

Diversification of germplasm and genetic enhancement of barley for biotic and abiotic stress and malting quality for different agro-ecologies

Section C: Promising lines developed for multi-locations evaluation trials and eventual release of varieties for farmers from Indian partner institutions.

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Introduction

Barley is a main staple crop and large areas in the world are devoted to the crop. In India, barley is an important crop cultivated since ancient times. The major barley growing states in India are Rajasthan, Uttar Pradesh, Haryana, Punjab, Madhya Pradesh, Uttarakhand, Himachal Pradesh, Bihar, Jammu and Kashmir, West Bengal, Chhatisgarh and Sikkim. However, its area decreased in the country throughout the 20th century, mainly due to competition against wheat. As a result, barley is generally confined to marginal, problematic soils as a rainfed crop. The main usages of barley in the country are feed for livestock (ca. 65%), malt (20-30%) and food (less than 10%). An increased interest in barley is apparent in the country since the 90s. The use of malt barley as a cash crop coupled with the increased number of breweries in the country, the high frequency of drought events that can make barley more suitable as feed than other crops (i.e. sugar cane or oats) in drought prone environments and its nutritional quality as food have increased the interest over barley. However, to fulfil the needs, new germplasm with superior productivity, yield stability, disease resistant and fit for purpose needs to be developed.

ICARDA has a long-lasting collaboration with the ICAR, IIWBR and other Indian research institutions that has resulted in a number of varieties released coming from ICARDA nurseries or having ICARDA germplasm as parental material. The interest of the NARS in ICARDA germplasm relies in its high productivity, diversity and resistance to biotic and abiotic stresses. In order to deliver fit-for-purpose varieties to the NARS that will ultimately reach the farmers, the Global Barley Breeding Program of ICARDA uses a multi-location approach to identify the best varieties combining the desired traits. Thus, combining the information from stress hot-spots in Morocco, Tunisia, Lebanon, India and Turkey among others, ICARDA is capable of selecting elite germplasm combining several traits of interest and with yield stability and specific adaptation. In the present report we show results of the efforts made in 2020 in India to provide the NARS with disease resistant high grain and straw yield genotypes as well as new diversity for Indian barley germplasm.

New elite barley lines transferred to Indian NARS for evaluation, use and promotion

Based on the results obtained in the ICARDA Multi-Location Testing in Morocco, Lebanon and India (See *Diversification of germplasm and genetic enhancement of barley for biotic and abiotic stress and malting quality for different agro-ecologies Section A: New diverse donors for desired traits identified and utilized in malt, feed and dual-purpose type barley*), a set of 198 elite lines for high and low input feed purposes as well as malt and naked barley genotypes were selected together with National Breeders. The set included potential donors of traits of interest and new disease resistant genes and genetic diversity was a main driver for selection. The set selected (198 lines) had 171 had unique pedigree combinations (86%) and up to 215 different parents were used to produce the lines. The high parental and pedigree diversity increase the chances to find diverse sources of genes of interest and novel combination of favorable alleles to be used in breeding (Figure 1)

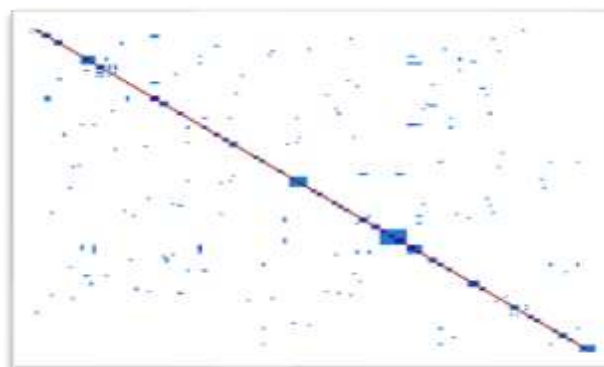


Figure 1 Pedigree matrix of the 198 elite barley lines transferred to Indian NARS in 2020. Light blue colours represent half-sister lines; dark blue colours represent full sister lines and red colours represent the same line.

The elite lines (Supp. Table 1) have been **transferred to the National Program** for further multi-location testing (Supp. Table 1).

Acknowledgements

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Supplementary Table 1: List of ICARDA elite barley genotypes transferred to the Indian National Program in 2020

N	Pedigree	Selection History
1	LEGACY/3/PETUNIA 1/CHEVRON-BAR//TOCTE/4/PENCO/CHEVRON-BAR/5/STANDER-BAR//CALI92/ROBUST/6/LIGNEE527/GERBEL/3/BOY-B*2/SURB//CI12225.2D/4/M104	ICM14CH29-7CH-0CH-0CH-0MR-7MR
2	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/7/MADRE SELVA	ICM14CH1-50CH-0CH-0CH-0MR-3MR
3	ZARZA//ATAH92/GOB/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	ICM14CH45-56CH-0CH-0CH-0MR-10MR
4	SLLO/ROBUST//QUINA/3/CALI92/4/LEGACY/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	ICM14CH86-32CH-0CH-0CH-0MR-6MR
5	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CIRU/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/IBTA80/8/CABUYA	ICM14CH38-47CH-0CH-0CH-0MR-9MR
6	ZACATECAS 4 (LEGACY/CHAMICO)/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CIRU	ICM14CH141-3CH-0CH-0CH-0MR-5MR
7	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/7/MADRE SELVA	ICM14CH3-26CH-0CH-0CH-0MR-9MR
8	STANDER-BAR/CABUYA/3/MSEL/ND19098-1//CANELA	ICM14CH94-1CH-0CH-0CH-0MR-6MR
9	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/7/DOÑA JOSEFA	ICM14CH2-48CH-0CH-0CH-0MR-7MR
10	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/7/DOÑA JOSEFA	ICM14CH2-7CH-0CH-0CH-0MR-10MR
11	ZARZA//ATAH92/GOB/7/GLORIA-BAR/COPAL/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	ICM14CH56-28CH-0CH-0CH-0MR-5MR
12	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/7/BREA/DL70//3*CABUYA	ICM14CH6-43CH-0CH-0CH-0MR-10MR
13	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/7/BR5180/M97.95/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	ICM14CH10-36CH-0CH-0CH-0MR-2MR
14	ZARZA//ATAH92/GOB/7/CHENG DU 105/ENCINO//CARDO/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	ICM14CH46-74CH-0CH-0CH-0MR-5MR
15	LEGACY/3/PETUNIA 1/CHEVRON-BAR//TOCTE/4/PENCO/CHEVRON-BAR/5/STANDER-BAR//CALI92/ROBUST/7/CHAMICO/TOCTE//CONGONA/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	ICM14CH22-3CH-0CH-0CH-0MR-2MR
16	UC1099 // UC1047 / BELLA UNION	UCD013-060-0CD-0CD-0CD-0MR-4MR
17	22IBYT7 // UC 1116 / YUMA	UCD013-020-0CD-0CD-0CD-0MR-9MR
18	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/7/MERIT,B//CLE150/W89.11369/3/CANELA	ICM14CH8-45CH-0CH-0CH-0MR-4MR
19	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/LEGACY/7/BREA/DL70//3*CABUYA	ICM14CH6-23CH-0CH-0CH-0MR-6MR
20	ZARZA//ATAH92/GOB/3/LIMON/BICHY2000//NE167/CLE176	ICM14CH59-48CH-0CH-0CH-0MR-7MR
21	SLLO/ROBUST//QUINA/3/CALI92/4/LEGACY/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M9846//CCXX14.AR23/PACO/3/PALTON	ICM14CH92-32CH-0CH-0CH-0MR-4MR
22	SLLO/ROBUST//QUINA/3/CALI92/4/LEGACY/5/MSEL//LIMON/BICHY2000	ICM14CH87-14CH-0CH-0CH-0MR-10MR
23	MP103MQ/MP179	UCD14-009-0UCD-0UCD-0MR-0MR-7MR
24	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CIRU/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/IBTA80/8/LIMON/BICHY2000//CANELA/3/MSEL	ICM14CH44-4CH-0CH-0CH-0MR-5MR
25	Frontier/RD2668	HIICB14-127-OTR-0MR-0MR-0MR-10MR
26	STANDER-BAR//CALI92/ROBUST/4/PFC 8562//ATAH92/GOB/3/CANELA	ICM14CH82-5CH-0CH-0CH-0MR-7MR
27	ZARZA//ATAH92/GOB/3/KASKADE/LEGACY	ICM14CH48-55CH-0CH-0CH-0MR-6MR
28	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/BR5180/7/MSEL//LIMON/BICHY2000	ICM14CH121-5CH-0CH-0CH-0MR-2MR
29	ZARZA//ATAH92/GOB/7/CHENG DU 105/ENCINO//CARDO/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1	ICM14CH46-21CH-0CH-0CH-0MR-4MR
30	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CIRU/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/IBTA80/8/LIMON/BICHY2000//CANELA/3/MSEL	ICM14CH44-47CH-0CH-0CH-0MR-8MR
31	ZARZA//ATAH92/GOB/3/JACARANDA//ENCINO/TOCTE	ICM14CH50-3CH-0CH-0CH-0MR-4MR
32	SLLO/ROBUST//QUINA/3/CALI92/4/LEGACY/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M9846//CCXX14.AR23/PACO/3/PALTON	ICM14CH92-32CH-0CH-0CH-0MR-1MR
33	MP103R/MP6	UCD14-150-0UCD-0UCD-0MR-0MR-5MR

34	MP103R/MP6	UCD14-150-OUCD-OUCD-OMR-OMR-10MR
35	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLU/5/PETUNIA 1/6/LEGACY/7/MADRE SELVA	ICM14CH1-56CH-0CH-0CH-OMR-3MR
36	ROLAND-BAR/RD2668	HIICB14-029-OTR-OMR-OMR-OMR-9MR
37	MSEL X ND22202	UCD013-074-0CD-0CD-0CD-OMR-8MR
38	MP103MQ/MP30	UCD14-049-OUCD-OUCD-OMR-OMR-7MR
39	Xena/Litani	HIICB10-0339-OAP-OTR-OMR-6MR
40	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/Gobernadora	HIICB10-0053-OAP-OTR-OMR-6MR
41	Manal/7/ESMERALDA/LEGACY/6/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BL LU/5/PETUNIA 1	HIICB10-0357-OAP-OTR-OMR-4MR
42	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/DWR28	HIICB10-0073-OAP-OTR-OMR-5MR
43	BR2//LM 844/QUILMES PAMPA/4/PFC8562//ATAH92/GOB/3/CANELA	RSI/ITV11B075S-2CH-04CJ-05CH-4CJ-0CH-OMR
44	MSEL//BUCK M8.88/E.ACACIA/4/PFC8562//ATAH92/GOB/3/CANELA	CICJ1011B278S-050CJ-3CH-04CJ-05CH-2CJ-0CH-OMR
45	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/Reem	HIICB10-0055-OAP-OTR-OMR-11MR
46	MSEL//LIMON/BICHY2000	CBSS06Y00152S-1Y-OM-05T-05CJ-05T-1CJ-0CH-OMR
47	CANELA//E.ACACIA/DEFRA/4/CLI18/E.QUEBRANCHO//E.QUEBRANCHO/NCL 95109/3/CANELA	CITV10B001S- 0100T-0100CJ-10CH-04CJ-0CH
48	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/Canela	HIICB10-0066-OAP-OTR-OMR-7MR
49	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/ACUARIO T95/BCD12DH	HIICB10-0127-OAP-OTR-OMR-3MR
50	Xena/CANELA/DEFRA	HIICB10-0354-OAP-OTR-OMR-19MR
51	DWRB92	
52	DWRB101	
53	BH885	
54	Alanda/5/Aths/4/Pro/Toll//Cer*2/Toll/3/5106/6/Baca'S'/3/AC253//CI08887/ CI05761/7/Alanda-01/3/Alanda//Lignee527/Arar	SICB12-0537-OTR-OTR-025KF-015AREC-4AREC-OKF
55	Carbo/Hamra/4/Rhn-08/3/DeirAlla106//DL71/Strain205/6/Rhn- 03/Eldorado/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda	ICB11-0172-OAP-030AREC-015TR-015AREC-2AREC-OKF
56	Arig8/Imperial//M7/3/Rt013/4/Alanda-01/5/Lignee527/NK1272//JLB70- 063/3/IPA99	SICB12-0613-OTR-OTR-025KF-015AREC-3AREC-OKF
57	Lignee527/NK1272//JLB70- 063/3/IPA99/5/Arig8/Imperial//M7/3/Rt013/4/Alanda-01	SICB12-0621-OTR-OTR-025KF-015AREC-4AREC-OKF
58	Hma-02//11012-2/CM67/3/Alanda/5/Rhn- 03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda/6/Osiris	ICB11-0186-OAP-030AREC-015TR-015AREC-5AREC-OKF
59	AwBlack/Aths//Arar/3/9Cr279-07/Roho/6/Alanda- 01/5/CI01021/4/CM67/U.Sask.1800//Pro/CM67/3/DL70/7/ArabiAbiad/Arar/ /H.spont.41-5/Tadmor/3/Sara	SICB12-0140-OTR-OTR-025KF-015AREC-1AREC-OKF
60	Rhn-03/3/Mr25-84/Att//Mari/Aths*3- 02/6/Lignee527//Bahtim/DL71/3/Api/CM67//Mzq/5/Alanda- 01/4/WI2291/3/Api/CM67//L2966-69/7/Furat-3	SICB12-0201-OTR-OTR-025KF-015AREC-3AREC-OKF
61	Lignee527//Bahtim/DL71/3/Api/CM67//Mzq/5/Alanda- 01/4/WI2291/3/Api/CM67//L2966-69/6/Lignee527/Chn-01//Arar/Rhn- 03/7/Rum/4/Rhn-03/3/Mr25-84/Att//Mari/Aths*3-02	SICB12-0390-OTR-OTR-025KF-015AREC-1AREC-OKF
62	Zanbaka/H.spont.41-2/4/Arar/H.spont.19-15//Hml/3/H.spont.41- 1/Tadmor/5/Zanbakian/6/WI2291/3/CI03309/Attiki//Hja33/4/Gustoe/5/Ara r/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor	SICB12-0385-OTR-OTR-025KF-015AREC-3AREC-OKF
63	Carbo/Hamra/4/Rhn-08/3/DeirAlla106//DL71/Strain205/5/ALISO/CI3909- 2//FALCON-BAR/3/HIGO	ICB11-0173-OAP-030AREC-015TR-015AREC-3AREC-OKF
64	Nadawa/Rhn- 03/3/Lignee527/Rihane//Arar/5/Lignee527/NK1272/4/Avt/Attiki//Aths/3/Gi za121/Pue	SICB12-0126-OTR-OTR-025KF-015AREC-1AREC-OKF
65	Alanda-01/VMORALIS	SICB12-0951-OTR-OTR-025KF-015AREC-2AREC-OKF
66	Lignee527/Aths//Lignee527/NK1272/3/Alanda/8/Alanda/5/Aths/4/Pro/Toll/ /Cer*2/Toll/3/5106/6/AwBlack/Aths//Arar/3/9Cr279-07/Roho/7/Robur- Bar/142-B//Astrix/Sutter332-3	SICB12-0628-OTR-OTR-025KF-015AREC-2AREC-OKF
67	Alanda/5/Aths/4/Pro/Toll//Cer*2/Toll/3/5106/6/Baca'S'/3/AC253//CI08887/ CI05761/7/Alanda/5/Aths/4/Pro/Toll//Cer*2/Toll/3/5106/6/CalMr/CI16155	SICB12-0539-OTR-OTR-025KF-015AREC-4AREC-OKF
68	BEKA/Harmal	HIICB14-065-OTR-OMR-OMR-OMR-3MR
69	Tadmor//Roho/Mazurka/3/Tadmor/5/Arig8/Imperial//M7/3/Rt013/4/Aland a-01	SICB12-0606-OTR-OTR-030KF-015AREC-2AREC-OKF
70	Tadmor//Roho/Mazurka/3/Tadmor/4/WI2291/Tadmor/8/Zanbaka/5/Pitayo/ Cam//Avt/RM1508/3/Pon/4/Mona/Ben//Cam/6/Moroc9- 75/ArabiAswad/7/WI2291/Tadmor	SICB12-0285-OTR-02TR-030KF-015AREC-1AREC-OKF
71	Nawair-1/9/PETUNIA 1/8/POST/COPAL/5/GLORIA-BAR/4/SOTOL//2762/BC- B/3/11012-2/TERN-B//H272/6/SIND89A-148/7/CARDO	SICB12-0831-OTR-OTR-030KF-015AREC-2AREC-OKF
72	IPA7/4/AwBlack/Aths//Arar/3/9Cr279-07/Roho/5/Rhn- 03//Lignee527/As45/6/Barque/Arta	SICB12-0081-OTR-OTR-030KF-015AREC-1AREC-OKF
73	HB120/Nawair-01	HIICB14-083-OTR-OMR-OMR-OMR-5MR

74	WI2291/3/CIO3309/Attiki//Hja33/4/Gustoe/5/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/6/Mundah/5/ALPHA-BAR/DURRA//CORACLE/3/ALELI/4/AF9205	SICB12-0338-OTR-OTR-030KF-015AREC-1AREC-OKF
75	Express/RD2668	SICB12-0801-OTR-OTR-030KF-015AREC-5AREC-OKF
76	DWR28/RD2668	SICB12-0781-OTR-OTR-030KF-015AREC-5AREC-OKF
77	Algeria 2012/C-6499	SICB12-0919-OTR-OTR-030KF-015AREC-3AREC-OKF
78	HB120/Manal	HIICB14-085-OTR-OMR-OMR-OMR-5MR
79	Rihane-03/3/As46/Aths*2//Aths/Lignee686/4/Alanda-01/6/WI2291/3/CIO3309/Attiki//Hja33/4/Gustoe/5/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor	SICB12-0396-OTR-OTR-030KF-015AREC-2AREC-OKF
80	ER/Apm/Harmal	ICB11-0114-OAP-030AREC-020TR-015AREC-3AREC-OKF
81	Namoi/T-6669	SICB12-0865-OTR-OTR-030KF-015AREC-2AREC-OKF
82	Lignee527//Bahtim/DL71/3/Api/CM67//Mzq/5/Alanda-01/4/WI2291/3/Api/CM67//L2966-69/6/Lignee527/Chn-01//Arar/Rhn-03/7/WI2291/3/CIO3309/Attiki//Hja33/4/Gustoe/5/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor	SICB12-0387-OTR-OTR-030KF-015AREC-3AREC-OKF
83	Roho/4/Zanbaka/3/ER/Apm//Lignee131/5/ArabiAbiad/Arar//H.spont.41-5/Tadmor/6/ArabiAbiad/Arar//H.spont.41-5/Tadmor/3/ArabiAbiad/Arar//H.spont.41-5/Tadmor	SICB12-0239-OTR-OTR-030KF-015AREC-1AREC-OKF
84	ArabiAbiad/Arar//H.spont.41-5/Tadmor/3/ArabiAbiad/Arar//H.spont.41-5/Tadmor/4/Mo.B1337/WI2291//Moroc9-75/3/Hml	SICB12-0223-OTR-OTR-030KF-015AREC-3AREC-OKF
85	Tantangara/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor*2/8/Zanbaka/5/Pitayo/Cam//Avt/RM1508/3/Pon/4/Mona/Ben//Cam/6/Moroc9-75/ArabiAswad/7/WI2291/Tadmor	SICB12-0298-OTR-OTR-030KF-015AREC-5AREC-OKF
86	Furat-3/7/Clipper//WI2291*2/WI2269/6/Moroc9-75/Hml-02/5/Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml	SICB12-0217-OTR-OTR-030KF-015AREC-2AREC-OKF
87	AC-6629/T-6669	SICB12-0885-OTR-OTR-030KF-015AREC-3AREC-OKF
88	Gobernadora/Nawair-1	SICB12-0703-OTR-OTR-030KF-015AREC-1AREC-OKF
89	UC1134/11HB44	UCD14-180-OUCD-OUCD-OMR-OMR-4MR
90	11HB13//UC1134/1047	UCD14-175-OUCD-OUCD-OMR-OMR-4MR
91	TAMALPAIS / 11HBSN44	UCD013-069-0CD-0CD-0CD-OMR-8MR
92	11HB13 // UC 1134/ UC 1047	UCD013-006-0CD-0CD-0CD-OMR-5MR
93	WI3167/4/ALISO/C13909-2//HB602/3/MOLA/SHYRI//ARUPO*2/JET/5/DD-21/WI3257	ICB10-0600-OAP-020TR-1AREC-OTR
94	BF891M-617//Aths/Lignee 686/4/Ssn/Badia//Arar/3/Gloria'S'/Copal'S'	ICB06-1300-1AP-OAP-OTR-2AREC-OTR
95	Atahualpa/Chigwell	HIICB10-0009-OAP-OTR-OMR-9MR
96	Atahualpa//Hml/Tadmor	ICB06-1094-26AP-OAP-OTR-1AREC-OTR
97	Giza129/Badia	ICB10-0750-OAP-020TR-7AREC-OTR
98	ICNB93-369/6/Viringa'S'//WI2291/WI2269/5/Atahualpa/4/300Union/Sv73608//Perugia/3/W28G15-1-N/Weihestephane173	ICB06-1246-2AP-OAP-OTR-3AREC-OTR
99	Giza130/Alanda-01	ICB10-0760-OAP-020TR-1AREC-OTR
100	Atahualpa/DD-21/4/Atahualpa/3/Mo.B1337/WI2291//Moroc9-75	ICB10-0618-OAP-020TR-4AREC-OTR
101	WI3167/6/ANCA/2469//TOJI/3/SHYRI/4/ATACO/5/ALELI/7/Schooner/Babunj//Noor68/Kataf	ICB06-1181-20AP-OAP-OTR-1AREC-OTR
102	WI3167/6/ANCA/2469//TOJI/3/SHYRI/4/ATACO/5/ALELI/7/BKFMaguelone1604/3/Apro//Sv.02109/Mari/4/Giza119/5/Shyri	ICB06-1180-37AP-OAP-OTR-1AREC-OTR
103	WI3167/4/ALISO/C13909-2//HB602/3/MOLA/SHYRI//ARUPO*2/JET/5/NB1054/Aleli//Gairdnaer	ICB10-0598-OAP-020TR-1AREC-OTR
104	Atahualpa/ICNB93-369	ICB10-0557-OAP-020TR-8AREC-OTR
105	Atahualpa/IraqiBlack/7/WI3159/6/ANCA/2469//TOJI/3/SHYRI/4/ATACO/5/ALELI	ICB10-0671-OAP-020TR-3AREC-OTR
106	CEV 96060//BUCK M8.88/E.ACACIA/3/CANELA/4/LOGAN-BAR/ALELI//AZAF	RSI/ICJ11-12B079S-47CJ-05CH-05CJ-7CH-0CJ-OMR
107	GRACE/3/PENCO/CHEVRON-BAR//ATAH92/GOB	ICM1213CJ15-74CJ-010CH-05CJ-8CH-OMR
108	MSEL/ND19098-1//CANELA/3/Sebastian	HIICB12-194-OTR-OTR-OMR-OMR-6MR
109	ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PACO/7/M122	HIICB12-484-OTR-OTR-OMR-OMR-6MR
110	LOGAN-BAR/MSEL//AZAF/3/BICHY2000/SHENMAI NO.3	HIICB12-048-OTR-OMR-OMR-OMR-10MR
111	BBSC/CONGONA/5/LEGACY/4/TOCTE//GOB/HUMAI10/3/ATAH92/ALELI/6/PFC9214//PENCO/CHEVRON-BAR	HIICB12-518-OTR-OTR-OMR-OMR-6MR
112	GRACE/3/PENCO/CHEVRON-BAR//ATAH92/GOB	ICM1213CJ15-11CJ-010CH-05CJ-7CH-OMR
113	VARBERG//Canela	HIICB12-056-OTR-OTR-OMR-OMR-3MR
114	SARA1-BAR/CAPUCHONA 20//M122	HIICB12-504-OTR-OTR-OMR-OMR-8MR
115	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M9846//CCXX14.ARZ3/PACO/3/PALTON/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M111/7/LEGACY/3/SVANHALS-BAR/MSEL//AZAF/GOB24DH	HIICB12-302-OTR-OTR-OMR-OMR-9MR

116	L94(Ryd3)//MSEL/Butta12-96	UCD13-025-OMR-OMR-1MR
117	MADRE SELVA/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/BRS180	ICM13CH11-40CH-05CJ-010CH-OMR
118	LIMON/BICHY2000//DEFRA/DESCONOCIDA-BAR/3/SHEINMAI NO.3/MSEL	HIICB12-481-OTR-OMR-OMR-OMR-4MR
119	ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PACO/7/ESMERALDA/3/SLO/ROBUST//QUINA/4/M104	HIICB12-528-OTR-OTR-OMR-OMR-3MR
120	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA/7/ESMERALDA/3/SLO/R OBUST//QUINA/4/M104	HIICB12-546-OTR-OMR-OMR-OMR-6MR
121	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/BRS180/7/TOCTE	IBM12CH206-9CH-05CJ-010CH-10CJ-0CH-OMR
122	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA/7/ESMERALDA/3/SLO/R OBUST//QUINA/4/M104	HIICB12-546-OTR-OMR-OMR-OMR-7MR
123	ATAHUALPA//M122	HIICB12-436-OTR-OTR-OMR-OMR-2MR
124	ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PACO/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M9846//CCXX14.ARZ3/PACO/3/PALTON	HIICB12-296-OTR-OMR-OMR-OMR-2MR
125	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/CARDO/BRS180	HIICB12-382-OTR-OTR-OMR-OMR-8MR
126	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/BASC/CONGONA/5/LEGACY/4/TOCTE//GOB/HUMAI10/3/ATAH92/ALELI	HIICB12-392-OTR-OMR-OMR-OMR-10MR
127	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA	HIICB12-383-OTR-OMR-OMR-OMR-5MR
128	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M9846//CCXX14.ARZ3/PACO/3/PALTON/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M111/7/LEGACY/3/SVANHALS-BAR/MSEL//AZAF/GOB24DH	HIICB12-302-OTR-OTR-OMR-OMR-9MR
129	LOGAN-BAR/MSEL//AZAF/4/AF9216/3/ZHEDAR#1/SHYRI//OLMO	HIICB12-042-OTR-OTR-OMR-OMR-2MR
130	MSEL/LA MOLINA 95//BRS195/ND19098-1	HIICB12-445-OTR-OMR-OMR-OMR-5MR
131	Atahualpa//BICHY2000//GOB/HUMAI10	HIICB12-405-OTR-OMR-OMR-OMR-8MR
132	DATCHA/3/MSEL/ND19098-1//CANELA	ICM1213CJ26-5CJ-010CH-05CJ-8CH-OMR
133	MSEL/LA MOLINA 95//SHAKIRA	HIICB12-226-OTR-OMR-OMR-OMR-8MR
134	PFC9202//LM 844/QUILMES PAMPA/3/CANELA/4/SHAKIRA	HIICB12-215-OTR-OTR-OMR-OMR-8MR
135	DATCHA/3/MSEL/ND19098-1//CANELA	ICM1213CJ26-22CJ-010CH-05CJ-4CH-OMR
136	CLASS//SHAKIRA	HIICB12-085-OTR-OMR-OMR-OMR-10MR
137	Carbo/Hamra/4/Rhn-08/3/DeirAlla106//DL71/Strain205/5/QB813-2/5/Aths/Lignee686/4/Rhn-03/3/Bc/Rhn//Ky63-1294	ICB09-0528-OAP-OAP-025AUB-3AUB-OMR
138	Baca'S'/3/AC253//CI08887/CI05761/4/Cen/Bglo'S'/5/Hma-02//11012-2/CM67/3/Arar/4/IPA265	ICB09-0093-OAP-OAP-025AUB-2AUB-OMR
139	Soufara-02/3/RM1508/Por//WI2269/4/Hml-02/ArabiAbiad//ER/Apm/5/Harmal	ICB10-1118-OAP-035AUB-020TR-3AUB-OMR
140	Rhn-03/Eldorado/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda/6/Baca'S'/3/AC253//CI08887/CI05761/4/Cen/Bglo'S'	ICB09-0552-OAP-OAP-025AUB-2AUB-OMR
141	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/BRS180/7/TOCTE	IBM12CH206-9CH-05CJ-010CH-10CJ-0CH-OMR
142	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA/7/ESMERALDA/3/SLO/R OBUST//QUINA/4/M104	HIICB12-546-OTR-OMR-OMR-OMR-7MR
143	ESMERALDA/3/SLO/ROBUST//QUINA/4/M104/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA	HIICB12-279-OTR-OTR-OMR-OMR-2MR
144	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M9846//CCXX14.ARZ3/PACO/3/PALTON/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/M111/7/LEGACY/3/SVANHALS-BAR/MSEL//AZAF/GOB24DH	HIICB12-302-OTR-OMR-OMR-OMR-7MR
145	R.T.RAMAGE/6/ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PACO	HIICB12-338-OTR-OTR-OMR-OMR-10MR
146	P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA	HIICB12-383-OTR-OMR-OMR-OMR-5MR
147	CANELA//E.ACACIA/DEFRA/4/CLI18/E.QUEBRANCHO//E.QUEBRANCHO/NCL 95109/3/CANELA	RSI/ICJ11-12B017S-23CJ-05CH-05CJ-9CH-0CJ-OMR
148	Melusine/Aleli/3/Matico/Jet//Shyri/4/Canela/5/MADRE SELVA	ICB11-0163-OMC-OMC-OMC-8MR

149	NACKTA/HJA A33//FNC1/3/Sebastian	HIICB12-265-OTR-OMR-OMR-OMR-2MR
150	C2-C8//UC1134//Lacey	UCD13-027-OUCD-OUCD-OMR-OMR-2MR
151	UC1134/UC969//Madera/UC937	UCD13-040-OUCD-OUCD-OMR-OMR-8MR
152	UC1134/UC969//Madera/UC937	UCD13-040-OUCD-OUCD-OMR-OMR-3MR
153	Clipper/Volla/3/Arr/Esp//Alger/Ceres362-1-1/4/Hml/5/Atahualpa/DD-21	ICB11-0313-OMC-OMC-OMC-1MR
154	UC1135//UC1134/Lacey	UCD13-024-OUCD-OUCD-OMR-OMR-9MR
155	UC1135//UC1134/Lacey	UCD13-079-OUCD-OUCD-OMR-OMR-2MR
156	Giza130/Alanda-01	ICB10-0760-0AP-020TR-2AREC-0TR
157	Atahualpa//Hml/Tadmor	ICB06-1094-21AP-0AP-0TR-1AREC-0TR
158	Saesea/4/Viringa'S//WI2291/WI2269/3/Viringa'S'	ICB06-1207-5AP-0AP-0TR-1AREC-0TR
159	WI3167/6/ANCA/2469//TOJI/3/SHYRI/4/ATACO/5/ALELI/7/Viringa'S//WI2291/WI2269/3/Viringa'S'	ICB06-1196-14AP-0AP-0TR-3AREC-0TR
160	Doña Josefa/ND25160	RSI/ICJ11-12B111S-4CJ-05CH-05CJ-10CH-0CJ-OMR
161	ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PA CO/7/M122	HIICB12-484-OTR-OTR-OMR-OMR-6MR
162	ATACO/BERMEJO//HIGO/3/CALI92/ROBUST/4/PETUNIA 1/5/PETUNIA 1/CHINIA/3/ATACO/BERMEJO//HIGO/6/ZIGZIG/3/M9846//CCXX14.ARZ3/PA CO/7/P.STO/3/LBIRAN/UNA80//LIGNEE640/4/BLLU/5/PETUNIA 1/6/ZIGZIG/4/EGYPT4/TERAN78//P.STO/3/QUINA	HIICB12-297-OTR-OMR-OMR-OMR-7MR
163	Rhn-03/Eldorado/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda/6/ICB_119151	ICB09-0556-0AP-0AP-025AUB-4AUB-OMR
164	WI2269/Espe/3/WI2291/Bgs//Hml-02/6/Moroc9-75/Hml/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131	ICB10-1038-0AP-035AUB-020TR-4AUB-OMR
165	Soufara-02/3/RM1508/Por//WI2269/4/Hml-02/ArabiAbiad//ER/Apm/5/Harmal	ICB10-1118-0AP-035AUB-020TR-3AUB-OMR
166	4-1MBN11/3/CANELA//E.ACACIA/DEFRA	RSI/ICJ11-12B202S-60CJ-05CH-05CJ-1CH-0CJ-OMR
167	4-1MBN11/2/AZAF/MSEL	RSI/ICJ11-12B200S-10CJ-05CH-05CJ-1CH-0CJ-OMR
168	Rhn-03/Eldorado/5/Rhn-03//Lignee527/NK1272/4/Lignee527/Chn-01/3/Alanda/6/Aths/Lignee686/4/Avt/Attiki//Aths/3/Giza121/Pue	ICB09-0576-0AP-0AP-025AUB-4AUB-OMR
169	AZAFRAN/4/CL118/E.QUEBRANCHO//E.QUEBRANCHO/NCL95109/3/CANELA	RSI/ICJ11-12B093S-2CJ-05CH-05CJ-5CH-0CJ-OMR
170	CANELA//E.ACACIA/DEFRA/4/CL118/E.QUEBRANCHO//E.QUEBRANCHO/NCL 95109/3/CANELA	RSI/ICJ11-12B017S-2CJ-05CH-05CJ-2CH-0CJ-OMR
171	4-1MBN11/3/CANELA//E.ACACIA/DEFRA	RSI/ICJ11-12B202S-39CJ-05CH-05CJ-10CH-0CJ-OMR
172	HB120/DWR28	HIICB14-095-OTR-OMR-OMR-OMR-2MR
173	Bodrga/Nawair-01	HIICB14-224-OTR-OMR-OMR-OMR-2MR
174	Tocada/DWRUB52	HIICB14-160-OTR-OMR-OMR-OMR-7MR
175	SLB21-81/SLB22-74//Mutant line No 6	SICB12-0594-OTR-OTR-030KF-015AREC-2AREC-OKF
176	T-6669/7/Moroc9-75/ArabiAswad/6/Ci07117-9/DeirAlla106//Bda/3/Arar/5/11012-2/Impala//Birence/3/ArabiAbiad/4/5604/1025	SICB12-0903-OTR-OTR-030KF-015AREC-3AREC-OKF
177	Mo.B1337/WI2291//Moroc9-75/3/Hml/4/Weeah11//WI2291/Bgs/3/ER/Apm//AC253	SICB12-0251-OTR-OTR-030KF-015AREC-1AREC-OKF
178	Arta/3/Legia/Laurel'S//Aleli/4/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/5/Zanbakian/6/Arta/3/Hml-02//Esp/1808-4L/4/ArabiAbiad/Arar//H.spont.41-5/Tadmor	SICB12-0329-OTR-OTR-030KF-015AREC-3AREC-OKF
179	SHYRI X LAUREL 5 (Both parents BYDV-RMV resistant)	UCD012-077-0CD-0CD-0CD-0CD-OMR-9MR
180	Sara/9/PETUNIA 1/8/POST/COPAL/5/GLORIA-BAR/4/SOTOL//2762/BC-B/3/11012-2/TERN-B//H272/6/SIND89A-148/7/CARDO	SICB12-0822-OTR-OTR-030KF-015AREC-2AREC-OKF
181	EFES28/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131	ICB11-0260-0AP-030AREC-020TR-015AREC-3AREC-OKF
182	WI2198/Hml-02//INRA55-86-2/Rt1703/3/Hml/4/Weeah11//WI2291/Bgs/3/ER/Apm//AC253	SICB12-0237-OTR-OTR-030KF-015AREC-4AREC-OKF
183	UC 1134 / UC 1047	UCD013-039-0CD-0CD-0CD-OMR-4MR
184	22IBYT7 // UC 1134 / UC 1047	UCD013-038-0CD-0CD-0CD-OMR-2MR
185	UC 1116 / UC 1047	UCD013-015-0CD-0CD-0CD-OMR-7MR
186	UC1118 // UC1116 / YUMA	UCD013-047-0CD-0CD-0CD-OMR-8MR
187	Nadawa/Rhn-03/3/Lignee527/Rihane//Arar/7/AwBlack/Aths//Arar/3/9Cr279-07/Roho/6/Alanda-01/5/Ci01021/4/CM67/U.Sask.1800//Pro/CM67/3/DL70	SICB12-0116-OTR-OTR-025KF-015AREC-5AREC-OKF
188	ROLAND-BAR/PL 172	HIICB14-023-OTR-OMR-OMR-OMR-4MR
189	Alanda-01/3/Alanda//Lignee527/Arar/7/Alanda/5/Aths/4/Pro/Toll//Cer*2/Toll/3/5106/6/Baca'S/3/AC253//Ci08887/Ci05761	SICB12-0552-OTR-OTR-025KF-015AREC-4AREC-OKF
190	As57/DL530//Alanda-01/4/Lignee527/Chn-01//Alanda/3/As57/Kc	SICB12-0420-OTR-OTR-025KF-015AREC-5AREC-OKF
191	QB813-2/5/Aths/Lignee686/4/Rhn-03/3/Bc/Rhn//Ky63-1294/7/Rhn-03/3/Mr25-84/Att//Mari/Aths*3-02/6/Lignee527//Bahtim/DL71/3/Api/CM67//Mzq/5/Alanda-01/4/WI2291/3/Api/CM67//L2966-69	SICB12-0176-OTR-OTR-025KF-015AREC-2AREC-OKF

192	Lignee527/Chn-01//Alanda/3/As57/Kc/6/Lignee527/Chn-01//Alanda/5/Arizona5908/Aths//Avt/Attiki/3/S.T.Barley/4/Aths/Lignee686	SICB12-0451-OTR-OTR-025KF-015AREC-4AREC-OKF
193	Avt/Attiki//M-Att-73-337-1/3/Aths/Lignee686/4/Kabaa/5/Alanda-01/3/Alanda//Lignee527/Arar	SICB12-0475-OTR-OTR-025KF-015AREC-3AREC-OKF
194	Rihane-03/3/As46/Aths*2//Aths/Lignee686/4/Alanda-01/6/WI2291/3/CI03309/Attiki//Hja33/4/Gustoe/5/Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor	SICB12-0396-OTR-OTR-025KF-015AREC-2AREC-OKF
195	10HBSN26 // MADERA / UC937	UCD013-071-0CD-0CD-0CD-0MR-4MR
196	UC 1047 / 11HB44	UCD013-012-0CD-0CD-0CD-0MR-8MR
197	10HBSN26 // MADERA / UC937	UCD013-071-0CD-0CD-0CD-0MR-5MR
198	ISHI / 11HBSN44	UCD013-068-0CD-0CD-0CD-0MR-3MR