

# Leafroll Color Atlas

Deborah Golino, Adib Rowhani, Sue Sim, Foundation Plant Services,  
University of California, Davis. Compiled April 5, 2010



## Leafroll Color Atlas Abbreviations

5BB	Kober 5BB, used as indicator for GVA
ArMV	Arabis Mosaic Virus
CabF	Cabernet franc, used as an indicator for leafroll
C. a.	Chenopodium amaranticolor, used as indicator for nepoviruses
C. q.	Chenopodium quinoa, used as indicator for nepoviruses
Cuc.	Cucumis sativa, used as indicator for nepoviruses
Fk	GFkV = Grapevine fleck virus
GFLV	Grapevine fanleaf virus
GVA	Grapevine virus A
GVB	Grapevine virus B
GVD	Grapevine virus D
LN-33	used as an indicator for corky bark
LR1-9	GLRaV-1 through 9 = Grapevine leafroll associated virus types 1 through 9
LR2RG	GLRaV-2RG= Grapevine leafroll associated virus type 2 Red Globe strain
LRCar	GLRaV-Car= Grapevine leafroll associated virus Carnelian strain
StG	St. George, used as indicator for nepoviruses (StG N) and RSP (StG RSP)
Phyt	phytoplasma
RSP	GRSPaV = Grapevine rupestris stem pitting associated virus
ToRSV	Tomato ringspot virus
Tob	Tobacco, <i>N. clevelandii</i> , used as indicator for nepoviruses
TobRSV	Tobacco ringspot virus
XF	<i>Xylella fastidiosa</i> (Pierce's disease)

# Leafroll Color Atlas Legend 1

Leafroll virus tests on first row.

Leafroll Color Atlas Image #

Scion/Rootstock

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	23.7	neg	neg	neg	neg	neg	
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>GFkV</b>	Comments					
36.6	neg	neg	neg						

Rugose wood virus and Fleck virus tests on second row.

**Yellow = Positive.** A lower number indicates a higher virus titer by TaqMan<sup>®</sup> qPCR test;  
 Gray = Inconclusive. Near threshold between positive and negative;  
 neg = Negative; blank = not tested.

# Leafroll Color Atlas Legend 2

Leafroll virus test

Nepovirus test

Fleck virus test

Leafroll Color Atlas Image # Scion/Rootstock

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2/ RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	neg	neg	neg	neg	neg	23.7	neg	neg	neg		neg	neg		
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I- StG Fk	E- GFkV	P- GFkV			
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	<b>POS</b>	<b>POS</b>	<b>POS</b>			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I- StG RSP	P- RSP	P- GVD	P- phyt.	P- XF							
neg		Rpt			neg	<b>POS</b>	<b>POS</b>	neg									

Rugose wood virus test

Other test

I = Biological index test; E = ELISA test; P = PCR test.

**Yellow = positive.** A lower number indicates a higher virus titer by TaqMan<sup>®</sup> qPCR test;

Gray = Inconclusive, near threshold between positive and negative;

neg = negative; blank = not tested.

# Leafroll Color Atlas Categories

Category	Description
A	Tests <b>positive</b> . Has leafroll symptoms. Includes classic and varied symptoms. Possible reasons for variation are: early stage of infection, time of year, variety effect, rootstock effect, virus type or virus strain within type or presence of a confounding factor such as potassium deficiency, water stress, or other disease.
B	Tests negative. Has red leaves. Some look like leafroll, some do not. Other possible causes of red leaves are potassium deficiency, water stress, or other disease.
C	Tests questionable, near threshold of positive and negative. May have red leaves or not.

# Category A

Tests **positive**.

Has leafroll symptoms.

# Category A

Tests **positive**.

Has leafroll symptoms.

# Examples	Variety	Rootstock
18	Cabernet Sauvignon	101-14 MGT, 110R, 1103P, 3309C, Kober 5BB, O39-16, St. George
16	Cabernet franc	101-14 MGT, 1103P, 3309C, O39-16, own roots (FPS index)
5	Pinot noir	101-14 MGT, 3309C, Riparia Gloire
2	Petite Sirah	110R
2	Zinfandel	St. George
<b>43</b>	<b>Total</b>	

# Category A

Tests **positive**.

Has leafroll symptoms.

19/43 have classic leafroll symptoms;  
24/43 have varied leafroll symptoms.







**Leafroll Color Atlas Image #1**

**Cabernet Sauvignon-7/ O39-16**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	23.7	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	Typical interveinal reddening with green major veins on basal. Planted spring, 2009. Photo taken 11-5-09.						
neg	neg	neg							



#4



**Leafroll Color Atlas Image # 4**

**Cabernet Sauvignon-4/O39-16**

LR-1	LR-2	LR-2 RG	LR-3	LR-4	LR-5	LR-6	LR-7	LR-9	LR-Car
neg	neg	neg	26.6	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>							
35.5	neg	neg	Photo taken 11-5-09.						



#34



Leafroll Color Atlas Image # 34

Cabernet Sauvignon-337/ 039-16

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	Rpt	POS	Rpt		neg	neg	
GVA	GVB	GVD	RSP						
neg	Rpt	neg							

Photo taken 10-15-09.



#27



Leafroll Color Atlas Image # 27

Cabernet Sauvignon-7/ O39-16

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	28.6	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP						
neg	neg	neg							

Photo taken 10-6-09.





#28



**Leafroll Color Atlas Image # 28** **Cabernet Sauvignon-7/ O39-16**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	19.5	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP						
neg	neg	neg		Photo taken 10-6-09.					





**Leafroll Color Atlas Image # 24**

**Cabernet Sauvignon-6/101-14 MGT**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	21.5	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>						
neg	neg	neg		Photo taken 10-6-09.					



#44



Leafroll Color Atlas Image # 44

Cabernet Sauvignon-7/ St. George

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	15.9	neg	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP	GFkV	Few basal leaves show symptoms. Photo taken 10-8-08.				
neg	neg	neg	32.8	17.0					



110R

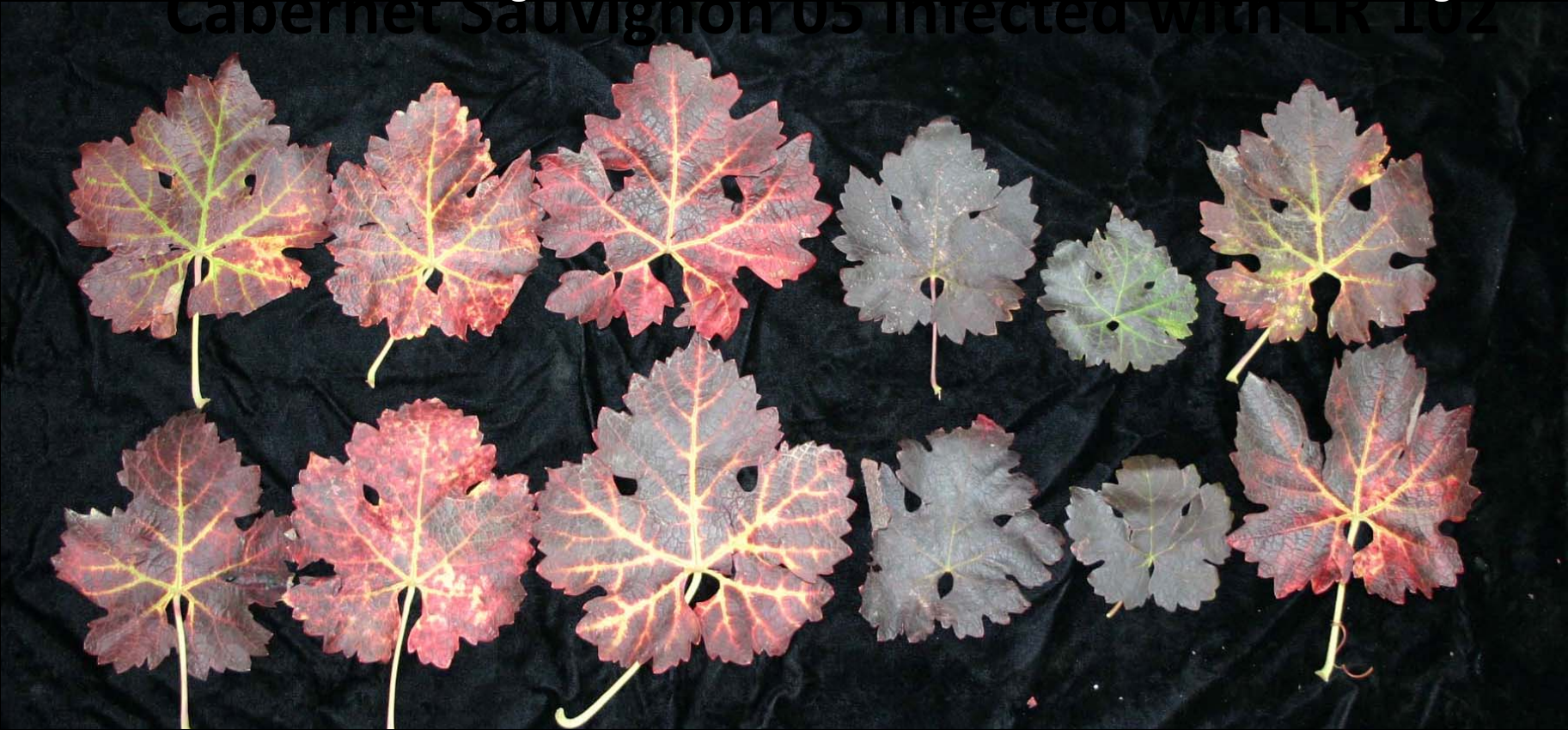
101-14 Mgt

1103P

3309C

Kober 5BB

St. George

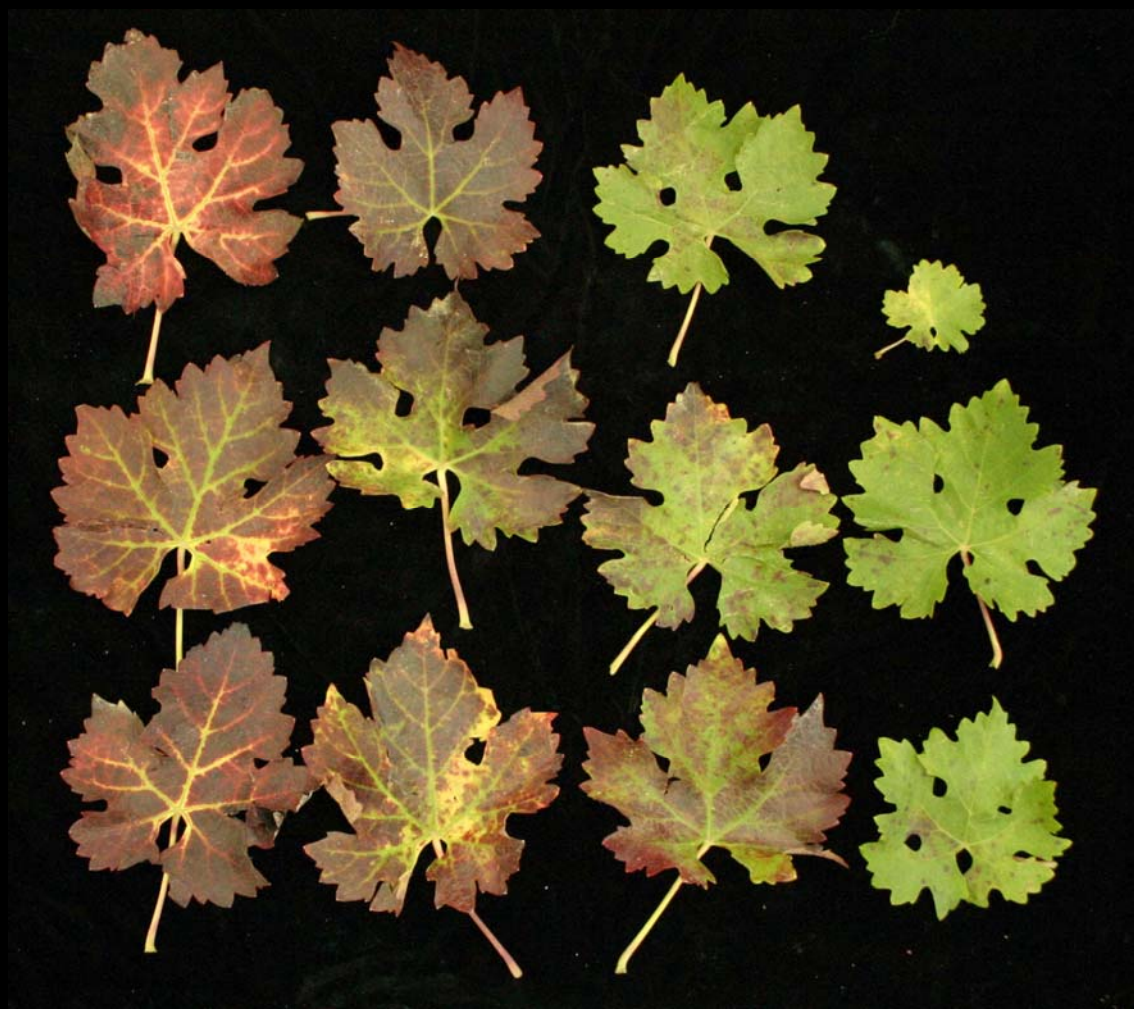


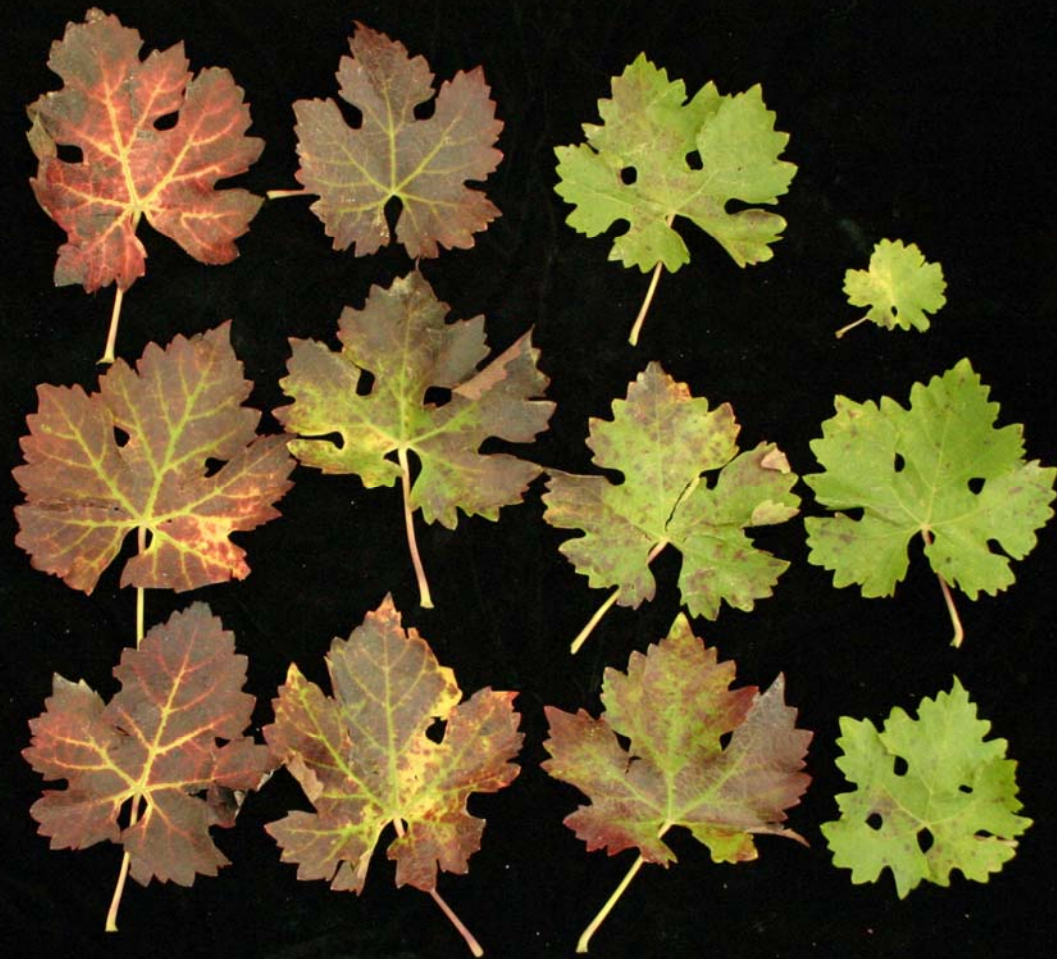
Cabernet Sauvignon-05 Infected With LR 102

Leafroll Color Atlas Image # 61 Cabernet Sauvignon-5/ six rootstocks

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
POS	POS	neg	neg	neg	POS				
GVA	GVB	GVD	RSP	GFKV	Experimental trial – all inoculated with the same virus accession (LR102). Photo taken 10-26-06.				
neg	POS	neg	POS	neg					







Leafroll Color Atlas Image # 62

Cabernet Sauvignon-5/ 110R

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
POS	POS	neg	neg	neg	POS				
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>	<b>GFkV</b>	Experimental trial - Leaves from one lateral branch on vine inoculated with virus accession LR 102. Photo taken 10-26-06.				
neg	POS	neg	POS	neg					



#2



**Leafroll Color Atlas Image #2**

**Cabernet Sauvignon-7/ O39-16**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	20.5	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD							
18.6	neg	neg	Patchy red from leaf margin inward. In same vineyard as #1. Photo taken 11-5-09.						



#35



Leafroll Color Atlas Image # 35

Cabernet Sauvignon-337/ O39-16

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	Rpt	POS	Rpt		neg	neg	
GVA	GVB	GVD	RSP						
neg	Rpt	neg							

Photo taken 10-15-09.



#36



**Leafroll Color Atlas Image # 36**

**Cabernet Sauvignon-337/ O39-16**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	neg	POS	Rpt		neg	neg	
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>						
neg	Rpt	neg							

Photo taken 10-15-09.







**Leafroll Color Atlas Image # 26**

**Cabernet Sauvignon-7/ O39-16**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	32.2	23	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP	Possible early stage of infection. Vines planted 2008. Photo taken 10-6-09.					
neg	neg	neg							





Leafroll Color Atlas Image # 33

Cabernet Sauvignon-8/ 101-14 MGT

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	POS	Rpt	neg		neg	neg	
GVA	GVB	GVD	RSP						
neg	neg	neg							

Possible early infection. Photo taken 10-15-09

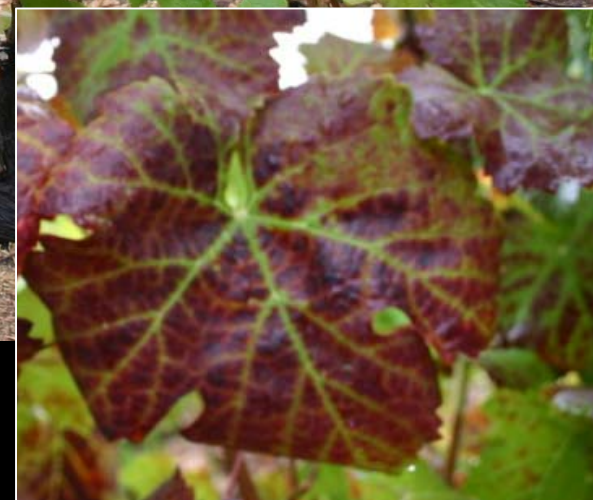




Leafroll Color Atlas Image # 9

Cabernet Sauvignon-31/101-14MGT

LR-1	LR-2	LR-2 RG	LR-3	LR-4	LR-5	LR-6	LR-7	LR-9	LR-Car
neg	neg	neg	34.6	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>							
30.6	neg	neg	Necrotic leaf margins, possible water stress. Photo taken 11-5-09						



#32



Leafroll Color Atlas Image # 32

Cabernet franc-332/ 1103P

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	POS	neg	neg		neg	neg	
GVA	GVB	GVD	RSP						
neg	POS	neg							

Photo taken 10-15-09







Leafroll Color Atlas Image # 31

Cabernet franc-312/ 1103P

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	POS	neg	neg		neg	neg	
GVA	GVB	GVD	RSP						
neg	POS	Rpt							

Photo taken 10-15-09.





Leafroll Color Atlas Image # 29

Cabernet franc-312/ 1103P

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	neg	neg	neg		neg	neg	
GVA	GVB	GVD	RSP						
neg	POS	Rpt		Photo taken 10-15-09.					





Leafroll Color Atlas Image # 17

Cabernet franc-214/101-14MGT

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	21	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	Photo taken 11-5-09.						
35.9	neg	neg							



#30



Leafroll Color Atlas Image # 30

Cabernet franc-312/ 1103P

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	neg	neg	neg		neg	neg	
GVA	GVB	GVD	RSP						
neg	POS	Rpt							

Photo taken 10-15-09.







Leafroll Color Atlas Image #16					Cabernet franc-214/101-14 MGT				
LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	34.8	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	Photo taken 11-5-09.						
36.1	neg	neg							





**Leafroll Color Atlas Image #19**

**Cabernet franc-327/101-14 MGT**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	32.7	37	neg	neg	neg	neg	neg	neg

GVA	GVB	GVD
neg	neg	33.9

Photo taken 11-5-09.



#42



Leafroll Color Atlas Image # 42

Pinot noir/Riparia gloire

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	31.8	neg	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP						
neg	neg	neg	19.9	Photo taken 10-8-08.					



#43



**Leafroll Color Atlas Image # 43**

**Pinot noir/Riparia gloire**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	33.1	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>	<b>GFkV</b>					
neg	neg	neg	17.7	35.0	Photo taken 10-8-08.				





#46



**Leafroll Color Atlas Image # 46**

**Pinot noir/ 101-14 MGT**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	28.2	neg	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP	GFkV					
neg	neg	neg	20.6	33.7	Photo taken 10-8-08.				



#48



**Leafroll Color Atlas Image # 48**

**Pinot noir/ 3309C**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	32.7	neg	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP	GFkV					
neg	neg	neg	21.2	neg	Photo taken 10-8-08.				





**Leafroll Color Atlas Image # 47**

**Pinot noir/ 101-14 MGT**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP	GFkV					
neg	neg	neg	POS	neg	Photo taken 10-8-08.				



#39



Leafroll Color Atlas Image # 39

Petite Sirah/ 110R

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	POS	neg	neg	neg	neg	neg	
GVA	GVB	GVD	RSP						
neg	POS	neg							

Photo taken 10-20-09.





#40



**Leafroll Color Atlas Image # 40**

**Petite Sirah/ 110R**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	POS	neg	neg	neg	neg	neg	
GVA	GVB	GVD	RSP						
neg	POS	neg							

Photo taken 10-20-09.



#41



**Leafroll Color Atlas Image # 41**

**Zinfandel/ St. George**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	POS	neg	POS	neg	neg	neg	neg	neg	
GVA	GVB	GVD	RSP						
neg	GVB	neg							

Dry, dead areas indicate potassium deficiency. Photo taken 10-20-09.





**Leafroll Color Atlas Image # 38**

**Zinfandel/ St. George**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	<b>POS</b>	neg	neg	neg	neg	neg	neg	neg	
GVA	GVB	GVD	RSP	Dry, dead areas indicate potassium deficiency and/or water stress. Photo taken 10-20-09.					
neg	neg	neg							

Cabernet franc index







**Leafroll Color Atlas Image #50**

**Cabernet franc/own roots**

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	<b>16.9</b>	neg		34.9		neg		neg	neg	neg		neg	neg	neg
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I-StG Fk	E- GFkV	P- GFkV			
<b>POS</b>	<b>POS</b>	<b>POS</b>	neg	neg	neg	neg	neg	<b>POS</b>	neg	neg		neg	neg	neg			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I-StG RSP	P- RSP	P- GVD	P- phyt.	P- XF							
neg		neg	neg	neg	rpt	neg	<b>POS</b>	neg	neg	neg	Photo taken 10-28-09.						





**Leafroll Color Atlas Image #51**

**Cabernet franc/own roots**

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	<b>22.6</b>	neg	<b>POS</b>	<b>25.5</b>		<b>27.8</b>		neg	neg	neg		neg	neg	neg
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I-StG Fk	E- GFkV	P- GFkV			
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg		<b>POS</b>	<b>POS</b>	<b>POS</b>			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I-StG RSP	P- RSP	P- GVD	P- phyt.	P- XF	Photo taken 10-28-09.						
neg		neg	<b>POS</b>		<b>POS</b>	neg	<b>POS</b>	neg	neg	neg							





**Leafroll Color Atlas Image #52**

**Cabernet franc/own roots**

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	<b>POS</b>	neg	neg	<b>POS</b>		neg		neg	neg	neg		neg	neg	neg
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I-StG Fk	E- GFkV	P- GFkV			
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg		<b>POS</b>	<b>POS</b>	<b>POS</b>			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I-StG RSP	P- RSP	P- GVD	P- phyt.	P- XF	Photo taken 10-28-09.						
<b>POS</b>		<b>POS</b>	neg		neg	<b>POS</b>	<b>POS</b>	neg	neg	neg							





**Leafroll Color Atlas Image # 53 Cabernet franc/own roots**

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	<b>POS</b>	neg	neg	<b>POS</b>		neg		neg	neg	neg		neg	neg	neg
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I-StG Fk	E- GFkV	P- GFkV			
neg	<b>POS</b>	<b>POS</b>	neg	neg	neg	neg	neg	<b>POS</b>	neg	neg		neg	neg	neg			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I-StG RSP	P- RSP	P- GVD	P- phyt.	P- XF	Photo taken 10-28-09.						
neg		neg	<b>POS</b>		<b>POS</b>	<b>POS</b>	<b>POS</b>	Rpt	neg	neg							







**Leafroll Color Atlas Image #54**

**Cabernet franc/own roots**

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	neg	neg	neg	<b>POS</b>		neg		neg	neg	neg		neg	neg	neg
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I-StG Fk	E- GFkV	P- GFkV			
<b>POS</b>	<b>POS</b>	<b>POS</b>	neg	neg	neg	neg	neg	neg	neg	neg		neg	<b>POS</b>	<b>POS</b>			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I-StG RSP	P- RSP	P- GVD	P- phyt.	P- XF	Photo taken 10-28-09.						
neg		neg	<b>POS</b>		<b>POS</b>	<b>POS</b>	<b>POS</b>	neg	neg	neg							





**Leafroll Color Atlas Image #55**

**Cabernet franc/own roots**

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	<b>POS</b>	neg	<b>POS</b>	<b>POS</b>		neg		neg	neg	neg		neg	neg	neg
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I-StG Fk	E- GFkV	P- GFkV			
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg		neg	neg	neg			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I-StG RSP	P- RSP	P- GVD	P- phyt.	P- XF							
<b>POS</b>		<b>POS</b>	neg		<b>POS</b>	<b>POS</b>	<b>POS</b>	neg	neg	neg	Photo taken 10-28-09.						









**Leafroll Color Atlas Image # 57 Cabernet franc/own roots**

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	neg	neg	neg	neg		<b>POS</b>		neg	neg	neg		neg	neg	neg
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I-StG Fk	E- GFkV	P- GFkV			
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg		neg	neg	neg			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I-StG RSP	P- RSP	P- GVD	P- phyt.	P- XF	Photo taken 10-28-09.						
neg		neg	neg		neg	neg	neg	neg	neg								







**Leafroll Color Atlas Image #58**

**Cabernet franc/own roots**

I- CabF	E- LR1	P- LR1	E- LR2	P- LR2	P- LR2RG	E- LR3	P- LR3	E- LR4	P- LR4	E- LR5	P- LR5	E- LR6	P- LR6	E- LR7	P- LR7	P- LR9	P- Car
<b>POS</b>	neg	neg	neg	<b>POS</b>	neg	<b>POS</b>	neg		neg		neg	neg	neg		neg	neg	neg
I- StG N	E- GFLV	P- GFLV	E- ArMV	P- ArMV	E- ToRSV	P- ToRSV	I- C. a.	I- C. q.	I- Cuc.	I- Tob	P- TobRSV	I-StG Fk	E- GFkV	P- GFkV			
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg		neg	neg	neg			
I- LN-33	E- CB	P- GVB	I- 5BB	E- GVA	P- GVA	I-StG RSP	P- RSP	P- GVD	P- phyt.	P- XF	Photo taken 10-28-09.						
neg		neg	neg		neg	neg	<b>POS</b>	neg	neg	neg							

Category B  
Tests negative;  
Has red leaves.

Category B  
Tests negative;  
Has red leaves.

Some look like leafroll, some do not.  
Other possible causes of red leaves are potassium deficiency, water stress, or other disease.

# Category B

Tests negative;  
Has red leaves.

# Examples	Variety	Rootstock
7	Cabernet Sauvignon	101-14 MGT, Teleki 5C
1	Cabernet franc	101-14 MGT
1	none	O39-16
1	Petite Verdot	110R
1	Zinfandel	St. George
<b>11</b>	<b>Total</b>	



#10



**Leafroll Color Atlas Image # 10**

**Cabernet Sauvignon-7/ 101-14MGT**

LR1	LR2	LR2 RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	Generalized pink color and pink speckles only on last 8 vines of each row. Possible water quality/quantity or root rot problems. Photo taken 11-5-09.						
neg	neg	neg							



#11



**Leafroll Color Atlas Image # 11**

**Cabernet Sauvignon-7/ 101-14MGT**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	Pink and red leaves only on last 8 vines of each row. Possible water quality/quantity or root rot problems. Photo taken 11-5-09.						
35.9	neg	neg							







Leafroll Color Atlas Image # 14

Cabernet Sauvignon-29/101-14MGT

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	Red speckles only on last 8 vines of each row. Possible water quality/quantity or root rot problems. Photo taken 11-5-09.						
34.6	22.9	neg							





**Leafroll Color Atlas Image #8**

**Cabernet Sauvignon-31/101-14 MGT**

LR-1	LR-2	LR-2 RG	LR-3	LR-4	LR-5	LR-6	LR-7	LR-9	LR-Car
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	Dark red speckles only on last 8 vines of each row. Possible water quality/quantity or root rot problems. Photo taken 11-5-09.						
36.6	neg	neg							



#13



**Leafroll Color Atlas Image # 13**

**Cabernet Sauvignon-29/ 101-14MGT**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	Pink color and pink and red speckles only on last 8 vines of each row. Tertiary veins still green. Possible water quality/quantity or root rot problems. Photo taken 11-5-09.						
35.7	25.3	neg							



#20

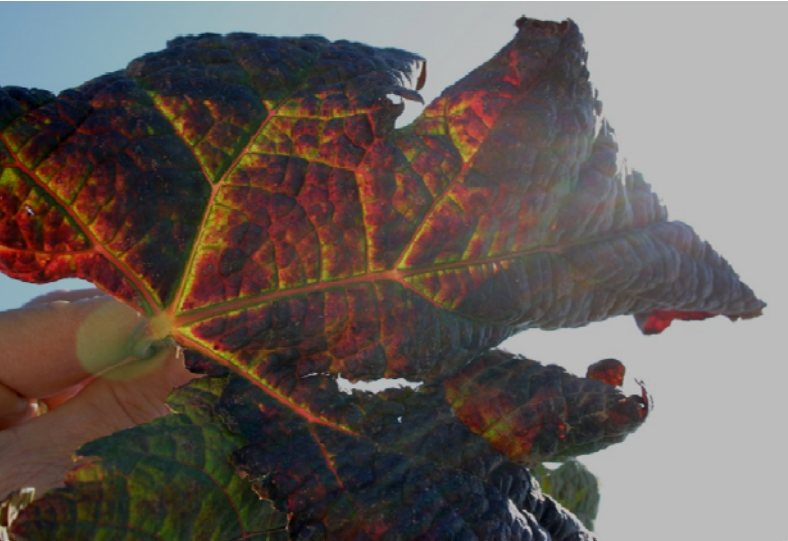


**Leafroll Color Atlas Image # 20**

**none/O39-16**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>	Red leaves only in areas near ground. Possible frost damage. Photo taken 11-16-09.					
neg	neg	neg	neg						





#45



**Leafroll Color Atlas Image # 45**

**Merlot-3/ St. George**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>	<b>GfKv</b>	Black leaves. Possible potassium deficiency. Photo taken 10-8-08.				
neg	neg	neg	neg						



#15



**Leafroll Color Atlas Image # 15**

**Cabernet franc-327/ 101-14 MGT**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD							
neg	neg	neg	Senescing leaf, necrotic margin, possible water stress. Photo taken 11-5-09.						





**Leafroll Color Atlas Image # 21**

**Cabernet Sauvignon-7/ Teleki 5C**

<b>LR1</b>	<b>LR2</b>	<b>LR2 RG</b>	<b>LR3</b>	<b>LR4</b>	<b>LR5</b>	<b>LR6</b>	<b>LR7</b>	<b>LR9</b>	<b>LRCar</b>
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>							
neg	neg	neg	Senescing leaves. Note that the tertiary veins are yellow. Photo taken 11-16-09.						



#22



**Leafroll Color Atlas Image # 22**

**Cabernet Sauvignon-7/ Teleki 5C**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>	Senescing leaves. Note that the tertiary veins are yellow. Photo taken 11-16-09.					
neg	neg	neg	neg						







**Leafroll Color Atlas Image # 37**

**Zinfandel/ St. George**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>	Possible potash deficiency. Photo taken 10-20-09.					
neg	neg	neg							



#23



**Leafroll Color Atlas Image # 23**

**Petit Verdot/O39-16**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
<b>GVA</b>	<b>GVB</b>	<b>GVD</b>	<b>RSP</b>						
neg	neg	neg							

Possible drought stress. Photo taken 10-6-09.

# Category C

Tests Questionable;

At threshold between positive and negative.

Some red leaves, some not.

# Category C

Tests Questionable;

At threshold between positive and negative.

Some red leaves, some not.

# Category C

## Tests Questionable;

### Some red leaves, some not.

# Examples	Variety	Rootstock
2	Cabernet Sauvignon	101-14 MGT, O39-16
1	Merlot	O39-16
<b>3</b>	<b>Total</b>	

#25







**Leafroll Color Atlas Image # 25**

**Merlot-181/ O39-16**

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	36.7	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	RSP						
neg	neg	neg		Photo taken 10-6-09.					

South side of each cordon green, north side pink



South side of each cordon green, north side pink



Leafroll Color Atlas Image #12

Cabernet Sauvignon-7/ 101-14MGT

LR1	LR2	LR2RG	LR3	LR4	LR5	LR6	LR7	LR9	LRCar
neg	neg	36.3	neg	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	Generalized pink color and pink speckles only on last 8 vines of each row. Possible water quality/quantity or root rot problems. Photo taken 11-5-09.						
35.9	neg	neg							





**Leafroll Color Atlas Image #7**

**Cabernet Sauvignon-7/ O39-16**

LR-1	LR-2	LR-2 RG	LR-3	LR-4	LR-5	LR-6	LR-7	LR-9	LR-Car
neg	neg	neg	35.5	neg	neg	neg	neg	neg	neg
GVA	GVB	GVD	No symptoms. Photo taken 11-5-09.						
29.8	neg	neg							