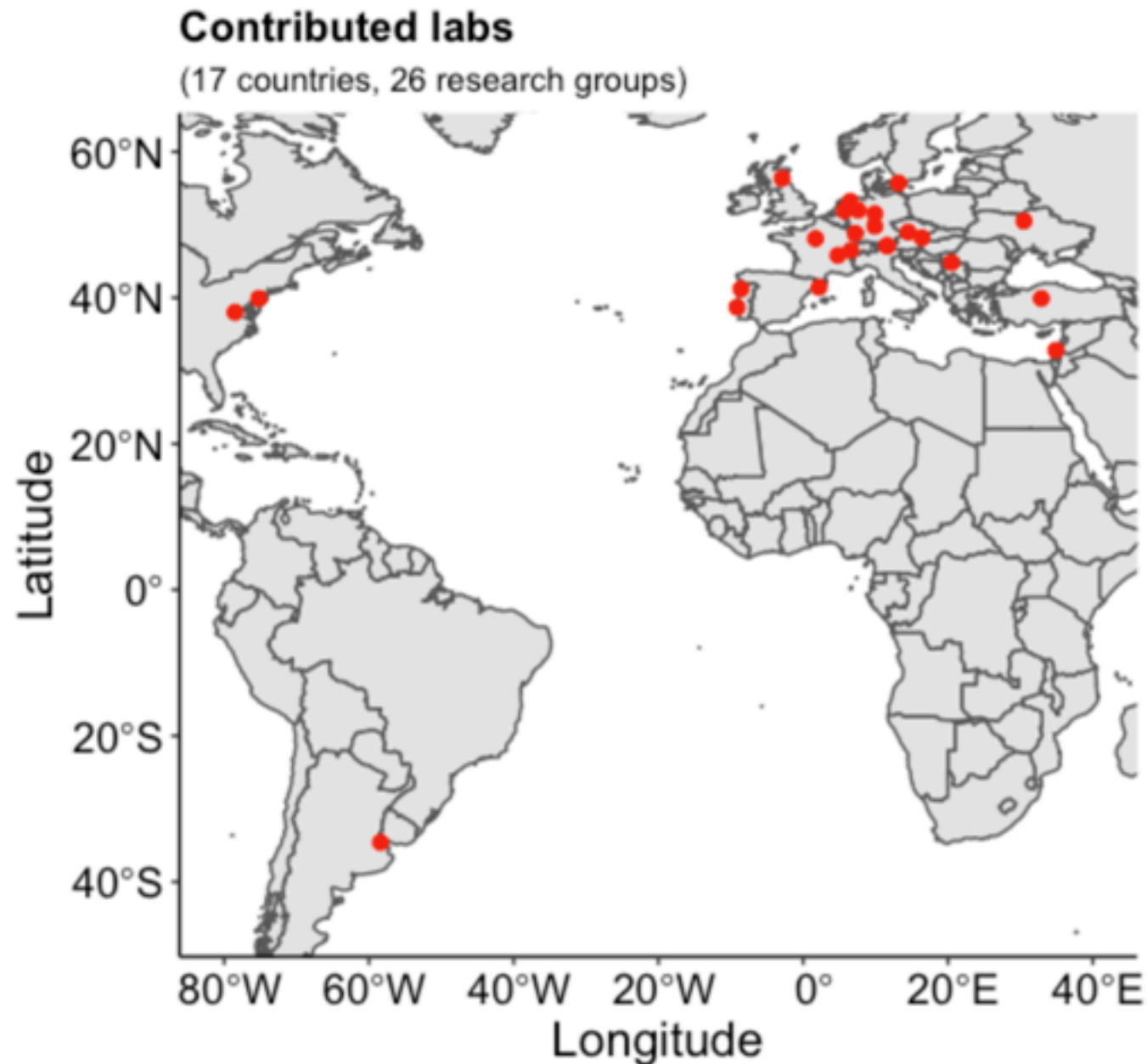
Esra Durmaz - Envel Kerdaffrec
University of Fribourg

Genetic variation in Europe



- Longitudinal / latitudinal population structure
- Continent-wide selective sweeps
- Candidate genes for local climate adaptation

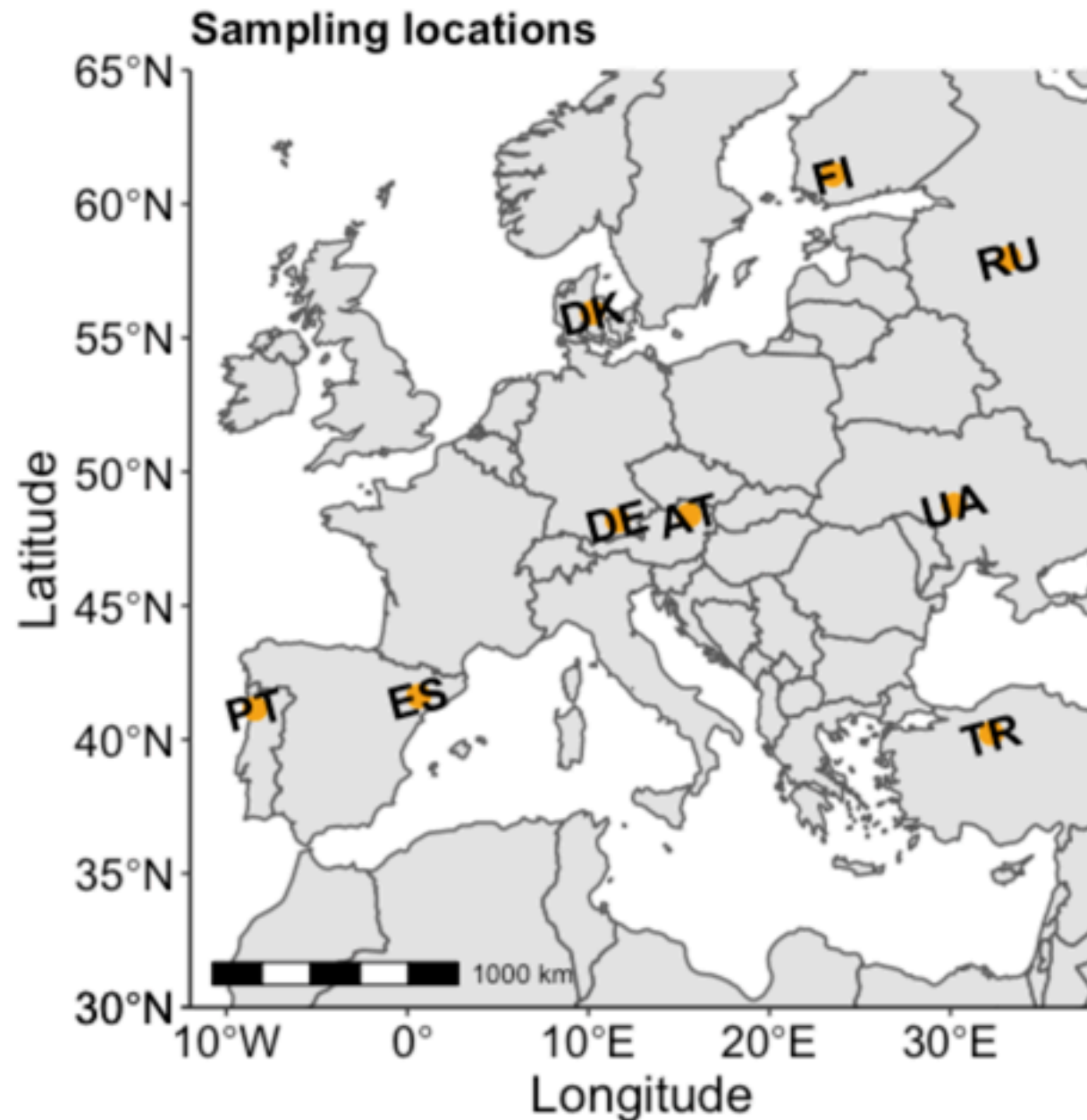
Collaborative phenotyping effort



17 Countries
26 Research groups
>100 Researchers

Sampling locations

9 Locations (173 isofemale lines)



- **Turkey**
 - collected in Yesiloz (Banu Onder)
- **Portugal**
 - collected in Recarei (Jorge Vieira)
- **Spain**
 - collected in Gimenells (Josefa Gonzalez)
- **Germany**
 - collected in Munich (Amanda Glaser-Schmitt)
- **Austria**
 - collected in Mauternbach (Andrea Betancourt)
- **Ukraine**
 - collected in Uman (Iryna Kozeretska)
- **Denmark**
 - collected in Karensminde (Mads Schou)
- **Russia**
 - collected in Valday (Elena Pasyukova)
- **Finland**
 - collected in Akaa (Maaria Kankare)

Élio Sucena, IGC

Phenotyped traits

Viability
Development time
Dry weight
Thorax length
Wing area
Circadian eclosion timing
Pigmentation
Fecundity
Diapause
Locomotor activity
Parasitoid resistance
Chill-coma recovery time
Cold-shock mortality
Heat-shock mortality
Starvation resistance
Lifespan

Phenotyped traits

Viability
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Dry weight
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Locomotor activity
Parasitoid resistance
Chill-coma recovery time
Cold-shock mortality
Heat-shock mortality
Starvation resistance
Lifespan

**> 400K
observations
(flies)**

Raw data curation

Master Sheets

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A1 fx Supervisor/PI

	A	B	C	D	E	F	G	H	I	
1	Supervisor/F	Diet	Batch	Population	Line	ReplicateVialOld	ReplicateVial	ProportionEggtoAdultSurviva		
2	Gibert	NS	1	AK	AK1	1	1_AK1_1	0.68		
3	Gibert	NS	1	AK	AK1	2	1_AK1_2	0.73		
4	Gibert	NS	1	AK	AK1	3	1_AK1_3	0.63		
5	Gibert	NS	1	AK	AK10	1	1_AK10_1	0.85		
6	Gibert	NS	1	AK	AK10	2	1_AK10_2	0.75		
7	Gibert	NS	1	AK	AK10	3	1_AK10_3	0.80		
8	Gibert	NS	1	AK	AK12	1	1_AK12_1	0.85		
9	Gibert	NS	1	AK	AK12	2	1_AK12_2	0.88		
10	Gibert	NS	1	AK	AK12	3	1_AK12_3	0.70		
11	Gibert	NS	1	AK	AK17	1	1_AK17_1	0.68		
12	Gibert	NS	1	AK	AK17	2	1_AK17_2	0.60		
13	Gibert	NS	1	AK	AK17	3	1_AK17_3	0.75		
14	Gibert	NS	1	AK	AK18	1	1_AK18_1	0.85		
15	Gibert	NS	1	AK	AK18	2	1_AK18_2	0.38		
16	Gibert	NS	1	AK	AK18	3	1_AK18_3	0.55		
17	Gibert	NS	1	AK	AK2	1	1_AK2_1	0.70		
18	Gibert	NS	1	AK	AK2	2	1_AK2_2	0.68		
19	Gibert	NS	1	AK	AK2	3	1_AK2_3	0.93		
20	Gibert	NS	1	AK	AK20	1	1_AK20_1	0.85		
21	Gibert	NS	1	AK	AK20	2	1_AK20_2	0.80		
22	Gibert	NS	1	AK	AK20	3	1_AK20_3	0.80		
23	Gibert	NS	1	AK	AK21	1	1_AK21_1	0.68		
24	Gibert	NS	1	AK	AK21	2	1_AK21_2	0.88		
25	Gibert	NS	1	AK	AK21	3	1_AK21_3	0.70		
26	Gibert	NS	1	AK	AK3	1	1_AK3_1	0.68		
27	Gibert	NS	1	AK	AK3	2	1_AK3_2	0.68		

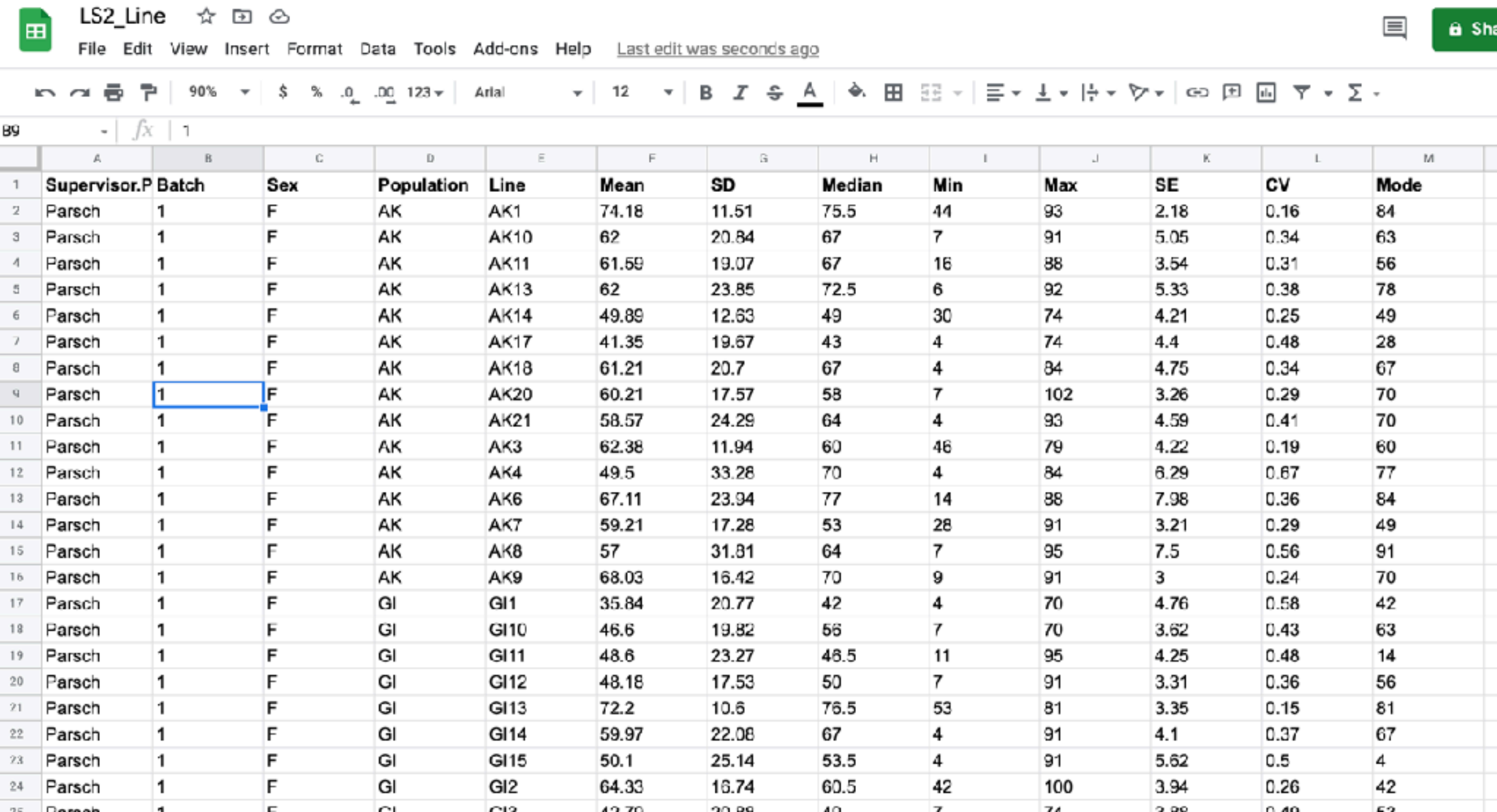
Summary stats

(by trait, supervisor.PI, population)

table_TL_pop												
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100% \$ % .0 .00 123 Calibri 12 B I U A												
G8 - 944												
	A	B	C	D	E	F	G	H	I	J	K	L
1	Supervisor.PI	Batch	Sex	Population	Mean	SD	Median	Min	Max	SE	CV	Mode
2	Kozeretska	1	F	AK	940.29	60.59	944	735	1112	3.11	0.06	948
3	Kozeretska	1	F	GI	931.27	59.39	940	747	1088	4.43	0.06	952
4	Kozeretska	1	F	KA	905.37	62.05	908	723	1052	4.01	0.07	952
5	Kozeretska	1	F	MA	972	64.9	972	787	1124	3.52	0.07	956
6	Kozeretska	1	F	MU	952.9	64.9	960	743	1084	3.52	0.07	980
7	Kozeretska	1	F	RE	965.72	58.14	966	799	1096	3.92	0.06	936
8	Kozeretska	1	F	UM	939.33	59.88	944	767	1100	3.87	0.06	948
9	Kozeretska	1	F	VA	962.97	55.76	964	795	1080	2.89	0.06	964
10	Kozeretska	1	F	YE	957.43	62.51	964	707	1116	3.88	0.07	976
11	Kozeretska	1	M	AK	838.75	52.54	843	639	968	2.7	0.06	827
12	Kozeretska	1	M	GI	833.71	54.67	839	627	976	4.07	0.07	851
13	Kozeretska	1	M	KA	803.39	52.11	811	631	956	3.36	0.06	843
14	Kozeretska	1	M	MA	870.85	58.54	876	699	1004	3.19	0.07	908
15	Kozeretska	1	M	MU	851.58	59.53	863	671	988	3.23	0.07	871
16	Kozeretska	1	M	RE	865.22	51.98	865	727	972	3.5	0.06	835
17	Kozeretska	1	M	UM	831.19	59.21	835	651	948	3.82	0.07	823
18	Kozeretska	1	M	VA	861.42	55.84	863	683	1197	2.9	0.06	896
19	Kozeretska	1	M	YE	848.51	57.59	855	651	980	3.57	0.07	859
20	Kozeretska	2	F	AK	931.78	52.08	924	803	1056	3.01	0.06	900
21	Kozeretska	2	F	GI	941.16	53.56	942	815	1056	4.53	0.06	988
22	Kozeretska	2	F	KA	917.88	61.03	916	759	1126	3.94	0.07	944
23	Kozeretska	2	F	MA	952.82	59.4	956	731	1152	3.69	0.06	969

Summary stats

(by trait, supervisor.PI, population, line)



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Supervisor.P	Batch	Sex	Population	Line	Mean	SD	Median	Min	Max	SE	CV	Mode
2	Parsch	1	F	AK	AK1	74.18	11.51	75.5	44	93	2.18	0.16	84
3	Parsch	1	F	AK	AK10	62	20.84	67	7	91	5.05	0.34	63
4	Parsch	1	F	AK	AK11	61.59	19.07	67	16	88	3.54	0.31	56
5	Parsch	1	F	AK	AK13	62	23.85	72.5	6	92	5.33	0.38	78
6	Parsch	1	F	AK	AK14	49.89	12.63	49	30	74	4.21	0.25	49
7	Parsch	1	F	AK	AK17	41.35	19.67	43	4	74	4.4	0.48	28
8	Parsch	1	F	AK	AK18	61.21	20.7	67	4	84	4.75	0.34	67
9	Parsch	1	F	AK	AK20	60.21	17.57	58	7	102	3.26	0.29	70
10	Parsch	1	F	AK	AK21	58.57	24.29	64	4	93	4.59	0.41	70
11	Parsch	1	F	AK	AK3	62.38	11.94	60	46	79	4.22	0.19	60
12	Parsch	1	F	AK	AK4	49.5	33.28	70	4	84	6.29	0.67	77
13	Parsch	1	F	AK	AK6	67.11	23.94	77	14	88	7.98	0.36	84
14	Parsch	1	F	AK	AK7	59.21	17.28	53	28	91	3.21	0.29	49
15	Parsch	1	F	AK	AK8	57	31.81	64	7	95	7.5	0.56	91
16	Parsch	1	F	AK	AK9	68.03	16.42	70	9	91	3	0.24	70
17	Parsch	1	F	GI	GI1	35.84	20.77	42	4	70	4.76	0.58	42
18	Parsch	1	F	GI	GI10	46.6	19.82	56	7	70	3.62	0.43	63
19	Parsch	1	F	GI	GI11	48.6	23.27	48.5	11	95	4.25	0.48	14
20	Parsch	1	F	GI	GI12	48.18	17.53	50	7	91	3.31	0.36	56
21	Parsch	1	F	GI	GI13	72.2	10.6	76.5	53	81	3.35	0.15	81
22	Parsch	1	F	GI	GI14	59.97	22.08	67	4	91	4.1	0.37	67
23	Parsch	1	F	GI	GI15	50.1	25.14	53.5	4	91	5.62	0.5	4
24	Parsch	1	F	GI	GI2	64.33	16.74	60.5	42	100	3.94	0.26	42
25	Parsch	1	F	GI	GI3	43.70	20.88	40	7	74	3.88	0.40	53

More data to come

Genotyping of all DrosEU isofemale lines for cosmopolitan inversions

Flatt lab

Genotyping of all DrosEU isofemale lines for Wolbachia presence / absence

Sucena, Pasyukova, Kapun, Vieira and Kozeretska Labs

	Country	Population	Line	Wolbachia	Spp
21	Portugal	GI	GI1	0	mel
22	Portugal	GI	GI2	0	mel
23	Portugal	GI	GI3	1	mel
24	Portugal	GI	GI4	1	mel
25	Portugal	GI	GI5	0	mel
26	Portugal	GI	GI6		
27	Portugal	GI	GI7		
28	Portugal	GI	GI8		
29	Portugal	GI	GI9		
30	Portugal	GI	GI10		

	Country	Population	Wolbachia_Freq
1	Finland	AK	100.00000
2	Portugal	GI	66.66667
3	Denmark	KA	85.00000
4	Austria	MA	75.00000
5	Germany	MU	94.73684
6	Spain	RE	47.05882
7	Ukraine	UM	69.23077
8	Russia	VA	75.00000
9	Turkey	YE	85.00000

Data Analyses - Linear models

Data structure is often very different between labs for a given trait

By lab linear models

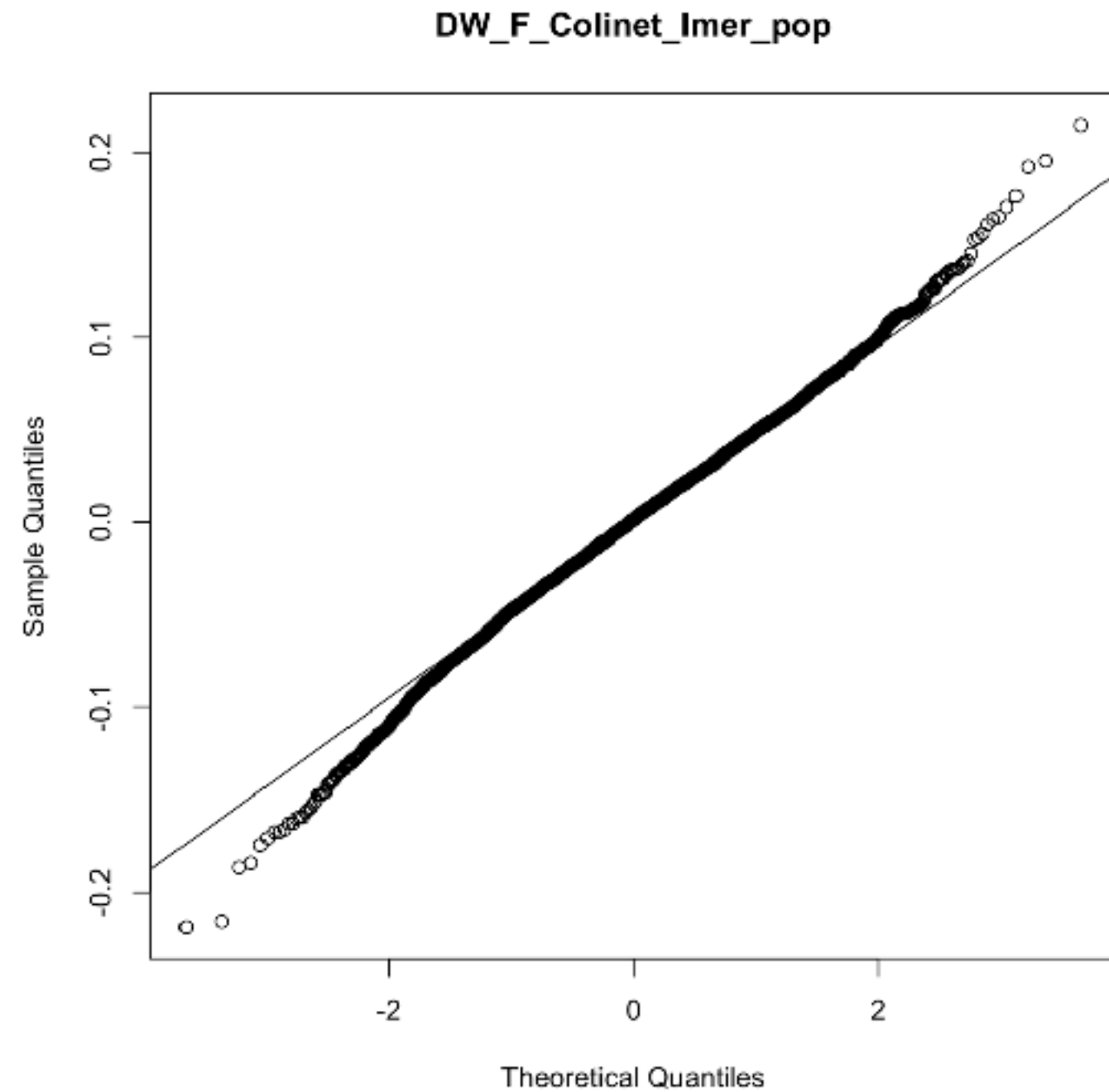
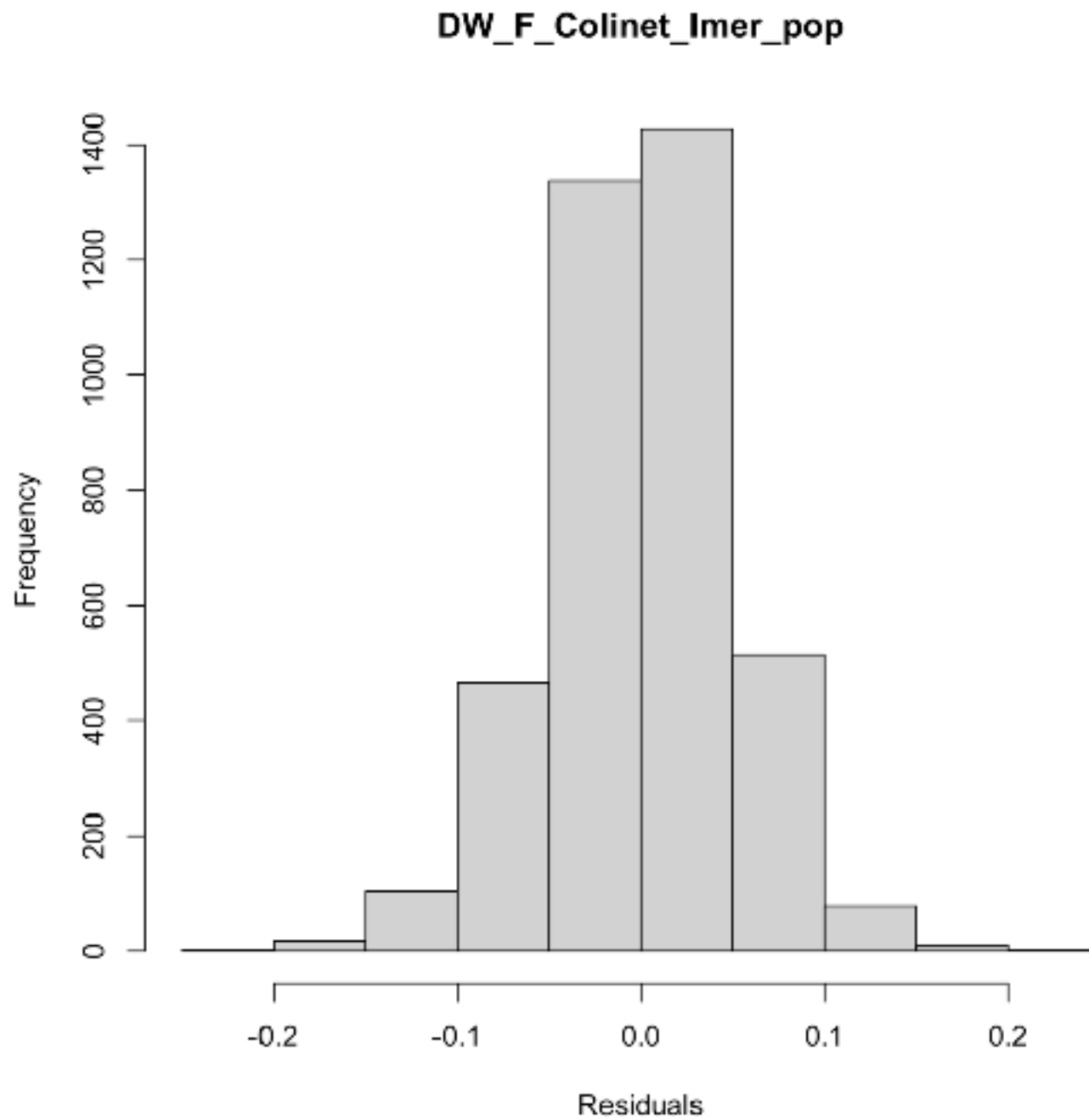
Effect of **Population**

$$\text{Trait} \sim \mathbf{Pop} + (1|\text{Batch}) + (1|\text{Pop:Line}) + (1|\text{Pop:Line:Rep})$$

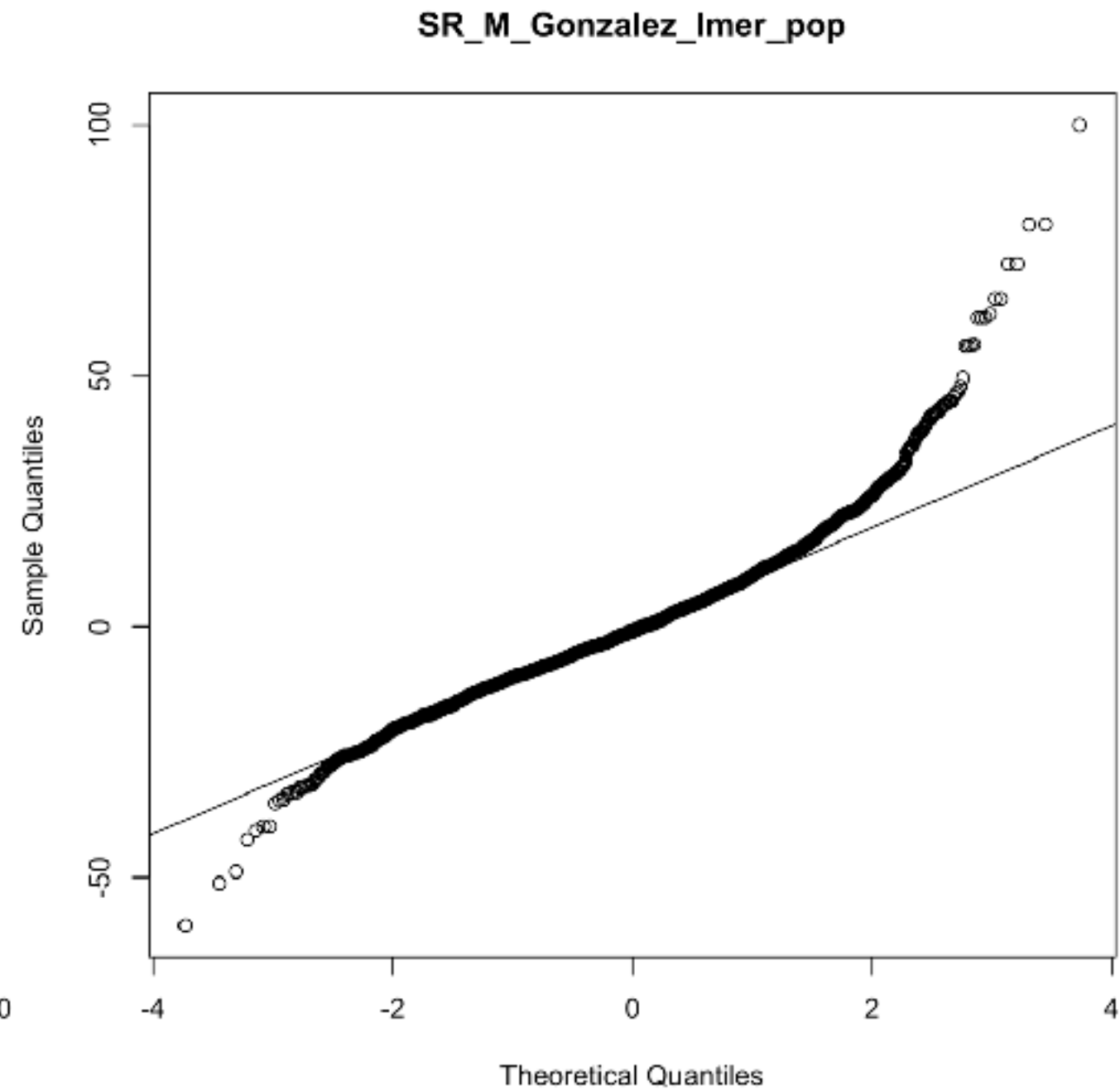
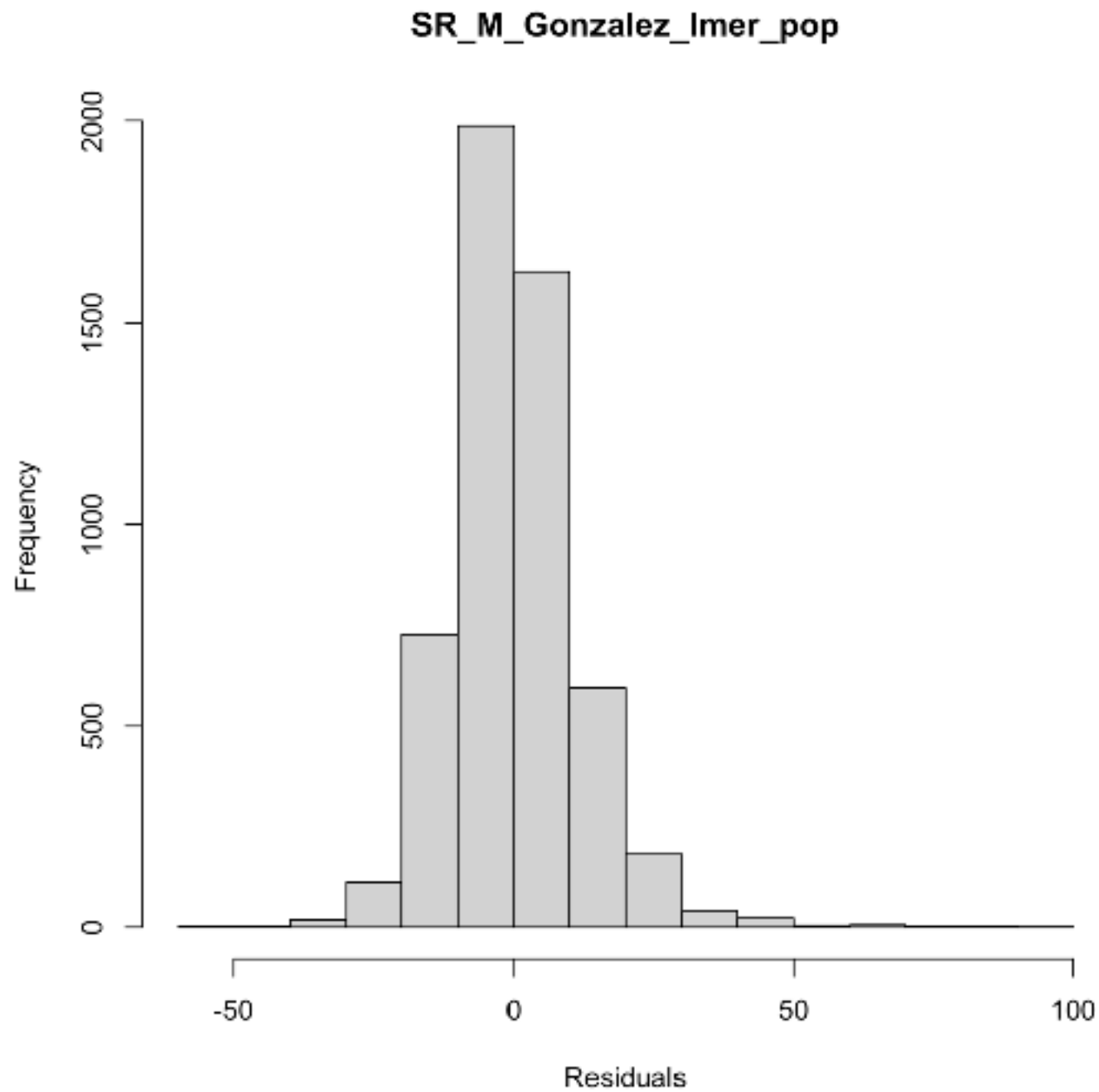
Effect of **Geography**

$$\text{Trait} \sim \mathbf{Latitude} + (1|\text{Pop}) + (1|\text{Pop:Line})$$
$$\text{Trait} \sim \mathbf{Longitude} + (1|\text{Pop}) + (1|\text{Pop:Line})$$
$$\text{Trait} \sim \mathbf{Altitude} + (1|\text{Pop}) + (1|\text{Pop:Line})$$

Data Analyses - Linear models



Data Analyses - Linear models



Data Analyses - Linear models

Lab	Trait	P_pop	P_lat	P_lon	P_alt
Gibert	DT_A_M	0.00411903	0.88586299	0.29072237	0.10448462
Grath	DT_A_M	0.39464922	0.77550126	0.55874592	0.55385116
Hoedjes	DT_A_M	2.33E-06	0.04847065	0.04653388	0.85491073
Schmidt	DT_A_M	0.00157514	0.9907888	0.81421063	0.76507136
Stamenkovic	DT_A_M	1.31E-06	0.42197125	0.91271177	0.87797845
Zwaan	DT_A_M	0.02641181	0.68615383	0.02272286	0.23778133
Schmidt	DT_P	0.00980389	0.30158807	0.98306566	0.75256992
Colinet	DW_F	0.0211077	0.55586596	0.36452327	0.70338226
Hoedjes	DW_F	0.06045045	0.618025	0.59666061	0.38479265
Onder	DW_F	6.17E-06	0.8937399	0.82648224	0.7108751
Colinet	DW_M	2.61E-05	0.59838127	0.30454569	0.28771321
Hoedjes	DW_M	0.75479687	0.47553285	0.43952368	0.28219758
Onder	DW_M	0.05659123	0.65639273	0.89485756	0.85942801
Billeter	Fec	0.00646079	0.03811958	0.65595049	0.34971821
Fricke	Fec	0.88401127	0.68923942	0.74909131	0.70919401
Parsch	HSM_F	4.87E-08	0.05358472	0.55013638	0.00889943
Vieira	HSM_F	4.17E-06	0.82736512	0.83791296	0.80847451
Parsch	HSM_M	4.88E-09	0.01630614	0.41022475	0.22601387
Vieira	HSM_M	0.00245386	0.25095189	0.50219194	0.69866839
Tauber	LA_AbsPhase	0.01006795	0.49832371	0.49832371	0.49832371
Tauber	LA_Activity	0.00014719	0.31475621	0.31475621	0.31475621
Tauber	LA_CircPhase	0.00545289	0.28632657	0.28632657	0.28632657
Tauber	LA_NDlog2	0.01058636	0.37389542	0.96297304	0.16536854
Tauber	LA_Period	0.02883036	0.2525985	0.2525985	0.2525985
Flatt	LS_F	1.23E-24	0.0038713	0.15128734	0.7776521
Parsch	LS_F	6.79E-09	0.09498368	0.3359701	0.45015785
Pasyukova	LS_F	0.01396514	0.31507442	0.15215752	0.27755561
Flatt	LS_M	3.02E-05	0.40399952	0.80184338	0.74218599
Parsch	LS_M	3.13E-06	0.00371864	0.12803162	0.40612978
Pasyukova	LS_M	7.30E-05	0.10035798	0.33658718	0.19604155
Abbott	Pgm_T4	1.33E-17	0.15858666	0.43734048	0.13512441
Gibert	Pgm_T4	0.01649333	0.79644136	0.01946249	0.10358836
Schmidt	Pgm_T4	0.00014264	0.4925767	0.7938205	0.52331487

96 linear models per predictor

67 models significant for Pop

14 models significant for Lat

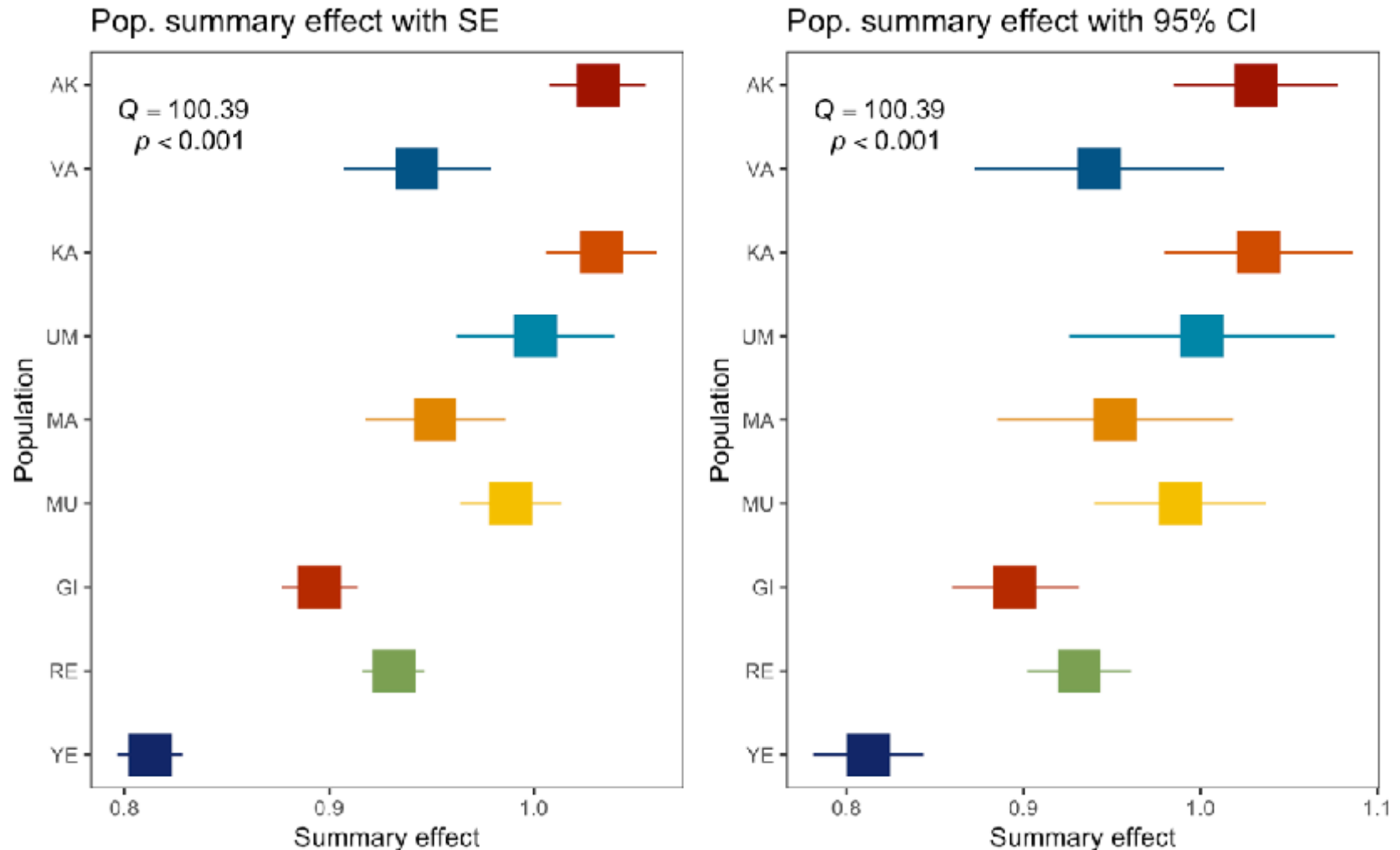
5 significant for Lon

3 significant for Alt

Data Analyses - Meta Analysis

Using linear models fitted values and SE for Pop

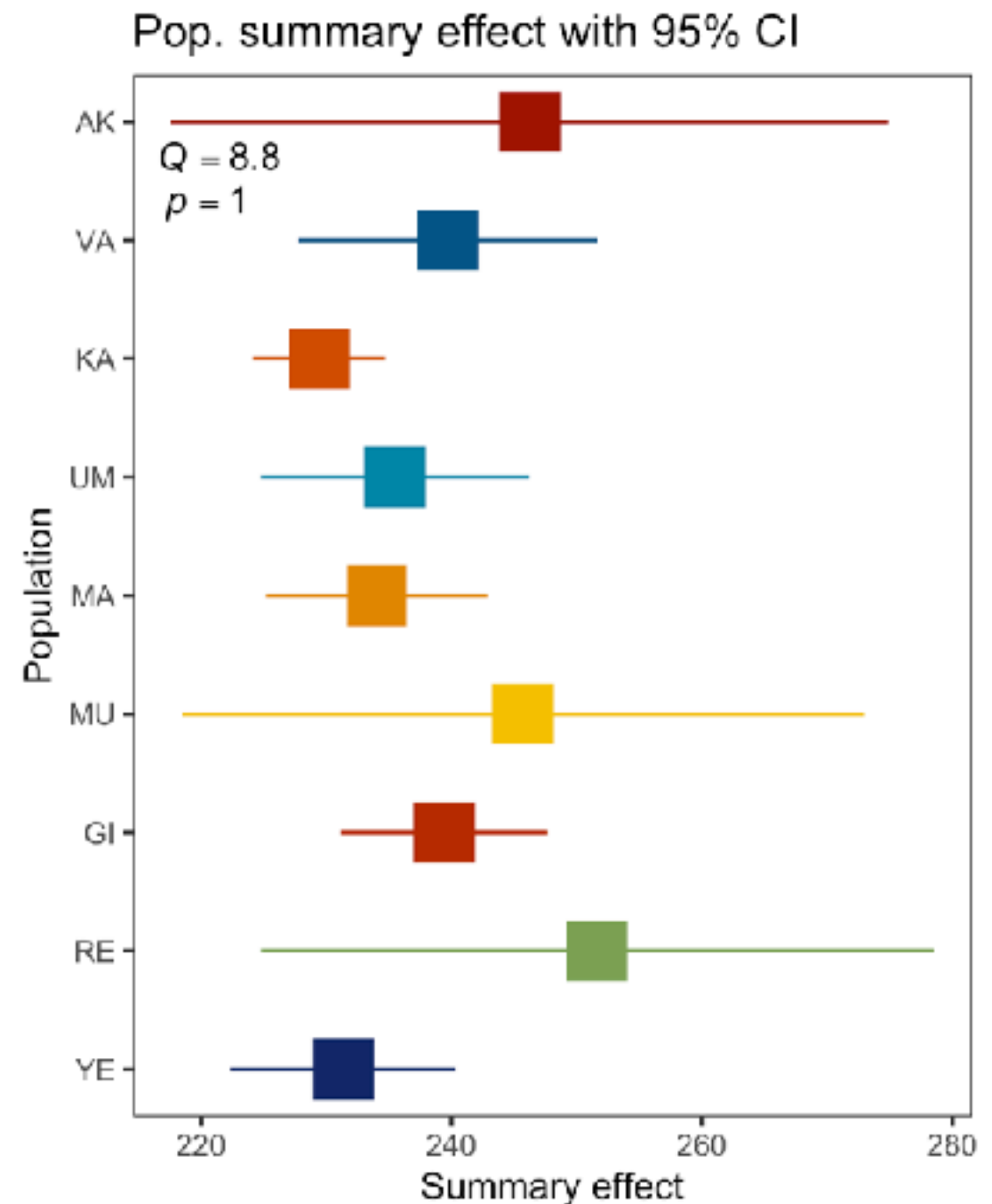
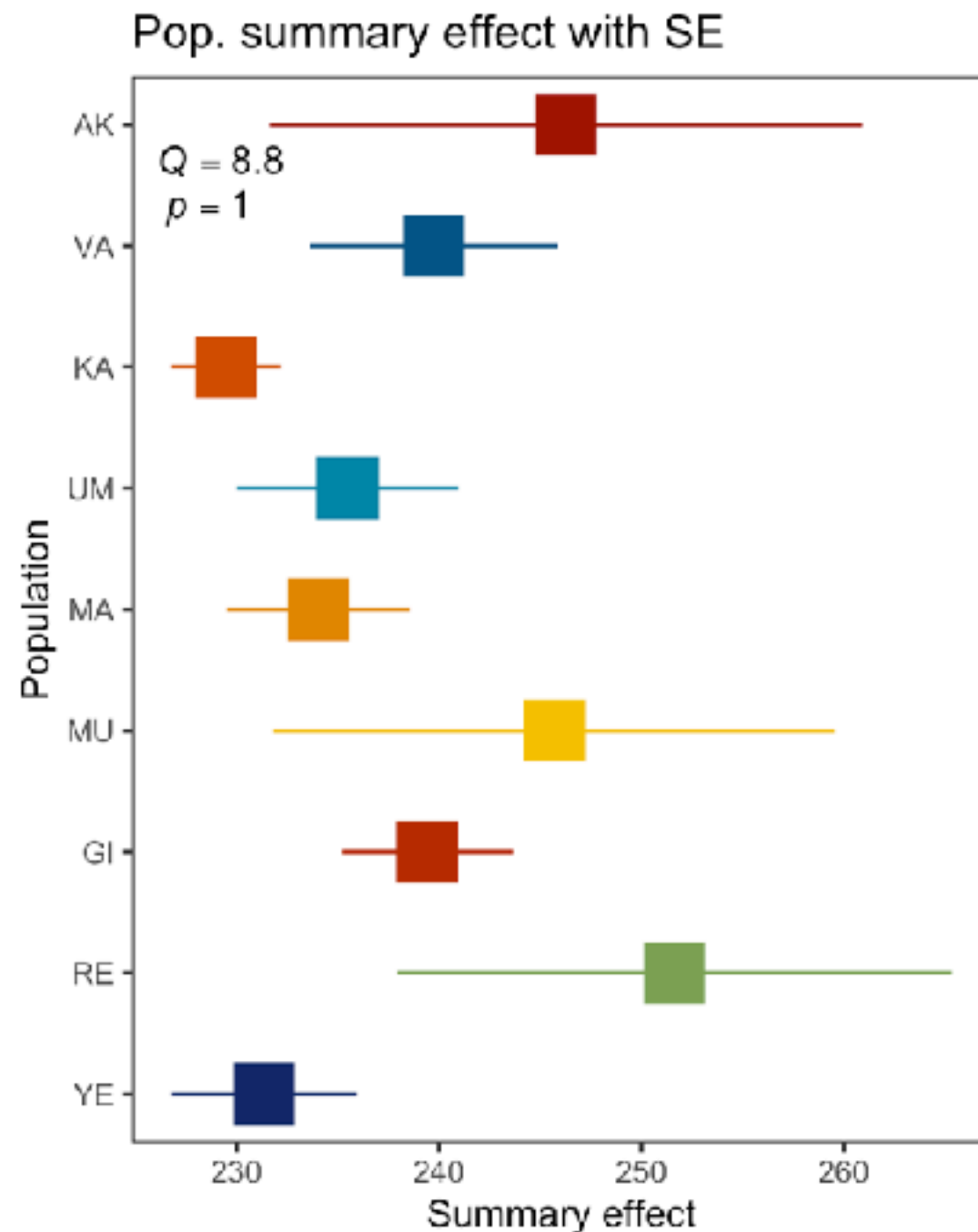
Egg-to-adult Viability (6 labs)



Data Analyses - Meta Analysis

Using linear models fitted values and SE for Pop

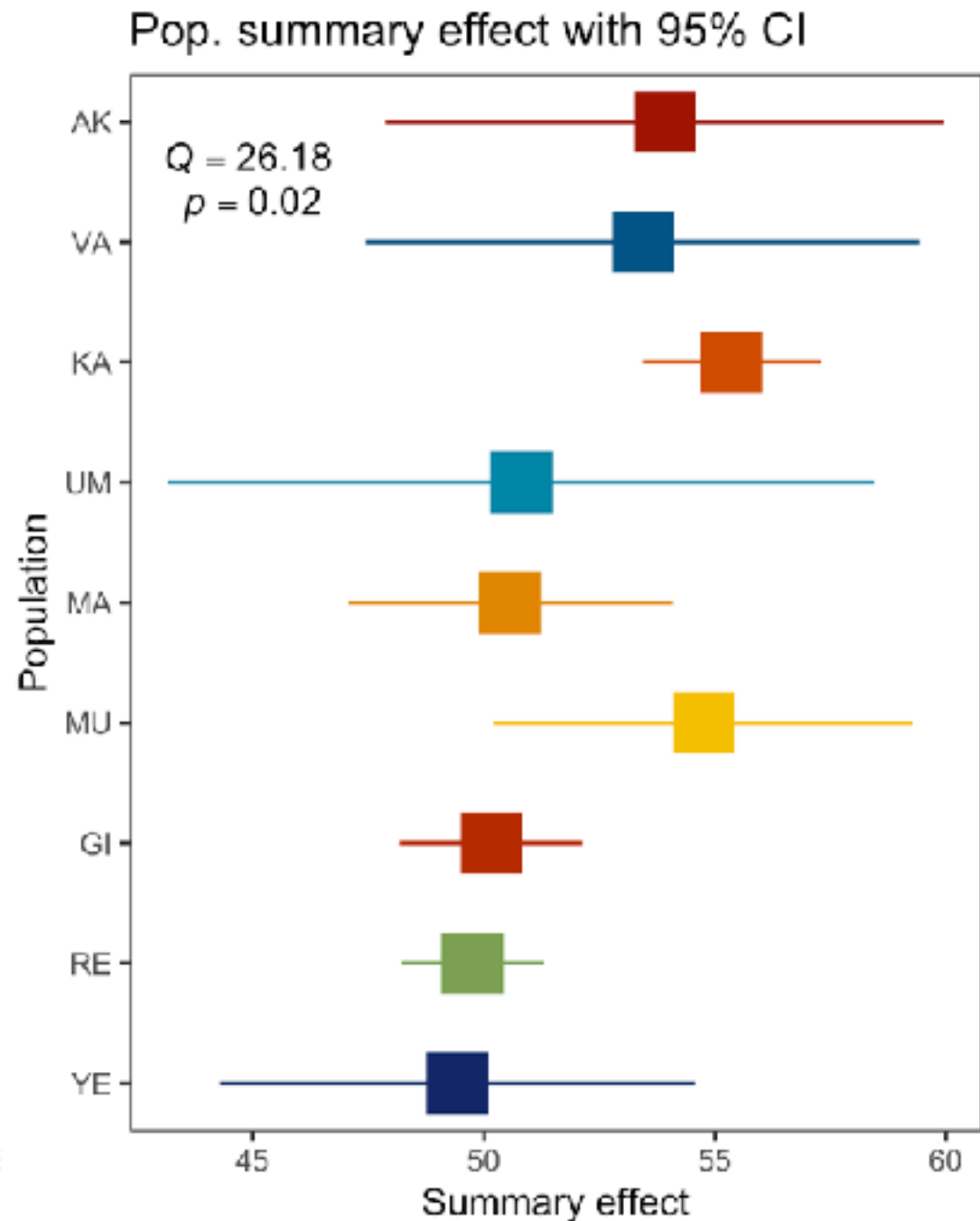
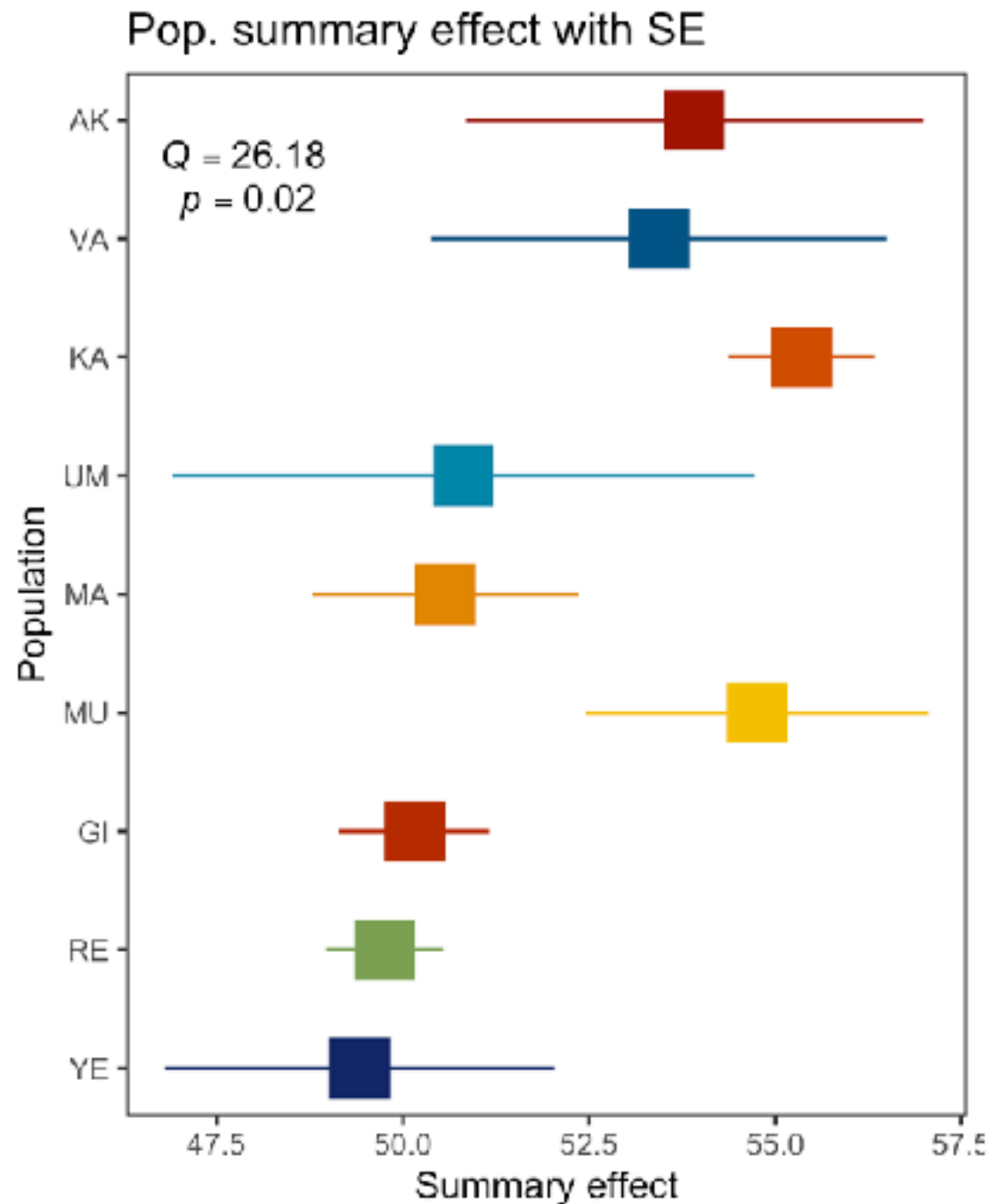
Dev. Time Adults - Females (6 labs)



Data Analyses - Meta Analysis

Using linear models fitted values and SE for Pop

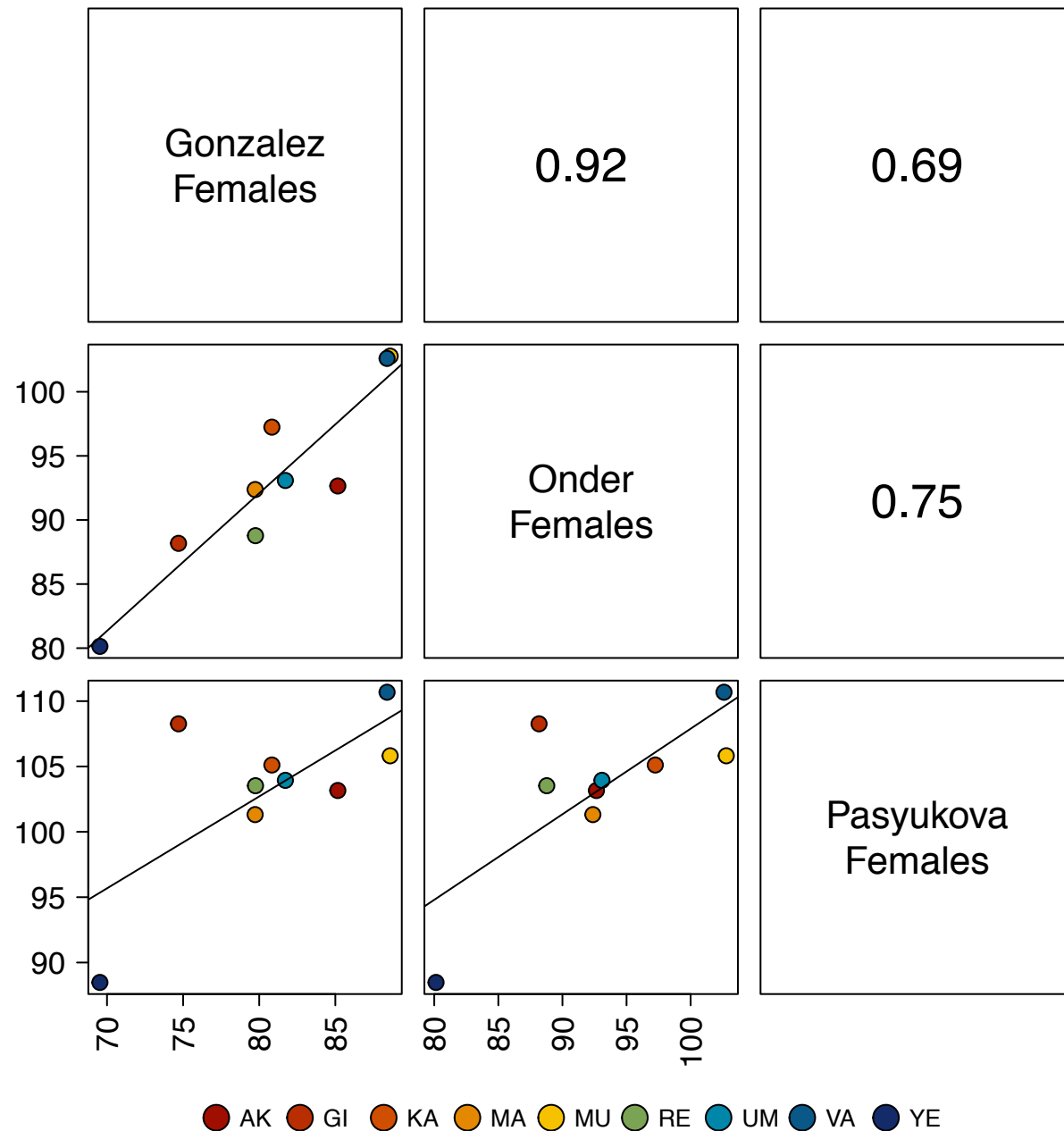
Lifespan - Males (3 labs)



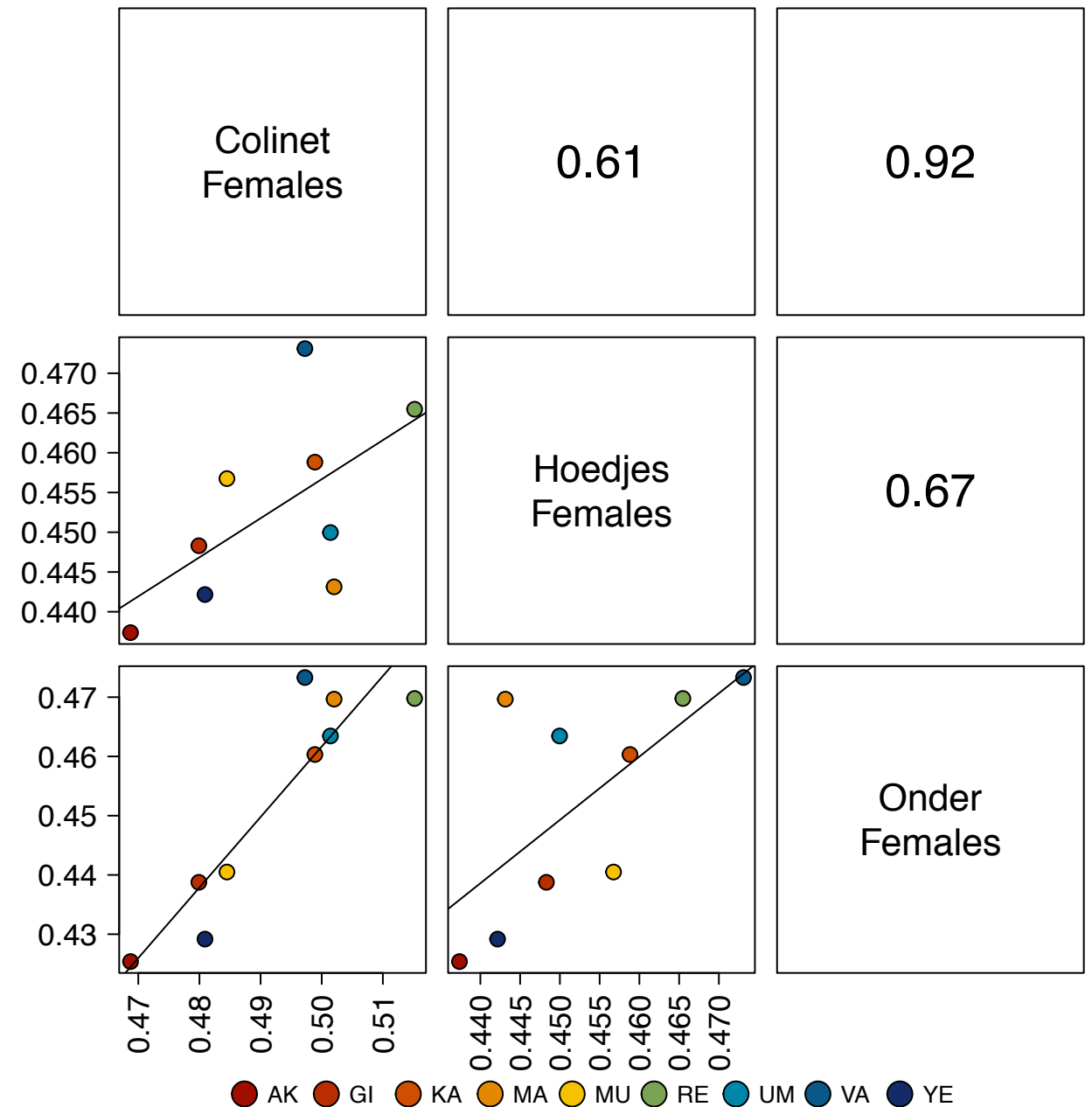
Lab correlations - Pop level

Pearson correlation using Pop fitted values

Starvation Resistance - Females



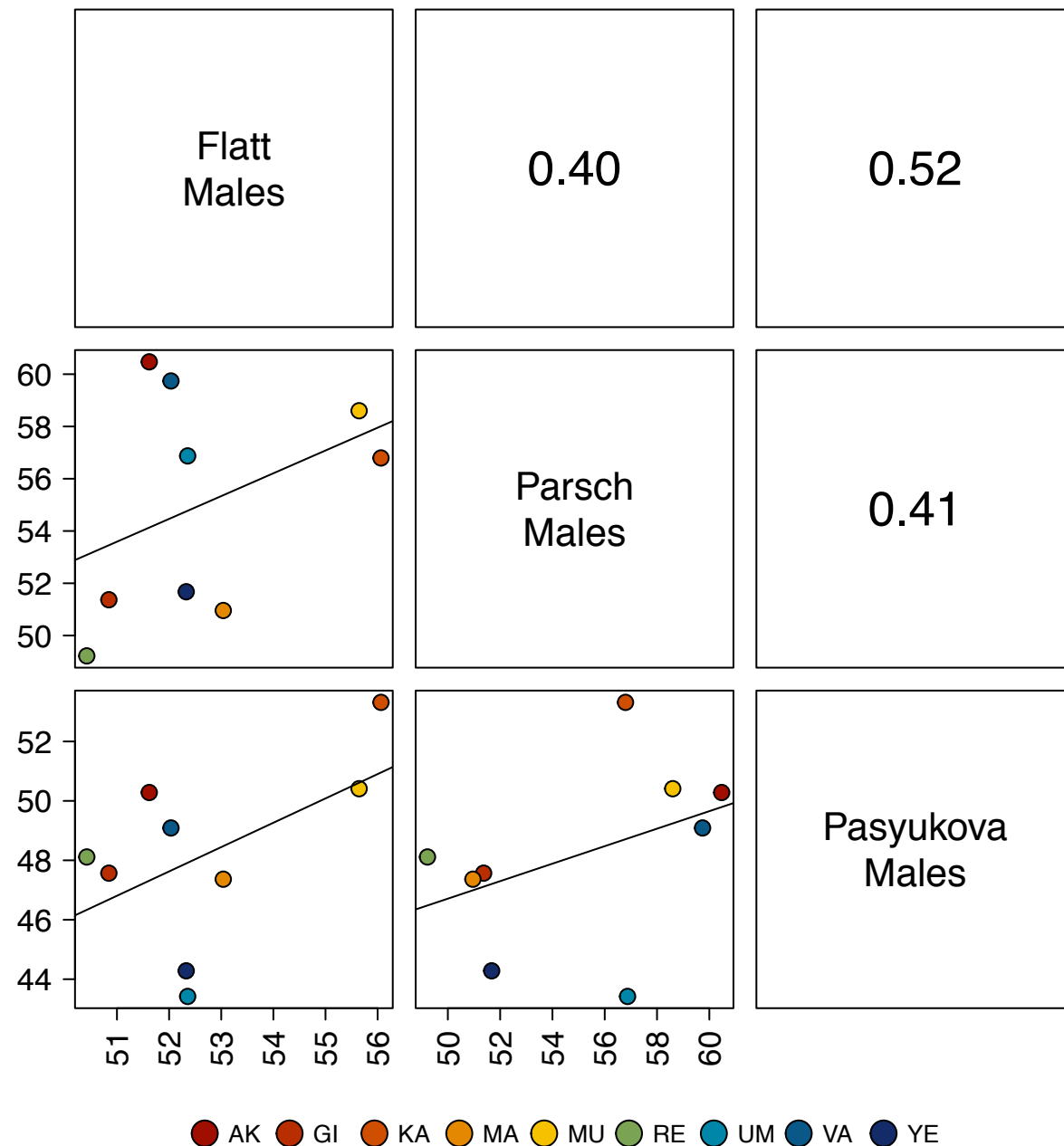
Dry Weight - Females



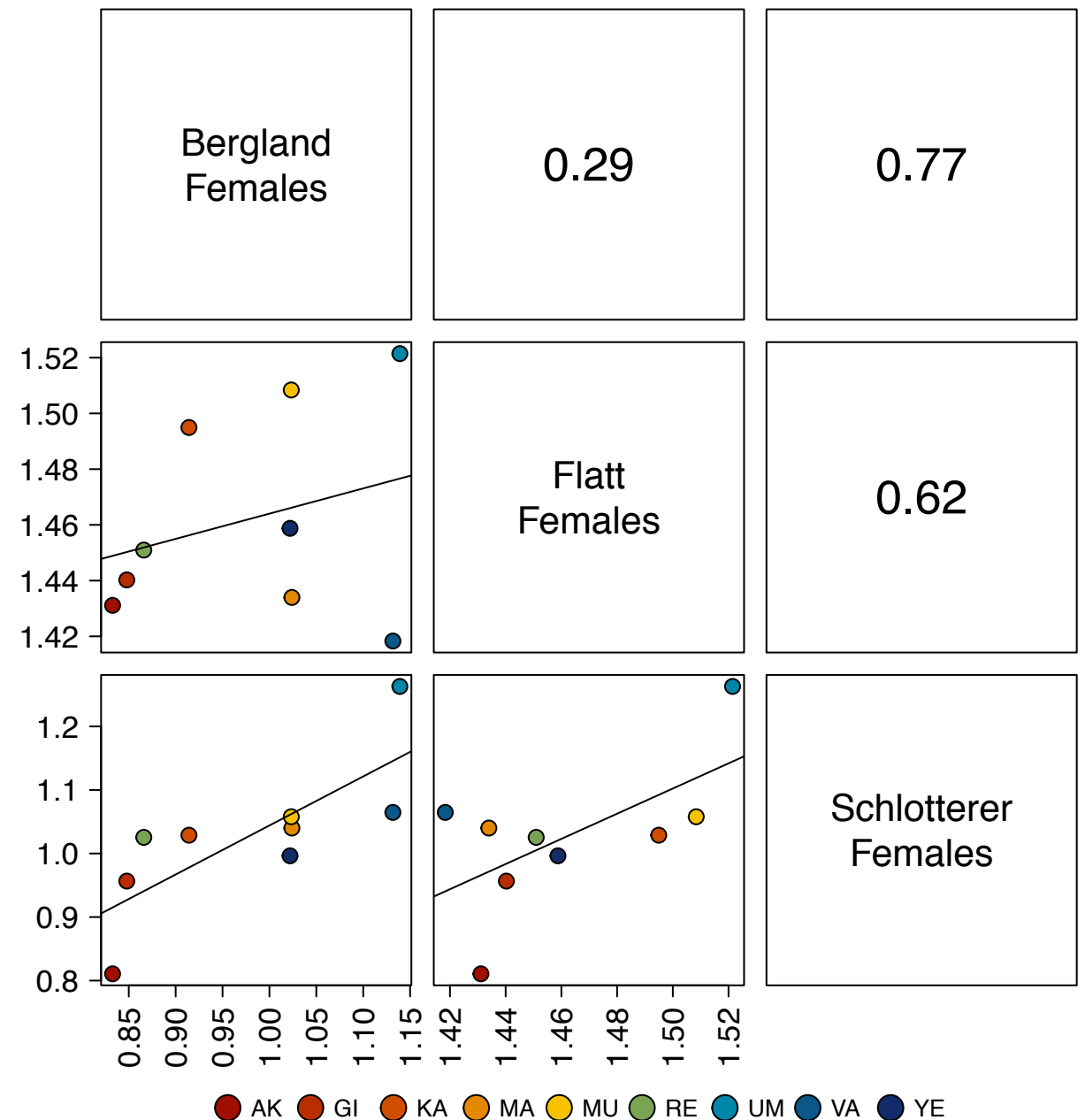
Lab correlations - Pop level

Pearson correlation using Pop fitted values

Lifespan - Males

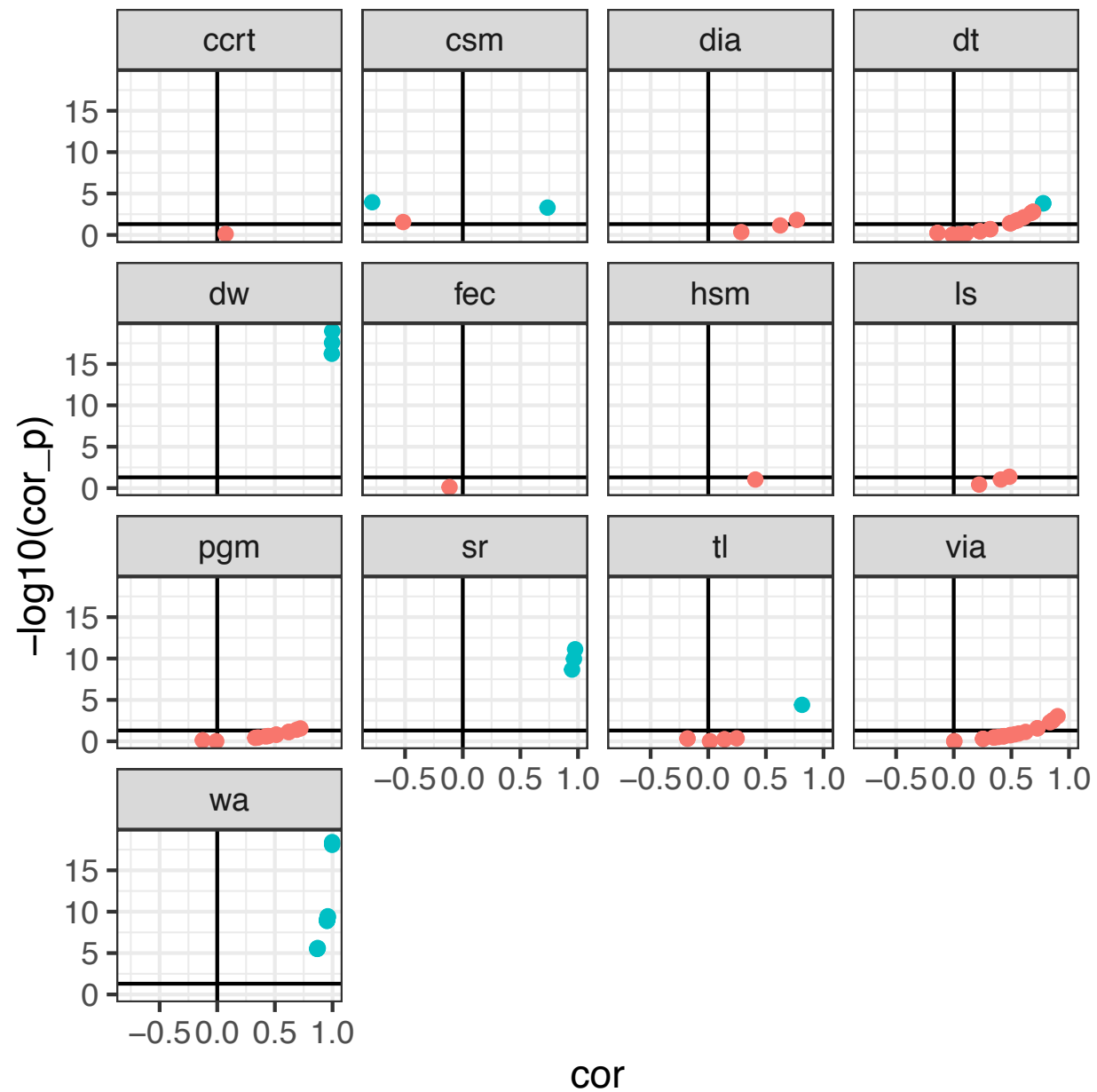


Diapause

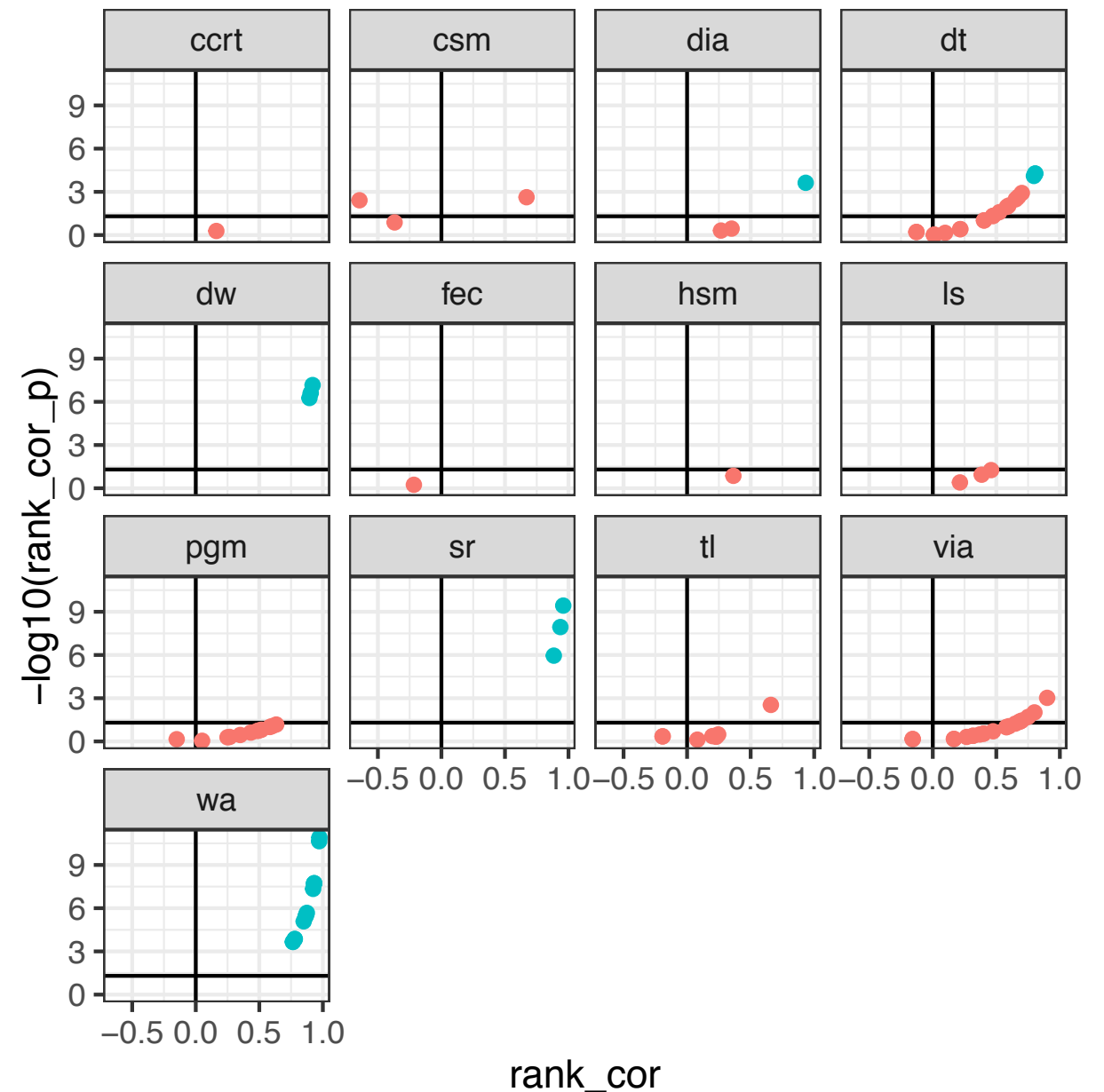


Lab correlations - Pop level

Correlation Between labs
Fitted pop. values



Rank Correlation Between labs
Fitted pop. values



Where is the data / do you want to contribute?

R markdown / HTML summary file

 DrosEU_PhenotypingWG.Rmd	20220523	18 days ago
 DrosEU_PhenotypingWG.html	20220528	13 days ago
 DrosEU_PhenotypingWG.md	20220528	13 days ago

Github repository

https://github.com/esradm/DrosEU_PhenotypingWG

Google drive repository (Github clone)

<https://drive.google.com/drive/folders/1grL1srM33vUH1DfC-SMj2wwMK-54u3sv>

Google Doc – Paper draft

<https://docs.google.com/document/d/1vyP-SGSXVkJMLqtXXn8FTf3NpYwEPAYL8OI5b8bZYxDo/edit#>

Join us @ droseuphenotyping.slack.com

https://join.slack.com/t/droseuphenotyping/shared_invite/zt-1afet8zsy-nAD3nJQxOi5NbFR0uaSGeA

