GENETIC IMPROVEMENT OF STONE FRUIT ROOTSTOCKS FOR RESISTANCE TO NEMATODES

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OBJECTIVES

1. Use greenhouse screening procedures for 40 candidate rootstocks to detect sources of root lesion nematode resistance. 2. Challenge 15 candidate rootstocks with ring nematode to identify differences in host suitability. 3. Establish a field site to determine graft compatibility of root lesion nematode resistant candidate rootstocks with standard scion cultivars. 4. Hybridize root lesion nematode resistant germplasm with known sources of root knot resistance during the 1992 bloom.

PROCEDURE

Hardwood cuttings of clonally propagated candidate rootstocks are rooted in a 3:1 sterile mixture of sand:sandy loam soil. Seedlots to be screened are kept in a sterile environment at 4C until the emergence of root tips. All plants entering the lesion nematode screen are potted in a 3:1 mix of sterilized sand:sterile sandy loam soil. This non-organic soil mix is necessary to ensure growth and development of both the *Prunus* candidate rootstock and root lesion nematode.

For optimal results, 32 uniform explants of a candidate rootstock are necessary in the lesion nematode screen. Half the plants are used as uninoculated controls while each of the remaining plants are inoculated with 150 live lesion nematodes. Control and inoculated groups are further sub-divided into a short term (90 day) or long term (150 day) harvest period. Thus, a total of eight plants are sampled for both controls and inoculated at each harvest period.

At the designated harvest period total root and shoot fresh weights are measured. Root systems are mist extracted for five days to obtain the number of lesion nematodes infesting the roots. The total number of nematodes extracted is divided by the root weight to standardize nematode numbers. Control and inoculated groups are compared for root weight, shoot weight and nematodes per unit weight of root by standard ANOVA procedures.

Clonally propagated root lesion nematode resistant rootstocks have been planted to a field site to examine graft compatibility and plant growth. 'Nemared' and 'M2624' have been included in the test as control rootstocks.

Root lesion resistant candidate rootstocks 'Bruce' and 'Deep Purple' were used as females for hybridizations during the 1992 bloom. Rootknot nematode resistant peach rootstocks 'Okinawa', 'Nemaguard', 'S-60' and 95-17 were laso used as female parents in planned hybridizations. 'GF557', 'SL1171' and 'Fla 1-1' were the main pollen sources during the 1992 bloom.

RESULTS

Fifty seedlots have been harvested and processed for screening against root lesion nematode. As in the past, standard screening procedures will be used with 150 nematodes being delivered for each single plant inoculation. Data are obtained 90 and 150 days past inoculation. Accession names and germplasm types of these accessions are presented in Table 1. Diverse peach germplasm has been included in these seedlots. All of our 'pillar' accessions will be screened at the same inoculation date for direct comparison. Three populations involve hybridizations between 'Okinawa' rootstock and different pollen parents that vary widely in their host suitability to root lesion nematode. Six seedlot populations represent progeny from the hybridization of 'Lovell' with 'GF557'. We hope to obtain data pertinent to the inheritance of root lesion nematode resistance from these populations.

Recently, a manuscript has been submitted to *Annals of Applied Biology* documenting the host suitability and plant growth of 83 *Prunus* accessions challenged with root lesion nematode. Ten accessions have been identified where fewer than half the initial population is present at harvest.

Data have been compiled for plant growth parameters and ring nematode population increases from 18 candidate rootstocks (Table 2). This list includes 'Deep Purple', a root lesion nematode resistant candidate rootstock and 'Lovell', currently the best rootstock available for protection against 'Peach Tree Short Life' in the SE United States. None of the 18 candidate rootstocks tested appear to suppress ring nematode reproduction. Data have recently been released by Wescott *et al.* indicating that no unsuitable *Prunus* hosts for ring nematode have been identified after screening nearly 400 accessions. Researchers at the ARS laboratory in Byron, GA have recently identified a seed-propagated peach rootstock that performs significantly better than 'Lovell' in Short Life sites. It is also known that this same rootstock is a suitable host for ring nematode. We are attempting to import this candidate rootstock for testing in Fresno County.

A field trial has been established at the Fresno, ARS location to compare root lesion nematode resistant candidate rootstocks with industry standard rootstocks. Specifically, 'Bruce', 'Redglow', 'Fla 1-1' and 'Deep Purple' have been planted with both 'M2624' and 'Nemared'. Determination of graft compatibility is a primary objective of this test. After the 1993 bloom, all trees will be inoculated with *P. vulnus*. Grafting or budding of the rootstocks with standard scion cultivars will occur as soon as the stocks are large enough.

Seed obtained from planned hybridizations during the 1992 bloom has been planted and hybrids are in the seedling stage. High risk crosses have been attempted between commercial seed-propagated peach rootstocks and root lesion nematode resistant plum accessions. At this point in time, it appears that we have a hybrid between 'Nemaguard' and 'Fla 1-1'. If this is a true hybrid, it offers the possibility of transferring root lesion nematode resistance from plum to peach germplasm. Seedling populations have been secured using both the seed parents 'Bruce' and 'Deep Purple' with PTSL tolerant plum selection SL1171. Embryos were rescued and grown in-vitro for the crosses 'Deep Purple' X 'GF557' and 'Deep Purple' X 'M2624'. One alleged hybrid has been established in each cross. The validity of their hybrid origin has yet to be ascertained.

CONCLUSIONS

Since 1988, 150 *Prunus* candidate rootstocks have been screened against root lesion nematode using standardized greenhouse procedures. Seedlots are available, and currently stratifying, for screening 50 more *Prunus* accessions against this pest. Data have been collected from 18 rootstock accessions challenged with ring nematode. All appear to be good hosts for this pest. A site has been estabished to examine field performance of several root lesion nematode resistant rootstocks. At this time, 'Bruce', 'Deep Purple', 'Fla 1-1' and 'Red Glow' will be compared with 'Nemared' and 'M2624'. Hybridizations were performed on 'Okinawa' using three pollen sources that vary widely in their root lesion nematode host suitability. We hope to obtain data relavent to the inheritance of resistance to root lesion nematode from these hybridizations.

Table 1. Seedlots collected during the 1992 fruiting season for screening against *P. vulnus*.

Accession Name	Type[x]	Accession Name	Type
Okinawa X GF557	PE	PI 41149	PE
Okinawa X Lovell	PE	0519.05	PE
Okinawa X Okinawa	PE	0519.06	PE
Pillar #67	PE	0521.06	PE
Pillar #68	PE	0520.05	PE
Pillar #74	PE	*P. ferganensis*	PE
Pillar #75	PE	*P. valgaris*	PE
Pillar #77	PE	*P. hortulana*	PL
Pillar #78	PE	*P. argentea* #198	AL
Pillar #82	PE	*P. divaricaia*	PL
Redwing	PL	*P. bleriana* 'Moseri'	PC
Sapa	PL	*P. fremontii*	PL
Sapalta	PL	Natsu Goromo	AP
Surprice	PL	Kobai	AP
Twilight	PL	Lantz	PL
Opata	PL	Oka	PL
Rutgers Redleaf	PE	Wayland	PL
NHNC3	PE	Weaver	PL
P259-47	AL	P259-51	AL
P259-54	AL	P259-57	AL
P251-122 (Lovell X GF557)	PE	P251-123 (Lovell X GF557)	PE
P251-126 (Lovell X GF557)	PE	P251-127 (Lovell X GF557)	PE
P251-128 (Lovell X GF557)	PE	P251-130 (Lovell X GF557)	PE

[x] AL=Almond, AP=Apricot, PC=Plumcot, PE=Peach, PL=Plum.

Table 2. Summary of plant growth parameters and ring nematode (Cx) soil populations 144 days after inoculation for a variety of *Prunus* candidate rootstocks.

Accession	Germplasm Type[z]	Cx inoc.	FW tops	FW roots	Rt:Sht	Cx/250cc
Harrow Blood X Okinawa	PE	1,000	5.5	8.3	1.51	297
		0	7.3	7.7	1.05	
Nemared X PI442380	PE	1,000	6.2	7.8	1.26	331
		0	9.2	10.8	1.13	
P114-92 X GF557	PEAL	1,000	6.0	6.8	1.13	201
		0	6.5	7.2	1.11	
P114-92 X 9-24	PEAL	1,000	5.8	5.9	1.02	176
		0	5.9	4.8	0.81	
R 9.5	AL	10,000	15.2	18.1	1.19	463
		0	14.1	18.5	1.31	
Harrow Blood	PE	10,000	14.7	24.4	1.66	379
		0	17.1	29.6	1.73	
95-17	PE	10,000	17.0	22.0	1.29	821
		0	20.8	29.0	1.39	
P70-67	PE	10,000	14.3	28.0	1.96	587
		0	15.9	36.4	2.29	
P67-154	PEAL	130	6.5	10.4	1.61	234
		0	3.7	5.9	1.66	
P67-158	PEAL	130	7.6	11.0	1.48	257
		0	5.6	8.0	1.47	
P67-121	PEAL	130	6.0	5.9	0.94	203
		0	5.2	5.7	1.09	
Deep Purple	PL	130	3.5	4.3	1.15	323
		0	1.9	4.2	2.29	
St. Anthony	PL	130	5.0	5.5	1.20	138
		0	1.3	2.9	2.44	
Lantz	PL	130	5.0	5.1	1.03	440
		0	2.6	4.2	1.71	
Lovell	PE	130	7.8	11.5	1.48	593
		0	5.8	6.8	1.21	
Nemaguard	PE	130	3.3	8.3	2.52	339
		0	3.9	10.0	2.56	
Pisa #2	PE	130	11.0	10.0	0.92	363
		0	7.2	5.6	0.77	
Pisa #5	PE	130	8.1	10.1	1.26	244
		0	6.6	8.4	1.31	

[z] AL=almond, PE=peach, PEAL=peach-almond, PL=plum