

Normal and Damaged Male Hazel Flowers

John Kelsey - - - 2024 Jan

In our earlier WV Hazel News, we explained how a well timed warm-then-cold winter weather cycle can disrupt hazel pollination for an active variety. Both the female and the male flowers of a pollinating pair need to be undamaged during their normal receptive stages to have pollination success. In our last WV News, we covered the female normal receptive progression, plus showed damaged female flowers and how they sometimes manage to recover after damage. Our experience is that the male flowers (catkins) are more easily damaged than the female flowers, and they do not recover. We want to know both if and when there is pollen shed - easy to say, but hard to see.

Hazel Male Flower - - - Observation Distance

Before getting into details, I must confess that we do not have a reliable accurate way to detect pollen shed. Last year, we thought we knew. This year we learned that we didn't know. That's progress. Consider the following observation distances

1. Windshield survey
2. Arm's length walk-by
3. Up close and touchy 1X
4. Hand lens 5X
5. Macro photos 15X
6. Optical Microscope 100X
7. Scanning Electron Microscope (SEM) 1000X



Distance 1 – Drive-by-shooting



Distance 2 - Arm's length walk-by



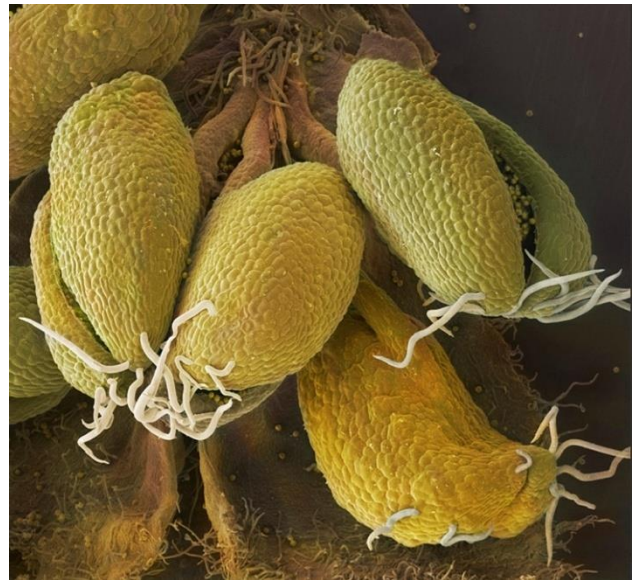
Distance 3 - Up close and touchy 1X



Distance 4 – Hand lens 5X



Distance 5 – Macro photos (sectioned) 15X

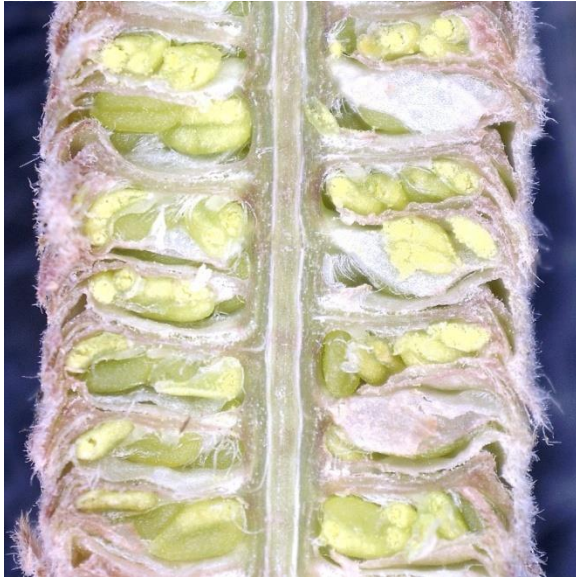


Distance 7 - SEM

Each method is closer, more accurate, more difficult, and slower. We would like to have an in-the-field pollen-shedding detection method: accurate, simple, and quick - hopefully at distance 3 or 4.

Male Flower - - - Normal Progression

Going into winter, catkins are compact and flexible with a green central core. Coming off the central core is a multitude of small leaf-like structures (bracts). Under each bract hides a group of anthers, and each anther is packed full of pollen grains. In my simple mind, an anther houses 1000 pollen grains, a catkin contains 1000 anthers, and a hazel has 1000 catkins. That's one billion pollen grains per hazel tree. If you want to challenge this math, I'll happily print a retraction.



Stage 0 – Compact and asleep



Stage 1 – Expansion started

The catkins stay dormant, compact, and freeze resistant until their chill hour requirement is met. After satisfying the chill requirement, some heat hours are required to expand the catkins and open the anthers.



Stage 2 – Fully expanded and shedding



Stage 2 – Anthers opening



Stage 3 – Spent - anthers completely open – pollen “Gone with the Wind”

Shortly after full expansion the anthers open up like clams and the pollen grains escape. My thinking is that the shedding happens rather quickly, (maybe over 2 or 3 days), because it is so hard to catch them in the actual act of shedding.

After shedding the catkins stay green and flexible for a couple of weeks. They look no different at arm's length, but the anthers are open and empty. Eventually the catkins turn brown, and the central stem becomes brown and brittle. The catkin's attachment to the tree also becomes brittle, and in a couple of more weeks the catkins all fall to the ground.

Male Flower - - - Freeze Damage

Catkins are most vulnerable to freeze damage during Stage 2 – shedding, and less so during Stage 1 – expanding. The catkin structure can also be wrecked by freezing during Stage 3 – Spent, but then the damage is too late to do any harm, since the pollen is gone.

Cecil Farris' variety, G17, has an early pollen shed. On the morning of 12/31/17, G17 was beginning Stage 2 – shedding and was freeze damaged. The overnight low was +7 degF. Four other varieties: Royal; TdG; Halls; and Grimo's 186M were in Stage 1 and were unaffected by the same cold event, and later all four survived -8 degF while still in Stage 1 – expanding.



Freeze damage to G17 catkins

The noticeable damage is the watery appearance of the central stem and the separation of the outer sheath of the central stem. This picture is the “morning after”. The pollen grains are probably okay, because freezing pollen for later use is a method often used by hazel breeders. The catkin central stem has phloem and xylem, just like a tree trunk. These anthers need chemical signals and energy to open and release pollen. Obviously, they will get neither from this damaged stem.

In later pictures of G17, the deterioration of the central stem continues. The anthers and pollen look about the same, but the anthers do not open further (about half the anthers were half way open throughout). These all are fresh samples from the tree.



Freeze damage to G17 catkins - later



Freeze damage to G17 catkins – much later

If freeze damage occurs before shedding begins, the anthers look okay, but fail to open. The catkins stop expansion and dry up with the anthers still closed.



Results of Stage 1 damage - Central stem withered and brittle – anthers remain closed

Male Flower - - - Conclusions

We are still in search of a field method to detect pollen shedding. Our black coffee cup method works great, if there is no wind. On a windy day, all the free pollen is shaken loose, and we can't shake any more loose by tapping the catkins against the inside of the black cup.



Pollen inside a black coffee cup

Expanded catkins stay green and flexible long after the pollen is gone, so the superficial appearance is not a good indicator of shedding. It seems that the best method will involve cutting or bending the catkin to expose the underside of the bracts, then using a hand lens to see the status of the anthers. I know the people at Oregon State and Rutgers can do this without a lens, but we need more practice.

Regarding catkin freeze damage, the key element seems to be the central stem. Catkin expansion is stem elongation and is halted. The anthers need water and energy from the central stem to mature and open. When the stem is damaged the anthers advance no further than their state at the time of the damage.

Catkins stay expanded and flexible for a couple of weeks after the damage, so superficial appearance, again, is not a good indicator. Sectioned macro photos can see the damage within hours, but that's hardly a field method.

Detecting damage, measuring hazel female receptivity and male pollen shedding do not directly solve our eastern hardiness problems. These observation tools get us a level deeper into understanding reasons for nut production variation cultivar-to-cultivar and year-to-year.