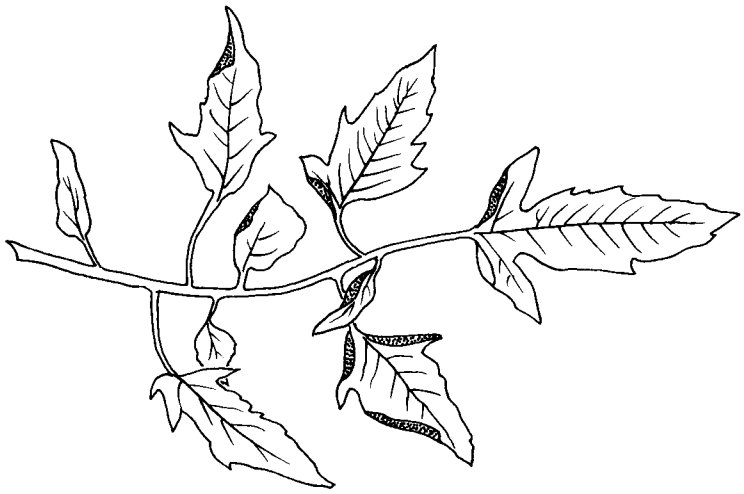
REPORT
of the
TOMATO GENETICS COOPERATIVE



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DEPARTMENT OF VEGETABLE CROPS
UNIVERSITY OF CALIFORNIA
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This report is a medium of exchange among members of information and stock relating to tomato genetics. None of the information herein may be used in publications without consent of the respective authors.

FOREWORD

The Tomato Genetics Cooperative is a group of workers who have a common interest in tomato genetics and who are organized informally for the purpose of exchanging information and stocks. Participation is voluntary, and costs of activities are met by assessments to members.

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As of December 31, 1977, TGC membership stood at 333, which, remarkably, is identical with the total of the previous year. The financial balance, $1074.92, is substantially lower than the $1251.54 one year earlier. Increased printing costs and higher postal charges are responsible for the difference. We hope that the increased member assessments started in October will offset these advancing costs.

The 1976 annual meeting was held in conjunction with the Tomato Breeders Round Table at Toronto, Canada on February 10. Minutes appear below. The 1978 meeting has been arranged again with the TBRT.

An extra feature of this Report is the first installment of an inventory of green-fruited tomato species, appearing as Appendix B. We are highly indebted to Miguel Holle for spearheading this massive project. A list of new genes reported since 1973 was intended for this Report but had to be postponed for various reasons. The many details incurred in this effort, the inventory, and other parts account for the delay in printing and distributing TGC 28.

We are again most grateful to the many willing workers who participated in preparing TGC 28. Dora Hunt again assumed full responsibility for memberships, financial accounts, and managing and editing this Report. Pat Pennell, Betty Perry, and Corky Wilkerson typed the master copies. Moira Tanaka did the art work. Paul Bosland and Randy Schuster assisted with the proof reading.

Coordinating Committee

L. Butler
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C. M. Rick, Chairman
Department of Vegetable Crops
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ANNUAL MEETING

The 1977 meeting of the Tomato Genetics Cooperative was held under the auspices of the Tomato Breeders Round Table in Hotel Constellation, Toronto, Canada February 10, 1977 at 5 p.m., C. M. Rick presided. Although the exact number of members present could not be determined amongst those attending the Round Table sessions, the presence of at least 30 members was estimated. The TBRT thus continues to provide the best opportunity for assembling TGC members for the annual meeting.

Recent activities of the TGC were briefly reviewed by the Chairman. As of December 31, 1976, the financial balance was $1251.54 and membership stood at 333.

The value of the section of TGC Reports on Bibliography of Papers in Tomato Genetics and Breeding was discussed. A show of hands revealed that 14 members used this section in their literature searches. This strong showing provides a useful concensus for continuation of the bibliography.

The Chairman outlined the NSF Grant recently approved for a Tomato Genetics Stock Center at Davis for the purpose of acquiring, maintaining, and distributing stocks of genetic interest. More information is presented in the Foreword of TGC Report #27. A brief discussion followed concerning the relationships of this Center with the TGC.

The meeting adjourned after the consummation of discussion and before the start of the customary happy hour.

C. M. Rick,
Secretary pro tem.

PART I

RESEARCH NOTES

Achkova-Valkova, Z., and P. Stoeva Bilateral hybridization of Lycopersicon peruvianum Mill. with some self-compatible species. (Submitted by C. Daskaloff)

The utilization of L. peruvianum as a female parent with self-compatible species from the genus Lycopersicon will give the opportunity to study the interaction of its cytoplasm with the genomes of these species. When the hybridization is done at a diploid level, L. peruvianum manifests considerable or full reproductive isolation. That's why hybridization at heteroploid level with three self-compatible species manifesting certain instability in their interspecific reproductive relations - L. hirsutum f. glabratum, L. minitum and S. pennellii (Atico) - has been applied.

The hybridization has been carried out in the greenhouse in two directions so that each parent takes part as an autotetraploid and a diploid. An indispensable condition for successful hybridization is the use of unemasculated buds. In order to preclude self pollination, about 24 h after the pollination the bared stigma has been covered with a layer of dextrine glue. The hybrid character of the plants has been determined by the chromosome number (2n=36) and some marked characteristics. Hybrid seeds have been obtained from the two directions of crossing on condition that L. peruvianum takes part as a diploid and its partner as a tetraploid. While the hybridization with L. minutum and S. pennellii is relatively easy (18.9 - 25.7 hybrid plants per 100 pollinated buds) hybridization with L. hirsutum f. glabratum is very difficult (2.1 - 2.4 hybrid plants per 100 pollinated buds). Phenotypically the sesquidiploids are diverted strongly towards the tetraploid parent. The fertility reaches up to 58%.

The sesquidiploid L. peruvianum (2n) X L. hirsutum f. glabratum (4n) was the first to be used for a bridge between L. peruvianum and other species because the work with it began earlier. The obtaining of F_2 and BC_1 was difficult. From 230 crosses with L. hirsutum f. glabratum 2 aneuploid plants with 25 and 26 chromosomes were obtained. The second backcross was easily obtained. The plants from BC_1 with L. hirsutum f. glabratum failed to cross with L. esculentum but in hybridization with L. pimpinellifolium from 147 pollinated buds 75 plants were obtained. Their hybrid character was determined by the orange color of the fruits. F_1 of this complex hybrid was crossed easily with L. esculentum (from 213 pollinated buds - 157 hybrid plants). The fruits of the new hybrid were red- or orange-colored with intermediate inheritance of fruit size.

Via the sesquidiploid L. peruvianum (2n) X L. hirsutum f. glabratum (4n) have been obtained BC_2 with L. esculentum. With the progress of the backcrosses in the first two cases an increasing of pollen fertility has been observed. These data suggest that the appearance of cytoplasmic male sterility can hardly be expected. It is too early to speak about certain phenotypic manifestations of the combination between the cytoplasm of L. peruvianum and the genome of L. esculentum.

The work for hybridization of L. peruvianum with L. esculentum was done in the period from the end of 1974 'til the middle of 1977. This characterizes the method as relatively quick and efficient in investigation of the interrelations of the cytoplasm of L. peruvianum and the genomes of the self-compatible species from the genus Lycopersicon.

Allavena, A., and G. P. Soressi Tetraploid parthenocarpic fruitful tomatoes.

Tetraploid seeds from hand-pollination of polyploid shoots following colchicine treatment (0.5% emulsion) of pat/pat F_3 seedlings have been obtained. These self-fertilized seeds produced 4N parthenocarpic plants as fruitful as the corresponding diploids. On the contrary the 4N homozygous pat^+ plants were amost completely sterile. Besides the 4N parthenocarpic fruits were larger and heavier (30%) than the corresponding 2N. In addition their soluble solids and pH did not significantly differ from the diploid pat/pat, while the ascorbic acid content was higher (20%). As the tetraploid tomatoes have not so far proved to be of economic importance mainly because of their reduced fertility, our data put in evidence the potential of the polyploidy coupled with the parthenocarpy in tomato breeding.

Atanassova, B. Combining ability for style and anther length in a tomato diallel cross.

Inheritance of style and anther length in tomato F_1 crosses is of great importance for hybrid seed production based on maternal lines with exserted stigma because these characters are the main components determining the manifestation of longistyly in F_1 flowers. The observed fact that short style is associated with shorter pollen tube length does not always guarantee successful correction of longistyly in F_1 (TGC, 1976) imposed a study on the combining ability for these two components in an 8 x 8 diallel cross including the following parental lines, form and cultivars: Rutgers-21, GCR-66, Red Cherry, line XXIV-13, Penelopa, line 7/3, L. pimpinellifolium-108 and L. hirsutum f. glabratum. Combining ability was estimated after Griffing (1956) method 2, model II.

Results obtained by the analysis of variance of and SCA for both components (Table 1) show that general, as well as specific, combining ability has a considerable effect on style and anther length variation. For both components GCA is much greater, which means that additive gene effects are greater than non-additive.

Data presented in Table 2 reveal that the choice of parental components can be based on GCA values. Line 7/3, which best corrects longistyly in F_1, has lowest GCA value for style length, while GCR-66, which has the longest style and for which correction of longistyly in its F_1 crosses is almost impossible, has also the highest GCA values for this character.

Considering anther length, however, SCA should be studied because by data of parental GCA no prediction can be made of the heterosis effect which in some cases is of great importance for correcting F_1 longistyly.

Table 1. Analysis of variance of general combining ability (GCA) and specific combining ability (SCA) for style and anther length.

		Source of variation	Sum of squares	DF	Mean square	F emp.	F theor. 5%	F theor. 1%
Style length	1975	GCA	107.94	7	15.42	514.00	2.12	2.90
		SCA	21.20	20	1.06	35.33	1.72	2.14
		Error	2.60	85	0.03			
	1976	GCA	80.96	7	11.57	1157.00	2.12	2.90
		SCA	13.00	20	0.65	65.00	1.72	2.14
		Error	0.91	85	0.01			
Anther length	1975	GCA	17.19	7	2.46	491.20	2.12	2.90
		SCA	11.22	20	0.56	112.20	1.72	2.14
		Error	0.40	85	0.005			
	1976	GCA	14.17	7	2.02	505.00	2.12	2.90
		SCA	9.21	20	0.46	115.00	1.72	2.14
		Error	0.31	85	0.004			

Table 2. Parental length of style and anther and general combining ability.

Parents	Style length mm		Style GCA		Anther length mm		Anther GCA	
	1975	1976	1975	1976	1975	1976	1975	1976
Rutgers-21	10.2	10.6	+0.45	+0.51	18.2	8.1	+0.03	0.00
GCR-66	12.3	13.1	+1.44	+1.70	18.6	8.7	+0.19	+0.25
Red Cherry	7.4	7.4	-0.84	-0.99	6.2	6.0	-0.62	-0.98
Line XXIV-13	7.3	7.1	-0.65	-0.63	9.4	9.6	+0.62	+0.54
Penelopa	5.2	4.8	-1.04	-1.20	8.0	7.9	+0.10	+0.23
Line 7/3	6.7	6.4	-1.31	-1.50	7.9	7.8	-0.49	-0.41
L. pimpinell.108	10.8	10.5	+0.84	+0.63	8.1	8.3	+0.02	-0.09
L. hirs. f. glab.	10.7	10.7	+1.09	+1.46	7.9	7.8	+0.53	+0.42

Avdeyev, Y. I., and T. V. Boeva Resistance of tomato to blossom-end rot.

The tomato blossom-end rot (BER) reduces early marketable yield of the tomato by 15-40 percent. In natural field conditions the disease is not constant. A plot with an area of 400 square meters where annually 100 percent of plants of susceptible varieties are affected by BER has been found. The conditions of different years modified the intensity of BER, greater damage occurring in hot dry years. In F_1 hybrids from crossing susceptible variety Mashinny 1 with the resistant variety Gumbert, the resistance is not completely dominant (Table). In F_2 the ratio of plants susceptible to BER to the others is from 1:40 to 1:60. It is supposed that the resistance to BER is caused by 2 or 4 independent incompletely-dominant genes with additive effect. The genes causing the given type of resistance may be designated by the following symbol "Ber (Ber-2,...)".

Distribution of plants according to the degree of expression of BER in hybrid combination (Gumbert X Mashinny).

Varieties & hybrids 1975	Total plants	(% of fruits affected by BER) 0	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	% affected by BER	Ave am't frts affected by BER/plant	Ave intensity of BER (%)
Mashinny 1	76		1	1	8	21	22	11	6	5	1	100	30.05	45.50
Gumbert	45	38	7									15.6	0.22	0.70
F_1 (Gumbert x Mashinny 1)	80	12	17	14	6	1						85.0	3.87	7.89
F_2 (Gumbert x Mashinny 1)	119	62	42	12		1		2				47.9	1.99	3.32

Cappadocia, M., and J. A. Meyer In vitro culture of flower buds and anthers from the hybrid L. esculentum x L. peruvianum.

With the aim of recovering haploid plants of tomatoes which combine different dosages of esculentum and peruvianum chromosomes, attempts have been made to culture on artificial media flower buds and anthers of the self-incompatible interspecific diploid hybrid between L. esculentum cv. San Marzano and L. peruvianum (for a description of the hybrid, see de Nettancourt et al., 1974).

Intact floral buds and anthers with microspores in late mononuclear stage were placed on the basic medium of Murashige and Skoog (1962) with vitamins (Nitsch and Nitsch, 1969) and different dosages of NAA, GA_3 and 6BA. Sucrose (20 g/1) and agar (7 g/1) were added to the medium; pH was adjusted to 5.8. A number of pretreatments with 2-4 D(10 ppm) were carried out.

After 7 days of culture (dark, 27°C) several microspores in the cultured buds and anthers were found to contain more than 2 nuclei (up to 8 in certain cases). The proportion of polynucleated microspores was higher in material pretreated with 2-4 D. In some of the anthers pretreated with 2-4 D and exposed to photoperiodical light during two weeks (16h, 6000 lux) after 5 days of culture in darkness, microspores could be clearly observed to have evolved into globular embryos (up to 32 cells).

References

Murashige, T. and F. Skoog, 1962. Physiol. Plantarum 15:473-497.
de Nettancourt, D., et al., 1974. Theoretical and Applied Genetics 44:278-288.
Nitsch, J. P., and C. Nitsch, 1969. Science 163:85-87.

Daskaloff, H., M. Konstantinova, and K. Moinova Inheritance of lycopene content in tomato fruits.

Analysis determining the lycopene content of tomato fruits in P_1, P_2 and F_1 plants of a 6 x 6 (n^2) diallel cross were made during the 1974-1977 period within the breeding program for high quality tomatoes. Results obtained showed that lycopene content, which is controlled by genes regulating the ability for its synthesis, is a hereditary character and although influenced by environmental factors it is typical for each tomato species or cultivar.

Correlation relationships between lycopene content and the parental dominance indicator Wr + Vr prove that the parents with low lycopene content have a larger number of dominant genes, while the genes in parents with high lycopene content are mostly recessive (Table).

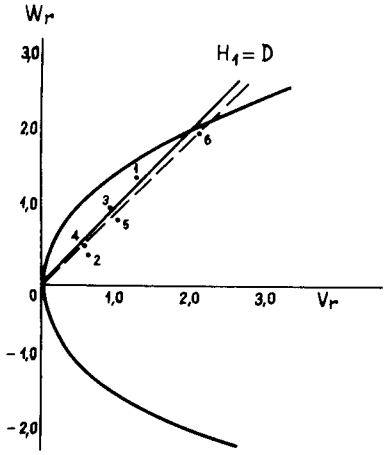
1975			1976			1977		
Parent*	Lyco-pene % mg	Wr + Vr	Parent*	Lyco-pene % mg	Wr + Vr	Parent*	Lyco-pene % mg	Wr + Vr
2	1.173	1.176	2	0.616	1.008	2	1.489	1.517
4	3.144	3.215	4	1.065	2.607	4	2.280	2.497
5	3.698	3.913	1	1.801	1.824	5	4.645	4.491
3	5.807	4.125	3	2.227	2.014	3	5.688	4.920
1	2.227	4.860	6	4.650	2.815	1	3.034	5.088
6	8.505	5.090	5	3.877	4.115	6	7.110	7.582

*1=Violet, 2=Caro red, 3=hp/hp, 4=Moneymaker, 5=Drouzba, 6=L. cheesmanii typicus.

The Wr + Vr graph for lycopene content inheritance shows that it is dominant. The parents are situated around the regression line (see fig.) according to their number of dominant or recessive genes.

The cultivars Caro red (2) and Moneymaker (4), which have a low lycopene content, posess the largest number of dominant genes, while L. cheesmanii typicus and the line Violet, the largest number of recessive genes. It is evident that low lycopene content is controlled by dominant genes.

Breeding for lycopene content is therefore comparatively slow and a component having a larger number of additive genes with high lycopene content should be included in the program.



Falavigna, A., and G. P. Soressi Birdsnest phenotypes as related with sundwarf genes.

An allelism test between mimic birdsnest phenotypes from different sources has been made. All the phenotypes considered are characterized by a progressive shortening of internodes strictly dependent upon the intensity of sun light as the original sundwarf (sd) mutant.

No.	Name	Source	Genetic symbol (tentative)
317	Birdsnest-type	Butler--Canada	sd-2 / sd-2
328	S. Marzano EMS	Soressi--Italy	sd-2 / sd-2
387	Moneymaker-R	Monti--Italy	sd-3 / sd-2
423	H-105	Lyall--Canada	sd-2 / sd-3
429	Ottawa-60	Lyall--Canada	sd-2 / sd-2
530	XP-1030	Asgrow--USA	sd-2 / sd-2

The obtained F_1 data, together with those of the F_2, F_3 and F_4 progenies of the cross 429 x 387, evidence the existence of two sundwarf genes (sd-2, sd-3), the first of which is incompletely recessive, interacting with each other and with sp and br Mendelian factors. As a consequence of the environment and genetic background influences, the segregating progenies bring about a range of phenotypes going from the rosette to the nearly normal habit. The well known birdsnest phenotype (TGC, 1966) is then recognized due to the interaction of the genes sd-2, sp and br; the sd-2 gene is likely to be the same or an allele of the original sundwarf (sd) mutant. The checking of the allelism between sd and sd-2 phenotypes and the screening of the segregating progenies is in progress.

Kopliovitch, E., N. Kedar, and Nira Retig Genotypic and environmental effects on heat-necrosis of heterozygous TMV-"resistant" lines.

Methods. In most experiments the lower three leaves of plants at the fourth true leaf stage were inoculated with race O of the virus. After 24 h the plants were given temperature treatments of 32° or 35°C for 24 or 48 h. The disease index (D.I.) reflected the number of plants infected and the severity of infection, where O=healthy, 1=1 to 10 systemic necrotic spots, 2=more than 10 necrotic spots,

and 4=newly developed leaves showing mosaic symptoms. The resistant material included the Tm-2^a lines #96 (=Davis 70T82-1), #167 (Ohio R.M. 9), #151 (Momor 92, Montfavet, France) and the Tm-2 line #150 (Moperou 111, Montfavet). The susceptible material included #33 (Hotset), #2 (Hawaii), #20 (Ejlon, Israel) and three local breeding lines, WM, #15 and #47.

Reciprocal effect. Line #96 served as the resistant, #2 and #15 as susceptible parents. F_1 plants with the susceptible parents as female were found to be far more resistant to the heat treatment than the reciprocal combinations. Thus, the percentage of healthy plants was 33% (+/Tm-2^a) and 17% (Tm-2^a/+) in one experiment, 72% and 46%, respectively, in the second, and 61% and 25% in the third experiment.

Parental genotypes. Six F_1 crosses between a resistant Tm-2^a female and 6 susceptible male parents showed little variation in resistance to the heat treatment. Similar results were obtained in two experiments with other Tm-2^a lines as female parent. However, in one experiment, comparing three Tm-2^a lines with a common susceptible male parent, the D.I. was significantly higher in the F_1 96 x 20 (D.I. 3.67) than in F_1 151 x 20 (1.83) or in F_1 167 x 20 (1.54).

Heat-necrosis in Tm-2/+. After 48 h of heat treatment at 35° C no disease symptoms were observed in plants of 4 different Tm-2/+ hybrids with #150 as ♀. Even a prolonged heat treatment of 72 h gave a very low D.I., with 5% to 15% of the plants showing some disease symptoms.

Duration of heat treatment and cumulative effect. Plants of 5 different hybrids (Tm-2^a/+) with #96 as female parent were inoculated and kept at 32°C for different time intervals before transfer to 20°C. With heat treatment for 24 or 48 h periods, 30% to 50% of the plants showed systemic necrosis, while all 10 h treated plants remained healthy. Similar results were obtained with #167 as female parent.

In the following experiment heat effects were not found to be cumulative even after 24 daily heat periods of 7 h. Inoculated plants were grown with a 12 h photoperiod for 24 days under a thermoperiod of 33° (7 h) and 20° (17 h). All of the 5 Tm-2^a/+ hybrid combinations with #151 as the resistant female parent remained healthy, while controls receiving only a single 24 h heat treatment showed a high incidence of disease.

Heat treatment before inoculation. In all the above experiments, plants were heat-treated after inoculation. In order to test the reverse situation, F_1 plants 151 x 33 (Tm-2^a/+) of different ages were kept for 48 h at 35° C before inoculation and immediately transferred to 25° C. The percentage of plants showing systemic necrosis was 25%, 0% and 0% with plants of the 1st, 2nd and 4th true leaf stage, respectively. Controls inoculated before the heat treatment reached a disease incidence of 75%. Thus, high temperature periods before inoculation caused systemic necrosis in very young seedlings only.

Laterrot, H., and F. Kaan Resistance to Corynebacterium michiganense of lines bred for resistance to Pseudomonas solanacearum.

In the last ten years, various tomato lines resistant to Pseudomonas solanacearum bred in tropical and subtropical stations were evaluated in Guadeloupe on soils infested by this pathogen. At the same time we have noted the reaction of these lines to Fusarium oxysporum f. sp. lycopersici pathotype 2 (artificial infection at the seedling stage) and to Corynebacterium (artificial field infection on adult flowering plants in Avignon). Our observations on relative resistance are reported in the Table. Thus 10 lines bred for P. solanacearum resistance which were confirmed for this character in Guadeloupe manifest a partial resistance to Fusarium pathotype 2. We mentioned this result for some of these lines in TGC 25 and in "Annales d'Amelioration des Plantes" 1977:27(1)25-34. We verified that all these lines are resistant to Fusarium pathotype 1 (gene I) and do not seem to have I-2 (a pathotype 2 resistance gene).

9 of these 10 lines manifest a partial resistance to C. michiganense. The resistance of Saturn and 72 TR 4.4. was mentioned by W. Henderson and S. Jenkins (North Carolina State University).

MR 4, given for Corynebacterium resistance, resists Pseudomonas and Fusarium 2 . MR 4 and 72 TR 4.4. pedigrees are similar.

However, Plovdiv 8/12, bred for Corynebacterium resistance, does not show any resistance to Fusarium 2 and P. solanacearum.

So we conclude that this tropical material resistant to Pseudomonas and Plovdiv 8/12 do not have the same Corynebacterium resistance factors.

We presently are trying to consolidate these factors by recurrent selection of highly Corynebacterium resistant lines based on Plovdiv 8/12 from one side, 72 TR 4.4. and I.R.A.T. L3 from the other side.

Line	Bred from	Breeder	Reaction to:**		
			Pseudomonas	Fusarium 2	Corynebacterium
Carette	CRA 66 (= OTB 2 ?)	Kaan (Guadeloupe, France)	R	RRR	RR
53.RC	"	"	RR	RRR	RR
Venus	L. esculentum var. cerasiforme (PI 129.080, Columbia) and L. esculentum var. pyriforme (Beltsville 3814, Puerto Rico)	Henderson (North Carolina, U.S.A.)	R	RR	R
Saturn		"	R	RR	R
72 TR 4.4.		"	RR	RRR	RR
74 TR 10		"	R	RR	R
I.R.A.T. L3	Complex hybrid including L. pimpinellifolium	Daly (I.R.A.T., Martinique, France)	RR	RRR	RRR
Farako-Ba	(University of Puerto-Rico)	D'Arondel des Hayes (Upper Volta)	RR	RR	R
Kewalo*	L. pimpinellifolium PI 127805A (Peru)	Gilbert (Hawaii, USA)	R	R	S
Hawaii* 7996	?	Gilbert (Hawaii, USA)	RRR	RR	RR
MR 4	Same as 72 TR 4.4.	Forster, Echandi, (North Carolina, USA)	RR	RRR	RR
Plovdiv 8/12	L. pimpinellifolium	Elenkov (Maritza Institute, Bulgaria)	S	S	RR
Monalbo	susceptible check	Laterott (I.N.R.A., Avignon, France)	S	S	S

* sp. lines.

** RRR - outstanding resistance, RR - good resistance, R - fair resistance, S - susceptibility.