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# Indices of Resistance to Root-Knot Nematodes for Primitive Race Stocks of Upland Cotton

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## ABSTRACT

None of 471 primitive race stocks of upland cotton, *Gossypium hirsutum* L., evaluated in this study for resistance to the root-knot nematode, *Meloidogyne incognita* (Kofoid & White) Chitwood, were as resistant as Auburn 634 RNR, but 18 were more resistant than Clevevilt-6, a strain of the most resistant upland cultivar known. Of race stocks evaluated, 5 (T-27, T-78, T-176, T-188, and T-495) exhibited the highest resistance to both root galling and root-knot nematode reproduction, approaching that of Auburn 634 RNR; 13 others were less resistant to root galling but were equally as resistant to root-knot nematode reproduction as these 5. These accessions are potentially important for developing multiple sources of resistance in upland cottons. Presently, germplasm in Auburn 634 RNR and related strains is the only source of high resistance in upland cotton. Having multiple sources of resistance would reduce genetic vulnerability in upland cotton. Index terms: cotton, cotton germplasm, cotton pests, *Gossypium hirsutum* L., *Meloidogyne incognita* (Kofoid & White) Chitwood, photoperiodic cotton, root-knot nematode, upland cotton.

The author thanks J. N. Jenkins, Mississippi State, Miss., and R. J. Kohel, College Station, Tex., for providing seed for this study.

The research reported in this publication was done in cooperation with the Alabama Agricultural Experiment Station.

This publication is available from the Crop Science Research Unit, Agricultural Research Service, 237 Funchess Hall, Auburn University, Auburn, Ala. 36849.

Agricultural Research Service, Agricultural Reviews and Manuals, Southern Series, No. 33, August 1983.

Published by the Agricultural Research Service (Southern Region), U.S. Department of Agriculture, P.O. Box 53326, New Orleans, La. 70153.

# Indices of Resistance to Root-Knot Nematodes for Primitive Race Stocks of Upland Cotton

By Raymond L. Shepherd<sup>1</sup>

## INTRODUCTION

The root-knot nematode, *Meloidogyne incognita* (Kofoid & White) Chitwood, is a major cotton pest in many areas of the world. Alone it causes subtle to severe stunting of plants, and, when combined with one or more of many cotton diseases, it increases their incidence and severity (Martin et al. 1956, Cauquil and Shepherd 1970). Presently, chemicals provide the only means for adequate control. Host-plant resistance would be the most desirable alternative to chemical control, if resistant cultivars could be developed. But currently, no commercially acceptable cultivar has enough resistance for adequate control. The highly resistant germplasm in Auburn 623 RNR (Shepherd 1974a) and its descendants, including Auburn 634 RNR (Shepherd 1982) is the only source of high root-knot nematode resistance presently available in upland cotton for use in breeding resistant cultivars. This germplasm was derived from crossing a wild cotton from Mexico (Mexico Wild) with Clewewilt-6, a strain of an old upland cultivar (Shepherd 1974b). Because of the genetic vulnerability that results from using a single source of resistance for breeding widely grown cultivars, we evaluated primitive race stocks of *Gossypium hirsutum* L. in an attempt to find new sources. The primitive race stocks maintained at Texas A&M University under Regional Research Project S-77 (U.S. Agricultural Research Service 1974) were chosen for evaluation because of their genetic diversity.

These primitive race stocks have been screened

by others for resistance to cotton insects (Jenkins et al. 1978, Wilson et al. 1981). All information obtainable on their resistance to pests is valuable to breeders making choices of parental stocks for breeding purposes, because multiple pest resistance would enhance the worth of cultivars ultimately developed in a breeding program.

Documentation of data on root-knot resistance of all race stocks evaluated in this study should provide researchers with several choices of root-knot resistant parent stocks of cotton and save them time by reducing numbers of parent stocks to consider. Small quantities of seed for these race stocks are available for research purposes from A. E. Percival, Curator for Cotton Germplasm, P.O. Box DN, College Station, Tex. 77841. When supply is short, a waiting period may be required. **Seed are not available in bulk quantities for commercial planting.**

Each of the 471 primitive race stocks was evaluated in a series of 10 greenhouse tests, with 6 plants of an entry constituting an experimental unit. Each of 50 races and 4 randomized experimental units of each of 4 checks were included in each test. The checks, representing a wide range in resistance, were: Auburn 634 RNR, an upland cotton breeding stock derived from a cross between Auburn 623 RNR and 'Auburn 56' (Auburn 634 RNR has the same high root-knot nematode resistance as Auburn 623 RNR); Clewewilt-6, an old upland cotton strain with moderate resistance; 'Auburn 56', intermediate between Clewewilt-6 and M-8 in resistance, and M-8, a highly susceptible doubled haploid found in 'Deltapine 14' by J. R. Meyer, Stoneville, Miss. Procedures to inoculate plants with root-knot nematodes are described in Shepherd (1979).

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## ROOT-GALLING AND REPRODUCTION INDICES

Root-knot nematode reproduction and root-galling indices for the 471 race stocks evaluated are given below. The race stocks ranged widely in resistance. While none were as resistant as Auburn 634 RNR, 18 of the 471 race stocks evaluated, or 3.8 percent, were more resistant than Clevevilt-6, based on reproduction index. Race stocks T-27, T-78, T-176, T-188, and T-495 exhibited highest resistance to both root galling and root-knot nematode reproduction, approaching that of Auburn 634 RNR. Race stock T-78 had previously been reported resistant by Jenkins et al. (1979). These race stocks are potentially important for transferring new sources of high resistance into upland cotton germplasm. Further research should be done to determine whether resistance identified in the race stocks can be transferred into agronomically acceptable upland cultivars and to determine how resistance affects performance of such cultivars. If feasible, resistance from several race stocks of diverse origin should be bred into several cultivars with different backgrounds.

Ratings given below were done as follows: About 40 days after inoculation with 8,000 eggs per plant, roots were washed free of soil and rated for amount of root galling based on the following index: 1, very light galling; 2, light; 3, moderate; 4, heavy; and 5, very heavy. Root-knot nematode egg masses on roots were then counted when numbers were smaller than those on Clevevilt-6. When numbers obviously equaled or exceeded those on Clevevilt-6, they were estimated in comparison with numbers on Clevevilt-6, 'Auburn 56', and M-8. Actual counts and estimated numbers of egg masses were converted to a root-knot nematode reproduction index as follows: 1, same or fewer egg masses as found on Auburn 634 RNR; 2, more than on Auburn 634 RNR but fewer than on Clevevilt-6; 3, same or more than on Clevevilt-6 but fewer than on 'Auburn 56'; 4, same or more than on 'Auburn 56' but fewer than on M-8; and 5, same or more than on M-8.

Race stock	Galling index	Reproduction index					Race stock	Galling index	Reproduction index					
		1	2	3	4	5			1	2	3	4	5	
T- 1	4				X		T-27	2			X			
T- 2	4				X		T-28	3			X			
T- 3	4					X	T-29	3			X			
T- 4	4				X		T-30	4					X	
T- 5	4				X		T-31	4						X
T- 6	4				X		T-32	4					X	
T- 7	4				X		T-33	4					X	
T- 8	4				X		T-34	4					X	
T- 9	4					X	T-35	4					X	
T-10	4				X		T-36	4					X	
T-11	4					X	T-37	4					X	
T-12	4				X		T-38	4					X	
T-15	2			X			T-39	4					X	
T-16	4				X		T-40	4						X
T-17	4					X	T-43	4					X	
T-19	3		X				T-44	3		X				
T-20	4				X		T-45	4					X	
T-21	4					X	T-48	4					X	
T-22	3		X				T-50	4					X	
T-24	4				X		T-53	4					X	
T-25	3		X				T-55	4					X	
T-26	3		X				T-56	4					X	



Race stock	Galling index	Reproduction index					Race stock	Galling index	Reproduction index					
		1	2	3	4	5			1	2	3	4	5	
T-57	4				X		T-112	4					X	
T-58	4				X		T-113	4					X	
T-59	4				X		T-114	4					X	
T-60	4				X		T-115	4					X	
T-61	4				X		T-116	4					X	
T-62	4				X		T-117	4					X	
T-63	4				X		T-118	4					X	
T-64	4				X		T-119	4					X	
T-65	4				X		T-120	4					X	
T-66	4				X		T-121	4					X	
T-67	4				X		T-122	3		X				
T-68	4				X		T-123	4					X	
T-69	4				X		T-124	4					X	
T-70	3		X				T-125	4					X	
T-71	4				X		T-126	4					X	
T-72	4				X		T-127	4					X	
T-73	4				X		T-130	4					X	
T-74	4				X		T-132	4					X	
T-75	3		X				T-133	4					X	
T-76	4				X		T-134	2					X	
T-77	4				X		T-139	4					X	
T-78	2		X				T-140	4					X	
T-79	4				X		T-141	4					X	
T-80	4				X		T-142	4					X	
T-82	4				X		T-146	4					X	
T-83	4				X		T-148	4					X	
T-84	4				X		T-149	3			X			
T-85	4					X	T-150	4					X	
T-87	4				X		T-151	4					X	
T-88	4					X	T-152	4					X	
T-89	4				X		T-153	4					X	
T-90	4				X		T-154	4					X	
T-91	4				X		T-155	2			X			
T-93	4				X		T-156	4					X	
T-95	4				X		T-157	4					X	
T-96	4				X		T-158	4					X	
T-97	4				X		T-159	4			X			
T-98	4				X		T-160	4					X	
T-100	4				X		T-161	4					X	
T-101	4				X		T-162	4					X	
T-102	4				X		T-164	4					X	
T-103	4				X		T-165	4						X
T-104	4				X		T-169	4						X
T-105	4				X		T-170	4					X	
T-106	4				X		T-171	3			X			
T-107	4				X		T-174	4					X	
T-108	4				X		T-175	4					X	
T-109	4				X		T-176	2			X			
T-110	4				X		T-177	3			X			
T-111	4				X		T-178	4					X	

Race stock	Galling index	Reproduction index					Race stock	Galling index	Reproduction index					
		1	2	3	4	5			1	2	3	4	5	
T-180	4				X		T-240	4					X	
T-181	4				X		T-242	4					X	
T-182	3				X		T-243	4						X
T-183	4				X		T-244	4					X	
T-186	4					X	T-245	4					X	
T-187	4				X		T-246	4					X	
T-188	2		X				T-247	3			X			
T-190	4				X		T-248	4					X	
T-191	4				X		T-249	4					X	
T-195	4				X		T-250	4					X	
T-196	4				X		T-251	4					X	
T-197	4				X		T-253	4						X
T-198	4				X		T-257	4					X	
T-199	4				X		T-258	4						X
T-200	4				X		T-259	4					X	
T-201	4				X		T-260	4					X	
T-202	4				X		T-261	4					X	
T-203	4				X		T-265	4					X	
T-204	4				X		T-266	4					X	
T-205	4				X		T-267	4					X	
T-206	4					X	T-271	4					X	
T-208	4				X		T-272	4					X	
T-209	4				X		T-273	4				X		
T-212	4				X		T-275	4						X
T-213	4				X		T-277	4				X		
T-214	4				X		T-278	3				X		
T-215	4				X		T-280	4					X	
T-216	4				X		T-281	4						X
T-217	4				X		T-283	3				X		
T-218	4				X		T-290	3					X	
T-219	4				X		T-293	4					X	
T-220	4				X		T-294	4						X
T-221	4				X		T-295	4					X	
T-222	4				X		T-296	4						X
T-223	4				X		T-297	4					X	
T-224	4				X		T-301	4					X	
T-225	4				X		T-302	4					X	
T-226	4				X		T-304	4						X
T-227	4				X		T-306	4					X	
T-228	4				X		T-307	4					X	
T-229	4				X		T-308	4					X	
T-231	4				X		T-309	4					X	
T-232	4				X		T-310	4						X
T-233	4				X		T-312	4						X
T-234	4				X		T-313	4					X	
T-235	4				X		T-314	4					X	
T-236	4				X		T-316	4					X	
T-237	4				X		T-318	4						X
T-238	4				X		T-320	4					X	
T-239	4				X		T-322	4					X	



Race stock	Galling index	Reproduction index					Race stock	Galling index	Reproduction index					
		1	2	3	4	5			1	2	3	4	5	
T-323	4				X		T-597	3					X	
T-324	4				X		T-600	4						X
T-325	4					X	T-604	4					X	
T-326	4				X		T-605	4					X	
T-328	4				X		T-606	4					X	
T-330	3				X		T-607	4					X	
T-331	4					X	T-609	4					X	
T-332	4					X	T-610	4					X	
T-333	4					X	T-611	4						X
T-337	4					X	T-612	4					X	
T-340	4				X		T-615	4					X	
T-341	4					X	T-616	4					X	
T-342	4				X		T-619	4					X	
T-344	4				X		T-620	4					X	
T-345	4					X	T-621	4					X	
T-368	4					X	T-622	4					X	
T-375	4				X		T-623	4					X	
T-377	4				X		T-627	4					X	
T-378	4				X		T-628	4					X	
T-396	4				X		T-633	4					X	
T-397	4				X		T-634	4					X	
T-399	4					X	T-635	4					X	
T-400	4				X		T-636	4					X	
T-404	4				X		T-638	4					X	
T-406	4				X		T-639	4					X	
T-408	4				X		T-640	4					X	
T-409	4				X		T-641	4						X
T-460	4				X		T-643	4					X	
T-461	4				X		T-645	4					X	
T-462	4				X		T-646	4						X
T-463	4				X		T-647	4					X	
T-464	3				X		T-649	4					X	
T-465	4				X		T-655	4					X	
T-466	4				X		T-657	4					X	
T-467	4				X		T-658	4					X	
T-469	3				X		T-663	4					X	
T-470	4					X	T-664	4					X	
T-473	4				X		T-665	4					X	
T-475	4				X		T-668	3					X	
T-477	4				X		T-672	4					X	
T-487	3		X				T-674	4					X	
T-488	4				X		T-675	4					X	
T-490	3				X		T-677	4					X	
T-495	2		X				T-678	4						X
T-497	3			X			T-681	4					X	
T-499	4				X		T-682	4					X	
T-503	4				X		T-684	4						X
T-570	4				X		T-685	4					X	
T-595	4				X		T-686	4					X	
T-596	4					X	T-687	4					X	

Race stock	Galling index	Reproduction index					Race stock	Galling index	Reproduction index					
		1	2	3	4	5			1	2	3	4	5	
T-693	4				X		T-931	4					X	
T-698	4					X	T-932	4					X	
T-700	4				X		T-933	4					X	
T-701	4				X		T-937	4						X
T-702	3				X		T-941	4					X	
T-704A	4				X		T-945	4					X	
T-705	4				X		T-948	4					X	
T-707	4				X		T-957	4					X	
T-709	4				X		T-957A	4					X	
T-710	4				X		T-974	4					X	
T-711	4				X		T-997	4					X	
T-717	4					X	T-998	4					X	
T-720	4				X		T-999	4					X	
T-725	4				X		T-1000	4					X	
T-730	4				X		T-1001	4					X	
T-731	4					X	T-1003	4					X	
T-733	4				X		T-1004	4						X
T-734	4				X		T-1004A	4						X
T-735	4				X		T-1005	4					X	
T-738	4				X		T-1006	4					X	
T-741	4				X		T-1007	4					X	
T-742	4				X		T-1010	4					X	
T-743	4				X		T-1015	4						X
T-748	4				X		T-1029	3						X
T-750	4				X		T-1036	4					X	
T-752	4				X		T-1042	4					X	
T-754	4				X		T-1043	4					X	
T-761	4					X	T-1046	4					X	
T-763	4				X		T-1049	4					X	
T-766	4					X	T-1053	4					X	
T-767	4				X		T-1054	4					X	
T-771	4				X		T-1055	4					X	
T-773	4				X		T-1086	4					X	
T-775	4				X		T-1094	4					X	
T-776	4					X	T-1097	4						X
T-778	4				X		T-1099	4					X	
T-788	4				X		T-1100	4						X
T-790	4				X		T-1103	4				X		
T-792	4				X		T-1105	4				X		
T-793	4					X	T-1106	4					X	
T-809	4					X	T-1107	4					X	
T-810	3			X			T-1109	4					X	
T-811	4				X		T-1110	4					X	
T-814	3			X			T-1111	4					X	
T-815	4				X		T-1113	4					X	
T-820	4				X		T-1115	4					X	
T-840	4				X		T-1116	4						X
T-884	4				X		T-1117	4					X	
T-893	4				X		T-1118	4					X	
T-898	4				X		T-1119	4					X	



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