

Apple Scab

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Apple Scab

Venturia inaequalis

- One of the most serious fungal disease of apples
- Infects leaves, blossoms and fruit
- Defoliates tree, fruit unmarketable
- Management is preventative so monitoring of wetting events (rain, humidity, etc) is critical





Leaf Symptoms

- Can occur on both sides of leaves, usually develop first on underside
- Young lesions: velvety brown to olive green, indistinct margins





Leaf Symptoms

- Older lesions: raised, dark green to gray brown, distinct margins, leaf cupping on underside of lesion
- Heavily infested leaves will curl, shrivel and fall from tree



Fruit Symptoms

- Small black spots develop on fruit, enlarging more slowly than on leaves



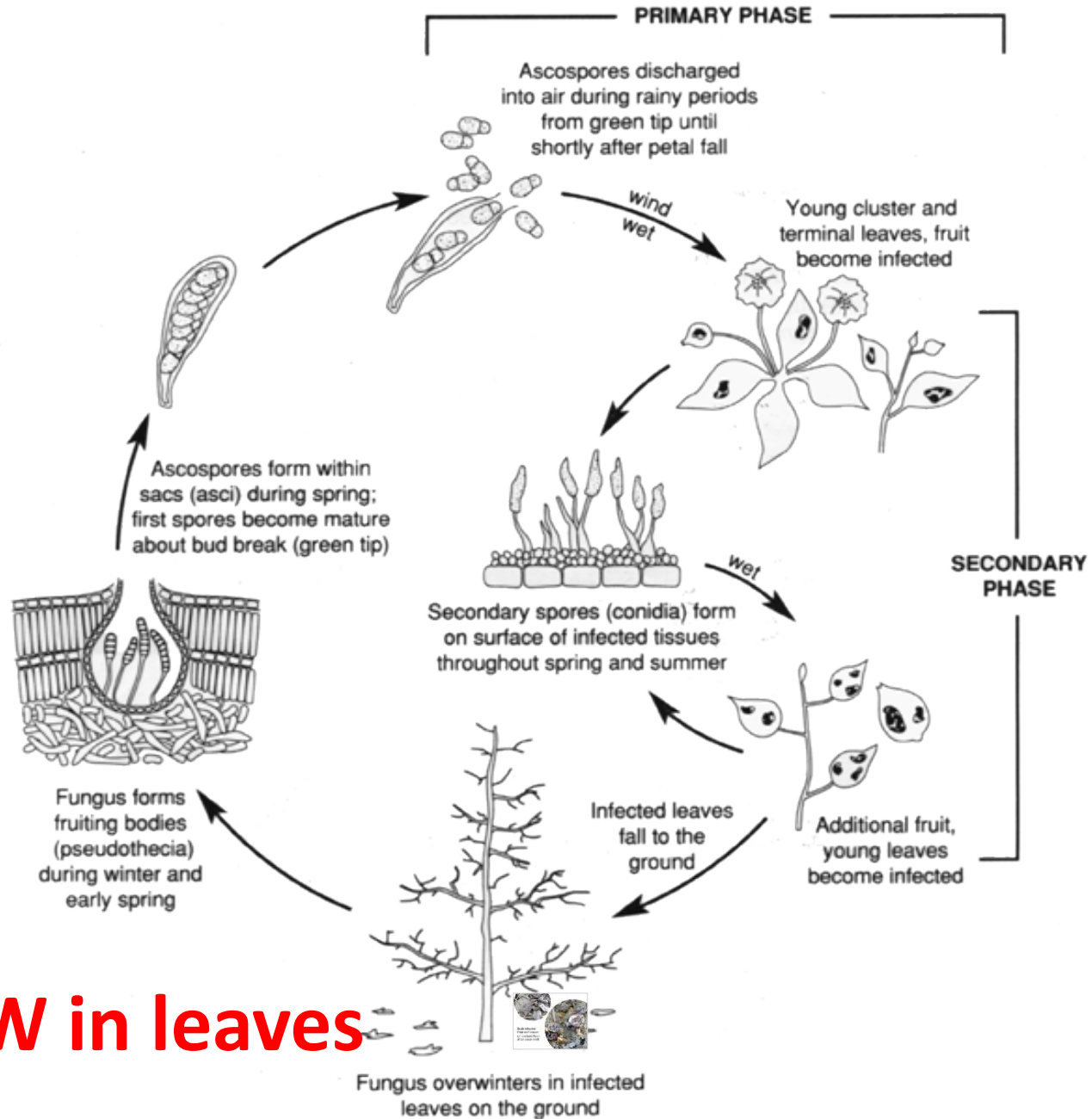




Fruit Symptoms

- Become brown, corky and scabby
- Heavily infected fruit becomes deformed and cracked when infected at an immature stage

APPLE SCAB DISEASE CYCLE



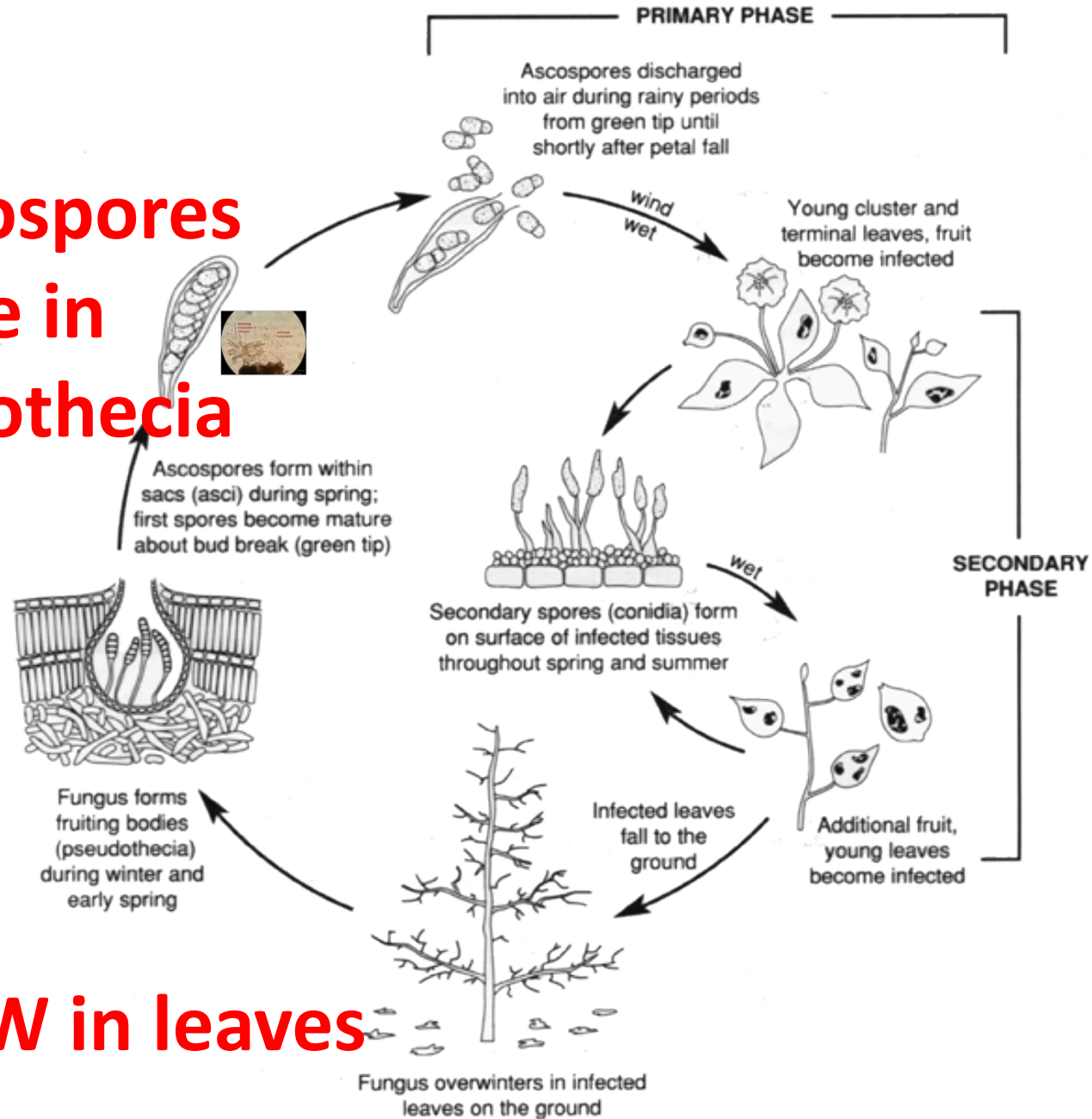
1. OW in leaves



Scab infected
fruit and leaves
on orchard floor
after snow melt

APPLE SCAB DISEASE CYCLE

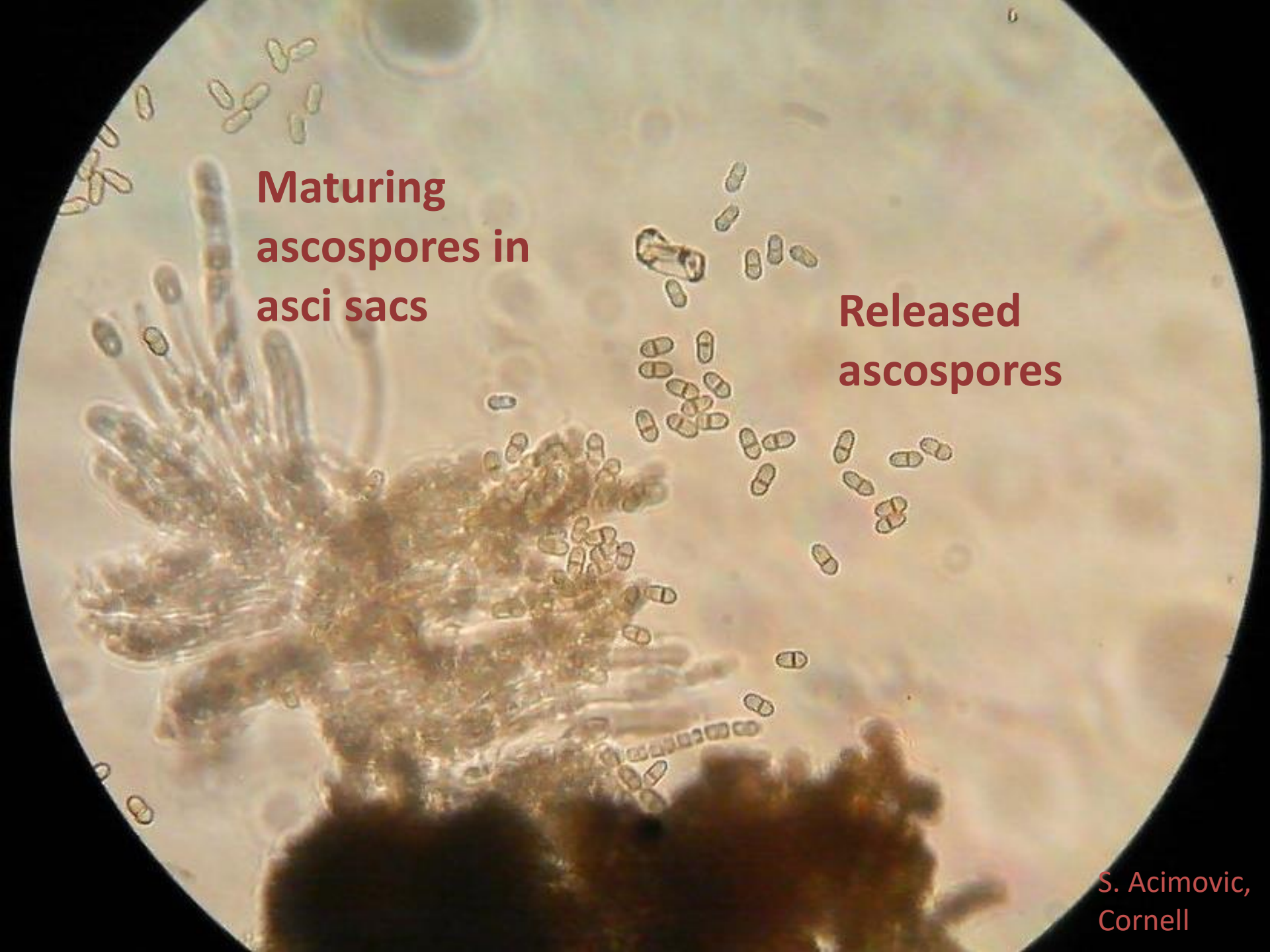
2. Ascospores mature in pseudothecia



1. OW in leaves

**Maturing
ascospores in
asci sacs**

**Released
ascospores**



APPLE SCAB DISEASE CYCLE

2. Ascospores mature in pseudothecia

3. Primary infection

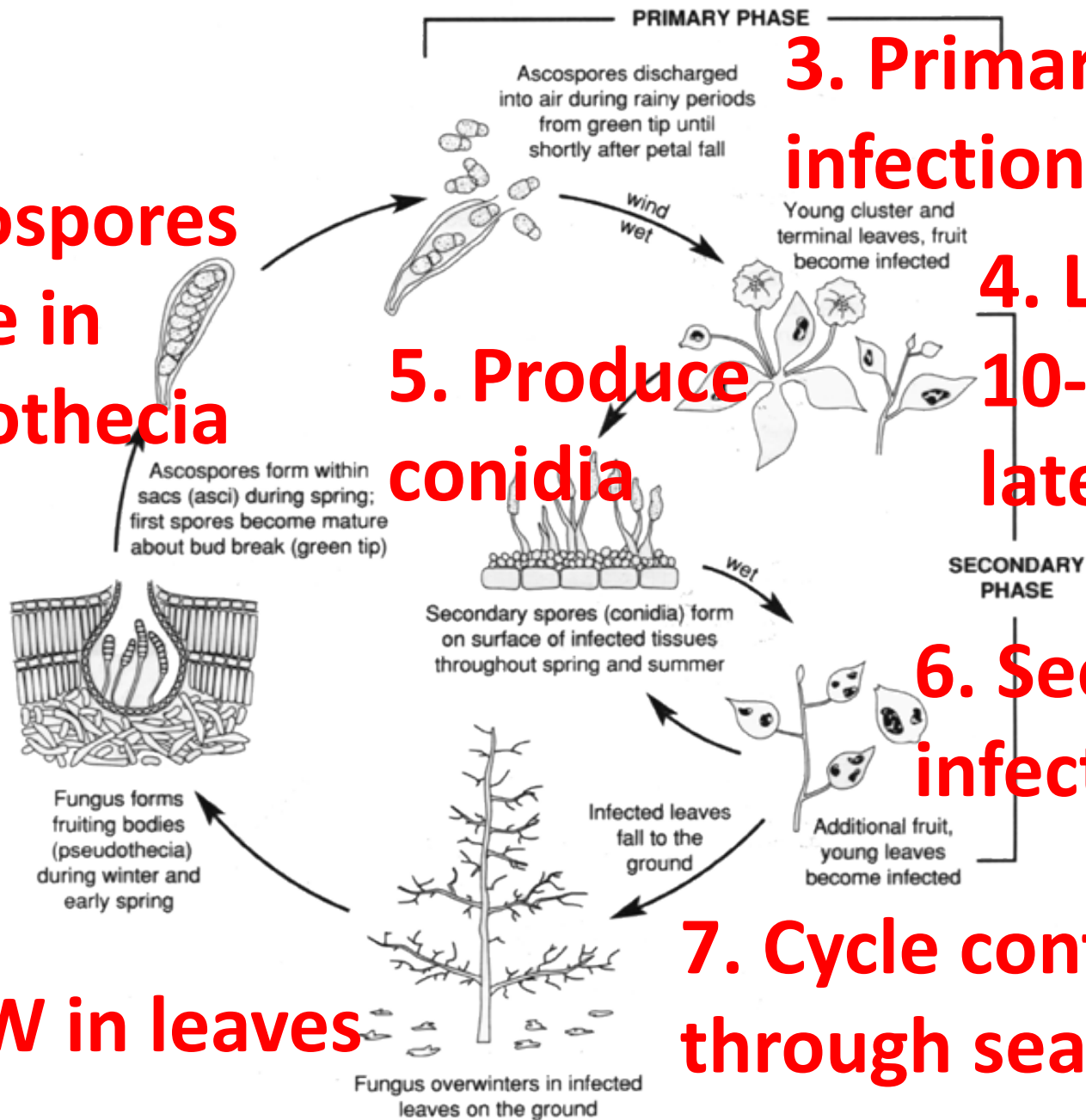
4. Lesions 10-28 days later

5. Produce conidia

6. Secondary infection

1. OW in leaves

7. Cycle continues through season



A primary infection occurs if the following three conditions are met:

Mature ascospores are present in leaf litter in the orchard

Weather conditions favour ascospore discharge and infection

Fungicide protection is inadequate to prevent infections



A secondary infection occurs once lesions are present and weather conditions are conducive to infection

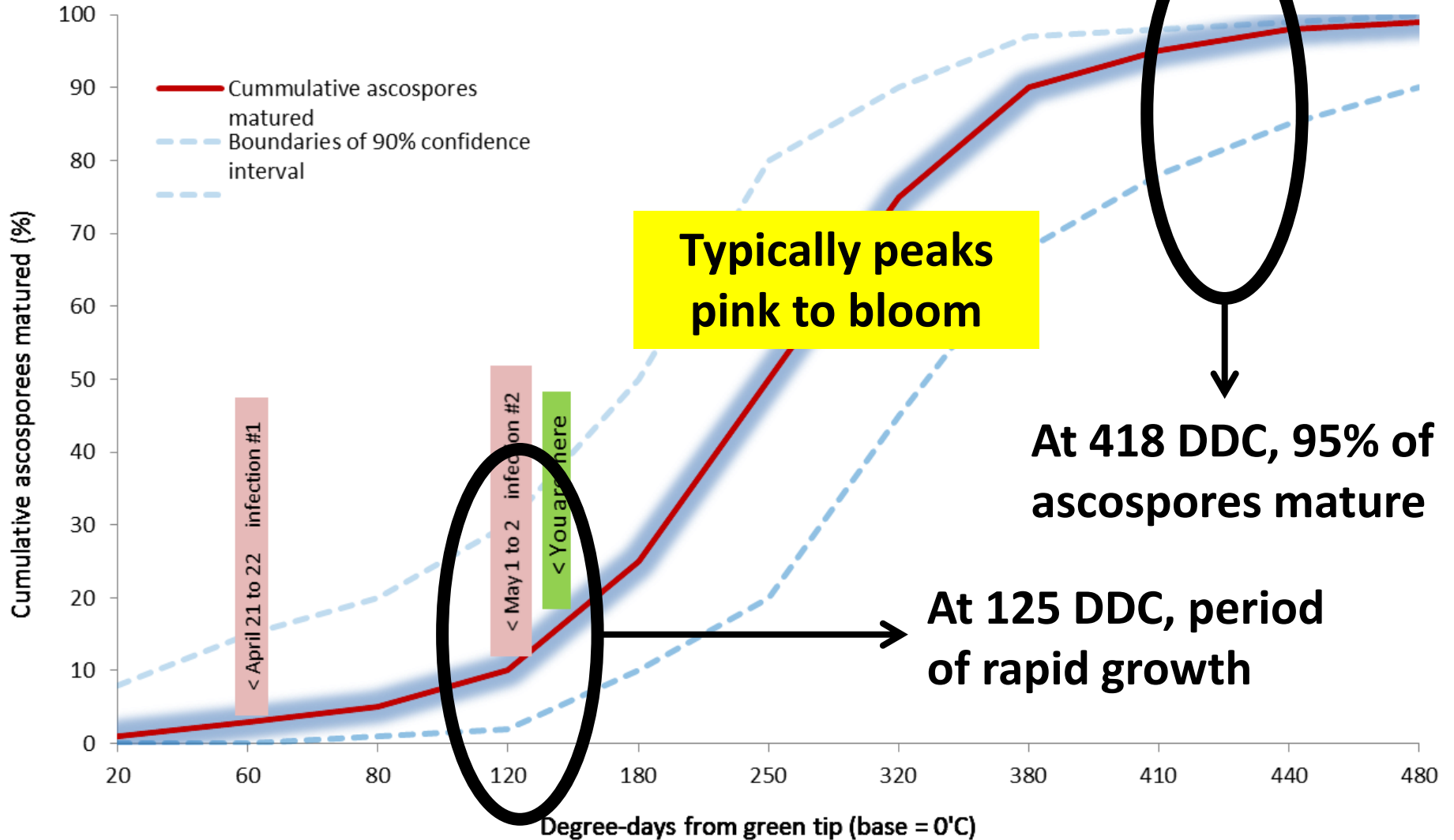
- Monitor from **green tip to harvest**, looking at **leaves** and **fruit**
- Calculate degree days Celsius (or DDC) to predict percentage of mature ascospores

$$\text{DDC} = \frac{\text{maximum } ^\circ\text{C} + \text{minimum } ^\circ\text{C}}{2} - 0^\circ\text{C}$$

- Begin accumulations at bud break, or when at least 50% of fruit buds on McIntosh are between silver tip and green tip
- Unusual weather may contribute to significant ascospore discharges earlier or later than the model predicts

Cornell University **PRIMARY SCAB** Model - Cumulative Percentage of Ascospores Matured at Various Degree-day Accumulations

Source: Gadoury, D.M., and MacHardy, 1982. A model to estimate the maturity of ascospores of *Venturia inaequalis*. *Phytopathology* 72:901-904



Calculating wetting period

- In a low-inoculum orchard, calculate the length of the wetting period using the following method:
 - When rain begins during the day (8:00 am to 7:00 pm), count the hours of leaf wetness from the first hour rain was recorded until the leaves are dry
 - When rain begins at night (7:00 pm to 8:00 am), count the hours of leaf wetness from 8:00 am until the leaves are dry
 - Add wet periods caused by intermittent rain, unless wet periods are separated by 10+ hours of dry weather
- For a high-inoculum orchard, calculate the length of the wetting period from the start of the rain until the leaves are dry, regardless of the time of day



Length of wetting period required for scab infection varies with temperature.

Wetting period required for fruit infection is longer than that required for leaf infection.

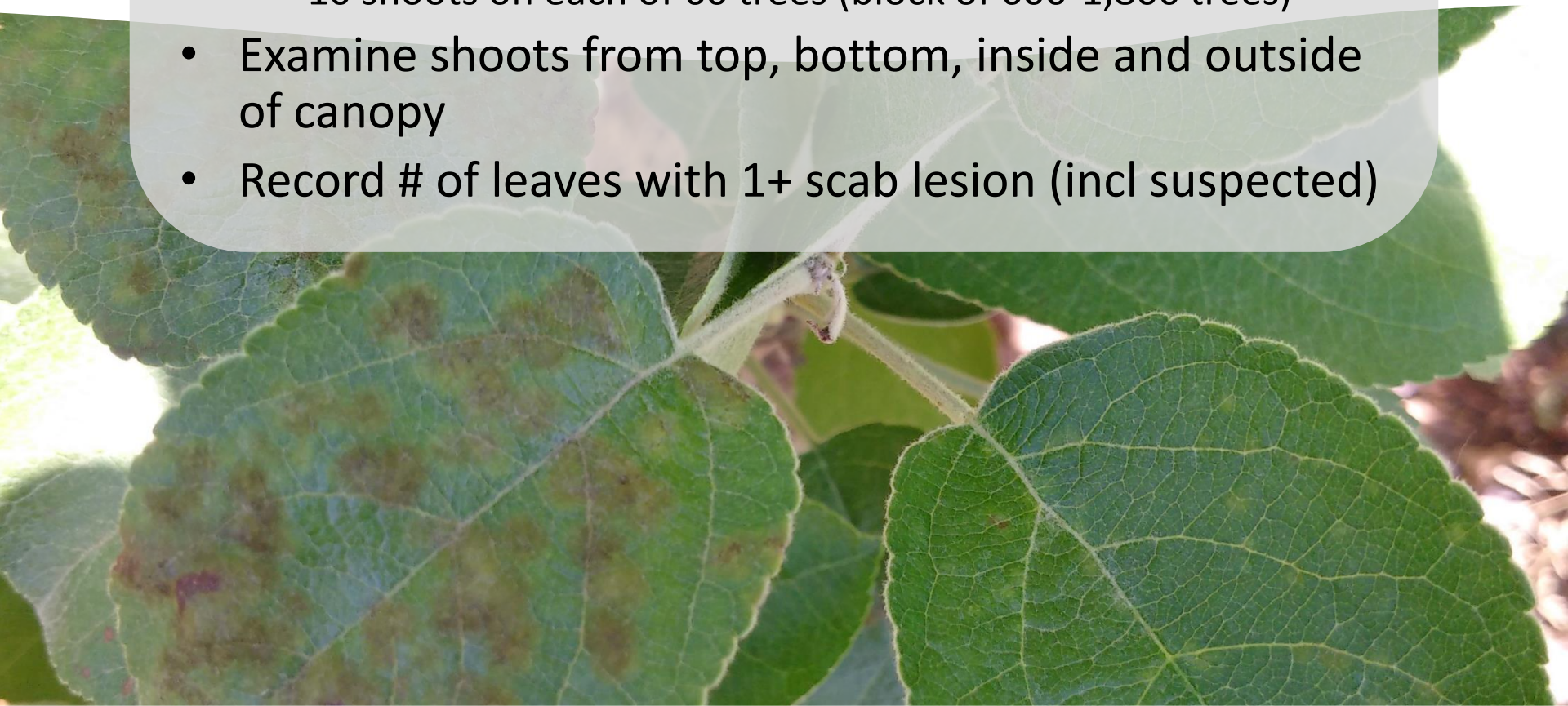
Secondary infection can occur day or night.

Average temp (°C)	PRIMARY INFECTION	SECONDARY INFECTION
1	40	37
2	34	33
4	27	26
5	21	23
6	18	20
7	15	17
8	13	15
9	12	13
10	11	12
11	9	10
12	8	9
13	8	9
14	7	9
15	7	9
16	6	9
17	6	8
18	6	8
19	6	8
20	6	7
21	6	7
22	6	7
23	6	8
24	6	9
25	8	11
26	11	14

Adapted from: Stensvand, A. et al. 1997.
Ascospore release and infection of apple leaves by conidia and ascospores of *Venturia inaequalis* at low temperatures. *Phytopathology* 87:1046-1053.

Determine inoculum (Potential Ascospore Dose)

- Assess in early fall to predict amount the following spring
- Randomly select trees throughout block (total 600):
 - 20 shoots on each of 30 trees (block of 300-900 trees)
 - 15 shoots on each of 40 trees (block of 400-1,200 trees)
 - 10 shoots on each of 60 trees (block of 600-1,800 trees)
- Examine shoots from top, bottom, inside and outside of canopy
- Record # of leaves with 1+ scab lesion (incl suspected)





Determining inoculum (Potential Ascospore Dose)

- If number of scabbed leaves is:
 - **50 or less** – low inoculum, could delay 1st spray
 - **50-100** – if sanitation used, low inoculum
 - **100 or more** – high inoculum, begin program at green tip
- Do not use PAD under the following conditions:
 - If Group 3 fungicides applied, especially after infection activity
 - Lesions inhibited but not killed
 - Cannot be detected in fall
 - If scabby, wild trees within 200 m of orchard

Cultural controls

- Common cultivars vary in susceptibility – handout
- Reduce inoculum by applying urea (45 kg/1,000 L water) and/or flail mowing in fall or spring

Chemical controls

- Primary scab – pre-infection fungicide program with higher rates and shorter intervals during times of rapid growth and/or peak infection period
- May need to include post-infection fungicide in wet conditions but do not rely on due to resistance management concerns
- Secondary scab – wait at least 2 weeks from end of primary scab period. If no scab, reduce rates and length intervals



In summary...

- Primary scab infection can occur any time there is a wetting event long enough to facilitate mature ascospore release and germination
- Monitoring temperature and leaf wetness will help determine ascospore maturity, as well as primary and secondary infection periods
- With frequent rainfall, the control of apple scab becomes extremely difficult, particularly if the disease becomes established from primary infections in the spring



Thank You!

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