Evaluation of some Egyptian wild types of beet (*Beta vulgaris* subsp. *maritima*)

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Abstract

Twenty-six wild types of beet (*Beta vulgaris* subsp. *maritima)* were collected in May / June 1992 from different districts representing the northwestern coast, the delta of Egypt and Upper Egypt. Agronomic observations were taken in 1992 / 93, 1993 / 94 and 1994 / 95 in the Western Nubaria area and in Alexandria, Egypt, and in 1995 in Fargo, North Dakota, USA. The goal was to evaluate the 26 accessions for agronomic traits: germination, leaf colour, growth habit, leaves, roots, bolting, seed-setting and seed-ripening. Differences in these characteristics were found among these accessions in both Egypt and the USA. The 26 accessions of wild beet also were evaluated at six locations in the USA by different evaluators for resistance to curly top, *Rhizoctonia*, leaf spot, cyst nematode, root aphid, rhizomania, virus yellows, root maggot and *Aphanomyces*. Considerable differences were recorded among the 26 accessions in their resistance to the different diseases. The objective of this study was to evaluate the usefulness of these wild types of beet *(B. vulgaris* subsp. *maritima)* in sugar beet (*B. vulgaris* subsp. *vulgaris* L.) breeding programmes in Egypt, the USA and worldwide.

Introduction

Although *B. vulgaris* subsp. *maritima* is considered the most important wild species for the improvement of sugar beet, other wild relatives should be collected, evaluated and utilized. Hijner (1952), Winslow (1954) and Golden (1959) found that three *Procumbentes* species, i.e. *Beta patellaris* Mog., *Beta procumbenes* Chr.Sm. and *Beta webbiana* Mog., were resistant to the cyst nematode, *Heterodera schachtii* Schm., which is the most important nematode pest of sugar beet (Steele 1984). Some success in developing resistance to *H. schachtii* has been achieved through the introgression of *B. patellaris* genes into the sugar beet genome through interspecific hybridization and repeated backcrosses (Savitzky 1975; Speckmann and De Bock 1982; Heibroek *et al.* 1983; Löptien 1984).

Collecting of the wild relatives of beet began many years back. The first US efforts were by George H. Coons of the USDA-ARS in 1925 (Coons 1975). He collected seed of *B. vulgaris* subsp. *maritima* along the coasts of southwestern France, the southeastern coast of England, and the coast of Italy near the mouth of the Po River. Another collecting expedition of his in 1935 went to England, France, Spain, Portugal, the Madeira Islands, the Canary Islands, Italy, Greece and Turkey.

Wild relatives and landraces of *Beta* are found in China, India, Central and European Asia; along the Mediterranean Coasts of Europe and Africa, and the European shores of the Atlantic Ocean. The first historical documentation of *Beta* germplasm collecting was by Munerati (Biancardi and Biaggi 1979). In Egypt, sugar beet production and breeding research began less than 15 years ago. Collecting of wild beet (*B. vulgaris* subsp. *maritima*) from Egypt was jointly initiated by M.A. El Manhaly (Egypt) and D.L. Doney (USA) in 1990 and the first

collecting was done by El Manhaly, Badawy and Doney in 1992. Twenty-six accessions were collected at that time.

The objective of this study was to evaluate the 26 accessions for utilization in sugar beet breeding programmes in Egypt, the USA and worldwide.

Materials and methods

Twenty-six accessions of wild beet (*B. vulgaris* subsp. *maritima)* were collected in May/June 1992 from three different districts in Egypt: (1) the northwestern coast, (2) the delta of the Nile, and (3) Upper Egypt. The seeds were divided between Sugar Crops Research Institute, Giza, Egypt and USDA Agricultural Research Service as cooperative research partners. Passport data for the 26 accessions are given in Table 1.

Evaluation of agronomic traits

Egypt

In November 1992, each of the 26 accessions was planted in one 10.5-m^2 plot at the Nubaria Agricultural Research Station (NARS). Seed was sown on 14 November 1992. Counts were taken 3 weeks later for percentage germination. Observations on the other traits, such as growth habit, leaf erectness, leaf blade pigmentation, hypocotyl colour, bolting percentage and dates, seed-setting date, male sterility and germs/ball were made in January, February and March 1993. In November 1993, 26 pots of 50-cm diameter were used to study the flowering at Alexandria. Observations were made on the same date as for the 1992 study. At the end of December 1994, the previous experiment was repeated to study the effect of planting date on the flowering of wild types of beet.

USA

The 26 accessions were planted in Fargo, North Dakota on 18 May 1995. The following were recorded: growth habit, leaf erectness, leaf blade pigmentation, leaf hairiness, leaf thickness, petiole length (mm), petiole width (mm), leaf blade length (mm), leaf blade width (mm), petiole colour, hypocotyl pigmentation, external root colour, main colour flesh, root shape, flower stern pigmentation, male sterility, multigerm, and bolting tendency (% on given dates). Most observations were made in late July. The percent of plants bolting was measured on 22 June and 20 July.

Evaluation for diseases and insect resistance in the USA

With the exception of WB 1001, 1002, 1006, 1007 and 1015, the accessions were evaluated for disease resistance. Table 2 lists the evaluators, locations and diseases for which they were evaluated.

Results and discussion

Evaluation for agronomic traits

Egypt

Table 3 list the values for the agronomic traits of the 26 accessions evaluated in Egypt. Percentage germination differed among the accessions. The highest

germination rates were for the Upper Egypt *maritima*, which ranged between 88 and 94%. Four accessions from the Delta (WB 1008, 1010, 1011 and 1012) ranged

Table 1. Egyptian collection of *Beta vulgaris* subsp. *maritima*, 1992. See key below for column definitions

1	2	4	5	6	7	8	9	10	11	13	14	15
WB1001	05/15	Matruth	Matruth	120E	31.1N	27.0E	20	BK	200	2	6	Collected by Manhaly
WB1002	04/20	Behira	Damanhur	170W	30.8N	29.4E	30	BK	9000	2	2	Collected by Manhaly
WB1003	05/28	Noubaria	Village 15	0.50NW	30.7N	29.3E	25	BK	5000	2	2	Collected by Manhaly, believed to have come in water from Delta
WB1001	06/22	Noubaria	Village 15	0.6W	30.7N	29.4E	25	SP	6000	2	2	On ditch bank, believe came in water from Deha
WB1005	06/23	Matruh	Al Metane	4.ON	31.5N	26.5E	20	SP	500	2	6	Around 5-yr-old greenhouse
WB1006	06/24	Dabah	Dabah	1.OE	31.1N	27.7E	25	SP, BK	25	1	2	95 km east of Matruh, around greenhouse
WB1007	06/24	El Hamem	El Omiad	I.OS	30.8N	29.0E	30	SP	10	2	3	3 km south of Hotel Adia, between greenhouses
WB1008	06/25	Alexandria	Village 2	area	31.0N	30.2E	25	SP, BK	50	1	12	Along ditch by garbage dump
WB1009	06/25	Alexandria	Village 1	area	31.0N	30.2E	25	SP, BK	200	2	12	Along ditch bank, many plants, dry
WB1010	06/25	Alexandria	Village 3	area	31 0N	30.2E	25	SP, BK	500	2	12	Along canal bank
WBI011	06/25	Alexandria	Village 4	main	31.0N	30.2E	25	SP, BK	5000	2	12	A few groups along canal
WB1012	06/25	Alexandria	Village 7	one	31.0N	30.2E	25	SP, BK	5000	2	12	Along canal, 1 green with red seed, & prostrate
WB1013	06/26	Alexandria	Village 10	area	31.0N	30.2E	15	SP, BK	5000	2	1	Very large field, seg stem, seed & growth habit
WB1014	06/26	Alexandria	Village 7	area	31 0N	30.2E	15	BK, SP	5000	2	1	Scattered along bank of ditch
WB1015	06/27	KafrAsh	Shaykh	3KW	31.1N	30.9E	15	BK	5000	2	12	Large group planted for comparison with SB
WB1016	06/27	Kafr Ash	Shaykh	1KW	31.1N	30.9E	15	BK	5000	2	12	Many small dry plants along ditch
WB1017	06/7	Bela	El Owywa	1KNW	31.1N	31.2E	15	BK, SP	5000	2	12	Scattered along bank of ditch
WB1018	06/7	Dumyat	Kafr Saad		31.3N	31.5E	15	BK, SP	500	2	12	Around greenhouses, very dry
WB1019	06/28	Port Said	Ext. Farm	area	31.1N	32.2E	15	BR	500	2	3	Plants scattered around greenhouses
WB1020	06/28	Port Said		31KS	30.8N	32.2E	15	BK	5000	2	3	Port Said Agric. Project, around greenhouses
WB1021	06/29	Fayum	Abo Khalaf	Farm	29.2N	30.9E	25	SP	500	2	2	Along canal bank
WB1022	06/29	Fayum	Harfosh	Farm	29.2N	30.9E	25	BK	5000	2	2	Small field planted by farmer for green veg.
WB1023	06/29	Baru Suwaf	El Azhary		29.0N	31.0E	25	SP	25	1	2	Plants by bridge, some coll. by family nearby
WB1024	07/01	Luxor	El Awania	Nile	25.3N	32.7E	82	BK	1000		12	Col. by farmer in May to plant for green veg.
WB1025	07/01	Luxor	El gamal		25.1N	32.6E	82	SP, BK	5000		12	Along Nile, neighbour children brought some plants
WB1026	07/01	Luxor	El Odysat		25.0N	32.5E	82	BK			12	Annant, coll. by farmer to sell at market

Col.	Type	Name/description
1	text 6	Wb number
2	text 5	Date of collecting
3	text 3	Subspecies name
4	text 10	Government (country)
5	text 10	Nearest town or city name
6	text 5	Distance in km from the nearest city or town
7	text 6	Latitude (N or S)
8	text 6	Longitude (E or W)
9	numeric	Altitude in meters
10	text 6	Sampling method (SP=single plant or BK=bulk)
11	numeric	Sampling area in square meters
12	numeric	Plants sampled - number
13	numeric	Uniformity (1=uniform, 2=segregating, 3=mixed)
14	numeric	Soil texture (1= clay, 2=silt, 4=fine sand, 6=coarse sand, 7=fine sand)
15	text 48	Notes

Table 2. List of evaluators, locations and descriptors evaluated

Evaluator	Location	Descriptor
A. Anderson	Fargo, ND	Root maggot
BSDF (T. Brown)	Twin Falls, ID	Curly top virus
C. Rush	Bushland, TX	*Aphanomyces*
D. Doney	Fargo, ND	Agronomic
E. Ruppel	Fort Collins, CO	*Rhizoctonia*
E. Ruppel	Fort Collins, CO	*Cercospora*
J. Michels	Bushland, TX	Root aphids
R. Lewellen	Salinas, CA	BWYV, rhizomania
S. Hafez	Parma, ID	Nematode

between 80 and 90% in germination. The germination of the remaining accessions was less than 80%. No observations were taken in 1995 owing to poor germination in the field.

Bolting: The Delta '*maritima*' flowered during the last 10 days of January, while the Fayum, Bani suwaf and Luxor types flowered 1 month later. Seed-setting occurred in February and March, respectively, for the groups.

Growth habit: With the exceptions of WB 1004 and 1013, the Delta '*maritima*' were all prostrate. WB 1004 was erect and prostrate and WB 1013 was procumbent and erect. The Fayum, Bani suwaf and Luxor types were erect to procumbent.

Hypocotyl pigmentation: Pink to red in all accessions.

Male sterility: None of the accessions was male sterile.

Germ: All accessions were multigerm and number of germs/ball ranged between two and four.

Leaf blade pigmentation: Light green to green in all types.

The observations of these traits in the second season (1994) did not differ from these.

USA

Table 4 list the values for the agronomic traits of the 26 accessions evaluated in the USA.

Bolting: Delta '*maritima*' types began bolting very early, some as early as 14 June and by 19 July most had set seed and discontinued pollinating. The Fayum and Luxor '*maritima*' began bolting later and by 20 July were just beginning to flower and pollinate.

Leaf colour: The Fayum and Luxor '*maritima*' were light green to green with no vein pigmentation. The Delta '*maritima*' were dark green. Most had a red central

vein on each leaf. The accession from Matruh (WB 1005) appeared to have darker red and more red pigmentation (not segregating for green petiole).

Growth habit: The Delta '*maritima*' were all prostrate except WB 1013, which came from a large field of wild beet near Alexandria, and was like the Fayum and Luxor accessions in all characteristics. The Fayum and Luxor '*maritima*' were erect to procumbent.

Leaves: The Delta '*maritima*' had very small leaves except as mentioned in 'Growth habit' above but the Matruh accession (WB 1005) had rounder leaves than the rest.

Roots: The Delta '*maritima*' were small in diameter and very 'sprangled'. The Fayum and Luxor '*maritima*' were sprangled but slightly swollen and larger in diameter than the Delta accessions. One accession from Luxor and one from Fayum contained some red beets that appeared to have been physically mixed.

Summary

There are basically two groups: Delta (North Atlantic type prostrate, small thick leaves, no leaf hairs) and the Luxor/Fayum (segregating for leaf size and shape, growth habit, root swelling, bolting and red types). The Luxor and Fayum accessions may have been leaf type crosses or mixed with Delta types in earlier generations (especially the two accessions with red (garden) types). The Luxor accessions have a higher frequency of procumbent-smaller leaf types than the Fayum accessions. An unusual mutant was noted in one plant of accession WB 1008. Part of the plant was normal and part had very deformed flowers and lighter foliage. The deformed flowers appeared to have reduced or extremely small aborted anthers and the ovaries were closed into a tube.

Evaluation for disease and pest resistance

Table 5 presents the evaluation data for resistance to curly top, *Rhizoctonia*, Cercospora leaf spot, sugar beet cyst nematode, root aphid, rhizomania, virus yellows, root maggot and *Aphanomyces*. The following reports of the evaluators summarize the behaviour of the Egyptian *B. vulgaris* subsp. *maritima* concerning disease resistance.

Key for Table 3:

1 Num = number of plants/plot
2 Grow H = growth habit: 1 = erect; 2 = erect and procumbent; 3 = procumbent; 4 = erect and prostrate; 5 = prostrate.
3 Leaf E = leaf erectness: 1 = prostrate; 2 = procumbent; 3 = erect.
4 LPig = Leaf blade pigmentation: 1 = light green; 2 = green; 3 = green red mixture; 4 = red.
5 Hyc = hypocotyl pigmentation: 1 = green; 2 = pink; 3 = red; 4 = mixed.
6 Bolt% = bolting percent and date.
7 Seed S% = seed-setting date.
8 Seed R Date = seed-ripening date.
9 MS = male sterility: 1 = fertile; 2 = semisterile; 3 = sterile.
10 Germ no/ball = number of germs/ball.

Table 3. Evaluation of agronomic traits in Egypt, 1993

Code WB number	1 Num	2 Grow H	3 Leaf E	4 LPig	5 Hyc
WB 1001	57	5	6	2	2
WB 1002	48	5	8	2	3
WB 1003	62	5	2	2	2
WB 1004	49	4	3	2	2
WB 1005	52	5	8	2	2
WB 1006	37	5	2	2	3
WB 1007	75	5	7	2	3
WB 1008	80	5	9	2	3
WB 1009	78	5	2	2	2
WB 1010	88	5	2	2	3
WB 1011	90	5	1	2	2
WB 1012	82	5	1	2	3
WB 1013	67	3 & 4	8	2	2
WB 1014	32	5	6	2	2
WB 1015	27	5	7	2	2
WB 1016	35	5	9	2	3
WB 1017	61	5	2	2	3
WB 1018	75	5	8	2	3
WB 1019	78	5	3	2	3
WB 1020	75	5	2	2	3
WB 1021	68	1 & 2	3 & 5	2	3
WB 1022	72	1 & 2	2	1 & 2	3
WB 1023	90	2	8	2	3
WB 1024	92	2	7	2	3
WB 1025	88	1 & 2	2	1 & 2	3
WB 1026	94	1 & 2	9	1 & 2	3

Code	6 Bolt%	Date	7 Seed S%	8 Seed R Date	9 MS	10 Germ no/ball
WB 1001	100	22.1	20.2	15.4	1	3 & 4
WB 1002	100	22.1	20.2	15.4	1	3
WB 1003	100	22.1	20.2	15.4	1	3
WB 1004	100	18.1	20.2	15.4	1	4
WB 1005	100	28.1	20.2	15.4	1	2 & 3
WB 1006	100	30.1	25.2	15.4	1	2 & 3
WB 1007	100	30.1	25.2	15.4	1	3
WB 1008	100	31.1	30.2	25.4	1	4
WB 1009	100	28.1	30.2	25.4	1	2 & 3
WB 1010	100	27.1	20.2	20.4	1	3 & 4
WB 1011	90	26.2	25.2	25.4	1	2 & 3
WB 1012	100	28.1	20.2	20.4	1	3
WB 1013	100	30.1	20.2	20.4	1	4
WB 1014	70	30.1	20.2	20.3	1	3 & 4
WB 1015	100	30.1	25.2	20.3	1	3
WB 1016	100	30.1	25.2	20.3	1	2 & 3
WB 1017	100	30.1	25.2	20.3	1	3
WB 1018	100	20.1	28.2	25.3	1	3
WB 1019	100	20.1	20.2	25.3	1	4
WB 1020	100	20.1	20.2	25.3	1	3 & 4
WB 1021	100	25.1	20.3	10.4	1	3 & 4
WB 1022	100	26.2	20.3	10.4	1	2
WB 1023	100	24.2	25.3	25.4	1	3
WB 1024	100	28.2	20.3	20.4	1	3
WB 1025	100	1.3	25.3	20.4	1	2 & 3
WB 1026	100	28.2	20.3	20.4	1	2 & 3

Table 4. Agronomic data for the Egyptian collection of *Beta vulgaris* subsp. *maritima* taken at Fargo, North Dakota USA in 1995

			Leaf E	Leaf		Lf	Pet L	Pet W	Blade L	Blade W
WB 1001	S62579	5	1	2	0	6	40	5-7	85-100	50-60
WB 1002	562580	5	1	2	0	6	40-70	5-8	80-95	50-70
WB 1003	562581	5	1	2	0	6	35-65	5-7	75-100	50-65
WB 1004	562583	5	1	2	0	6	30-75	5-7	80-110	55-75
WB 1005	562583	5	1	2	0	6	35-50	5-7	65-110	55-75
WB 1006	562583	5	1	2	0	6	30-50	5-7	55-90	35-60
WB 1007	562585	5	1	2	0					
W8 1008	562586	5	1	2	0	6	35-60	5-8	65-105	40-80
WB 1009	562587	5, few 1	1, few	2	0	6	35-60	6-7	75-105	60-75
WB 1010	562588	5	1	2	0	6	35-90	6-7	75-125	55-80
WB 1011	562589	5	1	2	0	6	35-50	5-7	80-90	50-70
WB 1012	562590	5	1	2	0	6	35-50	5-8	75-95	50-80
WB 1013	562591	1, few 3	8	1,	0	4	90-260	7-14	140-270	120-180
WB 1014	562592	5	1	2	0	6	35-60	6-7	85-105	60-75
WB 1015	562593	5	1	2	0	6	35-50	5-6	65-100	45-60
WB 1016	562594	5	1	2	0	6	30-60	5-8	85-100	60-65
WB 1017	562595	5	1	*2*	0	6	40-70	5-7	80-95	60-70
WB 1018	562596	5	1	2	0	6	35-60	5-8	85-95	60-75
WB 1019	562597	5	1	2	0	5 & 6	45-80	5-7	85-120	65-80
WB 1020	562598	5	1	2	0	6	40-70	5-7	85-95	55-70
WB 1021	562599	1, few 3	8 & 6	1 & 2	0	4	65-250	5-14	100-290	50-80
WB 1022	562600	1, few 3	8 & 6	1 & 2	0	4	70-310	7-15	120-260	70-160
WB 1023	562601	2	8 & 6	1 & 2	0	4	60-290	7-15	110-290	80-160
WB 1024	562602	2	8 & 6	1,	0	4	75-160	5-9	75-190	35-115
WB 1025	562603	1 & 2	6 & 8	1,	0	4	45-215	5-13	85-220	55-120
WB 1026	562604	1 & 2	6 & 8	1 & 2	0	4	30-150	4-13	65-275	45-150

Rating descriptors and scales

Growth habit (Grow H): 1 = erect; 2 = erect and procumbent; 3 = procumbent; 4 = erect and prostrate; 5 = prostrate.

Leaf erectness (Leaf E): 1 = prostrate; 5 = procumbent; 9 = erect.

Leaf blade pigmentation (Leaf Pig): 1 = light green; 2 = green; 3 = green red mix; 4 = red.

Leaf hairiness (Hair): 0 = hairs absent; 3 = hairs scarce; 5 = hairy; 7 = very hairy.

Leaf thickness (Lf Thick): 3 = thin; 5 = medium; 7 = thick.

Petiole length (Pet L): (minimum - maximum in mm).

Petiole width (Pet W): (minimum - maximum in mm).

Leaf blade length (Blade L): (minimum - maximum in mm).

Leaf blade width (Blade W): (minimum - maximum in mm).

Petiole colour (Pet Col): 1 = green; 2 = pink; 3 = red; .4 = mixed; 5 = yellow.

Hypocotyl pigmentation (Hy Col): 1 = green; 2 = pink; 3 = red; .4 = mixed.

External root colour (Rt Col): 1 = white; 2 = yellow; 3 = orange; 4 = red; 5 = dark red.

Main colour of flesh (Flesh Col): 1 = white; 2 = yellow; 3 = orange; 4 = red; 5 = purple.

Root shape (Rt Shape): 1 = narrow elliptic; 2 = elliptic; 3 = circular; 4 = broad elliptic; 5 = narrow oblong; 6 = narrow triangular; 7 = non-swollen; 8 = fibrous.

Flower stem pigmentation (Stem Pig): 1 = light green; 2 = green; 3 = green red mix; 4 = red.

Male sterility (MS): 1 = fertile; 2 = semi-sterile; 3 = sterile.

Multigerm (Germ no/ball): number of germs/seedball.

Bolting tendency (% on given date) (Bolt%-Date): first date = 22 June 1995; second date = 20 July 1995.

Table 4. Continued

WB No.	PI No.	Pet Col	Hy Col	Rt Col	FleshCol	Rt Shape	Stem Pig	MS	Germ(no/ball)	Leaf vein	Bolt%-Date
WB 1001	562579	2	3	1	1	7	2	1	3 & 4	Rd, few Gr	100-22/6
WB 1002	562580	2	3	1	1	7	2	1	3 & 4	Gr, few Rd	100 22/6
WB 1003	562581	2	3	1	1	7	2	1	3 & 4	Green	100-22/6
WB 1004	562583	2	2 & 3	1	1	7	2	1	2 & 3	Gr, few Rd	100-22/6
WB 1005	562583	2	3	1	1	7	2	1	2 & 3	Red	100-22/6
WB 1006	562583	2	3	1	1	7	2	1	3 & 2	Gr, few Rd	1100-22/6
WB 1007	562585	2		1	1	7	2	1	3 & 4		100-22/6
W8 1008	562586	2	3	1		7	2	1	2 & 3	Gr, few Rd	100-22/6
WB 1009	562587	2	3	1	1	7	2, few	1	2 & 3	Gr, few Rd	100-22/6
WB 1010	562588	2	3	1	1	7	2	1	3	Gr, few Rd	100-22/6
WB 1011	562589	2	3	1	1	7	2	1	2 & 3	Gr, few Rd	100-22/6
WB 1012	562590	2	3	1	1	7	2	1	3 & 4	Gr, few Rd	100-22/6
WB 1013	562591	1, few 2	2	1	1	7	1, few 2	1	3, 4 & 5	Green	6-2/6 100-20/7
WB 1014	562592	2	3	1	1	7	2, few 3	1	4 & 3	Gr, few Rd	100-22/6
WB 1015	562593	2	3	1	1	7	2	1	3	Green	100-22/6
WB 1016	562594	2	3	1	1	7	2, few 3	1	3 & 2	Gr, few Rd	100-22/6
WB 1017	562595	2	3	1	1	7	2	1	3 & 2	Gr, few Rd	100-22/6
WB 1018	562596	2	3	1	1	7	2	1	3	Gr, few Rd	100 22/6
WB 1019	562597	2 & 1	3	1	1	7	2	1	3 & 4	Green	100-22/6
WB 1020	562598	2	3	1	1	7	2	1	3 & 4	Gr, few Rd	100-22/6
WB 1021	562599	1, few 2	2 & 3	1	1	7	1, few 2	1	2 - 5	Green	25-22/6 100-20/7
WB 1022	562600	1, few 2	2 & 3	1	1	7	1	1	3	Green	40-22/6 100-20/7
WB 1023	562601	1, few 2	2 & 3	1, few 4	1, few 4	7	1, few 3	1	3	Green	50-22/6 100-20/7
WB 1024	562602	1, few 3	3	1, few 4	1, few 4	7	1, few 4	1	2 & 3	Green	50-22/6 100-20/7
WB 1025	562603	1, few 2	3	1	1	7	1, few 2, 4	1	2 & 3	Green	50-22/6 100-20/7
WB 1026	562604	1, few 2	2 & 3	1	1	7	1, few 2	1	2 & 3	Green	50-22/6 100-20/7

Sugar beet root aphid – J. Michels, Texas A&M Bushland Exp. Station
"Three entries, PI 562582 (WB 1004), PI 562681 (WB 1003), and PI 562587 (WB 1009) showed no signs of aphid colonization and scored lower than the resistant check, Seedex 'Ranger'. The presence of level 3 infestation indicates that sugar beet root aphid can colonize the roots, but the absence of any level 4 infestations indicates a possibility of some resistance. All entries in the first run except ACH05 (the susceptible check), PI 562597, and PI 562591 were free of level 4 infestations and therefore may show some signs of resistance. Any entries with level 4 infestations, even in one plant, indicates that the roots are prone to high levels of infestation and would likely be susceptible in the field. In the second run, all entries except PI 562604 and PI 562599 may exhibit some resistance to sugar beet root aphid colonization." (J. Michels, pers. comm.).

Leaf spot - E. Ruppel, USDA-ARS, Fort Collins, CO
"Inoculations were performed on July 7 and 13, and evaluations were made on August 31, September 7, and 14; the peak of the epidemic occurred around September 14. On September 14, means of the resistant and susceptible infernal controls were 3.9 and 5.9 (scale of 0 - 9), respectively, across the nursery. In 1994 (September 2), these means were 3.3 and 4.8, respectively. Means of contributor lines on September 14 ranged from 3.8 to 7.2, compared with 3.0-5.8 in 1994. Coefficients of variation across contributor tests ranged from 5.6-12.3 on September 14, indicating the uniformity of our nursery and the evaluations. PI entries ranged from 4.75 to 9.50 with a mean of 7.29 indicating nothing significantly more than the susceptible check." (E. G. Ruppel, pers. comm.).

***Rhizoctonia* - E. Ruppel, USDA-ARS, Fort Collins, CO**
"The hot, dry weather of late July and August provided ideal conditions for the development of an excellent disease nursery. Differences among entries in all tests were highly significant (P = 0.0001). Mean DIs across all tests for highly resistant FC705-1, resistant FC703, and highly susceptible FC9Ol controls were l.7, 2.1 and 4.3, respectively. Percentages of healthy roots were 51.2, 36.9 and 8.0 for these controls. Percentages of roots in disease classes 0 through 3 were 96.5, 94.9 and 58.2, respectively. The highest and lowest DIs for contributor lines were 6.6 and 0.9, respectively. The DIs of PI entries ranged from 4.75 to 7.00 indicating nothing significantly more resistant than the susceptible check." (E.G. Ruppel, pers. comm.).

Curly top - T. Brown, BSDF, Kimberly, ID
"The 1995 Curly Top Nursery was again conducted in Kimberly, ID. T. Brown continues to serve a Manager and reports directly to T. Schwartz. The official tests in the nursery this year were rated by T. Brown, Dr L. Panella and D. Traveller. It was the general consensus that the 1995 Curly Top nursery was one of the best in many years. The field was treated with good agronomic practices, i.e. fertilizing, irrigation and weed control. The differentiation among lines was excellent, ratings ranging from 2 to 9. This is the first year we have identified any accession exhibiting curly top resistance. Those showing moderate resistance are from the Fayum and Luxor regions and accession WB 1013. These are all more leaf-type accessions." (D. Doney, pers. comm.).

Table 5. Evaluation data for collecting conducted in 1995. Curly top by T. Brown (BSDF), *Rhizoctonia* and Leaf spot by E. Ruppel (USDA), Nematode by S. Hafez (U. of Idaho), Root aphid by G. Michels (Texas A & M), Rhizomania and Virus Yellows by R. Lewellen (USDA), Root maggot by A. Anderson (North Dakota State U.) and *Aphanomyces* by C. Rush (Texas A & M)

WB code	PI No.	Curly top	*Rhizoctonia*	Leaf spot	Nematode[†]	Root aphid[‡]	Root maggot	*Aphanomyces*
WB 1003	562581	9.0	6.78	9.50	869	1.00	7.0	4.8
WB 1004	562582	9.0	6.37	9.50	683	1.00	7.0	4.6
WB 1005	562583	9.0	7.00	9.50	861	1.67	7.0	4.6
WB 1008	562586	9.0	6.87	9.00	750	2.67	7.0	3.4
WB 1009	562587	9.0	6.23	9.00	799	1.00	7.0	3.6
WB 1010	562588	9.0	6.81	9.00	782	1.92	7.0	5.6
WB 1011	562589	9.0	6.91	9.00	650	2.07	7.0	5.0
WB 1012	562590	9.0	6.78	9.00	921	1.50	7.0	3.6
WB 1013	562591	5.5	5.09	5.50	713	2.73	7.0	6.6
WB 1014	562592	9.0	6.79	9.00	762	2.13	7.0	4.0
WB 1016	562594	9.0	6.91	8.00	789	2.17	7.0	4.6
WB 1017	562595	9.0	7.00	9.00	839	2.33	7.0	3.6
WB 1018	562596	9.0	6.89	9.50	798	2.33	7.0	4.2
WB 1019	562597	7.5	5.03	5.50	759	2.67	7.0	3.4
WB 1020	562598	9.0	6.78	9.00	576	2.33	7.0	4.0
WB 1021	562599	6.5	5.06	5.00	846	2.67	7.0	4.4
WB 1022	562600	6.0	5.39	5.00	784	1.27	7.0	7.6
WB 1023	562601	6.5	5.72	5.00	729	1.54	7.0	6.6
WB 1024	562602	7.0	5.82	4.75	679	2.20	7.0	4.4
WB 1025	562603	6.5	4.75	5.50	433	2.00	7.0	4.6
WB 1026	562604	6.0	6.15	5.00	740	2.47	7.0	3.8
	Susc. Check	6.0	4.70	5.25	594	2.47	7.0	1.5
	Res. Check	4.5	1.30	3.25		1.27	3.0	
	LSD 0.05	0.7	0.93	0.85	NS	0.60		

[†] Average number of cysts in the root-soil system at harvest

[‡] Rating based on: 1= no nymphs or adults present; 2= nymphs present, no adults present; 3= nymphs present, few adults present; 4= nymphs present, many adults present.

Note: Rhizomania and virus yellows evaluation: All lines were very easy bolting and had to be removed in mid-July before hard seed-set. They bolted so rapidly that scoring them in the field was difficult. No information on virus yellows reaction was obtained. When removed from the field, the root system was examined and all appeared to be highly susceptible to rhizomania (BNYVV).

Sugar beet Cyst Nematode - S. Hafez, Univ. of ID, Parma Exp. Station

"Twenty-one sugar beet plant introduction (PI) accessions and the susceptible genotype WS-PM-9 were grown in a greenhouse in the presence of sugar beet cyst nematode. No significant differences between the susceptible check and any of the PIs were found for the number of nematode cysts, eggs or larvae in the soil-root system at harvest."(S. Hafez, pers. comm.).

Conclusions

It could be concluded that some accessions (e.g. WB 1008, 1004 and 1009) could be used in breeding programmes for root aphid resistance. Many authors have come to the conclusion that the *B. vulgaris* subsp. *maritima* types could be use as genetic resources for some disease resistance (Doney and Whitney 1990). Further study of these 26 accessions is planned. New collections of Egyptian *B. vulgaris* subsp. *maritima* will be made this spring from unexplored areas such as: areas surrounding the Red Sea, Sinai, some oases and other locations in Upper Egypt, etc. It is possible that better sources of disease resistance might be found among them.

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