

Physiological Specialization in *Tranzschelia discolor*

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ABSTRACT

Bolkan, H. A., Ogawa, J. M., Michailides, T. J., and Kable, P. F. 1985. Physiological specialization in *Tranzschelia discolor*. Plant Disease 69:485-486.

Results of inoculation trials conducted under greenhouse conditions in California and in New South Wales, Australia, demonstrated specialized parasitism by various isolates of *Tranzschelia discolor*. The names *T. discolor* f. sp. *dulcis* for strains that attack almond, *T. discolor* f. sp. *persicae* for strains that attack peaches, and *T. discolor* f. sp. *domesticae* for strains that attack prunes are proposed.

The fungus *Tranzschelia discolor* (Fuckel) Tranzschel & Litvinov, the cause of rust of stone fruits, is of considerable economic importance in many parts of the world (19), including California (3,9). It is mainly a leaf disease causing premature defoliation. Common hosts are almonds (*Prunus dulcis* (Mill.) Webb), apricots (*P. armeniaca* L.), peaches (*P. persica* (L.) Batsch.), prunes (*P. domestica* L.), plums (*P. americana* Marsh.), nectarines (*P. persica* (L.) Batsch. var. *nectarina* (Ait.) Maxim.), and occasionally cherries (*P. avium* L.).

Pathogenic specialization is a known phenomenon in species of various fungi (1,2,6,13), although *T. discolor* previously was assumed to have no biological specialization. It was noted as early as 1931 (3), however, that when uredinial stages of *T. discolor* were abundantly present on prunes in the Sacramento Valley of California, the fungus did not attack other *Prunus* species, even when they were growing adjacent to affected peach trees. On the other hand, in the Santa Clara Valley, the rust was present on prunes but not on peaches grown in adjacent fields. In 1983, while conducting a survey on the occurrence and distribution of *T. discolor* on almonds in California (9), we observed that peach and almond trees grown immediately adjacent to prunes and/or plums heavily infected with *T. discolor* were free of the rust symptoms. These observations prompted us to investigate the possibility of parasitic specialization of *T. discolor* on prunes, almonds, and peaches. This paper summarizes the results of our investigations.

MATERIALS AND METHODS

Urediniospore collections. Urediniospore collections were made from commercial fields at several locations in California during late summer to early fall 1983 and early summer 1984. Affected leaves from each *Prunus* species studied were collected separately, placed in plastic bags in an ice chest, and transported to the laboratory, where the urediniospores were vacuum-collected. Urediniospores from each host species under investigation were bulked separately to form a composite isolate per host species to increase the probability of a wide range of parasitic diversity. Urediniospores thus obtained were stored in sealed glass tubes in a refrigerator at 4 C until used for inoculation.

Plant material and inoculation method. Six-month-old almond (cultivar Non Pareil), peach (cultivar Lovell), and prune (cultivar French) nursery stock obtained from a commercial nursery and grown in plastic pots (30 × 27 cm) in a greenhouse were used for inoculation tests. About 25 mg of urediniospores of a given culture, with 50–80% spore germination on water agar, were suspended in 20 ml of sterilized, distilled water containing a surfactant (one or two drops of Tween 80 per 100 ml of water) and atomized onto leaves of test plants (5 ml of urediniospore suspension per plant). After inoculation, the plants were individually covered with a plastic bag for

48 hr and kept in a greenhouse where temperatures ranged from 17 to 26 C. Three nursery stock plants per host species per fungus culture were tested. The experiment was done twice, once in 1983 and again in 1984.

RESULTS AND DISCUSSION

Five to six weeks after inoculation, typical uredinia and urediniospores developed on inoculated plants of the respective original host species from which the fungal culture was obtained (Table 1). In no case did an isolate from one host species infect another host species. In all tests, individual plants from a host species reacted uniformly to each particular rust culture. Similar pathogenicity tests in New South Wales, Australia, gave similar results with a prune and a peach isolate, respectively, of *T. discolor*. No distinctive morphological differences were observed among the isolates of *T. discolor* obtained from different host species.

These results are in accordance with those of Thomas et al (17), who reported negative results on almond, peach, and cherry with urediniospores from prune, but differ somewhat from those of Smith (12), who reported positive results on peach and almond with urediniospores from French prune. We have no explanation for the positive results reported by Smith (12). Our 1983 and 1984 results are evidence that under the conditions tested, the fungus *T. discolor* found in California is composed of isolates with specialized parasitism.

The most generalized definition of pathogenic forms relates to differences in host ranges "at the species level or higher" (10). Results (Table 1) of our study showed that isolates of *T. discolor* were highly specific, infecting only the original host species. In our investigations, isolates from different host species could not be separated by morphological

Table 1. Reactions of three *Prunus* species to *Tranzschelia discolor* urediniospore inoculations

Inoculum source ^a	Years tested	<i>Prunus</i> species and inoculation response ^b		
		<i>P. dulcis</i>	<i>P. persica</i>	<i>P. domestica</i>
<i>P. dulcis</i>	1983, 1984	+	–	–
<i>P. persica</i>	1984	–	+	–
<i>P. domestica</i>	1983, 1984	–	–	+

^a Host species from which urediniospores were obtained.

^b + = Infection (uredinia and urediniospores present); – = no infection (uredinia and urediniospores absent).

Accepted for publication 17 December 1984 (submitted for electronic processing).

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characteristics. Pathogenicity, on the other hand, always differentiated isolates obtained from different hosts. Since Goldsworthy and Smith's observations (3) and our data show that *T. discolor* is composed of isolates with differences in specific pathogenicity, it is natural that subgrouping be considered, using pathogenicity as a taxonomic criterion. The idea of using specific pathogenicity as a basis to separate populations within a given species has been accepted by many investigators and is in accordance with the International Code of Botanical Nomenclature (16). Johnson (4), Kenneth (5), Kuan and Erwin (6), Luttrell (7), Munk (8), Savile (11), Snyder and Hansen (14,15), and Walker (18) all considered data on parasitism as important as morphological data in the assessment of certain taxa. We therefore suggest the use of formae speciales to separate the almond, peach, and prune strains of *T. discolor* as follows: *T. discolor* f. sp. *dulcis* for strains that attack almonds, *T. discolor* f. sp. *persicae* for strains that attack peaches, and *T. discolor* f. sp. *domesticae* for strains that attack prunes.

The present information on specialized parasitism of *T. discolor* on stone fruits is

important in rust disease management programs. This is especially true for California, where somewhat random plantings of almonds (169,862 ha), peaches (28,711 ha), and prunes (31,843 ha) occur in all the major fruit-producing regions.

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