Storage and Market Diseases of Fruit. XIII

By

E. G. Hall

Division of Food Research, CSIRO

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COOL STORAGE DISORDERS OF CITRUS FRUITS

Citrus fruits are sensitive to chilling and are liable to develop a variety of physiological injuries to the rind in cool storage. Storage spot is the most important of these injuries.

Storage Spot (Cold Storage Pitting)

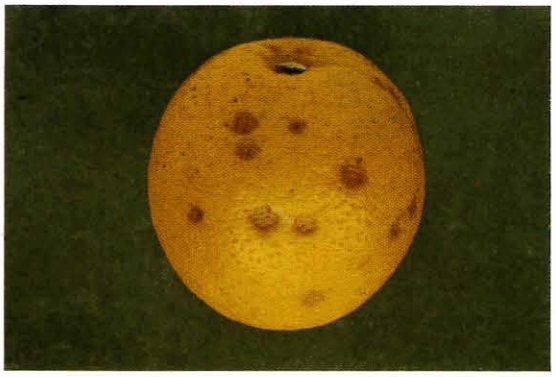
The term storage spot refers to sunken spots or pits, usually comparatively shallow, or areas of varying size and shape, generally brown in colour, which may develop on the skin during cool storage over a wide range of temperatures from −1°C to 10°C but most commonly in the range 3–8°C. True storage spot is a physiological cold injury, but because of wide variation in symptoms and similarity to lesions of fungal origin, the disorder cannot be identified on appearance alone. It is useful to separate storage spot disorders into *lateral spot* and *button spot*; the latter originates around the button, the weakest part of the fruit, and is more likely to be infected with weak parasitic fungi like *Colletotrichum* and *Alternaria*.

At the generally recommended storage temperatures of 4–7°C the most common form of lateral spot on oranges consists of irregular, discrete, moderately sunken, brown spots (Fig. 49). The disorder may also show as small more or less circular and deeply sunken spots (Fig. 50), or as diffuse darker and less sunken areas more scald-like in character (Fig. 51). Button storage spot (Fig. 52) may be quite extensive and show evidence of considerable desiccation or, at higher temperatures, of fungal infection via the button, which may penetrate into the albedo (inner white pith of the skin) and produce button rots or centre rots. These low-grade infections are more active on weaker, more mature, or long-stored fruit. Somewhat similar lesions occur on grapefruit and mandarins; on the latter storage spot is often associated with *oleocellosis* (rind oil burn).

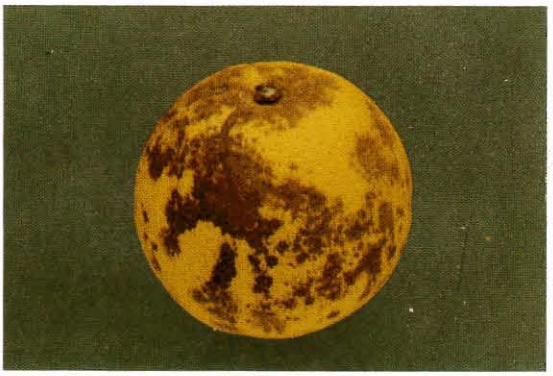
On grapefruit, storage spot is often pale at first and the spots are small and numerous with dark oil glands; later they often coalesce to form dark patches (Fig. 53). On lemons storage spot is usually a more definite pitting, with the oil glands showing darkly in the lesions (Fig. 54).

Little is known about the cause of storage spot, except that it is a chilling injury and is often

49 Storage spot (pit) on Valencia oranges. Lateral type, normal.



50 Storage spot (pit) on Valencia orange. Lateral type, small sunken pits.



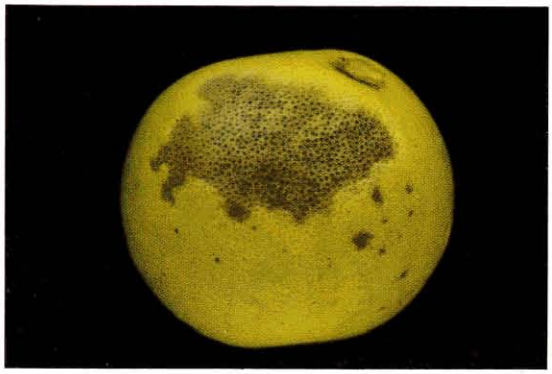
51 Storage spot on Valencia orange. Lateral type, diffuse, scald-like.

associated with fungal infections. It develops most rapidly at about 7°C, and can be avoided by storage above a certain critical temperature, which is about 10°C for oranges and mandarins and 13°C for grapefruit and lemons. Temperatures high enough to avoid chilling injury, however, are generally unsatisfactory for storage because of more rapid staling and development of fungal infections. At lower temperatures storage life can be short because of the development of bitter off-flavours and scald. Less mature fruit picked early in the season is usually more susceptible. Grapefruit and lemons are more susceptible than oranges and mandarins and should be stored at 10°C and 12°C respectively, compared with generally about 5°C for the latter. Any weakening of the rind by infection, or mechanical or chemical injury, predisposes to storage spot; lower humidities, with accompanying higher evaporation, accentuate the lesions.

Further reading

Huelin, F. E. (1942).—The handling and storage of Australian oranges, mandarins and grapefruit. Coun. Sci. industr. Res. Aust. Bull. No. 154.

Fawcett, C. S. (1936).—'Citrus Diseases and Their Control.' 656 pp. (McGraw-Hill: New York.)



53

Storage spot on Marsh grapefruit. Lateral type.

52

Storage spot (pit) on Valencia oranges. Button or stem-end type.

54

Storage spot (pit) on Eureka lemons.