Surface Features of a Novel Peach x Nectarine Hybrid

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Abstract. Fruit of 3 of 70 trees from a cross of 'Pekin' peach x ‘Durbin’ nectarine [(Prunus persica (L.) Batsch)] had a dull, slightly rough surface intermediate in appearance to the shiny, smooth surface of a nectarine and the pubescent surface of a peach. Scanning electron photomicrographs of the epidermis revealed short, often multicellular, papillae 20-80 μm in length but no long hairs of the normal 200-500 μm length. Fruit buds on the three trees were glabrous in contrast to the pubescent buds of peaches and nectarines.

Pubescence on peach fruit consists of individual elongated epidermal cells ranging in length from 50 to over 500 μm (3). Presence or absence of pubescence is controlled by a single genetic factor (Gg) with nectarine the homozygous recessive genotype (6). Both the GG and Gg genotypes are peaches, but personal observation (V. E. Prince) and published accounts (4, 10) suggest that often the heterozygote has lighter pubescence. Other genes also affect the amount of pubescence present (6). Even though peach breeders have selected against heavy pubescence to increase coloration and consumer acceptance, peaches produced commercially are nonetheless brushed, or “defuzzed” during packing, possibly increasing post-harvest disease (2). Very lightly pubescent fruit could eliminate the need for brushing, retaining the character of a peach and the beneficial effects of pubescence in enhancing spray retention (3) and in acting as a physical barrier to disease infection (5). A simply inherited gene for reduced pubescence (Fig. 2) in peach pubescence appears to be unique to the rough-skin fruit.

The development of the rough-skin surface is not understood. Dorsey and Potter (3) suggested that the long hairs of normal peach fruit form and elongate before bloom, whereas the short papillae are normal hairs that cease elongation with cell wall thickening within a month after bloom. The novel rough-skin epidermis is set well before bloom because by bloom the base of the ovary, which is densely pubescent in peach and smooth and shiny in nectarine, appears distinctively dull and rough, similar to the skin of mature fruit. Further study is needed to determine if the absence of long hairs and the presence of multilocular structures on this unique fruit may be attributed to aberrations in hair initiation or elongation or to other unknown factors.

This character is presumably under genetic control since it occurred in 3 different seedlings from one cross. Genetic studies will be made to determine the mode of inheritance and the possible interaction with the Gg locus. The possibility of bee pollination from P. kansuensis also will be investigated. In addition, the effect of the rough-skin on pes-

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Fig. 1. Scanning electron photomicrographs of the surface of mature fruit of the following at 200 X: a) seedling nectarine; b) rough-skin hybrid of 'Pekin' x 'Durbin'; c) moderately pubescent peach, sibling to b.
Supercooling Young Developing Fruit and Floral Buds in Deciduous Orchards

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Abstract. Young developing fruit of apricot (Prunus armeniaca L.), peach (P. persica (L.) Batsch), sweet cherry (P. avium L.), plum (P. domestica L.) and pear (Pyrus communis L.) were supercooled to −5 to −8°C if detached from the woody tissues whereas attached fruit supercooled only to −2 to −3.8°C. Ice nucleation active (INA) bacteria raised the nucleation temperature of detached fruit. Ice crystals appeared to form within the vascular system and then advance by progressive crystal growth into all the fruit on a single stem. In peach attached buds lost their ability to supercool when they reached full bloom.

The potential ability to promote supercooling of plant tissues and thus enhance frost protection is of topical interest to pomologists since the recent discovery that strains of Pseudomonas syringae van Hall and Erwinia herbicola (Lohnis) Dye, commonly found in orchards, are an important source of ice nucleation (1, 4). Tender annual plants such as bean, corn and tomato can avoid frost injury down to −5°C if they are free of ice nucleation active (INA) bacteria. The degree of frost injury is proportional to the log of the bacterial population (4).

Supercooling is known to occur in fruit tissues, although it is believed to be rare in orchards (2). Ice crystals can grow through the stem, presumably the vascular system, of lemons at a rate of 2–3 cm/min (5). In boxwood there also is evidence for the presence of internal nucleation sites in the wood (3).

This paper reports preliminary data describing certain limitations in supercooling of tissues during bud development that must be overcome if substantial frost protection through elimination of INA bacteria is to be achieved in deciduous fruit orchards.

Samples collected for freezing analysis came from bearing trees of apricot, peach, sweet cherry, prune, and pear. The orchard had very low levels of INA bacteria, ranging from not detectable to less than 100/g fresh tissue weight, in its natural flora throughout the developmental stages from first swelling to full bloom.

Freezing curves were developed by measuring tissue temperatures with inserted thermocouples connected to a 24-point recording potentiometer that recorded points at 30 sec. intervals or measuring relative temperatures using differential thermal analysis with the sensor on the tissue surface. Most curves were developed at rates of temperature decrease near 1°C per hour. Samples were brought directly from the field and placed in an insulated box which was put into a freezer with a programmed temperature controller. The nucleation temperature was defined as the lowest temperature measured before an increase in temperature was observed. INA bacteria were applied by dipping the fruits in a P. syringae strain W4N26 cell suspension (average nucleation frequency at −5°C is 6 × 10−4 nuclei/cell) containing between 108 and 109 colony-forming units/ml to provide an excess.

Developing fruit detached with its pedicel from woody tissue supercooled to a lower temperature than fruit attached to shoots 30 cm long (Table 1). Each sample consisted of 12 fruits. The marked difference in ice nuc-

Fig. 2. Multicellular papilla of rough-skin hybrid at 1360×.