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# APPLE SCAB

*by John R. Hartman*

Apple scab is the most consistently serious disease of apples and flowering crabapples in Kentucky. The most noticeable losses result from the reduced quality or premature dropping of infected fruit, but the disease also causes a general weakening of the tree when infected leaves are shed prematurely. For flowering crabapples, summer defoliation from scab invariably results in fewer flowers the next spring. The best control of scab is provided by use of scab-immune cultivars. A good spray program also can provide excellent control of apple scab, but failure to follow such a program can lead to substantial losses on susceptible varieties, especially in a wet year. The apple and flowering crabapple scab fungus also attacks hawthorn and mountain ash; closely related fungi cause scab diseases of pear and pyracantha.

## *Symptoms*

### Leaves

Indefinite olive-green to brown spots (lesions) appear on either surface of infected leaves, although those on the upper leaf surface may be easier to see. Spots range in size from that of a pinhead to slightly smaller than a dime. As the disease progresses, the lesions develop a more definite outline and become covered with a greenish black, velvety growth (Figure 1). Eventually, tissue near the lesions thickens and bulges upward. If heavily infected, leaves may become disfigured and/or turn yellow and drop prematurely.

### Fruit

Symptoms on the fruit are similar to those on the leaves, although on fruit the spots may be more distinctly outlined. Older lesions turn dark brown to black, develop a corky ("scabby") appearance, and frequently become cracked as the fruit enlarges (Figure 2). Uneven growth in the vicinity of the "scabs" can cause fruit to become severely deformed if infections occur while the fruit is still small. Heavily infected fruit may drop prematurely.

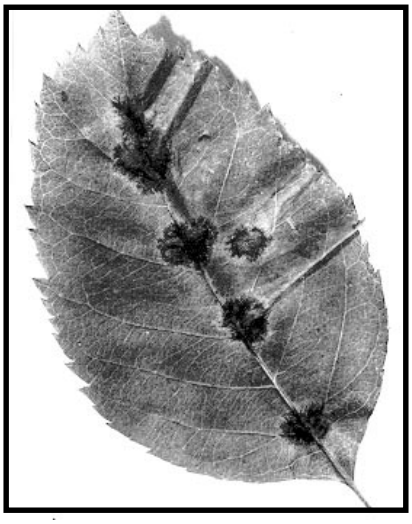

*Figure 1.—Mature, well-outlined apple scab leaf lesions, covered with a dark, velvety growth.*

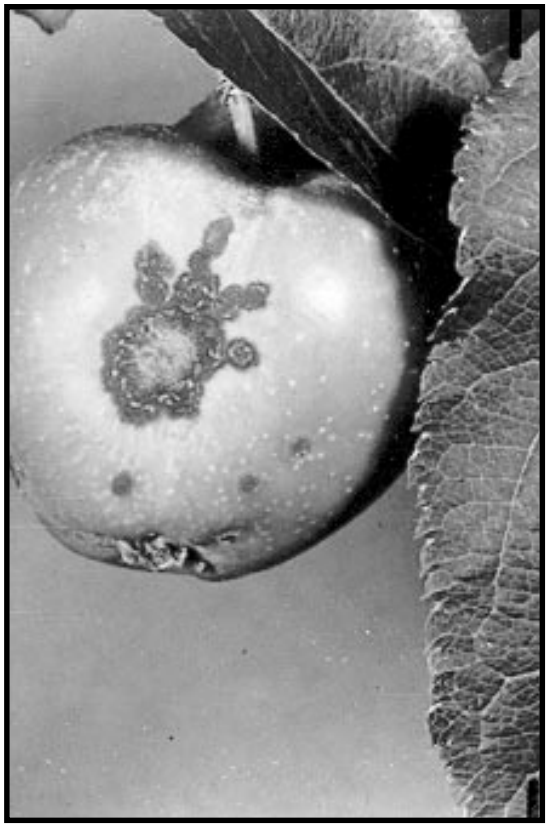

*Figure 2.—Typical, cork-like apple scab fruit lesions.*

## *Disease Cycle*

The apple scab fungus (*Venturia inaequalis*) survives the winter in diseased leaves that fell the previous growing season. During spring rain showers, ascospores are ejected from fungal fruiting bodies which have formed in these fallen leaves; then the ascospores are carried by wind currents to newly-emerged leaves, flower sepals, and very young fruit. These spores can then germinate and cause an initial (primary) infection if the apple tissue remains continuously wet (with rain or dew) for a minimum number of hours, depending on the temperature (Table 1). Ascospore discharge (and, therefore, primary infection) may continue from bud-break to as long as two to four weeks after petal fall, although seven to 10 days is a more common time limit.

If primary infection occurs, thousands of secondary spores (conidia) are soon formed in established scab spots. How soon these spores appear after primary infection is also dependent on the weather (Table 2). Once formed, conidia can be washed or splashed to adjacent fruit and leaves. Here they are capable of causing secondary infections after wet periods approximately three hours shorter than required for ascospore (primary) infection. Thus, if the average temperature was 63 to 75 degrees F (see Table 1), then light, moderate, and heavy degrees of secondary scab infection would require wetting periods of six, nine, and 15 hours, respectively. Additional infective conidia are then produced throughout the season each time a new lesion develops. Conidia are thus able to function as "repeating spores," multiplying a few initial primary infections into hundreds or thousands of secondary infections as the year progresses.

## *Control*

**1**. A regular fungicide spray program is the principal means of controlling scab on most apple varieties. (See UK Extension publication ID-92, "Commercial Tree Fruit Spray Guide," or ID-21, "Disease and Insect Control Program for Home Grown Fruit in Kentucky" for specific recommendations.) Remember from the preceding discussion of the disease cycle that secondary scab infections can only occur if primary infections occur first. Also remember that primary infection can only occur from bud break until two to four weeks after petal fall. This means a strong, conscientious control program during the relatively short primary scab "season" greatly aids in control of secondary scab through the rest of the year.

Be aware that most spray programs are designed to leave a constant, adequate spray residue on susceptible tissue before an infection period occurs. If Tables 1 and 2 indicate that an infection period occurred before you were able to apply a scheduled spray, you may still obtain control by applying a fungicide capable of eradicating new infections. Some standard fungicides (and several new ones) have this eradicative (or "kickback") activity if applied within 18 to 72 hours after the start of an infection period, depending on the material. See ID-92 or consult your county Extension agent for specific product information.

Growers with special weather monitoring equipment such as Envirocaster or Metos may spray apples on an "as needed" basis as determined by recognized infection periods. The weather monitors contain a computer chip which can process the weather information and, using Table 1, alert the grower electronically that an infection has occurred. Fungicides with eradicative or "kickback" activity are then used for scab control only when needed. This approach is often incorporated into integrated pest management (IPM) programs for apples.

Another IPM approach makes use of eradicant fungicides applied at scheduled intervals during the primary scab infection period. This technique reduces the total number of spray applications required for scab control. Details are presented in Extension publication ID-92.

**2**. Apple varieties vary considerably in their susceptibility to apple scab. Several new varieties—Enterprise, Freedom, Gold Rush, Jonafree, Liberty, Macfree, Nova Easy, Prima, Priscilla, Redfree, Sir Prize, and William's Pride—are highly resistant or immune to scab and are particularly well suited to homeowners wishing to avoid the expense and/or effort associated with chemical control. Among the more standard varieties, Jonathan is moderately resistant, Golden Delicious is moderately susceptible, and Red Delicious, McIntosh, Cortland, and Rome Beauty are very susceptible. A number of crabapple varieties are also highly resistant or immune to apple scab.

**3**. Prune trees to allow good spray penetration and air circulation, thereby promoting rapid drying of fruit and leaves. If control breaks down and defoliation occurs early in the year, fertilize and water trees to promote new bud growth. This will help reduce the weakening effects of premature leaf loss. Do not fertilize or water trees late in the growing season as this practice prevents trees from properly hardening off for the coming winter.

**Table 1. Approximate Number of Hours of Continuous Wetness Required for Primary (Ascospore) Apple Scab Infection at Different Air Temperatures**

| | Degree of Infection | | |
|---|---|---|---|
| **Average Temperature Degrees F** | **Light hours[1]** | **Moderate hours** | **Heavy hours** |
| 78 | 13 | 17 | 26 |
| 77 | 11 | 14 | 21 |
| 76 | 9½ | 12 | 19 |
| 63 to 75 | 9 | 12 | 18 |
| 62 | 9 | 12 | 19 |
| 61 | 9 | 13 | 20 |
| 60 | 9½ | 13 | 20 |
| 59 | 10 | 13 | 21 |
| 58 | 10 | 14 | 21 |
| 57 | 10 | 14 | 22 |
| 56 | 11 | 15 | 22 |
| 55 | 11 | 16 | 24 |
| 54 | 11½ | 16 | 24 |
| 53 | 12 | 17 | 25 |
| 52 | 12 | 18 | 26 |
| 51 | 13 | 18 | 27 |
| 50 | 14 | 19 | 29 |
| 49 | 14½ | 20 | 30 |
| 48 | 15 | 20 | 30 |
| 47 | 17 | 23 | 35 |
| 46 | 19 | 25 | 38 |
| 45 | 20 | 27 | 41 |
| 44 | 22 | 30 | 45 |
| 43 | 25 | 34 | 51 |
| 42 | 30 | 40 | 60 |

[1] *The infection period is considered to start at the beginning of the rain.*

**Table 2. Time Required for Production of Secondary Scab Inoculum at Different Temperatures**

| **Temperature** | **Days Required for Conidia Development Following Primary Infection** |
|---|---|
| Degrees F | Days |
| 30-40 | 18 |
| 41-45 | 16 |
| 46-50 | 14 |
| 51-55 | 13 |
| 56-60 | 12 |
| 61-65 | 10 |
| 66-70 | 08 |
| 71-75 | 07 |

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