A Search for Resistance in *Lycopersicon* spp. to *Nacobbus aberrans*

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ABSTRACT

Veremis, J. C., Cap, G. B., and Roberts, P. A. 1997. A search for resistance in *Lycopersicon* spp. to *Nacobbus aberrans*. Plant Dis. 81:217-221.

Accessions of *Lycopersicon cheesmanii*, *L. chmielewskii*, *L. esculentum* var. *cerasiforme*, *L. hirsutum*, *L. parviflorum*, *L. peruvianum*, *L. pennellii*, *L. pimpinellifolium*, and three interspecific hybrids of *L. peruvianum* with *L. esculentum*, were screened for resistance to the false root-knot nematode (*Nacobbus aberrans*) in greenhouse tests. Variability in nematode reproduction levels was observed within *L. chmielewskii* accessions LA 2695 and LA 2663 in initial tests with *N. aberrans* from Argentina; however, interspecific hybrids of *L. esculentum* cv. UC-82 $\times$ *L. chmielewskii* LA 2695, *L. esculentum* cv. UC-82 $\times$ *L. chmielewskii* LA 2663, and all the parent plants were susceptible in subsequent tests to the isolate of *N. aberrans* from Argentina and to an isolate from Mexico. The interspecific hybrids that possess the gene *Mi* and additional novel resistance to *Meloidogyne* spp. (root-knot nematodes) and all other exotic tomato accessions tested were susceptible to *N. aberrans* in our tests. Thus, we have been unable to identify or confirm resistance to two *N. aberrans* isolates in a range of *Lycopersicon* germ plasm accessions, including those that possess genes for resistance to root-knot nematodes.

Additional keywords: *Mi* gene, tomato

The false root-knot nematode, *Nacobbus aberrans* (Thorne) Thorne & Allen, is an important pathogen of vegetable and field crops in the Americas. This nematode has been confused with widely diverse nematode taxa, and its occurrence has been underestimated because the saccate sedentary females and the symptomatic galls they induce can be mistaken easily for those associated with other saccate nematodes, particularly other gall-forming species such as *Meloidogyne*, from which *Nacobbus* derives its common name.

Luc's (13) revision of *Nacobbus* recognizes Sher's (22) synonyms within the genus. However, the validity of species, subspecies, and races is not fully resolved. Baldwin and Cap (1) emphasized that knowledge of *Nacobbus* diversity, biology, and control is limited by inadequate systematics. Studies with seven populations of *N. aberrans* from Argentina supported the existence of polymorphisms based on isozyme electrophoretic characters (6). Boluarte and Jatala (2) proposed an international race classification scheme with six plant species that differentiated seven physiological races and two variants of *N. aberrans*. Numerous races of *N. aberrans*

have been observed in the highlands surrounding Lake Titicaca in southeastern Peru and northwestern Bolivia, and this region may be the center of origin of *N. aberrans* (3,11). *N. aberrans* has a broad host range among crops and noncultivated plants representing at least 18 different botanical families (3,10).

Galling on roots of tomato (*Lycopersicon esculentum*) cultivars that have the *Mi* gene, which confers resistance to *Meloidogyne incognita*, *M. javanica*, and *M. arenaria*, in soils infested with both *M. incognita* and *N. aberrans* is commonly observed. Sisler and Casaurang (23) found that all cultivated tomatoes tested were susceptible to *N. aberrans*, including cvs. Rossol and Planeuco (which carry *Mi*); however, they found resistance in some cultivars of pepper (*Capsicum annuum*). Resistant potato (*Solanum tuberosum*) germ plasm has also been found (8). Histopathological changes induced by *N. aberrans* in resistant potato roots involved a hypersensitive response of inhibition by the formation of necrotic cells surrounding the invading nematode (7). The feeding site induced by *Nacobbus* in a susceptible host is the formation of a spindle, heart, or irregularly shaped syncytium (3). Unlike either the giant cells induced by *Meloidogyne* spp. or the syncytia induced by *Heterodera* spp., wall ingrowths are absent in *Nacobbus* syncytia, thus more closely resembling the syncytia induced by *Rotylenchulus*.

The development of tomato cultivars resistant to *N. aberrans* would be an important contribution to tomato production,

particularly for less developed countries (18). Resistance to *Meloidogyne* has been identified in the wild tomato *Lycopersicon peruvianum* and introgressed into tomato cultivars with considerable success (15). Novel heat-stable *Meloidogyne* resistance genes have been identified in *L. peruvianum* and transferred to hybrids with *L. esculentum* (5,25). *M. incognita* and *M. arenaria* resistance in wild tomato has been characterized with differential interactions operating as a gene-for-gene system between specific R genes and nematode biotypes (25).

The objectives of this study were to test the novel heat-stable resistance to *Meloidogyne* spp. in *L. peruvianum* genotypes for resistance to *N. aberrans* and to search among other selected exotic *Lycopersicon* spp. germ plasm sources for resistance to two isolates of *N. aberrans*.

MATERIALS AND METHODS

Plant material. Seeds of exotic tomato accessions with an LA designation were obtained from the C. R. Rick Tomato Genetics Stock Center at the University of California, Davis; and those with a PI designation were from the Northeast Regional Plant Introduction Station at Geneva, New York. The exotic tomato seeds were pretreated as described by Rick and Borgnino (17) and germinated in vermiculite together with untreated seeds of *L. esculentum* cvs. Rutgers, Tropic, and UC-82 used as susceptible controls and VFN-8 carrying the *Meloidogyne* resistance gene *Mi*. Seedlings were grown in a greenhouse with 25°C air temperature and 45% RH, in the Nematode Isolation and Quarantine Facility (NIQF) at the University of California, Riverside. Clones were obtained agamically (cuttings from young stems three nodes in length) from the following genotypes: *Lycopersicon chmielewskii* LA 2695, LA 2663, and their interspecific hybrids with *L. esculentum*; *L. esculentum* cv. UC-82 $\times$ *L. peruvianum* PI 270435-2R2; *L. esculentum* line ms-31 $\times$ *L. peruvianum* PI 126443-1MH (4); and PI 126443-1MH $\times$ EPP-1 (24). Stem segments were dusted with rooting powder containing 2 g of 1-naphthaleneacetamide, 1 g of indole-3-butyric acid, and 4.40 g of thiram per liter. The dusted cuttings were planted in vermiculite and maintained in a mist chamber for at least 1 week, when cuttings started to produce new roots.

Hybrids of *L. esculentum* and *L. chmielewskii* LA 2695 and LA 2663.

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Accepted for publication 23 October 1996.

Pollen from clones of the two parents *L. chmielewskii* LA 2695 and LA 2663 was collected and stored as described by McGuire (14). One day before anthesis (when the petals changed from green-yellow to light yellow), flowers of *L. esculentum* UC-82 were emasculated and hand-pollinated with pollen from clones of *L. chmielewskii* LA 2695 or LA 2663. Pollinated ovaries were enclosed with paper bags or capsules to avoid cross-pollination.

Nematode cultures. The *N. aberrans* isolates were from infested tomato fields in Gorina, Buenos Aires, Argentina, and in Chapingo, Mexico. The isolates were reared in an isolation room at 25°C and 45% RH on tomato cvs. Rutgers or Tropic, grown in 4-liter disposable pots filled with steam-sterilized loamy sand (78% sand, 22% silt) and fertilized with Osmocote. After 60 to 70 days, soil and roots in the pots were allowed to dry for 1 week, placed in plastic bags, and transferred to a refrigerator at 4°C for another week before use as an inoculum source. The drying and chilling treatment proved to be effective in breaking the dormancy of the fourth-stage juveniles (J4), and possibly also the dormancy of the eggs.

Screening of tomato genotypes. Screening was carried out in the NIQF under state and federal regulations. One-month-old tomato seedlings and rooted cuttings were transferred to 600 cm³ disposable pots filled with steam-sterilized loamy sand soil infested with *N. aberrans*. This isolate was reared in the same soil on tomato for at least six generations, and the final number of combined J3, J4, and

young vermiform females was approximately 150/100 cm³ of soil. Numerous viable eggs were also present in the soil used for the screening. Two weeks after the plants were transferred to infested soil, 5 g of chopped infected tomato roots mixed with infested soil of the same *N. aberrans* isolate was added to each pot. Seventy-five days after transfer to infested soil, the root systems were washed free of soil under tap water, damp-dried with paper towels, and weighed. Roots were immersed overnight in 75 ppm erioglaucine (Aldrich, St. Louis, MO) stain solution to highlight egg masses for counting (16). Eggs were extracted from roots macerated in 1% NaOCl solution in a commercial blender and rinsed through a series of sieves with openings of 850, 106, and 38 µm. The egg suspension was adjusted to a known volume, and the number of eggs was counted under a dissecting microscope (9). The number of eggs per gram of root was calculated by dividing the total number of eggs per root system by the total fresh root weight. Index of resistance (IR) was calculated by using the number of eggs per gram of root of the entry as a percentage of the number on the susceptible tomato cv. Rutgers. Galling index values per root system were as follows: 1 = trace infections with few small galls, 2 = less than 25% of roots galled, 3 = 25 to 50% of roots galled, 4 = 51 to 75% of roots galled, and 5 = more than 75% of roots galled (12). Plants were considered resistant when the galling index was less than 2. Means of eggs per gram of root and galling index for each tomato line were subjected to ANOVA with the Super

ANOVA program (Abacus Concepts Inc., Berkeley, CA), which accounted for variable numbers of replicate plants per test line.

RESULTS

Reaction of *Lycopersicon* genotypes to *N. aberrans* from Argentina. *Lycopersicon cheesmanii* LA 426 supported the most nematode reproduction, with a mean of 13,149 eggs per g of root, higher than the majority of the other treatments (Table 1). Reproduction levels on *L. esculentum* cvs. Rutgers and VFN-8, *L. peruvianum* PI 128656 and PI 128657, *L. peruvianum* var. *glandulosum* PI 126440 and PI 126443, and their interspecific hybrids did not differ from LA 426, indicating a susceptible reaction in each case, with 5,773 to 9,017 eggs per g of root and a high galling response (>100 galls per root system). A second group of plant genotypes was intermediate in reaction and did not differ in numbers of eggs per g of root from *L. esculentum* cv. VFN-8. This group included *L. parviflorum* LA 1322, *L. esculentum* var. *cerasiforme* LA 2260, *L. cheesmanii* LA 1044 and LA 317, *L. pennellii* LA 716 and LA 1942, and *L. peruvianum* PI 270435 and PI 129152.

Four accessions—*L. chmielewskii* LA 2695 and LA 2663, *L. peruvianum* LA 153, and *L. peruvianum* var. *glandulosum* LA 1973—supported significantly less reproduction than did the susceptible tomato control cvs. VFN-8 and Rutgers. The wide range of scores within an accession indicated segregation for resistance. The average numbers of galls per root system in *L. chmielewskii* LA 2695 and LA 2663 (16 and 43, respectively) were less than half the number observed in the susceptible control, and the average gall numbers for *L. peruvianum* LA 153 and *L. peruvianum* var. *glandulosum* LA 1973 (65 and 56, respectively) were also lower than numbers

Table 1. Reproduction (eggs per g of root) of and root galling by an isolate of *Nacobbus aberrans* from Argentina on *Lycopersicon* spp. genotypes in a greenhouse experiment

Tomato genotypes	n	Fresh root wt. (g)	Eggs per g of root		Galls per root syst.	IR ^a value	
			Mean	Range		<10%	>10%
LA 2695	14	18	1,409 g ^y	290-3,601	16	5	9
LA 153	10	42	1,411 g	248-4,993	65	4	6
LA 2663	11	35	1,497 fg	105-3,358	43	4	7
LA 1973	4	28	1,633 fg	738-3,558	56	2	2
LA 1322	3	20	2,263 e-g	1,774-3,056	41		3
LA 2260	7	58	3,064 e-g	1,517-4,649	90		7
LA 1044	2	42	3,174 e-g	2,594-3,755	75		2
PI 270435	3	16	3,392 d-g	1,333-4,533	>100		3
PI 129152	9	40	3,716 d-g	1,558-10,850	>100		9
LA 716	9	14	4,327 d-g	833-8,338	72		9
LA 1942	6	14	4,373 c-g	638-14,761	37	2	4
LA 317	6	24	4,880 c-g	271-8,233	54	1	5
VFN	17	41	5,773 b-f	1,769-12,160	>100		17
PI 126443	10	27	6,232 b-e	3,243-12,125	>100		10
PI 126440	11	35	6,276 b-e	2,533-13,678	>100		11
PI 128657	10	30	7,434 b-d	4,000-12,861	>100		10
PI 128656	12	24	8,110 bc	2,760-11,726	>100		12
Rutgers	19	44	8,407 bc	5,240-11,430	>100		19
F ₁ G ^z	4	18	8,944 b	7,500-11,167	>100		4
F ₁ P ^z	4	20	9,017 b	8,444-9,900	>100		4
LA 426	2	23	13,149 ab	5,611-20,687	>100		2

^a Index of resistance, number of eggs per g of root as a percentage of the numbers on the susceptible tomato cv. Rutgers.

^y Values followed by the same letter are not significantly different ($P \leq 0.05$) according to Duncan's new multiple range test.

^z F₁G and F₁P, interspecific hybrids between *L. esculentum* cv. UC82 × *L. peruvianum* PI 270435 and *L. esculentum* line ms-31 × *L. peruvianum* var. *glandulosum* PI 126443, respectively.

Table 2. Reproduction (eggs per g of root) of an isolate of *Nacobbus aberrans* from Mexico on *Lycopersicon esculentum* UC82 × *L. chmielewskii* hybrid lines and their *L. chmielewskii* parental accessions in a greenhouse experiment

Tomato genotype	Eggs per g of root
<i>L. esculentum</i>	
Tropic	774 a ^y
VFN-8	902 a
Hybrid lines	
UC82 × LA 2663	4,640 b
UC82 × LA 2695	6,905 c
<i>L. chmielewskii</i>	
LA ^z 2663	1,638 a
LA 2695	3,611 b

^y Values followed by the same letter are not significantly different ($P \leq 0.05$) according to Duncan's new multiple range test. Values are means of five replicate root systems.

^z Local accessions, maintained in the C. M. Rick Tomato Genetics Stock Center, University of California, Davis.

in the susceptible controls. Also, all the genotypes with egg numbers greater than VFN-8 had heavy galling responses.

In *L. chmielewskii* LA 2695 and LA 2663, *L. peruvianum* LA 153, and *L. peruvianum* var. *glandulosum* LA 1973, more than 50% of the total plants for each entry had individual IR values below 10% (Table 1). Two accessions, *L. pennellii* LA 1942 and *L. cheesmanii* LA 317, which supported intermediate numbers of eggs on roots and low numbers of root galls, had two of four and one of five plants, respectively, that had IR values less than 10, suggesting that these accessions may be segregating for resistance to *N. aberrans*. The average root weight was variable among treatments, and there may be a carrying-capacity effect in that fewer infection sites were available to the nematode on plants with small root mass. For example, the average root weight for the most susceptible entry, *L. cheesmanii* LA 426, was 23 g, whereas the average root weights of the putative resistant *L. chmielewskii* LA 2695 and *L. peruvianum* LA 153 were 18 and 42, respectively. The morphology and health of the roots in the wild tomato accessions varied within the accessions.

Reactions of *L. chmielewskii* hybrids to *N. aberrans* from Mexico. The *L. esculentum* × *L. chmielewskii* crosses produced variable numbers of viable F₁ seeds. Most of the mature F₁ seeds germinated, and seedlings grew vigorously. Their morphological characters of leaf shape, sepals, hirsuteness, indeterminate growth habit, fruit color, and length of style exerted from the anther cone were intermediate between the *L. esculentum* and *L. chmielewskii* parents in both crosses (data not shown). The number of eggs per g of root produced on the susceptibles Tropic and VFN-8 was high in each case and confirmed that a successful uniform inoculum was achieved (Table 2). The hybrid UC-82 × *L. chmielewskii* LA 2695 supported significantly higher reproduction than did the

other genotypes. The numbers of eggs per g of root produced on *L. chmielewskii* LA 2663 and LA 2695 were higher than on the susceptible cultivars, and their hybrids supported even higher egg production ($P \leq 0.05$). Without exception among replicates within the treatments, all plants had high numbers of galls per root system (data not shown). The average root weight was variable among treatments, and this may have affected the egg production level to some extent. For example, the average root weight for the most susceptible entry, UC82 × *L. chmielewskii* LA 2695, was 2.7 g, and for Tropic it was 12.6 g.

Rescreening of *Lycopersicon* clones to *N. aberrans* from Argentina. Clones of plants from several accessions that were putatively resistant to the *N. aberrans* isolate from Argentina were re-screened with the same isolate (Table 3). Although significant differences ($P \leq 0.05$) were observed in mean numbers of eggs per g of root produced on the clones, they all gave a susceptible reaction (IR values 43 to 139). In addition, all the genotypes had heavy galling responses, with numbers above 100 in each case.

Reactions of *Lycopersicon* spp. to *N. aberrans* from Argentina. Additional accessions of several *Lycopersicon* spp. tested with the *N. aberrans* isolate from Argentina all had high mean galling indices, ranging from 3.5 to 5.0, similar to those of *L. esculentum* cvs. Tropic and VFN-8 (Table 4). The interspecific bridge hybrid *L. peruvianum* var. *glandulosum* PI 126443-1MH × EPP-1 had an average galling index of 4.4. These reactions indicated high susceptibility in each case.

DISCUSSION

Within some accessions in the original screening, striking variability occurred in which more than 50% of the individuals supported very low *N. aberrans* reproduction, suggesting segregation for resistance. However, retesting of the more promising

individual clones from these accessions indicated that they were susceptible escapes from nonuniform soil inoculum in the first experiment. Although uniform soil infection level is difficult to achieve or confirm, increasing the level of inoculum reduced the chance of escapes as demonstrated in our later tests. Resistant entries such as resistant bean, pepper, or potato cultivars also can be planted for helpful comparative purposes.

Table 4. Galling caused by an Argentina isolate of *Nacobbus aberrans* on *Lycopersicon* spp. accessions in a greenhouse experiment

Tomato genotype	n	Galling index
<i>L. esculentum</i>		
Tropic	5	5.0 e ^w
VFN-8	5	5.0 e
Hybrid ^x		
PI 126443-1MH × EPP-1	5	4.4 cd
<i>L. peruvianum</i>		
PI 126448	5	5.0 e
PI 126926	3	5.0 e
PI 128646	7	5.0 e
PI 129152	11	5.0 e
PI 247087	6	4.5 c-e
PI 251305	6	4.5 c-e
PI 251307	3	4.0 bc
LA ^z 111	6	4.5 c-e
LA 464	4	5.0 e
LA 1708	9	4.6 c-e
LA 2770	3	4.0 bc
LA 2774	4	5.0 e
<i>L. chmielewskii</i>		
LA 2663	6	4.6 c-e
LA 2695	6	4.2 c
LA 1028	4	3.5 ab
LA 1317	3	4.0 bc
LA 1325	4	4.5 c-e
<i>L. pimpinellifolium</i>		
PI 143524	4	4.0 bc
PI 126436	3	5.0 e
PI 126932	3	5.0 e
PI 126937	3	5.0 e
PI 230327	3	5.0 e
PI 251320	3	4.0 bc
PI 375937	3	5.0 e
PI 379058	6	5.0 e
PI 390691	3	5.0 e
LA 1269	6	5.0 e
LA 1280	4	4.5 c-e
<i>L. hirsutum</i>		
PI 127826	5	4.8 c-e
PI 134418	3	5.0 e
PI 390514	6	4.8 c-e
PI 415127	3	5.0 e
LA 407	3	5.0 e
LA 2090	4	4.5 c-e

^w Galling indices were calculated as follows: 1 = trace infections with few small galls, 2 = less than 25% roots galled, 3 = 25 to 50% roots galled, 4 = 51 to 75% roots galled, and 5 = more than 75% roots galled. Values followed by the same letter are not significantly different ($P \leq 0.05$) according to LSD test.

^x Interspecific hybrid of *L. peruvianum* var. *glandulosum* PI 126443-1MH × EPP-1.

^y Plant introductions, maintained in the Northeast Regional Plant Introduction Station at Geneva, New York.

^z Local accessions, maintained in the C. M. Rick Tomato Genetics Stock Center at the University of California, Davis.

Table 3. Reproduction of an isolate of *Nacobbus aberrans* from Argentina on putative resistant *Lycopersicon* spp. genotypes in a greenhouse experiment

Tomato genotype	n	Root fresh wt. (g)	Eggs per g of root		IR ^x value (%)
			Mean	Range	
<i>L. esculentum</i>					
Rutgers	5	98	17,147 b ^y	13,732-22,951	100
VFN	5	100	13,858 b	11,716-19,353	80
<i>L. chmielewskii</i>					
LA ^z 2663	5	21	15,104 b	7,366-19,583	88
LA 2695	5	23	8,926 c	6,852-13,095	52
<i>L. peruvianum</i>					
LA 153	5	111	7,410 c	6,049-8,670	43
LA 1973	2	27	23,833 a	21,434-26,232	139
<i>L. pennellii</i>					
LA 1942	5	8	8,796 c	2,592-15,000	52

^x Index of resistance, number of eggs per g of root as a percentage of the number on the susceptible tomato cv. Rutgers.

^y Values followed by the same letter are not significantly different ($P \leq 0.05$) according to Duncan's new multiple range test.

^z Local accessions, maintained in the C. M. Rick Tomato Genetics Stock Center at the University of California, Davis.

The dormancy mechanism of *Nacobbus* spp. is not clearly understood, but some authors suggest that *N. aberrans* requires drought conditions to break dormancy of J4 (10). In our study, chilling combined with drought was observed to increase the infectivity of the nematode inoculum. When eggs or J2 were extracted from tomato roots and used directly for inoculum, little or no infection occurred.

The positive association between the amount of root galling and the amount of egg production by *N. aberrans* on susceptible roots was similar to evaluations for *Meloidogyne* spp. reproduction and root galling. Occasionally, we observed low galling and high egg production, but never vice versa. A comparison of the egg production and galling evaluation results suggests that galling index can be used for *N. aberrans*; a good correlation exists between the amount of galling and the ability to support egg production of *N. aberrans*, as has been used in screening for resistance to *Meloidogyne* spp. The root gall index should indicate the reproductive capability of *N. aberrans* in tomato and allow detection of resistance less laboriously in large screenings than would determination of egg production. Each replicate entry can be genetically different from others of the same line for many traits, including host suitability. Some accessions had low galling indices, which raised questions about whether the nature of variability was genetic in these accessions, even though they supported high levels of nematode reproduction. We have observed similar relationships within *Lycopersicon* genotypes evaluated for *Meloidogyne* resistance. The low numbers of galls compared with the susceptible controls in these accessions may be an important characteristic for conferring field tolerance; however, no meaningful index of tolerance is possible on the wild tomato plants because of the difficulty of determining the relative growth or yield of a wild accession compared with commercial tomato cultivars.

L. esculentum cv. VFN-8, bearing the *Meloidogyne* resistance gene *Mi*, was fully susceptible to *N. aberrans*, confirming the observations by Sisler and Casaurang (23) with cultivars bearing *Mi*. Susceptibility to *N. aberrans* was observed also for the *L. peruvianum* accessions that carry novel resistance genes to *M. incognita*. The inter-specific embryo rescue and bridge line hybrids carrying novel *Meloidogyne* resistance genes (5,25) were also highly susceptible to these two isolates of *N. aberrans*. Therefore, we can conclude that the known *Meloidogyne* resistance genes do not confer resistance to *N. aberrans*. It would be interesting to know whether other isolates of *N. aberrans* behave similarly to the two tested isolates for reaction to the novel *Meloidogyne* resistance. Evidently, host-parasite specific recognition

mechanisms for *N. aberrans* are not the same as for *Meloidogyne*. This result is not unexpected considering that clear differences in compatibility-incompatibility relationships for *Meloidogyne* resistance genes occur within and between *Meloidogyne* species (19,21,25). *Nacobbus* and *Meloidogyne* spp. belong to different families and elicit a different susceptible response in the same host; therefore, it is not surprising that they have different recognition mechanisms through parallel evolution to induce a galling response in the host. However, conserved genetic control in the plant and the nematode and common stabilizing natural selection mechanisms should be operating to allow for morphological similarity to be derived from the co-evolution.

These results suggest that the tested entries of *L. chmielewskii*, *L. peruvianum*, *L. peruvianum* var. *glandulosum*, *L. hirsutum*, and *L. pimpinellifolium* do not constitute promising sources of resistance to the isolates of *N. aberrans* from Argentina and Mexico. However, additional screening in *Lycopersicon* for resistance to *N. aberrans* should be made, because the entries for each accession tested here are limited compared with the large germ plasm resource of wild relatives of tomato. Roberts and Stone (20) proposed that the primary condition in *Solanum* spp. was susceptibility to cyst nematodes (*Globodera* spp.) and that resistance was developed as a consequence of nematode attack. Thus, in nematode centers of origin, a mixture of susceptible and resistant host genotypes is present (20). The susceptible *L. chmielewskii* accessions LA 2695 and LA 2663 were collected in Cuzco, relatively close to Lake Titicaca (southeast Peru and northwest Bolivia), a region that is proposed to be the center of origin of *N. aberrans* (11). From an evolutionary standpoint, it would be interesting to find low parasitism rates of different *N. aberrans* isolates from that area on *Lycopersicon* accessions collected around Lake Titicaca. An exhaustive screening of wild *Lycopersicon* species indigenous to the Lake Titicaca area would be important for identification of potential sources of *N. aberrans* resistance if they have been selected and are not extinct. The *L. chmielewskii* LA 2695 and LA 2663 accessions are also susceptible to all *Meloidogyne* isolates tested in our laboratory (unpublished data). The screening of this material and of other *Solanaceae* with several populations of *N. aberrans* will be valuable in clarifying the relationships among sedentary endoparasitic nematodes and their hosts. Resistance to *N. aberrans* has been found in two other genera of the *Solanaceae*, *Solanum* and *Capsicum* (3,11,23), and *Lycopersicon*-*Solanum* intergeneric hybrids hold potential to improve resistance to nematodes as well as other desirable characters not present in *L. esculentum*.

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