

Sub Name: FOOD MICROWBIOLOGY

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SPOILAGE OF FRUITS AND VEGETABLES:

It is estimated one-fourth of the harvested fruits and vegetables is spoiled before consumption. Spoilage of fresh fruits and vegetables usually occurs during storage and transport. Vegetables and fruits reach the consumer as fresh, dried, frozen, fermented, pasteurized, or canned. Contamination may take place during harvesting, handling, transportation or storage unless proper hygienic conditions were not maintained. Mechanical damage may increase the susceptibility to decay and the growth of microorganisms may take place. Washing process in contaminated water may moisten surfaces enough to permit entry and growth of organisms. Storage in contaminated containers, use of contaminated dressing materials, possible contact with decayed products, unhygienic handling, fly infestation etc. will also cause an accelerated rate of spoilage.

The deterioration of raw vegetables and fruits may result from physical factors, action of their enzymes, microbial action, or combinations of all these. Microbial spoilage in fruits and vegetables varies not only with the kind of fruit or vegetables but also to some extent with the variety. Microbial spoilage may due to (1) plant pathogens acting on stems, leaves, flowers, or root of the plant, on the fruit or other special parts used as foods; (2) saprophytic organisms, which may be secondary invaders after the action of plant pathogen or may enter a healthy fruit or vegetable, as in the case of various ?rots? or grow on its surface, as when bacteria multiply on moist, piled vegetables. At times a saprophyte may succeed the pathogen or a succession of saprophytes may be involved in the spoilage. The most commonly occurring types of microbial spoilage are as follows:

1. Bacterial soft rot, caused by *Erwinia carotovora* and related species, which are fermenters of pectins, *Pseudomonas marginalis*, *Clostridium* and *Bacillus* spp. Have also been associated with these rots. It results water-soaked appearance, a soft, mushy consistency, and often a bad odor.
2. Gray mold rot: caused by species of *Botrytis*, eg: *B.cinerea*, which is favored by high humidity and warm temperature.
3. Rhizopus soft rot: caused by species *Rhizopus*, eg *R.stolonifer*. A rot results that often is soften and mushy. The cottony growth of the mold with small, black dots of sporangia often covers masses of the foods.
4. Anthracnose, usually caused by *Colletotrichum lindemuthianum*, *C. coccodes* and other species. The defect is a spotting of leaves and fruit or seedpods.
5. *Alternaria* rot, caused by *Alternaria tenuis* and other species. Areas become greenish-brown early in the growth of the mold and later turn to brown or black spots.
6. Blue mold rot: caused by species of *Penicillium digitatum* and other species. The bluish-green color that gives the rot its name results from the masses of spores of the mold.
7. Downy mildew, caused by species of *Phytophthora*, *Bremia*, and other genera. The molds grow in white, woolly masses.
8. Watery soft rot caused chiefly by *Sclerotinia sclerotiorum*, is found mostly in vegetables.

9. Stem-end rots, caused by species of molds of several genera, e.g., *Diplodia*, *Alternaria*, *Phomopsis*, *Fusarium*, and others, involve the stem ends of fruits.
10. Black mold rot, caused by *Aspergillus niger*. The rot gets its name from the dark-brown to black masses of spores of the mold, termed "smut".
11. Black rot, often caused by species of *Alternaria* but sometimes of *Ceratostomella*, *Physalospora*, and other genera.
12. Pink mold rot, caused by pink-spored *Trichothecium roseum*.
13. Fusarium rots, a variety of types of rots caused by species of *Fusarium*.
14. Green mold rot, caused usually by species of *Cladosporium* but sometimes by other green-spored molds, e.g., *Trichoderma*.
15. Brown rot, caused chiefly by *Sclerotinia* (*Monilinia fructicola*) species.
16. Sliminess or souring, caused by saprophytic bacteria in piled, wet, heating vegetables.

Fungal spoilage of vegetables often results in water-soaked, mushy areas, while fungal rots of fleshy fruits such as apples and peaches frequently show brown or cream-colored areas in which mold mycelia are growing in the tissue below the skin and aerial hyphae and spores may appear later. Some types of fungal spoilage appear as "dry rots," where the infected area is dry and hard and often discolored. Rots of juicy fruits may result in leakage.

The composition of the fruit or vegetable influences the likely type of spoilage. Thus, bacterial soft rot is widespread for the most part among the vegetables, which are not very acid. Because most fruits and vegetables are somewhat acid, are fairly dry at surface. Thus the character of the spoilage will depend the product attacked and the attacking organism.