

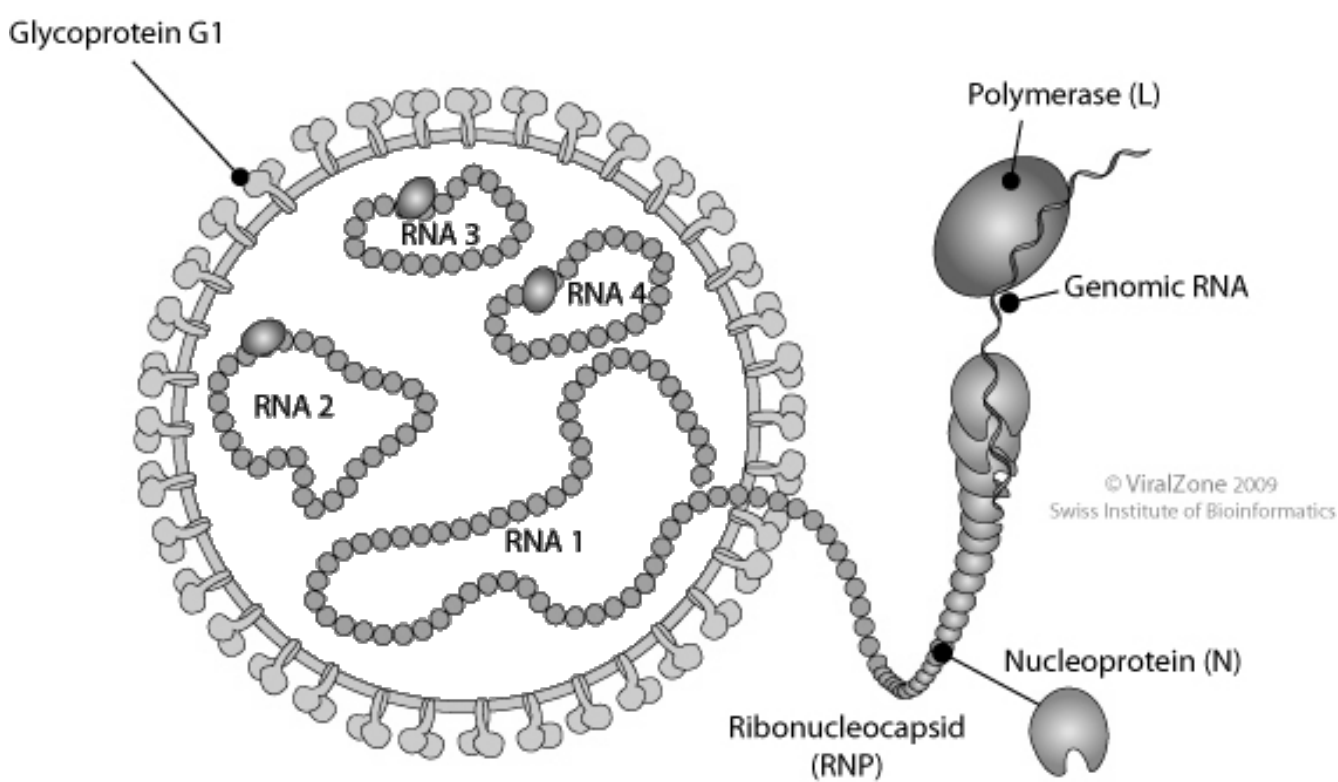


SCRI Grant No: 2014-51181-22644  
United States National Institute  
Department of of Food and  
Agriculture Agriculture

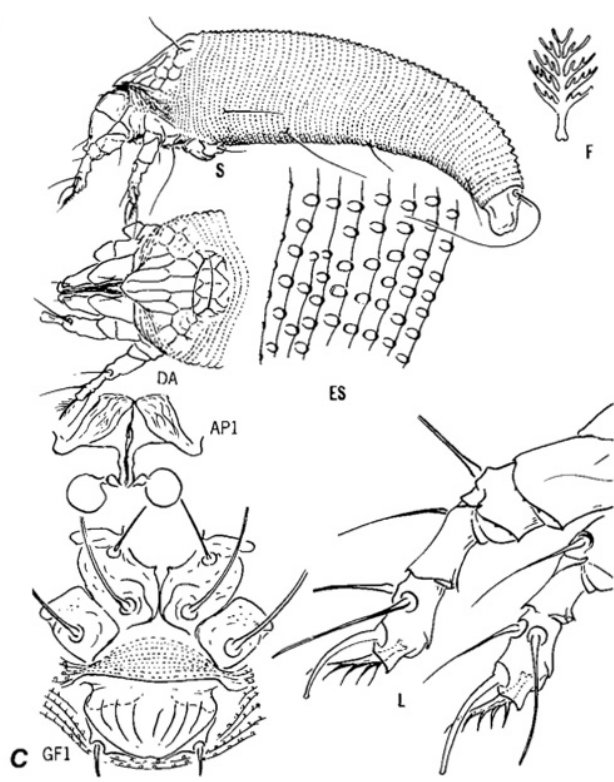


# EVALUATION OF ROSE GERMPLASM FOR RESISTANCE TO ROSE ROSETTE DISEASE

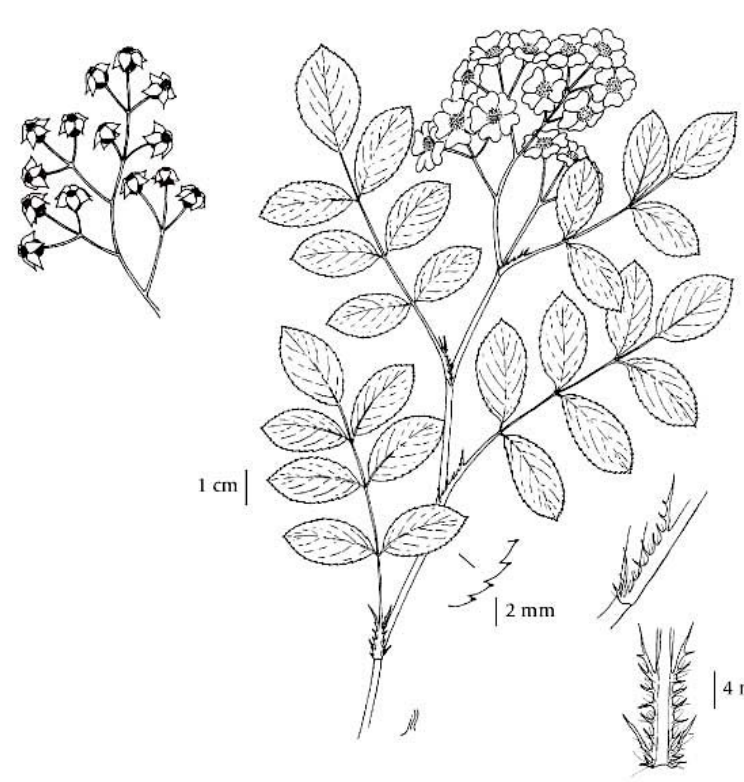
Danielle Novick & Tom Evans | University of Delaware, Newark, DE



Rose rosette disease (RRD) is a lethal disease of rose caused by **rose rosette emaravirus**. The virion (left) consists of a double membrane-bound body containing 7 negative-sense RNAs. Other members of the emaravirus genus include high plains virus and pigeonpea sterility mosaic virus.



*Rose rosette emaravirus* is vectored by the eriophyid mite ***Phyllocoptes fructiphilus*** (Acari: Eriophyidae). This mite is 140–170 microns in length, travels long distances on air currents, and hides in the leaf axils and buds of roses. It can acquire the virus in less than 5 days and retransmit within an hour of feeding.



Roses (*Rosa spp.*) are the only known hosts of RRD. ***Rosa multiflora***, a noxious weed and invasive plant in most of the U.S., serves as a reservoir for the virus and its vector. Eradication efforts for *R. multiflora* have had little effect, resulting in the spread of RRD across much of North America.

## INTRODUCTION

Rose rosette disease (RRD) is a systemic, incurable, and lethal viral disease of roses. Symptoms may appear within a month of infection and most symptomatic plants die within 1–3 years. RRD has become more prevalent over the last few decades due to the spread of the invasive weed, *Rosa multiflora*, which serves as a reservoir for the pathogen and vector.

### Known resistance

There is no known resistance among commercial rose cultivars and the few rose species that have demonstrated resistance are not ideal candidates for introgression of resistance genes into commercially viable cultivars. These species include *R. californica*, *R. carolina*, *R. palustris*, *R. setigera*, and *R. spinosissima*.

### Economic impact

Landscape roses are a high-value ornamental with a North American retail market approaching \$1 billion in value (Vineland Research and Innovation Centre).

### Symptoms of rose rosette disease

- Abnormal reddening
- Witches' broom
- Leaf and bud distortion
- Thorn proliferation
- Extreme succulence
- Blossom blight
- Shoot elongation
- Stunting
- Dieback
- Plant death

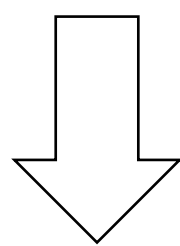


## OBJECTIVE

The objective of this study is to identify rose genotypes that merit consideration as candidates in a breeding scheme for resistance to RRD. Additional evaluations of rose germplasm are being conducted at Oklahoma State University, University of Tennessee, and Texas A&M University. Data from all of these studies will inform marker-assisted and conventional rose breeding programs.

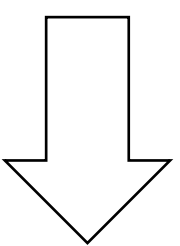
## METHODS

**151 rose genotypes** (3 replicates) planted in a randomized block design in Newark, DE in May 2015



All roses augmented 5 times between May 2015 and October 2016

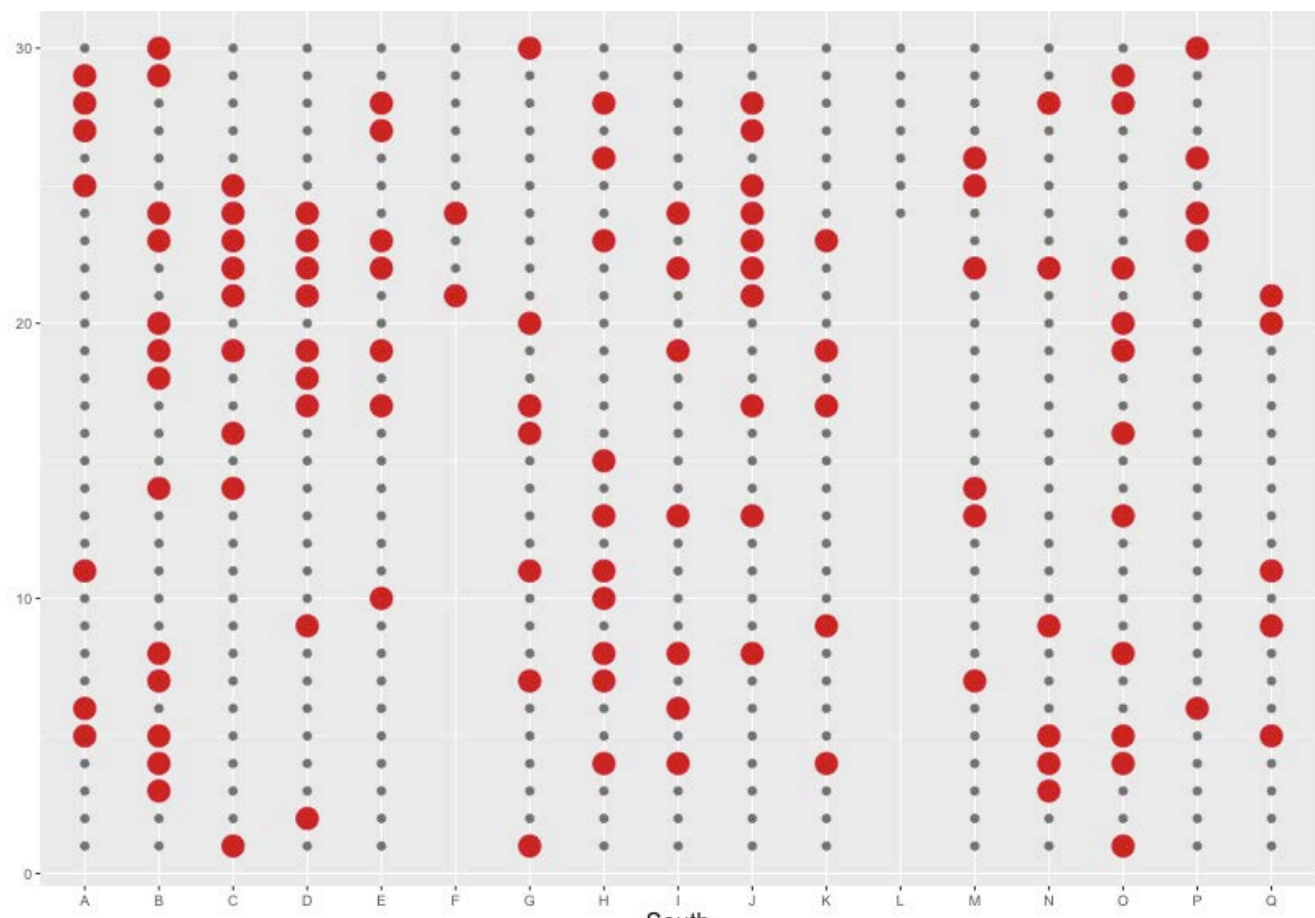
Augmentation = introduce viruliferous vector mites to field by twist-tying symptomatic shoots of RRD-infected *Rosa multiflora* to actively growing shoot tips of target roses



Symptomatic roses confirmed for RRD with endpoint RT-PCR



**Top left:** Aerial photograph of rose plot taken in August 2016. Overlay shows the three replicates of the randomized block design.  
**Top right:** Planting roses in the field in May 2015.  
**Bottom left:** Augmenting a rose by twist-tying a symptomatic shoot of *R. multiflora* (inoculum) to a target rose in the resistance trial.  
**Bottom right:** A rose, 'Mermaid', showing symptoms of RRD.



**Left:** Depiction of rose field from overhead showing all individuals that have become symptomatic since the start of the trial. Within 18 months of planting 31% were infected with RRD.

● Infected  
● Not infected

## RESULTS

|  |  |   |
|--|--|---|
| 262-97-4<br>89-1<br>Abbaye de Cluny<br>Adobe Sunrise<br>Amber gem<br>Belinda's Dream<br>Bonica<br>Carefree Beauty<br>Carefree Celebration<br>Carefree Delight<br>Carefree Sunshine<br>Champlain<br>Champneys Pink Noisette<br>Charisma<br>CK25<br>Coral Drift<br>Dee-lish<br>Desmond Tutu<br>Dr. Huey<br>Dream Come True<br>Ducher<br>E02-17-3<br>Easy Elegance Calypso<br>Easy Elegance Kashmir<br>Easy Elegance My Girl<br>Elle<br>Eyeconic Melon Lemonade<br>Fire Meidiland<br>Fortuniana | Francis Meilland<br>GNIS<br>Golden Fairy Tale<br>Gypsy<br>Hot Cocoa<br>I03-4-5<br>Iceberg<br>Intrigue<br>J06-20-14-3<br>Joseph's Coat<br>Julia Child<br>Korsteimm<br>La Marne<br>Laev 17-10<br>Limoncello<br>Linda Campbell<br>Marmalade Skies<br>Mermaid<br>Miracle on the Hudson<br>MORSoucrest<br>Nearly Wild<br>ORA 050.07<br>ORA 295.08<br>Oso Easy Double Red<br>Oso Easy Fragrant Spreader<br>Oso Easy Honey Bun<br>Oso Easy Italian Ice<br>Oso Easy Lemon Zest<br>Oso Easy Mango Cream | Oso Easy Mango Salsa<br>Oso Easy Paprika<br>Oso Easy Pink Cupcake<br>Oso Happy Candy Oh<br>Oso Happy Petite Pink<br>Oso Happy Smoothie<br>Poseidon<br>Queen Elizabeth<br>Red Drift<br>Rosa odorata<br>Rosa roxburghii<br>Rosa soulieana<br>Rosa wichuraiana var. poterifolia<br>Rosarium Uetersen<br>Sally Holmes<br>Sevillana<br>Stormy Weather<br>Strawberry Hill<br>Tahitian Treasure<br>Teasing Georgia<br>Tequila<br>The Knock Out Rose<br>Tournament of Roses<br>Westerland<br>Windermere<br>Winner's Circle<br>Zephirine Drouhin |
| 195-95<br>2-30-07<br>201-98-A<br>4-48-07<br>6-91-9<br>66-84-18<br>90-1C<br>90-82<br>American Pillar<br>Basye's Blueberry<br>Basye's Purple<br>Brite Eyes<br>Caldwell Pink<br>Carefree Wonder<br>Cherry Parfait<br>Chuckles<br>De La Griffieraie<br>E02-15-4<br>Electron<br>Fair Molly<br>Frau Dagmar Hartopp<br>Fuzzy Wuzzy Red  | G02-2-1<br>J. P. Connell<br>John Cabot<br>John Davis<br>Kordes Perfecta<br>Lady of Shalott<br>Lafter<br>Little Buckaroo<br>Love<br>M4-4<br>Manetti<br>Mevrouw Nathalie Nypels<br>Michelangelo<br>Moore's Striped Rugosa<br>Morden Blush<br>Morden Centennial<br>Morden Fireglow<br>Mr. Lincoln<br>Nicole Carol Miller<br>Old Blush<br>Oso Easy Cherry Pie<br>Papa Hemeray  | Peter Mayle<br>Purple Pavement<br>Raspberry Kiss<br>Rosa arkansana<br>Rosa bracteata<br>Rosa carolina<br>Rosa foliolosa<br>Rosa palustris<br>Rosa rugosa<br>Rosa rugosa alba<br>Rosa setigera<br>Rosa virginiana<br>Rosa wichuraiana<br>Rosa woodsii<br>Sir Thomas Lipton<br>Skylark<br>Sophy's Rose<br>Sorcerer<br>Star Delight<br>The Endeavor<br>Therese Bugnet<br>Winnipeg Parks  |

## CONCLUSIONS

Of the 151 genotypes evaluated, 85 were confirmed susceptible to RRD. Many of the remaining 66 will likely develop symptoms as the study continues through 2018. Any roses remaining symptom-free will be assayed to confirm the absence of viral replication. Further research is needed to determine if susceptibility is affected by different RRV isolates or by co-infection with other viruses.

85 confirmed susceptible

66 without symptoms (so far)