

LENTICEL AND CUTICLE DISORDERS: A SURVEY

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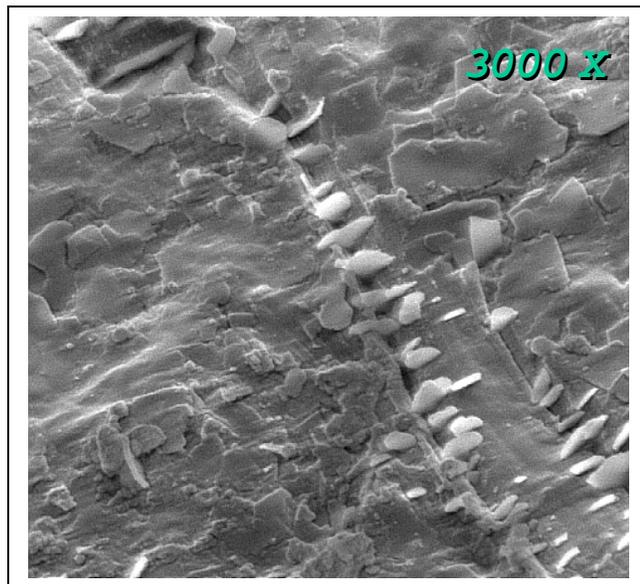
INTRODUCTION

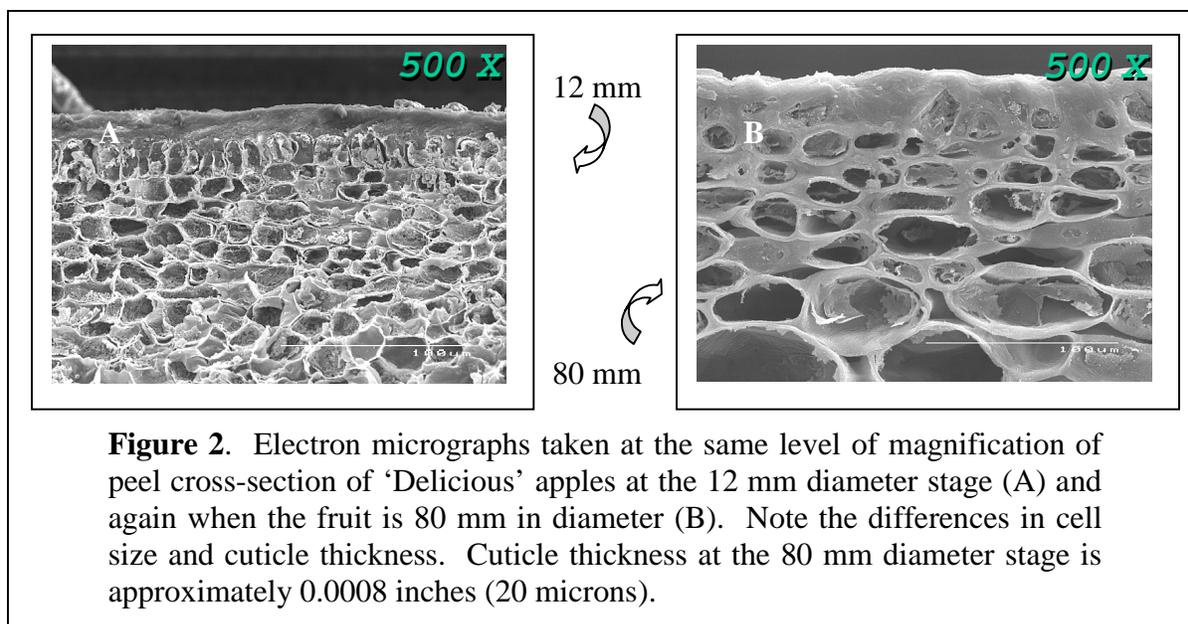
In the last several years there has been an increase in the incidence of blemishes associated with the fruit lenticel and cuticle. The purpose of this presentation was to briefly identify the major areas of concern, characterize differences that might distinguish one from another, and establish a common ground for future discussion and research.

THE FRUIT CUTICLE

A brief overview of the fruit surface is in order. First, in plant anatomy textbooks, an apple is considered a modified leaf. That means in its primordial state, the fruit and the leaf meristem were once similar if not identical. This is important because like the leaf, the fruit also has stomata that may be functional at first, but later lose function as the cuticle begins to grow and rigidifies the stomatal cells. Lenticels also come from trichome scars and breaks in the cuticle. Depending on the cultivar, stage of development, and environmental conditions, the cuticle will vary in structure, composition, thickness and permeability. It is formed by the enzymatic linkage of components in the wax and gradually thickens with time. How then, does the cuticle “grow”? Imagine a small balloon over which you spread a thin layer of vanilla icing. When this dries, it becomes semi-solid. As the interior cells grow and enlarge, only one thing can happen—the cuticle splits from the internal pressure. Because this event is a process rather than an event, my reasoning is the cuticle begins to tear internally very slowly. This is sensed by the epidermal cells (from which the cuticle components exude), which then prepare to “seal” the tear before any further desiccation occurs. I have coined this mechanism, “Tear and Repair” or “Rip and Stitch”. Figure 1 is an electron micrograph showing one of the forms of this process.

Figure 1. Surface of ‘Delicious’ apples showing a small cut in the surface and the subsequent growth of wax platelets. Eventually, the platelets will “bend” and cover the cut, sealing the opening and preventing any further loss in moisture. Wax platelets form as soon as the blossom is exposed to the air, and continue until the fruit senesces.

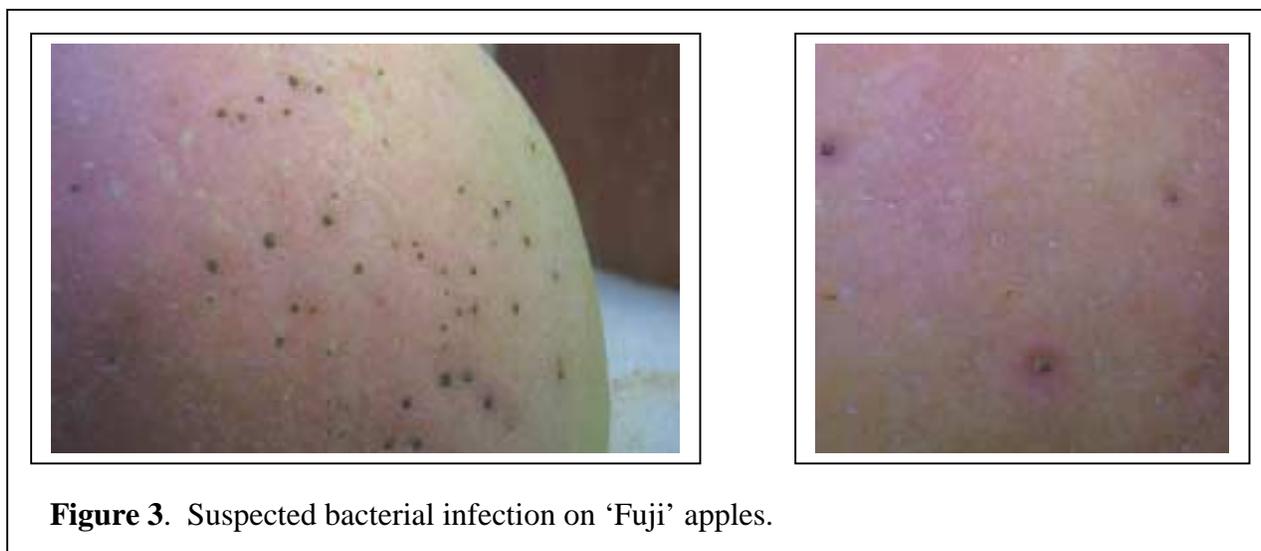




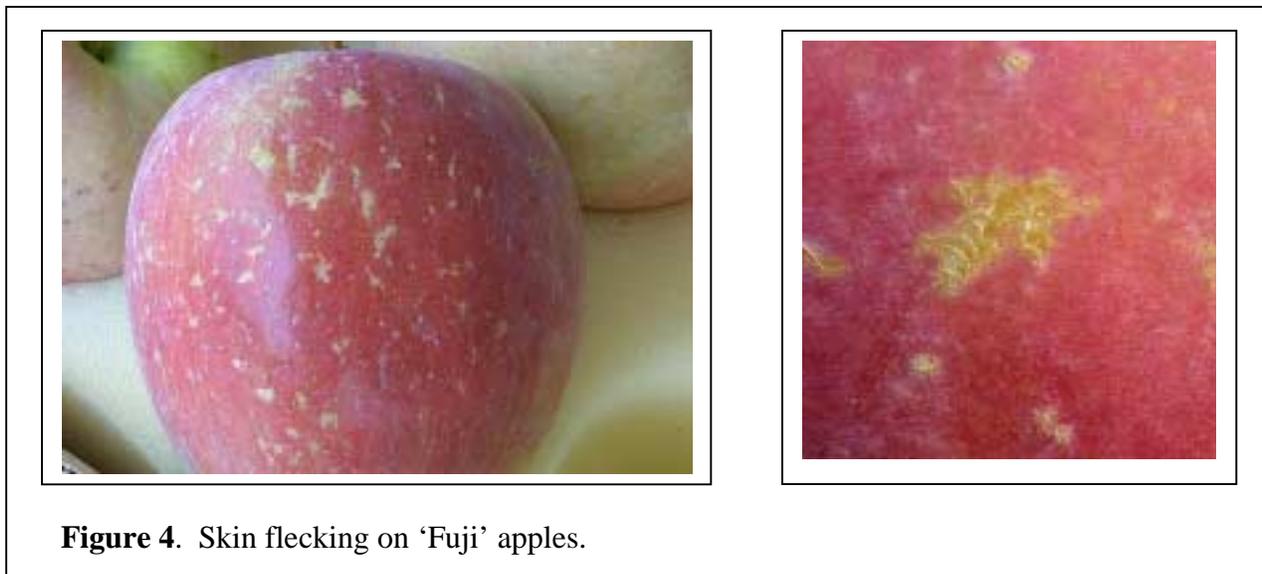
The main point is the apple cuticle is a dynamic, growing tissue. As long as the fruit is enlarging, the cuticle is in a constant state of growth by this ‘tear and repair’ mechanism and has as its base the synthesis of wax and wax platelets on the surface. Anything that alters wax growth and development has the potential to change the nature of the cuticle. These factors might include humidity, temperature, tree health and substances applied to the fruit and foliage. Importantly, these factors may well enhance cuticle development or affect it unfavorably.

LENTICEL AND CUTICLE BLEMISHES

Generally, there were three classes of peel blemish that were observed: 1) lenticel infection, 2) skin flecking, and 3) lenticel breakdown.



The suspected infection such as that in Figure 3 has been found both in ‘Gala’ and ‘Fuji’ apples. My technician, Carol Duplaga, is in the process of isolating and identifying the pathogen, which appears bacterial in nature. We cannot yet be certain, however, until a complete trial is conducted and isolated strains verified by chemical methods.



“Flecking” is specific to ‘Fuji’. Although, we are classifying it here as a disorder, it is not confined to the lenticels and, indeed, may not even be a disorder as much as it is a trademark of the cultivar. Nevertheless, it occurs more in certain years and appears to be related to growth rate and weather conditions. However, whether or not it is related to russetting as is commonly seen in ‘Golden Delicious’ will require additional research and verification.



Lenticel breakdown occurs both in ‘Fuji’ and ‘Gala’ apples. The lenticels initially appear only slightly darkened, however, usually after packing, the cells underlying the lenticel itself begin to

deteriorate and depressions appear. This disorder tends to increase the longer the fruit remain in storage. Fruit stored in CA tend to show the disorder more than those in RA.

SUMMARY

This survey showed there are a number of concerns related to the finish of both ‘Gala’ and ‘Fuji’ apples. Not all of them fit neatly into the classifications listed above, and only the predominant issues were addressed. Outside of infection, which can hopefully be eliminated with bactericides, the other concerns may have multiple causative factors and, therefore, may not be as easy to eliminate. Moreover, some of the blemishes such as “Flecking” on ‘Fuji’ are so cultivar specific, such as is the case with russetting on ‘Bosc’ pears, it may be worth considering an allowance in grading standards to account for the phenomenon.