scaffolds Update on Pest Management and Crop Development

FRUIT JOURNAL

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APPLE SCAB

UNDERSTANDING AND INTERPRETING APPLE SCAB ASCOSPORE MATURITY DATA
(Wayne Wilcox)

❖❖ Scab season's just about to start, and we'll soon begin supplying the traditional ascospore maturity counts. However, as I wrote in a similar newsletter article last year, I'm increasingly convinced that these numbers are relatively meaningless or even harmful unless they're viewed within some sort of larger context (remember the phrase about "lies, damned lies, and statistics"). So, as long as we're going to keep reporting and referencing these counts, let's at least stop a minute and think about what they really mean.

UNDERSTANDING THEM. Every week, Ron Nevill (my technician) collects a batch of scabby leaves from an unsprayed McIntosh block here at Geneva, brings them back to the lab, and conducts two different tests:

(1) A standard quantity of leaves is wetted up, and the scab fungus is allowed to discharge ascospores for 1 hr into a petri dish. These spores are then counted under the microscope, and the number of spores per low power (LP) field is reported. By comparing data from week to week, this gives a good measure of the relative number of spores that are ready to shoot during an upcoming rain. The only problem is that you can't figure out how many spores will be released over the entire season (thus, what percentage of the season's inoculum is represented by each discharge test) until the season is over and you add up all the numbers. However, these figures are fairly consistent from year to year, so we usually have a pretty good idea what constitutes a "low" and a "high" shoot (see table below).

(2) Twenty individual fruiting bodies (pseudothecia) of the scab fungus are removed at random from different leaves, squashed on a microscope slide, and Ron counts the number of asci in each of five maturity categories, according to how they look under the microscope: categories 1-3 are rated as immature, those in category 4 are rated as mature, and those asci that have already discharged their spores are placed in category 5. The problem here is that spores in category 4, which are always reported and thought of as "mature and ready to shoot", only **appear** to be so. In actual fact, ascospores turn brown and look like they're ready to shoot—i.e., they become "morphologically mature"—about 1-2 weeks before they truly are ready to go. (Anybody wishing to delve into all the gory details on this should see a recent journal article by D. Gadoury, et al., Plant Dis. 76: 277-282). So, are morphological maturity ratings exaggerating the threat early in the season? Is there a better way of assessing initial inoculum availability?

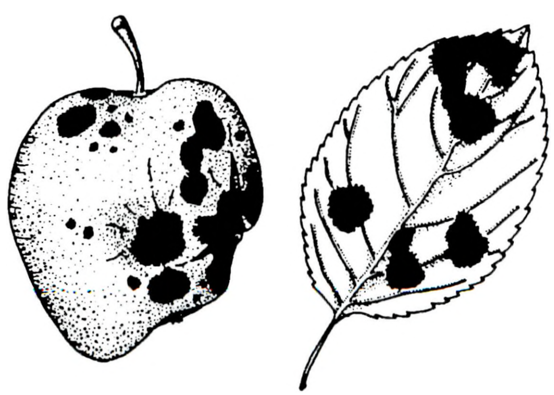
Below, I've summarized the data from our ascospore maturity determinations at Geneva over the last 5 years. These include the percentage of asci **appearing** to be "mature" and those that had already discharged their ascospores, as determined by the standard microscopic examination of squashed fruiting bodies as described above. Also included are the data from the ascospore discharge tests, expressed as we report them each week (spores/ LP field, 1 hr shoot) and as a cumulative percentage of the season's total "catch" through the date in question.

Finally, for each assessment date I've also provided the number of degree days (base 32°F) accumulated after the first date of McIntosh green tip. About 10 yr ago, Gadoury and MacHardy in

continued...

New Hampshire provided data suggesting that (i) the first mature ascospores are ready to shoot at green tip; (ii) maturation continues slowly for the next 175-225 degree days [base 32°F] after green tip; then (iii) the vast majority of spores begin to mature rapidly after this point. This model has never been tested or used extensively outside of New England, but it may have promise.

				% OF ASCI		ASCOSPORE DISCHARGE TEST	
YEAR	DATE	PHEN[a]	DD(32)[b]	"Mature"	Dischrgd	Spores/LP field	Cumulative %
'88	4/14	GT	0	5	<1	6	1
	4/21	QIG	52	11	1	11	3
	4/28	HIG	123	13	2	4	4
	5/5	TC	212	14	3	29	10
	5/20	BL	583	22	37	83	24
	5/26	PF	764	18	48	118	45
	6/2		999	18	71	94	63
	6/9		1184	10	84	154	90
	6/16		1414	10	90	73	100
'89	4/21	GT	0	2	0	0	0
	4/27	QIG	61	3	0	0	0
	5/5	HIG	188	7	1	27	5
	5/11	TC	283	13	4	20	8
	5/18	P	425	47	8	149	34
	5/26	BL	684	46	26	230	73
	6/1	PF	865	39	45	96	90
	6/7		1073	11	86	52	98
	6/16		1350	2	98	9	100



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This newsletter available on CENET, in the Tree Fruit News bulletin board under FRUIT.

				% OF ASCI		ASCOSPORE DISCHARGE TEST	
YEAR	DATE	PHEN[a]	DD(32)[b]	"Mature"	Dischrgd	Spores/LP field	Cumulative %
'90	3/29	GT	0	6	0	0	0
	4/5	GT	55	16	1	13	1
	4/12	QIG	96	31	2	28	4
	4/19	HIG	151	25	5	35	8
	4/26	TC	287	37	7	64	14
	5/4	BL	545	-	7	217	36
	5/10	BL	656	45	23	214	57
	5/17	PF	810	31	42	24	60
	5/24		954	25	56	112	71
	5/31		1152	19	71	86	79
	6/8		1399	13	82	178	97
	6/14		1586	9	91	35	100
'91	4/4	GT	0	9	0	0	0
	4/11	HIG	189	33	5	44	4
	4/18	TC	268	21	3	90	12
	4/25	TC	348	22	6	84	20
	5/2	P	529	30	27	114	31
	5/9	BL	662	31	43	146	44
	5/16	PF	865	29	50	150	58
	5/23		1076	33	47	243	80
	5/30		1362	28	62	146	94
	6/6		1607	16	79	72	100
'92	4/16	ST	-	12	0	0	0
	4/24	QIG	75	27	<1	30	3
	4/30	HIG	141	38	5	46	8
	5/6	TC	262	45	5	108	20
	5/15	BL	481	66	6	177	40
	5/21	BL	637	46	47	221	64
	5/28	PF	803	13	78	201	86
	6/4		937	17	75	58	93
	6/12		1228	2	97	66	100

[a] Approximate phenological stage of McIntosh trees at Geneva: ST = silver tip, GT = green tip, QIG = 1/4" green, HIG = 1/2" green, TC = tight cluster, P = pink, BL = bloom, PF = petal fall

[b] Accumulated number of degree days (base 32°F) since McIntosh green tip

INTERPRETING THESE NUMBERS. Three major points stand out:

(1) As stated above, spores that look mature early in the season often aren't ready to shoot. For example, in 1990, 16% of the spores appeared to be mature at green tip, but only 1% were actually ready to shoot when they were wetted up and given a chance. Similarly, 24% of the spores were rated as "mature" (category 4) in

the 4/24 sampling at quarter-inch green last year, but only 3% were really ready to go.

(2) As predicted by the Gadoury/MacHardy model, actual spore maturity (as measured by the ability of spores to discharge) proceeded slowly for the first 175-225 degree days (base 32°F) after green tip, then advanced rapidly. This start of rapid maturation usually coincided with the tight cluster stage of McIntosh bud development. The model was much less accurate in predicting apparent (morphological) maturity, which it was not designed to do.

(3) Neither tree phenology nor the degree-day model was a good predictor of when most ascospore inoculum was depleted. This may be due to differences in rainfall patterns during the various years or to inaccuracies in our sampling methods. It is quite possible that our figures overstate the threat late in some seasons, judging by some other workers' spore-trapping studies. For instance, our sampling method does not adequately account for the decomposition of overwintering leaf litter as we get into the bloom and post-bloom periods, nor the possibility of spore entrapment by taller orchard grass at these times.

WHAT DOES IT MEAN FOR 1993? We'll continue to collect and report ascospore data as in the past, partly because it's expected and partly because we can learn from them. However, be careful in how you interpret these figures. Accumulated number of degree-days since green tip and tree phenology are probably better indicators of primary inoculum availability than our morphological maturity (category 4) ratings. However, look at the 5-yr trends and keep your eyes out for potential deviations, particularly early in the year.

Don't forget that maturity percentages are MUCH less important than the base level of inoculum in a particular orchard. The number of ascospores immediately available in an orchard with 0.1% leaf scab last fall and 30% of its spores mature is exactly the same as in an orchard with 3% leaf scab last fall and only 1% ascospore maturity!

With this in mind, however, also remember last summer's constant rains: by the time they developed, primary *scab was under* control, fruit had become moderately resistant to scab, but terminal leaf growth kept on going. The result: generally good fruit scab control, but more terminal leaf scab (on an area-wide basis) than we've seen in quite some time. Many growers have more overwintering inoculum in their orchards than they're accustomed to, and a good snowpack has provided optimum conditions for the early stages of spore development.

Don't forget that the delayed spray programs we've been working with assume low primary inoculum levels—we don't have a good handle on how much we can deviate from typically low levels and still get away with it. Those using early fixed copper sprays should take care of a little scab inoculum that might sneak through before starting with SI's around tight cluster. Finally, as always, don't play games if scab got away from you in a particular block last year. Clean it up, so you can go back to a low-inoculum program in 1994.❖❖

FIELD NOTES

HUDSON VALLEY

DISEASE UPDATE
(Dave Rosenberger)

Apple scab ascospore maturity, Highland, NY:

Date	Immature	Mature	Discharged	Tower shoot
April 6	90%	10%	0%	0 spores
April 12	81%	8%	1%	5 spores

❖❖ Significant ascospore discharge usually begins when 15-18% of the spores are mature. With warm weather last week and rain over the week-end, I would expect ascospores will be ready to go later this week. Thus, ascospores will be available about the time most cultivars reach green tip. Infection periods prior to mid-week will probably be of little importance, but I would guess that economically important infections could develop from infection periods occurring after April 15. As usual, early infection periods are of concern primarily in orchards that had scab last year or in orchards adjacent to recently abandoned apple trees. In clean orchards, the first fungicide application can be delayed at least another week, or perhaps until tight cluster if the orchard will receive a program of SI fungicides starting at tight cluster.

This could be a great year for apple scab! The following factors could favor severe outbreaks of scab in eastern New York:

1. Early ascospore development: In previous years when we had less snow cover, ascospore development in leaves has sometimes been delayed by sub-freezing temperatures and drying of the exposed leaf litter on the soil surface. This year, our February-March snow cover and the water from the subsequent snow melt provided ideal conditions for timely ascospore development.

2. Many orchards had less-than-perfect scab control last year, so there will be carry-over inoculum in more than the usual number of orchards.

3. Apple scab remained active through summer in many orchards last year because of our unusually cool and wet summer. Apple scab usually becomes less active when summer daytime temperatures regularly exceed 80-85°F. At the Hudson Valley Lab, we had only 11 days with a high temperature greater than 85°F in 1992, compared with 50 days in 1991 and 27 days in 1990.

4. Low rates of fungicide that are sometimes applied in the first spray may fail to control scab. Use of excessively low rates of dodine and mancozeb in some early sprays last year may have contributed to development of scab problems later in the season.

Dodine (Syllit) is still a good fungicide for early-season sprays in eastern NY except where resistance to dodine is suspected. However, if dodine is applied at less than the minimum label rate of 1 lb/A (approximately 6 oz/100 gallons), control failures are likely and selection for resistance to dodine can be accelerated. For growers spraying alternate rows, the actual amount of dodine applied per acre should still be at least 1 lb unless the spray interval for the alternate sides never exceeds 5 days. Note that dodine was initially tested at rates of 12-16 oz/100 gallons when the product was under development. The rate was gradually reduced to a minimum of 6 oz/100 gallons, a rate that was considered the breaking point for this fungicide. Reducing application rates for dodine to less than 6 oz/100 gallons will likely result in a control failure.

Fire Blight

Now is the time to apply copper sprays for controlling fire blight. Copper sprays applied at silver-tip to green-tip bud stages will help to reduce over-wintering inoculum. These delayed-dormant copper sprays are recommended for orchards in which fire blight was present either of the last two seasons. Copper sprays are especially important for pears and for apple trees with blight-susceptible rootstocks or stem-pieces (M.9, M.26, Mark). Remember, however, that copper sprays applied after green tip (i.e., half-inch green or later) can cause severe fruit russetting in years when there is insufficient rain to remove the copper residues before tight cluster.

Black Knot on Plums and Prunes

If plum and prune trees have not already been pruned and checked for black knot, it is important to do so soon. Black knots will become more difficult to spot after buds burst and growth begins. The primary defense against black knot is sanitation. All black knot infections must be removed from orchard trees and from wild cherry trees in adjacent hedgerows. The knots that are removed must be collected and burned. Knots left in the trees or on the orchard floor will pump out thousands of ascospores. None of the available fungicides will control black knot effectively when high doses of ascospores are being released from existing black knots within the orchard. Ascospore release for black knot usually occurs from white bud through about second cover, but now is the time to reduce inoculum levels by removing knots.❖❖

BULLETIN

HEAT OF THE DAY
(Art Agnello)

❖❖ Those of you who have used the "Upcoming Pest Events" section of this newsletter to predict certain pest activities may recall our mentioning a publication in the works listing all the events for which we have collected DD information. That publication is now available, and although we will continue to add to our data base, this list will serve as a good place to start for many of the pest events in this area. For a copy (free), write to: Bulletins, Communications Services, Jordan Hall, N.Y.S. Agric. Expt. Sta., Geneva, NY 14456.

Agnello, Kain & Spangler, 1993. Fruit pest events and phenological development according to accumulated heat units. N.Y. Food & Life Sci. Bull. 142. ❖❖

INSECT TRAP CATCHES

Number/Trap/Day, Geneva NY

	4/1	4/5	4/8	4/12
Green fruitworm	0	0	0	0.4*
Pear psylla adults (panel trap)	0	0	0.1*	0
Redbanded Leafroller	0	0	0	0
Spotted Tentiform Leafminer	0	0	0	0

Number/Trap, HVL, Highland NY

	4/4	4/9	4/11
Green fruitworm	0	2*	0
Pear psylla (panel trap)	0	7	1
Redbanded Leafroller	0	0	0
Spotted Tentiform Leafminer	0	0	0
Sparganothis Fruitworm	0	0	0

(Dick Straub, Peter Jentsch)

* 1st catch

PHENOLOGIES

Geneva: Apple, pear, cherry, peach, plum: **All dormant**
Highland: Apple (McIntosh): **Green tip**
Plum (Stanley): **Swollen bud**

PEST FOCUS

Pear psylla adults active, laying eggs

UPCOMING PEST EVENTS

	43°F	50°F
Current DD accumulations (Geneva 1/1 - 4/12):	62	23
(Highland 1/1- 4/12):	97	83

Coming Events:	Ranges:	
Green fruitworm 1st adult catch	41-143	9-69
Pear psylla 1st oviposition	27-147	10-72
Redbanded leafroller 1st adult catch	32-480	17-251
Spotted tentiform leafminer 1st adult catch	73-433	17-251
McIntosh at silver tip	64-67	17-19
McIntosh at green tip	24-161	4-74
Sweet cherry at swollen bud	67-137	17-67

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