

Genetic variability, heritability and genetic gain of common bean (*Phaseolus vulgaris* L.) genotypes in response to Mexican bean weevil (*Zabrotes subfasciatus* Boheman) infestation

Shiferaw G. Tigist*, Gemechu Keneni, Amelework Assefa, Julia Sibiya

Table 1. Description of the genotypes used in this study.

No	Genotype	Seed colour	Seed size	Geenpool	Origin/Source	Breeding status
1	207934	Red	Small	Mesoamerican	B.Gumz	Landrace
2	207935	Carioca	Medium	Mesoamerican	B.Gumz	Landrace
3	207938	Black	Small	Mesoamerican	B.Gumz	Landrace
4	211346	Red	Small	Mesoamerican	B.Gumz	Landrace
5	211347	Black	Small	Mesoamerican	B.Gumz	Landrace
6	211348	Black	Small	Mesoamerican	B.Gumz	Landrace
7	211349	Yellow	Small	Mesoamerican	B.Gumz	Landrace
8	211356	White	Small	Mesoamerican	B.Gumz	Landrace
9	211361	Red	Small	Mesoamerican	B.Gumz	Landrace
10	211362	White	Small	Mesoamerican	B.Gumz	Landrace
11	228522	Red	Small	Mesoamerican	Amhara	Landrace
12	NC-02	Brown	Small	Mesoamerican	Amhara	Landrace
13	NC-03	Carioca	Small	Mesoamerican	Amhara	Landrace
14	NC-05	Red	Small	Mesoamerican	Amhara	Landrace
15	NC-07	Red	Small	Mesoamerican	Amhara	Landrace
16	NC-10	Brown	Small	Mesoamerican	Amhara	Landrace
17	NC-16	Red	Small	Mesoamerican	Amhara	Landrace
18	NC-17	Red	Small	Mesoamerican	Amhara	Landrace
19	211266	Cream	Small	Admixture	Amhara	Landrace
20	211267	White	Small	Mesoamerican	Amhara	Landrace
21	211269	Black	Small	Admixture	Amhara	Landrace
22	NC-08	White	Small	Mesoamerican	Amhara	Landrace
23	NC-09	Carioca	Medium	Mesoamerican	Amhara	Landrace
24	NC-12	Red	Small	Mesoamerican	Amhara	Landrace
25	NC-13	Cream	Small	Mesoamerican	Amhara	Landrace
26	NC-14	Speckled	Large	Andean	Amhara	Landrace
27	NC-15	Cream	Large	Mesoamerican	Amhara	Landrace
28	NC-18	Speckled	Large	Andean	Amhara	Landrace
29	NC-20	Black	Small	Mesoamerican	Amhara	Landrace

No	Genotype	Seed colour	Seed size	Geenpool	Origin/Source	Breeding status
30	NC-39	Cream	Small	Mesoamerican	Amhara	Landrace
31	NC-44	Brown	Small	Mesoamerican	Amhara	Landrace
32	NC-48	Red	Small	Mesoamerican	Amhara	Landrace
33	NC-49	Black	Small	Mesoamerican	Amhara	Landrace
34	NC-50	Carioca	Small	Mesoamerican	Amhara	Landrace
35	NC-51	Red	Small	Mesoamerican	Amhara	Landrace
36	NC-52	Speckled	Large	Andean	Amhara	Landrace
37	NC-53	Yellow	Small	Mesoamerican	Amhara	Landrace
38	NC-54	Carioca	Small	Mesoamerican	Amhara	Landrace
39	NC-57	Carioca	Small	Mesoamerican	Amhara	Landrace
40	NC-61	Black	Small	Mesoamerican	Amhara	Landrace
41	215719	Pinto	Small	Mesoamerican	Amhara	Landrace
42	215720	White	Small	Mesoamerican	Amhara	Landrace
43	207534	White	Small	Mesoamerican	Amhara	Landrace
44	NC-25	Brown	Medium	Mesoamerican	Amhara	Landrace
45	NC-28	Cream	Medium	Mesoamerican	Amhara	Landrace
46	NC-29	Speckled	Large	Andean	Amhara	Landrace
47	NC-30	Carioca	Small	Mesoamerican	Amhara	Landrace
48	NC-34	Speckled	Large	Andean	Amhara	Landrace
49	232196	White	Small	Mesoamerican	Oromiya	Landrace
50	237079	White	Small	Mesoamerican	Oromiya	Landrace
51	237080	Yellow	Medium	Mesoamerican	Oromiya	Landrace
52	212860	White	Small	Mesoamerican	Oromiya	Landrace
53	215391	White	Small	Mesoamerican	Oromiya	Landrace
54	230044	White	Small	Mesoamerican	Oromiya	Landrace
55	230661	White	Small	Mesoamerican	Oromiya	Landrace
56	215048	White	Small	Mesoamerican	Oromiya	Landrace
57	215049	Black	Small	Mesoamerican	Oromiya	Landrace
58	228911	White	Small	Mesoamerican	Oromiya	Landrace
59	228913	Red	Small	Mesoamerican	Oromiya	Landrace
60	201066	Red	Small	Mesoamerican	Oromiya	Landrace
61	213197	White	Small	Mesoamerican	Oromiya	Landrace
62	208995	Red	Large	Andean	Oromiya	Landrace
63	208699	Yellow	Medium	Andean	Oromiya	Landrace
64	208702	Black	Small	Mesoamerican	Oromiya	Landrace
65	208703	Black	Small	Mesoamerican	Oromiya	Landrace
66	208705	Black	Medium	Mesoamerican	Oromiya	Landrace
67	211340	Black	Small	Mesoamerican	Oromiya	Landrace
68	211302	Brown	Medium	Andean	Oromiya	Landrace
69	211304	White	Small	Mesoamerican	Oromiya	Landrace
70	211305	Yellow	Small	Admixture	Oromiya	Landrace
71	NC-22	Cream	Medium	Not known	Amhara	Landrace

No	Genotype	Seed colour	Seed size	Geenpool	Origin/Source	Breeding status
72	211311	Yellow	Medium	Andean	Oromiya	Landrace
73	211314	White	Small	Mesoamerican	Oromiya	Landrace
74	211325	Red	Small	Mesoamerican	Oromiya	Landrace
75	208638	Speckled	Large	Andean	Oromiya	Landrace
76	241134	White	Small	Mesoamerican	Oromiya	Landrace
77	223329	Mottled	Medium	Andean	Oromiya	Landrace
78	219231	Speckled	Medium	Andean	Oromiya	Landrace
79	228812	White	Small	Mesoamerican	Oromiya	Landrace
80	228813	White	Small	Mesoamerican	Oromiya	Landrace
81	230526	Red	Small	Mesoamerican	Oromiya	Landrace
82	211315	White	Small	Mesoamerican	Oromiya	Landrace
83	211320	White	Small	Mesoamerican	Oromiya	Landrace
84	211323	Red	Small	Mesoamerican	Oromiya	Landrace
85	211333	White	Small	Mesoamerican	Oromiya	Landrace
86	230525	Cream	Small	Mesoamerican	Unknown	Landrace
87	211331	White	Small	Mesoamerican	Unknown	Landrace
88	211546	Carioca	Small	Mesoamerican	SNNPR	Landrace
89	211552	Black	Small	Mesoamerican	SNNPR	Landrace
90	214663	Red	Small	Mesoamerican	SNNPR	Landrace
91	214664	Red	Small	Mesoamerican	SNNPR	Landrace
92	214675	Black	Small	Mesoamerican	SNNPR	Landrace
93	214676	White	Small	Mesoamerican	SNNPR	Landrace
94	214678	Pinto	Small	Mesoamerican	SNNPR	Landrace
95	228084	Red	Small	Not known	SNNPR	Landrace
96	214665	Red	Small	Mesoamerican	SNNPR	Landrace
97	237993	Red	Small	Mesoamerican	SNNPR	Landrace
98	241739	Red	Small	Mesoamerican	SNNPR	Landrace
99	211279	Black	Small	Mesoamerican	SNNPR	Landrace
100	211280	Cream	Small	Mesoamerican	SNNPR	Landrace
101	211284	Red	Small	Mesoamerican	SNNPR	Landrace
102	211286	Carioca	Small	Mesoamerican	SNNPR	Landrace
103	213046	Black	Small	Mesoamerican	SNNPR	Landrace
104	215051	White	Small	Mesoamerican	SNNPR	Landrace
105	241752	Red	Small	Mesoamerican	SNNPR	Landrace
106	241756	Brown	Small	Mesoamerican	SNNPR	Landrace
107	241757	Red	Small	Mesoamerican	SNNPR	Landrace
108	208367	White	Small	Mesoamerican	SNNPR	Landrace
109	241736	Red	Small	Mesoamerican	SNNPR	Landrace
110	228077	Red	Medium	Mesoamerican	SNNPR	Landrace
111	228082	Red	Small	Mesoamerican	SNNPR	Landrace
112	241734	Red	Small	Mesoamerican	SNNPR	Landrace
113	228085	Red	Small	Mesoamerican	SNNPR	Landrace

No	Genotype	Seed colour	Seed size	Geenpool	Origin/Source	Breeding status
114	228086	White	Small	Mesoamerican	SNNPR	Landrace
115	241748	Red	Small	Mesoamerican	SNNPR	Landrace
116	244805	White	Small	Mesoamerican	SNNPR	Landrace
117	KK25/MAIAWA/19	Red	Medium	Mesoamerican	Malawi	Resistant line
118	KK25/NAGAGA/184	Red	Large	Andean	Malawi	Resistant line
119	MAZ 200	Red	Large	Andean	CIAT	Resistant line
120	MAZ 203	Red	Large	Andean	CIAT	Resistant line
121	MAZ 153	Mottled	Large	Mesoamerican	CIAT	Resistant line
122	SMARC 4	White	Small	Mesoamerican	Pannar seed company	Resistant line
123	RAZ-28-8	Mottled	Small	Mesoamerican	Pannar seed company	Resistant line
124	RAZ-9	Yellow	Medium	Mesoamerican	Pannar seed company	Resistant line
125	RAZ-2	White	Small	Mesoamerican	Pannar seed company	Resistant line
126	SCR-11	Red	Medium	Mesoamerican	CIAT	Breeding line
127	SCR-15	Red	Medium	Andean	CIAT	Breeding line
128	SCR-26	Red	Medium	Mesoamerican	CIAT	Breeding line
129	RAZ-40	White	Medium	Andean	CIAT	Resistant line
130	RAZ-36	White	Small	Mesoamerican	CIAT	Resistant line
131	RAZ-44	White	Small	Mesoamerican	CIAT	Resistant line
132	RAZ-42	White	Small	Mesoamerican	CIAT	Resistant line
133	RAZ-11-1	White	Small	Mesoamerican	CIAT	Resistant line
134	RAZ-11	White	Small	Mesoamerican	CIAT	Resistant line
135	RAZ-120	White	Medium	Mesoamerican	CIAT	Resistant line
136	Mexican 142	White	Small	Mesoamerican	EIAR	Variety
137	Kufanzik	Pinto	Medium	Mesoamerican	HU	Variety
138	Tinkie	Red	Large	Andean	HU	Variety
139	Gofta	Cream	Medium	Mesoamerican	HU	Variety
140	Red wolyata	Red	Small	Mesoamerican	EIAR	Variety
141	Awash-1	White	Small	Mesoamerican	EIAR	Variety
142	Awash Melka	White	Small	Mesoamerican	EIAR	Variety
143	Deme	Speckled	Large	Andean	EIAR	Variety
144	DRK	Red	Large	Admixture	EIAR/AQOS	Variety
145	Beshbesh	Cream	Small	Mesoamerican	EIAR	Variety
146	Roba	Cream	Small	Mesoamerican	EIAR	Variety
147	KAT-B1	Yellow	Medium	Andean	EIAR	Variety
148	Nasir	Red	Small	Mesoamerican	EIAR	Variety
149	Ser 125	Red	Small	Mesoamerican	EIAR	Variety
150	Wedo	Cream	Medium	Mesoamerican	ARARI/SARC	Variety
151	Ayenew	Pinto	Small	Mesoamerican	HU	Variety
152	207942	Black	Small	Mesoamerican	B.Gumz	Landrace
153	207943	Black	Small	Mesoamerican	Oromiya	Landrace
154	207949	White	Small	Mesoamerican	Oromiya	Landrace
155	211274	Brown	Small	Mesoamerican	Unknown	Landrace

No	Genotype	Seed colour	Seed size	Geenpool	Origin/Source	Breeding status
156	211278	Carioca	Small	Mesoamerican	SNNPR	Landrace
157	211282	Red	Small	Mesoamerican	SNNPR	Landrace
158	211293	Red	Medium	Mesoamerican	SNNPR	Landrace
159	211294	Red	Small	Mesoamerican	SNNPR	Landrace
160	211313	White	Small	Mesoamerican	Oromiya	Landrace
161	211321	White	Small	Mesoamerican	Oromiya	Landrace
162	211322	White	Small	Mesoamerican	Oromiya	Landrace
163	211324	White	Small	Mesoamerican	Oromiya	Landrace
164	211327	White	Small	Mesoamerican	Oromiya	Landrace
165	211329	White	Small	Mesoamerican	Oromiya	Landrace
166	211332	Red	Small	Mesoamerican	Oromiya	Landrace
167	211339	White	Small	Mesoamerican	Oromiya	Landrace
168	211341	Black	Small	Mesoamerican	Oromiya	Landrace
169	211344	Red	Small	Mesoamerican	B.Gumz	Landrace
170	211350	White	Small	Mesoamerican	B.Gumz	Landrace
171	211365	White	Small	Mesoamerican	Unknown	Landrace
172	211366	Red	Small	Mesoamerican	Unknown	Landrace
173	211367	Yellow	Small	Mesoamerican	Unknown	Landrace
174	211382	Black	Small	Mesoamerican	Amhara	Landrace
175	211483	Black	Small	Mesoamerican	Amhara	Landrace
176	211553	Black	Small	Mesoamerican	Unknown	Landrace
177	213198	Red	Small	Mesoamerican	Oromiya	Landrace
178	214662	Red	Small	Mesoamerican	SNNPR	Landrace
179	214667	Red	Small	Mesoamerican	SNNPR	Landrace
180	214671	Red	Small	Mesoamerican	SNNPR	Landrace
181	214677	Black	Small	Mesoamerican	SNNPR	Landrace
182	215050	White	Small	Mesoamerican	Oromiya	Landrace
183	215542	Yellow	Small	Andean	Unknown	Landrace
184	215545	Red	Small	Mesoamerican	Unknown	Landrace
185	216820	White	Small	Mesoamerican	Oromiya	Landrace
186	219233	Red	Small	Mesoamerican	Unknown	Landrace
187	219337	Red	Small	Mesoamerican	SNNPR	Landrace
188	219338	Red	Small	Mesoamerican	SNNPR	Landrace
189	219389	Red	Small	Mesoamerican	SNNPR	Landrace
190	219340	Red	Small	Mesoamerican	SNNPR	Landrace
191	228079	Red	Small	Mesoamerican	SNNPR	Landrace
192	228080	Red	Medium	Mesoamerican	SNNPR	Landrace
193	228081	Red	Small	Mesoamerican	SNNPR	Landrace
194	228083	Red	Medium	Mesoamerican	SNNPR	Landrace
195	228088	Red	Small	Mesoamerican	SNNPR	Landrace
196	228089	Red	Small	Mesoamerican	SNNPR	Landrace
197	228090	Red	Small	Mesoamerican	SNNPR	Landrace

No	Genotype	Seed colour	Seed size	Geenpool	Origin/Source	Breeding status
198	228246	White	Small	Mesoamerican	Oromiya	Landrace
199	228247	Red	Small	Mesoamerican	Oromiya	Landrace
200	228811	White	Small	Mesoamerican	Oromiya	Landrace
201	228912	White	Small	Mesoamerican	Oromiya	Landrace
202	229814	Red	Small	Mesoamerican	Amhara	Landrace
203	235502	White	Small	Mesoamerican	Unknown	Landrace
204	235503	Black	Small	Mesoamerican	Unknown	Landrace
205	235506	Red	Small	Mesoamerican	Unknown	Landrace
206	235507	Carioca	Small	Mesoamerican	Unknown	Landrace
207	235508	Yellow	Medium	Mesoamerican	Unknown	Landrace
208	RAZ-19	White	Small	Mesoamerican	CIAT	Resistant line
209	241729	Red	Medium	Mesoamerican	Unknown	Landrace
210	241730	Red	Small	Mesoamerican	Unknown	Landrace
211	241737	Red	Small	Mesoamerican	SNNPR	Landrace
212	241750	Red	Small	Mesoamerican	SNNPR	Landrace
213	RAZ-138	White	Small	Admixture	CIAT	Resistant line
214	241807	White	Small	Mesoamerican	Amhara	Landrace
215	241813	Red	Small	Mesoamerican	Amhara	Landrace
216	241814	White	Small	Mesoamerican	Amhara	Landrace
217	241809	Black	Small	Mesoamerican	Unknown	Landrace
218	MAZ 112	Mottled	Medium	Mesoamerican	CIAT	Resistant line
219	MAZ 151	Mottled	Medium	Admixture	CIAT	Resistant line
220	MAZ 172	Mottled	Medium	Andean	CIAT	Resistant line
221	MAZ 174	Mottled	Large	Andean	CIAT	Resistant line
222	MAZ 179	Mottled	Medium	Andean	CIAT	Resistant line
223	MAZ 180	Mottled	Medium	Andean	CIAT	Resistant line
224	MAZ 198	Pinto	Medium	Mesoamerican	CIAT	Resistant line
225	MAZ 202	Red	Large	Admixture	CIAT	Resistant line
226	MAZ 204	Red	Large	Andean	CIAT	Resistant line
227	MAZ 205	Red	Medium	Andean	CIAT	Resistant line
228	MAZ 215	Mottled	Medium	Andean	CIAT	Resistant line
229	MAZ 217	Mottled	Large	Andean	CIAT	Resistant line
230	RAZ-28	Pinto	Medium	Mesoamerican	CIAT	Resistant line
231	SAB 14	White	Medium	Andean	CIAT	Breeding line
232	SCR-28	Red	Medium	Mesoamerican	CIAT	Breeding line
233	SAB 17	White	Medium	Andean	CIAT	Breeding line
234	SCR 24	Red	Medium	Mesoamerican	CIAT	Breeding line
235	SCR 14	Red	Medium	Mesoamerican	CIAT	Breeding line
236	SCR 19	Red	Medium	Mesoamerican	CIAT	Breeding line
237	Line smc-21	White	Medium	Admixture	CIAT	Breeding line
238	Line SEC-8	White	Large	Admixture	CIAT	Breeding line
239	SAB 9	White	Large	Andean	CIAT	Breeding line

No	Genotype	Seed colour	Seed size	Geenpool	Origin/Source	Breeding status
240	SCR-6	Red	Medium	Mesoamerican	CIAT	Breeding line
241	SCR-37	Red	Medium	Mesoamerican	CIAT	Breeding line
242	SCR-36	Red	Medium	Mesoamerican	CIAT	Breeding line
243	SCR-9	Red	Medium	Mesoamerican	CIAT	Breeding line
244	SCR-25	Red	Medium	Mesoamerican	CIAT	Breeding line
245	SCR-35	Red	Medium	Mesoamerican	CIAT	Breeding line
246	SCR-34	Red	Medium	Mesoamerican	CIAT	Breeding line
247	SCR-7	Red	Medium	Mesoamerican	CIAT	Breeding line
248	SCR-1	Red	Medium	Mesoamerican	CIAT	Breeding line
249	SCR-22	Red	Medium	Mesoamerican	CIAT	Breeding line
250	SCR-20	Red	Medium	Mesoamerican	CIAT	Breeding line
251	SCR-3	Red	Medium	Mesoamerican	CIAT	Breeding line
252	SCR-13	Red	Medium	Mesoamerican	CIAT	Breeding line
253	Hirma	Red	Large	Andean	HU	Variety
254	Chercher	White	Small	Mesoamerican	EIAR	Variety
255	Dursitu	Red	Small	Mesoamerican	EIAR	Variety
256	Babile	Red	Medium	Andean	HU	Variety
257	Hundene	Mottled	Medium	Andean	HU	Variety
258	Haramaya	Cream	Medium	Mesoamerican	HU	Variety
259	Fidise	Mottled	Medium	Andean	HU	Variety
260	AFR 702	Red	Large	Andean	SARI	Variety
261	Ibado	Mottled	Medium	Andean	SARI	Variety
262	OMO-95	Red	Small	Mesoamerican	SARI	Variety
263	ETAW- 01-L-7A	White	Small	Mesoamerican	CIAT	Breeding line
264	SARI-1	Red	Small	Mesoamerican	SARI	Variety
265	ETAW-01-L-7-6K	Mottled	Medium	Andean	SARI	Variety
266	ETAW- 01-L-7-20A	Mottled	Large	Andean	CIAT	Breeding line
267	Dinknesh	Red	Small	Mesoamerican	EIAR	Variety
268	Batu	White	Large	Andean	EIAR	Variety
269	KAT-B9	Red	Medium	Andean	EIAR	Variety
270	Nazareth-2	White	Small	Mesoamerican	EIAR	Variety
271	Cranscope	Speckled	Medium	Andean	EIAR	Variety
272	Lehode	Cream	Medium	Not known	ARARI/SARC	Variety
273	NC-01	Cream	Small	Mesoamerican	Amhara	Landrace
274	NC-06	Red	Small	Mesoamerican	Amhara	Landrace
275	NC-11	Cream	Medium	Mesoamerican	Amhara	Landrace
276	NC-19	Red	Small	Mesoamerican	Amhara	Landrace
277	NC-24	Red	Small	Mesoamerican	Amhara	Landrace
278	RAZ-111	White	Small	Admixture	CIAT	Resistant line
279	NC-32	Yellow	Medium	Mesoamerican	Amhara	Landrace
280	NC-33	Yellow	Medium	Mesoamerican	Amhara	Landrace
281	NC-35	Carioca	Small	Mesoamerican	Amhara	Landrace

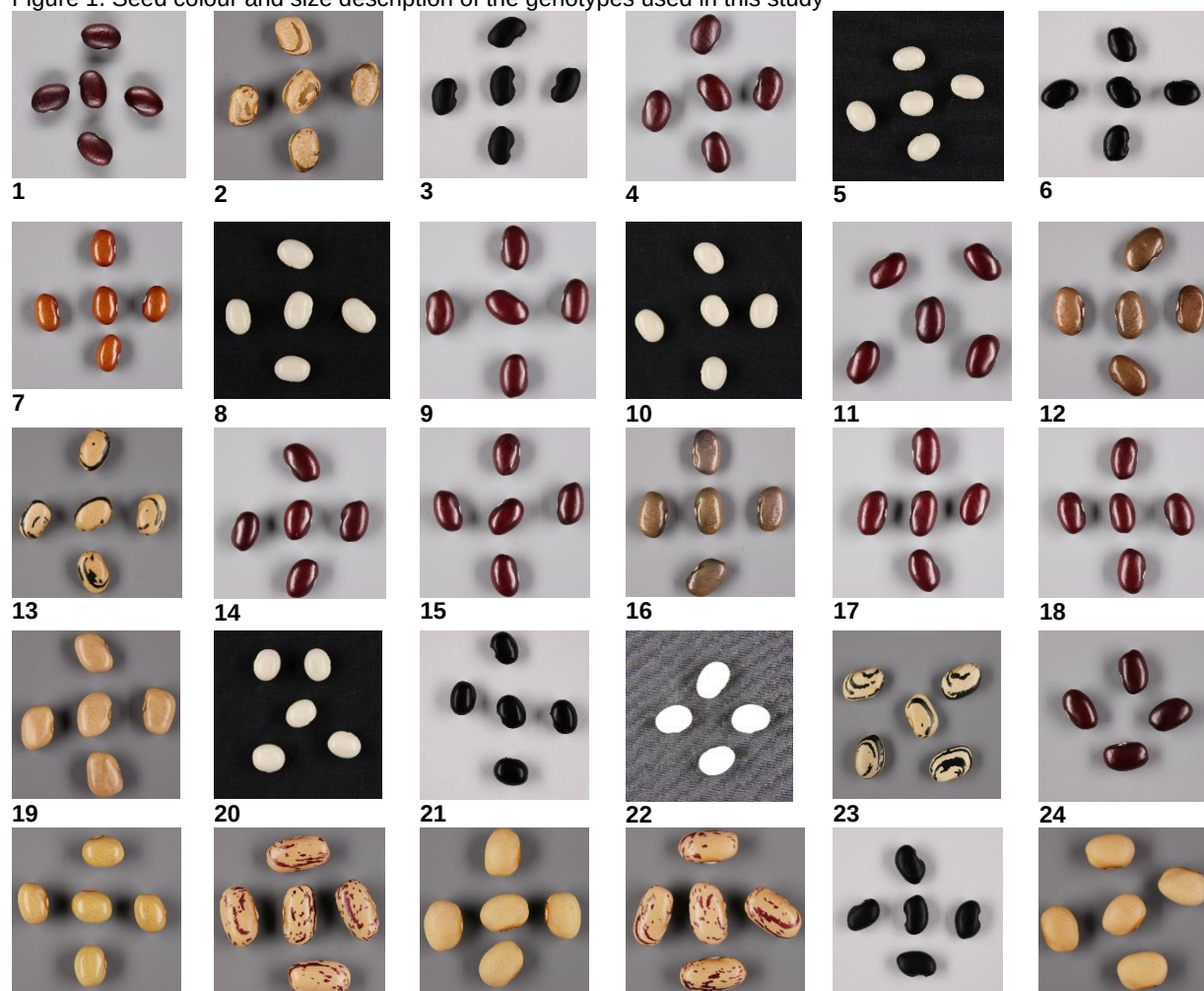
No	Genotype	Seed colour	Seed size	Geenpool	Origin/Source	Breeding status
282	NC-36	Black	Small	Mesoamerican	Amhara	Landrace
283	NC-37	Cream	Small	Mesoamerican	Amhara	Landrace
284	NC-38	Cream	Medium	Mesoamerican	Amhara	Landrace
285	NC-40	Red	Small	Mesoamerican	Amhara	Landrace
286	NC-41	Black	Small	Mesoamerican	Amhara	Landrace
287	NC-43	Brown	Small	Mesoamerican	Amhara	Landrace
288	NC-45	Brown	Medium	Mesoamerican	Amhara	Landrace
289	NC-46	Black	Small	Mesoamerican	Amhara	Landrace
290	NC-47	Red	Small	Mesoamerican	Amhara	Landrace
291	NC-55	Black	Small	Mesoamerican	Amhara	Landrace
292	NC-56	Speckled	Medium	Andean	Amhara	Landrace
293	NC-58	Black	Small	Mesoamerican	Amhara	Landrace
294	NC-59	Red	Small	Mesoamerican	Amhara	Landrace
295	NC-60	Red	Small	Mesoamerican	Amhara	Landrace
296	NC-62	Red	Small	Mesoamerican	Amhara	Landrace
297	NC-63	Black	Small	Mesoamerican	Amhara	Landrace
298	RAZ-34	White	Small	Mesoamerican	CIAT	Resistant line
299	RAZ-114	White	Small	Mesoamerican	CIAT	Resistant line
300	RAZ-119	White	Small	Mesoamerican	CIAT	Resistant line

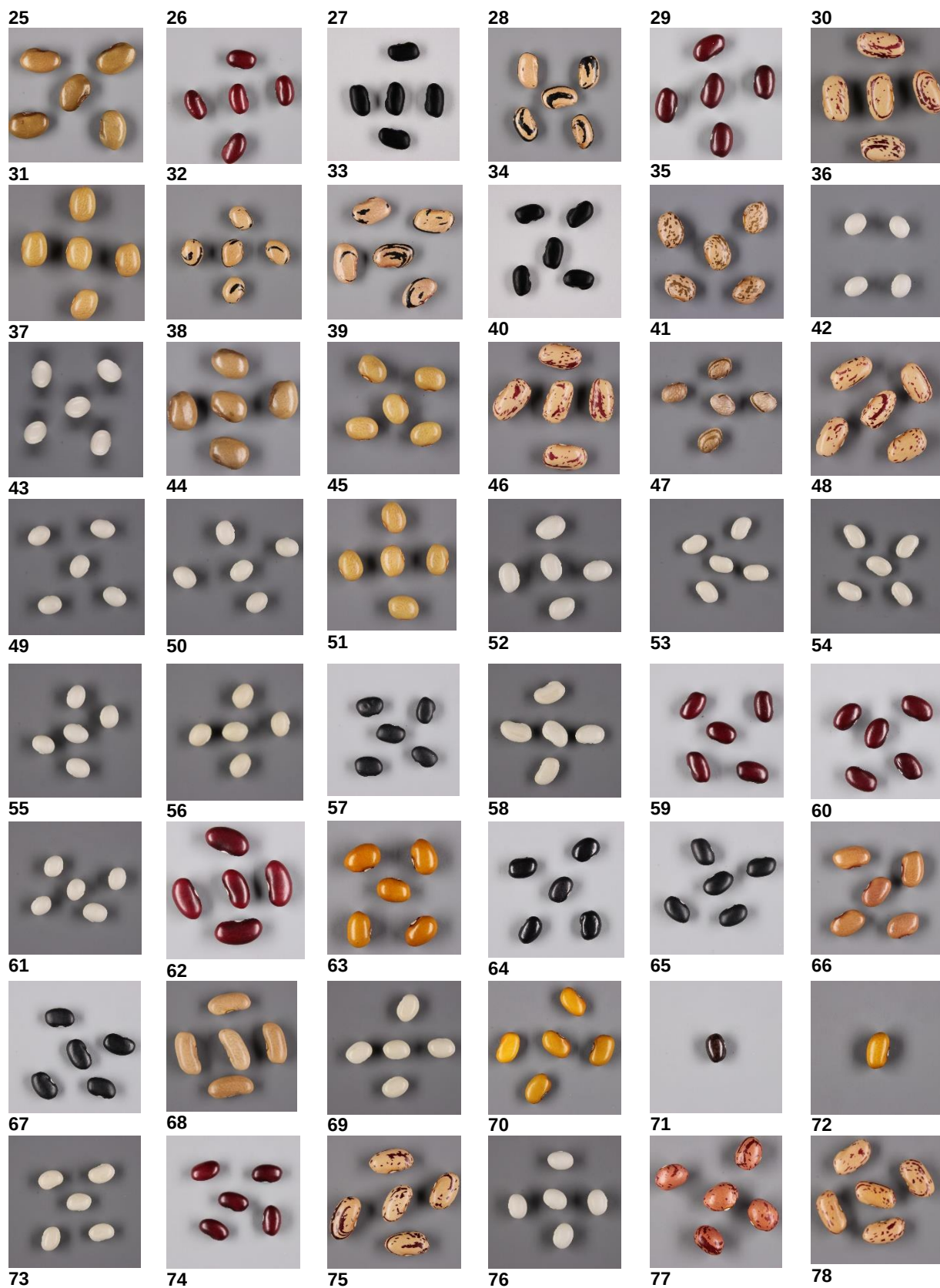
Table 2 Clustering of 300 common bean genotypes into two clusters based on the 13 response characters to infestation by bean bruchid

Cluster	No. of entries	Genotypes included
Cluster I		
SC-1	48 (16%)	Acc. Nos. 211293, 211302, 211367, 214675, 215048, 215050, 215719, 215720, 219231, 219389, 223329, 228077, 228079, 228082, 228083, 228246, 228522, 228811, 228812, 228813, 228911, 230525, 237079, 241756, 241757, 244805, 241809, KK25/MAIAWA/19, SAB-14, SCR-35, AFR 702, SARI-1, Awash-1, Dinknesh, Batu, KAT-B9, Nasir, NC-02, NC-35, NC-38, NC-40, NC-41, NC-46, NC-47, NC-48, NC-49, NC-51, NC-60
SC-2	86 (28.7%)	Acc. Nos. 207534, 207949, 208367, 208703, 211266, 211269, 211278, 211279, 211282, 211286, 211304, 211311, 211313, 211315, 211321, 211324, 211325, 211329, 211333, 211348, 211349, 211361, 211366, 211546, 211552, 212860, 213197, 214662, 214667, 214676, 215049, 215051, 215545, 216820, 219233, 219337, 219338, 228080, 228084, 228085, 228086, 228088, 228089, 228090, 228247, 229814, 230526, 230661, 232196, 235502, 235506, 237993, 241730, 241750, 241752, 241807, 241813, 241814, Ayenew, SCR-14, SCR-6, SCR-36, SCR-9, SCR-7, SCR-20, Babile, ETAW-01-L-7-6K, Roba, Nazareth-2, Ser 125, Lehode, NC-09, NC-13, NC-19, NC-22, NC-30, NC-32, NC-36, Mexican 142, NC-43, NC-44, NC-50, NC-53, NC-54, NC-59, NC-61
SC-3	10 (3.3%)	Hirna, Deme, DRK, Cranscope, NC-25, NC-29, NC-34, NC-39, NC-45, NC-52
SC-4	30 (10%)	Acc. Nos. 208638, 208995, 208699, 215542, 235508, 237080, MAZ 215, SAB-9, SCR-24, Line smc-21, SAB-17, SCR-25, SCR-34, SCR-15, SCR-3, Kufanzik, Tinkie, Fidise, IBADO, ETAW- 01-L-7-20A, KAT-B1, Wedo, NC-01, NC-06, NC-11, NC-12, NC-14, NC-15, NC-18, NC-28

Cluster II		
SC-5	23 (7.7%)	RAZ-19, RAZ-138, MAZ 151, MAZ 172, MAZ 174, MAZ 179, MAZ 200, MAZ 203, MAZ 153, RAZ-28-8, RAZ-28, RAZ-9, RAZ-2, RAZ-40, RAZ-111, RAZ-36, RAZ-44, RAZ-42, RAZ-11-1, RAZ-11, RAZ-120, RAZ-114, RAZ-119
SC-6	46 (15.3%)	Acc. Nos. 207935, 208702, 211267, 211280, 211284, 211294, 211320, 211322, 211323, 211331, 211340, 211344, 211346, 211350, 211356, 211362, 213046, 213198, 214663, 214664, 214665, 214677, 228081, 228912, 228913, 230044, 235503, 235507, 241729, 241734, 241739, 241748, SCR-28, SCR-19, SCR-22, SCR-26, SCR-13, Chercher, Dursitu, Haramaya, OMO-95, NC-05, NC-08, NC-10, NC-17, NC-37
SC-7	57 (19%)	Acc. Nos. 201066, 207934, 207938, 207942, 207943, 208705, 211274, 211305, 211314, 211327, 211332, 211339, 211341, 211347, 211365, 211382, 211483, 211553, 214671, 214678, 215391, 219340, 241134, 241736, 241737, KK25/NAGAGA/184, MAZ 112, MAZ 180, MAZ 198, MAZ 202, MAZ 204, MAZ 205, MAZ 217, SMARC 4, Line SEC-8, SCR-37, SCR-11, SCR-1, Gofa, Hundene, Red wolayta, ETAW-01-L-1-7A, Awash Melka, Beshbesh, NC-03, NC-07, NC-16, NC-20, NC-24, NC-33, NC-55, NC-56, NC-57, NC-58, NC-62, NC-63, RAZ-34

Figure 1. Seed colour and size description of the genotypes used in this study







79



80



81



82



83



84



85



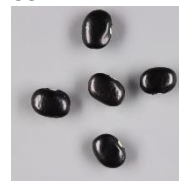
86



87



88



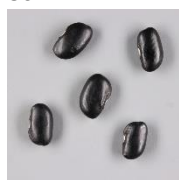
89



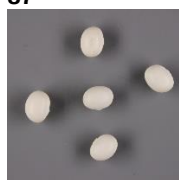
90



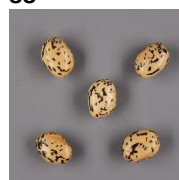
91



92



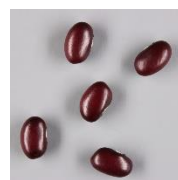
93



94



95



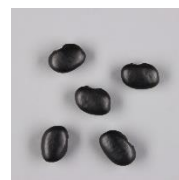
96



97



98



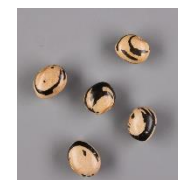
99



100



101



102



103



104



105



106



107



108



109



110



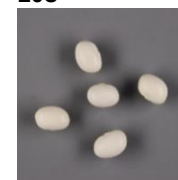
111



112



113



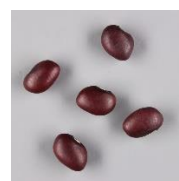
114



115



116



117



118



119



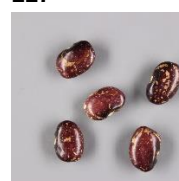
120



121



122



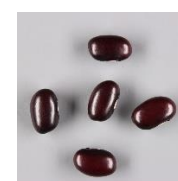
123



124



125



126



127



128



129



130



131



132



133



134



135



136



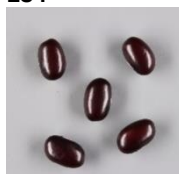
137



138



139



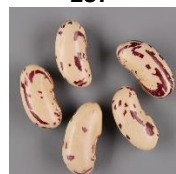
140



141



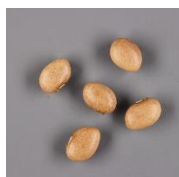
142



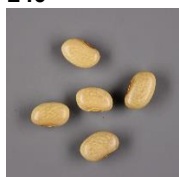
143



144



145



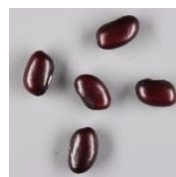
146



147



148



149



150



151



152



153



154



155



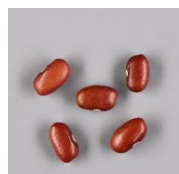
156



157



158



159



160



161



162



163



164



165



166



167



168



169



170



171



172



173



174



175



176



177



178



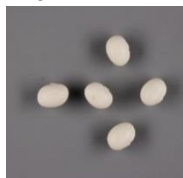
179



180



181



182



183



184



185



186



187



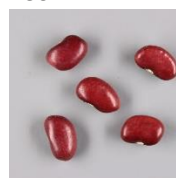
188



189



190



191



192



193



194



195



196



197



198



199



200



201



202



203



204



205



206



207



208



209



210



211



212



213



214



215



216



217



218



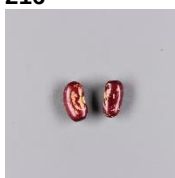
219



220



221



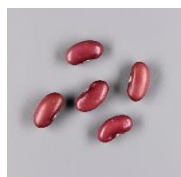
222



223



224



225



226



227



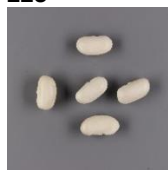
228



229



230



231



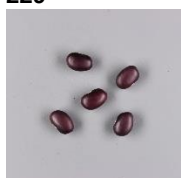
232



233



234



235



236



237



238



239



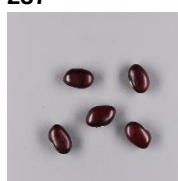
240



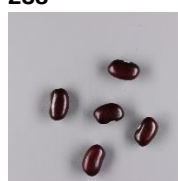
241



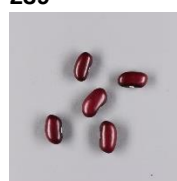
242



243



244



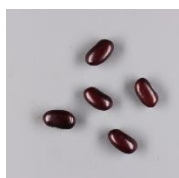
245



246



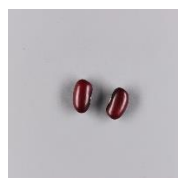
247



248



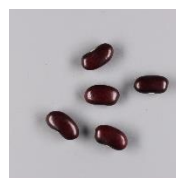
249



250



251



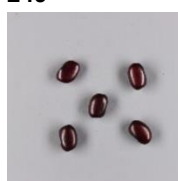
252



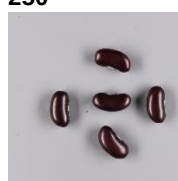
253



254



255



256



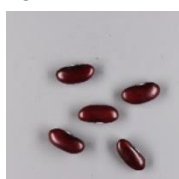
257



258



259



260



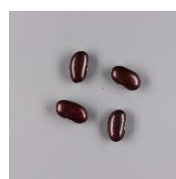
261



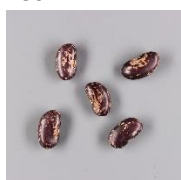
262



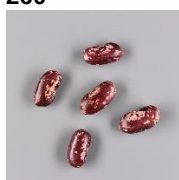
263



264



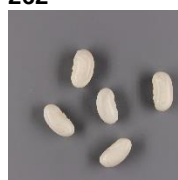
265



266



267



268



269



270



271



272



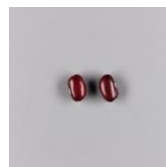
273



274



275



276



277



278



279



280



281



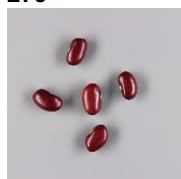
282



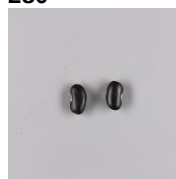
283



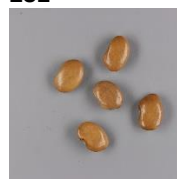
284



285



286



287



288



289



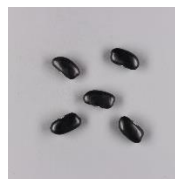
290



291



292



293



294



295



296



297



298



299



300