

Breeding for CLR-Resistance Coffee at HARC

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SCRI NIFA USDA Grant

Developing an efficient breeding pipeline for producing CLR-resistant coffee cultivars and maintain unique quality

Lisa Keith (PBARC) - CLR Bioassays

Dapeng Zhang (BARC) - Genotyping of F1s with Obata

Qingyi Yu (PBARC) – Mapping/Genotyping of F2s with Catimor

Tracie Matsumoto (PBARC) - Phenotyping/Cupping

Andrea Kawabata (UH) - Extension

Genetic Resources of CLR-Resistance in HARC germplasm collection

- Catimor – T5175 and T8667; derived from CIFC HdT 832/1
 - F1s from crosses with many Hawaiian commercial varieties
 - One field-grown F2 population from T5175xMA2-7
- Obata – derived from CIFC HdT 832/2
- BA10 – S_H3 gene from *C. liberica*

F2 of Catimor Crosses

>3000 plants as of 5/30/23

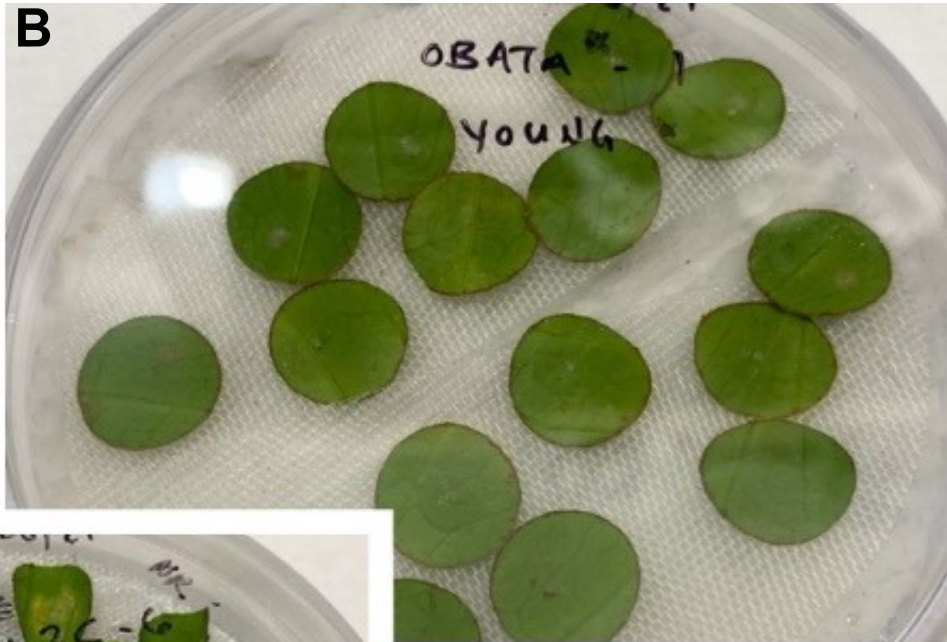
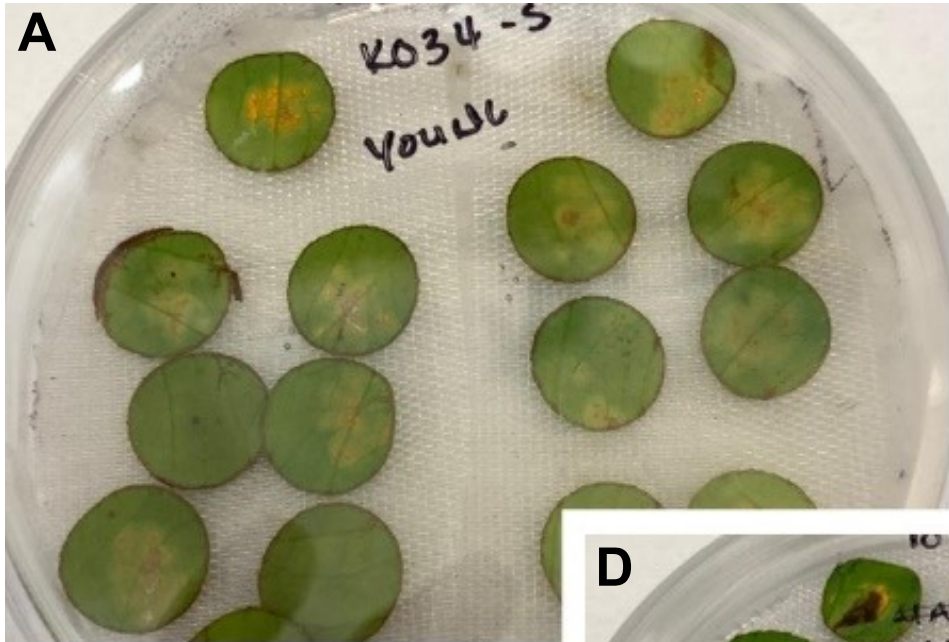
Cross number 99-	Group	Female parents	Male parent	Number of plants	Notes
22	Mokka	T5175	MA2-7	152	Field-grown mature plants from 2 F1s
11	Mokka	T5175	Mokka	371	From 4 F1s
12	Mokka	T8667	MK(Maui)	272	From 3 F1s
38	Mokka	MA1-12	T5175	129	From 3 F1s
90	Others	T5175	OA12	188	From 3 F1s
93	Others	T8667	OA11C	107	From 4 F1s
88	Red Catuai	T5175	MA10	410	From 5 F1s
98	Red Catuai	T8667	MA10	339	From 4 F1s
110	Red Catuai	KA19	T8667	199	From 4 F1s
81	Typica	T8667	Typica (Blue Mt)	194	From 4 F1s
91	Typica	T8667	Typica (BMT)	228	From 5 F1s
175	Typica	T5175	KO34	100	From 4 F1s
178	Typica	KO32	T5175	156	From 4 F1s
14	Yellow Catuai	T8667	KA18	142	From 4 F1s
21	Yellow Catuai	KA17	T5175	155	From 5 F1s
142	Yellow Catuai	KA18	T5175	97	From 1 F1s

Genotyping of F2 of T5175 x MA2

F2 Progeny	Inferred Parentage	
	MA2-70-2	5175-7-1
25-1	0.567	0.433
25-2	0.504	0.496
25-3	0.352	0.648
25-5	0.246	0.754
25-6	0.371	0.629
25-7	0.644	0.356
25-8	0.568	0.432
25-9	0.543	0.457
25-10	0.479	0.521
25-12	0.406	0.594
25-13	0.353	0.647
25-14	0.539	0.461
25-15	0.368	0.632
25-16	0.439	0.561
25-17	0.574	0.426
25-18	0.429	0.571
25-19	0.550	0.450
25-20	0.445	0.555
25-21	0.505	0.495
25-22	0.575	0.425
25-23	0.413	0.587
25-24	0.463	0.537
25-25	0.391	0.609
25-26	0.549	0.451
25-28	0.610	0.390
25-29	0.359	0.641
25-30	0.600	0.400
25-31	0.581	0.419
25-32	0.527	0.473
25-33	0.468	0.532
25-34	0.584	0.416
25-35	0.453	0.547
25-36	0.446	0.554
25-37	0.557	0.443
25-38	0.454	0.546
25-39	0.401	0.599
25-40	0.436	0.564
25-42	0.507	0.493
25-43	0.680	0.320
25-44	0.353	0.647
25-46	0.744	0.256
25-47	0.509	0.491
25-48	0.583	0.417
25-49	0.520	0.480
25-50	0.469	0.531
25-51	0.403	0.597
25-53	0.508	0.492
25-56	0.487	0.513
25-57	0.545	0.455
25-58	0.463	0.537
25-62	0.462	0.538
25-63	0.426	0.574
25-64	0.480	0.520
25-65	0.424	0.576
25-66	0.465	0.535
25-67	0.464	0.536
25-68	0.526	0.474
25-69	0.502	0.498
F1-25	0.480	0.520
F1-25	0.479	0.521
MA2-70-2	0.995	0.005
5175-7-1	0.007	0.993

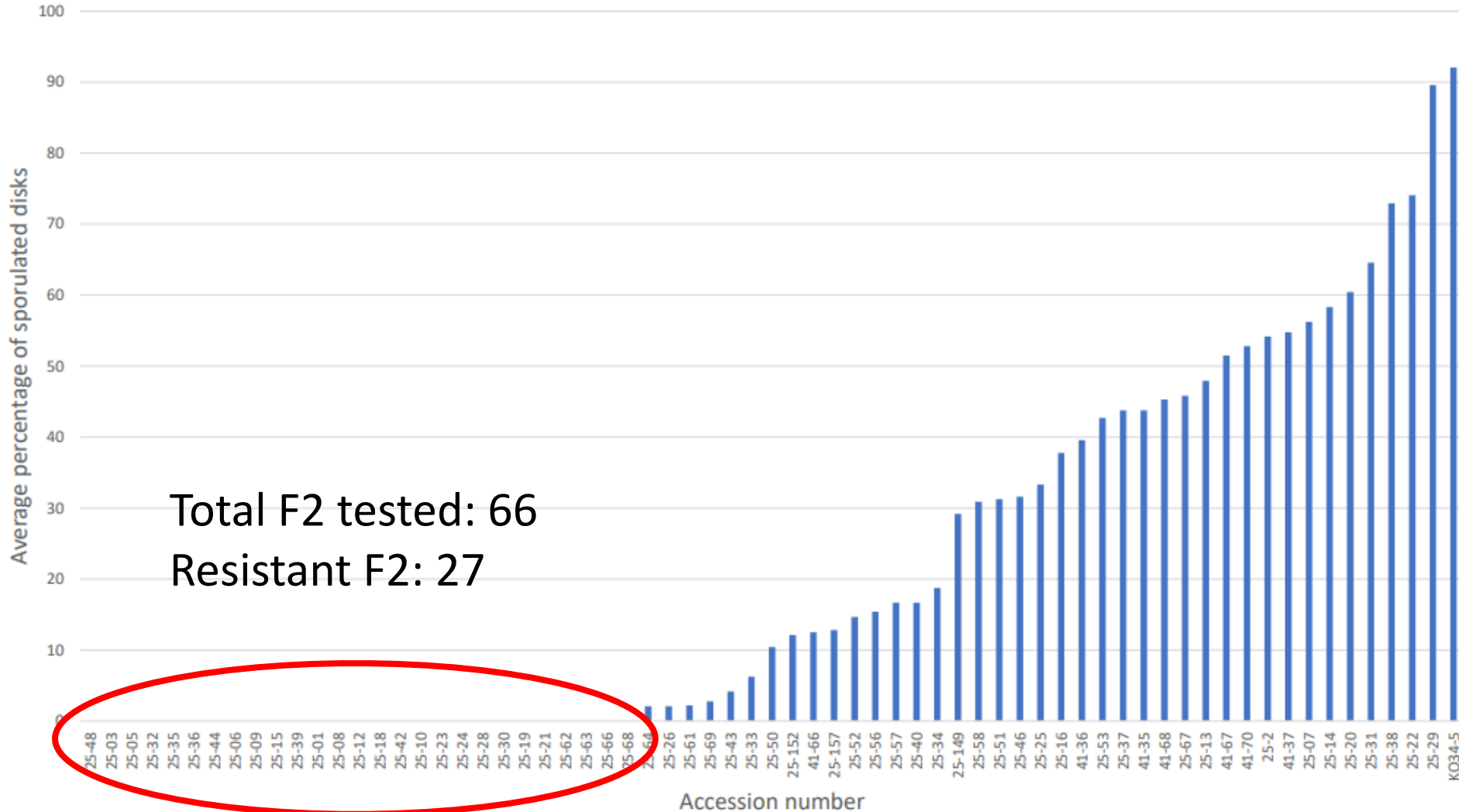
CLR Bioassay

Blaine Luiz, Lisa Keith



CLR Bioassays of T5175 x MA2-7

Blaine Luiz, Lisa Keith



Leaf size and shape of CLR-resistant F2s from T5175 x MA2

F2



Red Catuai (KA19)



Catimor (T8667)



Parent 1
Catimor (T5175)



Parent 2
Tall Mokka (MA2C)



25-19



25-21



25-23



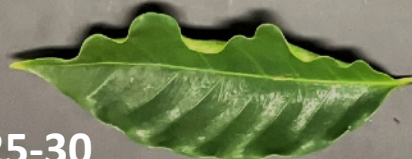
25-24



25-28



25-29



25-30



25-34



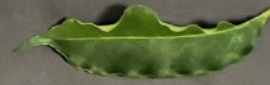
25-35



25-36



25-62



25-63



25-66



25-68



F2



Red Catuai (KA19)



25-21



25-35



Catimor (T8667)



25-23



25-62



Parent 1

Catimor (T5175)



25-24



25-63



Parent 2

Tall Mokka (MA2C)



25-28



25-68



25-30



Cherry size and shape of CLR-resistant F2s from T5175 x MA2-7

Cupping Results of Kunia-Grown Coffee

ID	Sensory	Score
25-19	Chocolate, Creamy, Yellow Fruits, Tropical	83
KA19C-8	Nutty, Creamy, Yellow Fruits	82
5175-7-2	Creamy, Nutty, Yellow Fruits, Sweet	82
8667-6-8	Creamy, Tropical, Honey, Macadamia	83.5
8667-6-9	Bright, Macadamia, Creamy, Yellow Fruits	82.5

Cupped by certified Q-graders from Olympia Roasters and HARC (Juli Burden)

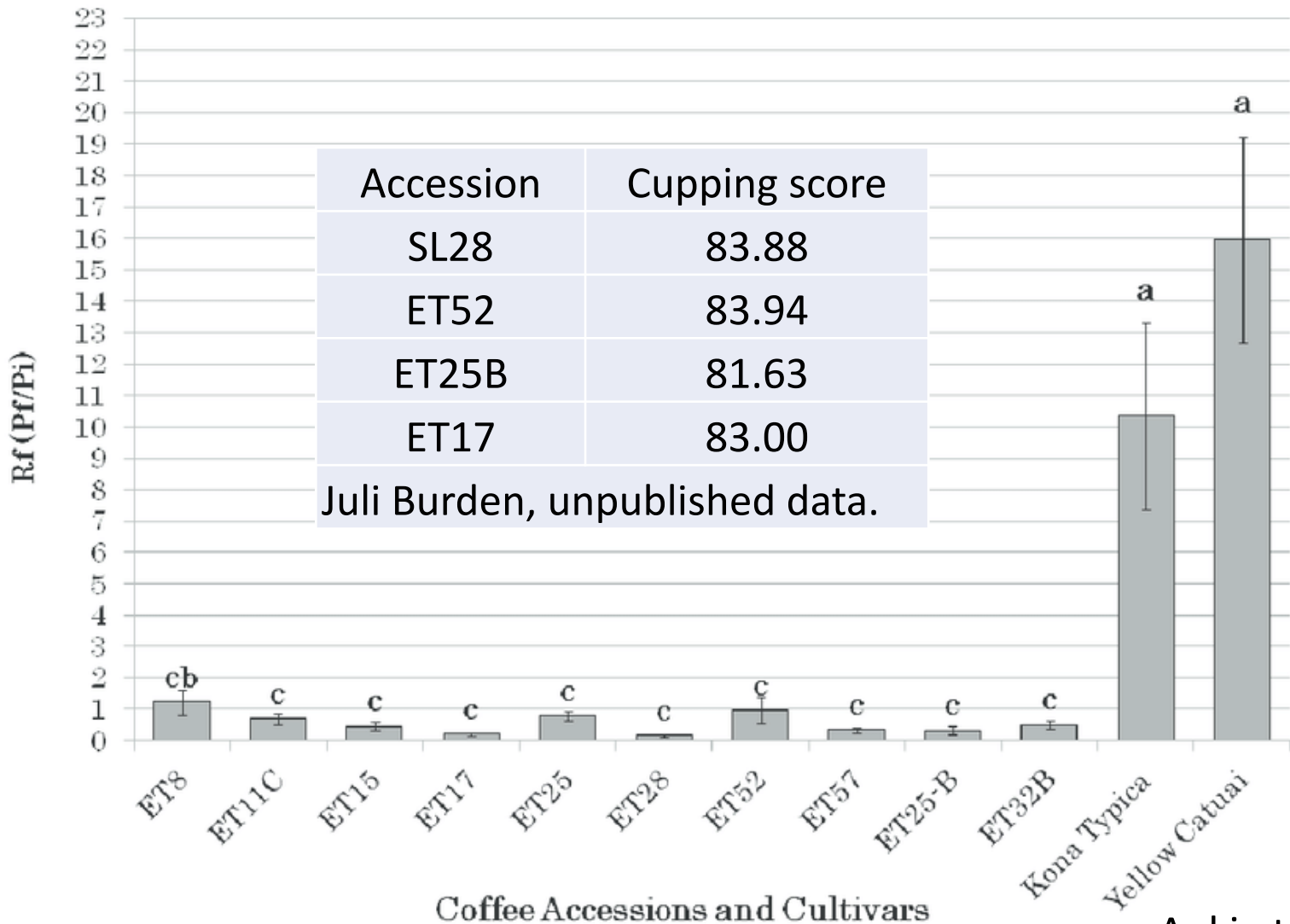


F1 of Obata Crosses

655 plants as of 5/30/23

Group	Cross Number 22-	Female parent	Male parent	Number
Other	259,292	OA11C	Obata	4+
Other	254,255,293	OA12C	Obata	42
Red Catuai	231,232,233,253,291	KA19C	Obata	140
Red Catuai	234,234,251,285	MA10C	Obata	75
Typica	286	KO32	Obata	47
Typica	246,247,260,290	KO33C	Obata	44
Typica	240,287	KO34	Obata	32
Yellow Catuai	235,238,289	KA17C	Obata	47
Yellow Catuai	236,237,257,288	KA18C	Obata	142
Ethiopian	281,284	ET25B	Obata	72

Genetic Resources of Nematode-Resistance in HARC Germplasm Collection



Control Plants

>1,500 plants as of 5/30/23

CLR-Resistant

T5175	69
T8667	232
Obata-1	89
Obata-2	60

CLR-Susceptible

KA17	176
KA17C	25
KA18	130
KA19	211
KA19C	120
KO32	79
KO33	201
KO33C	20
KO34	276







CLR Bioassay

- Leaf disc assays (Lisa Keith, Blaine Luiz, PBARC)
 - 6 large healthy leaves
 - Smaller discs - 2 large healthy leaves
- Natural infection in Maunawili (Sayaka Aoki)
 - 199 plants sent to Maunawili on 1/27/23
 - CLR spores observed on 12 plants as of 5/30/23
 - 1/8 (12.5%) under heavy infected feral coffee plants
 - 11/191 (5.8%) on the bench
- Inoculation chamber (Sayaka Aoki)
 - Optimizing humidity and temperature for establishing CLR infection using a humidifier and two fans
 - Using heavily infected branches from feral coffee trees as spore sources

CLR Inoculation Chamber



Genotyping

Zhang (USDA Beltsville)



All Obata F1
CLR-resistant Catimor F2
Controls for field planting

Field Trials of Selected CLR-Resistant Plants

- Kona – Greenwell Farms
- Maui – MauiGrown
- Oahu – Dole Foods, Waialua Estate Coffee and Chocolate
- Kauai – Kauai Coffee

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