THE MANY FACES OF ROSE ROSETTE DISEASE

A VIRUS OF DISGUISES

Presented by
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VIRUS ARE SPECIAL

- Very small and simple disease-causing agents
- Multiply in the cells they invade and travel through plant at a cellular level
- Difficult to attack chemically without doing equal damage to the host cell
- Overcomes plant’s antiviral defenses
- Prevention rather than cure is key
- Spread by propagation (infected when you bought it), insects, seed, root grafts

Most viruses show up in spring when temps are relatively cool; or summer when plants are stressed.
Rose Rosette Disease (RRD)

- "THE MAJOR PLANT DISEASE OF ROSES IN THE WORLD"
- Caused by the Rose Rosette Virus (RRV)
- Does not show up with symptoms of variegated foliage like other virus
- Different, deadly & contagious
- Only affects roses

NCPN June 2022
ROSE ROSETTE DISEASE

- RRV can only replicate inside living cells – if bush is dead, disease is likely dead also.
- Disease transmissions occur more often in summer.
- Warmer parts of the US can see transmission year-round.
- Consider virus is systemic – infecting the entire plant.
- When symptoms occur depends on the cultivar, age, size and general health of the plant.

Ghislaine de Feligonde infected with RRD

NCPN June 2022
RRD is Not New – Our Understanding Is

RRV infected every bush in this hedge of roses at post office in Chattanooga, TN
While RRD was first described in the 1940’s, only in the last 10 – 15 years has the virus become a problem in commercial, public, residential rose plantings and commercial production facilities.

Personal conversation with Jeekin Lau, June 2022

Lau, et al, July 2022

Frontiers in Science

Tulsa Rose Garden
NEW NAME – SAME VIRUS

- RRV is an “Emaravirus”
- RRV is 1 of 9 Emaravirus in the US
- Emaraviruses attack specific plant groups
- Name change brings RRV into same naming protocol as other Emaravirus

“Emaravirus Rosacea”
Then / Now – What’s Different?

**Up until 1990’s**

- Cuttings taken by hand.
- Diseased plants identified before contamination.

**Now**

- Cuttings taken by machine.
- If RRD infected tissue harvested – no way to know where the sick plant is.
What Else is Different?

TX rose industry stepped up, burned the fields – RRD gone until 2011

Select destruction of plants testing positive. Remainder left in the fields.

Weeks Roses Production Field
Wasco, Calif
RRD – How Roses Get It It

➢ Primary reason - transmitted Eriophyid (wingless) mite, Phylloxoptes fructiphilus or Eriophyes eremus
  ➢ Can only travel about 30-50 yards on air currents
  ➢ Mites dislodged from plant starve to death in 5 days
  ➢ Mites move from plant to plant by:
    ➢ Walking (if plants touch)
    ➢ Blown by wind or leaf blowers
    ➢ Hitchhiking a ride on insects, birds, humans

➢ 2nd Reason - Plant propagation, budding, grafting and movement of infected plant stock

Other means of transmission discounted

Since the mite is the primary means of infection – eliminating the mite makes sense
RRD in Houston 2014-2022

The Galleria 2018

Tanglewood 2014

Louis Felipe

Knock Out

Richmond 2017

Vectoring mites found in 40% of samples tested
RRD in Houston 2014-2022

Vectoring mites found in 40% of samples tested
RRD in Houston 2014 - 2022

Memorial City Mall 2018

Cypress 2022

The Woodlands 2020

Vectoring mites found in 40% of samples tested

David Austin Rose
Populations of *P. fructiphilus* are **40 times or higher** on witches broom than on asymptomatic foliage on an infected plant.

Pruning off rosettes until the plant can be removed makes sound epidemiological sense.
DELAY Can Be the Enemy

If you wait until witches broom forms – you’ve lost the plant

Mite populations have built until they are ballooning to other plants

Other plants likely infected

Windham 2019

As the number of mites increase by 10, the symptoms of RRD are 1.25 times more likely to be observed...Solo, et al 2020; NCPN June 2022
Important to Know

➢ Symptoms can appear 3 weeks to 1 year after inoculation

➢ Plants in stress more prone to contract virus and more prone to demonstrate

➢ Disease symptoms accelerate as weather is hotter

➢ Infected plants usually die within one year after symptoms appear
  - do they die from RRV or from being weakened to the point that they succumb to other pests/disease?

➢ May not be readily apparent especially in densely foliated shrub roses. Check the plant’s interior for abnormal growth
Important to Know

- Symptoms can differ between cultivars
- Important to know what is normal for your rose
- If 2 or more symptoms are present, the plant is likely infected (Windham 2019)
- Most common symptoms
  - Witches broom
  - Strapped leaves
  - Flattened stems
  - Increased thorniness
  - Rubbery stems/thorns

Excessive overgrown thorns
Know What’s Normal in Your Rose

Electron (HT)

Thorn pattern normal for this rose

Homeowner thought bush had RRD because of thorniness
Detection: Compare Normal to Abnormal on Same Bush

- Distorted sepals
- Strapped leaves
- Increased thorniness
- Misshapen flower buds
What to Do?

- Currently there is no cure
- Prevention by using clean planting stock and destroying infected plants are most important steps for control
- Early detection and removal of infected plants is the best way to reduce the spread and impact of the virus
- Make sure it is RRD before you act!

Study biological control agents and match them to when the population of mites is the highest

The success of control could be increased if the control(s) reduce the number of mites to a low density because few would transmit RRV through feeding

Monterrosa, et al 2021
Shirmat Joseph, NCPN June 2022
Miticides Successfully Used to Stop RRV in the Field Studies

- Akari, Forbid, Kontos and Talstar have prevented RRV in research plots for 5 years (control plants fail in 2 yrs or less) – check label before use

- Work is underway to determine proper spray intervals, when to start and stop spraying and if spray intervals are the same for the all miticides

A systemic miticide has a better chance of reaching the niche areas of the plants where mites located
Antiviral Compounds / Application

Antiviral efficacy trial (rate, application type & timing)

Using with and without a miticide

Company suggests that compounds may also induce resistance to fungal diseases and aphids

This trial is in process
Stop Using Leafblowers!

- This apartment complex had 1 bush with 1 witches’ broom
- When they learned of RRD they had the lawncare person cut it off
- He/She blew the witches broom in a pile with a leafblower for easy clean-up
- In 3 weeks, all 150 bushes on the property had symptoms of RRD
- Live mites were found on infected specimens

The leafblower was responsible for relocating mites from one sick plant to 150 healthy bushes!!!
RRD – Looks Like Other Things

- Symptoms confused with:
  - Chilli thrips
  - Herbicide Damage
  - Chlorosis (Yellowing)
  - Spider Mite Damage
  - Normal New Growth
  - Over Fertilization

In a 3 week period in 2019 – there were 11 cases of RRD misdiagnosis in Houston
RRD or Chilli Thrips

Chili Thrips Damage - note dark lesions in leaf tissue

Leaf distortion caused by RRV

With RRD - leaves typically do not have lesions
RRD or Herbicide Damage

Tested by OK State Path Lab – Herbicide Damage

Herbicide damage – City sprayed curb on the other side of the fence

Brush killer applied to right-of-way near this cemetery. Exposure to vapor caused damage.
RRD or Herbicide Damage

Professional landscaper sprayed Round-up along church parking lot

Herbicide sprayed on shoulder of the road 200 yds from a collection of roses
RRD or Spider Mite Damage

Webbing is a dead give-away for spider mite damage.
“Strapped” (narrow) Leaves

Narrow leaves are normal in some cultivars.

Compare size & shape of normal leaves to those that are abnormal.

Strapped leaves with RRV can be red, yellow, bronze, green or a mix.
Rubbery Stems / Thorns
Only RRV Causes This

Thorns will bend from side to side without breaking off
Distorted Blooms / Buds
Lots of Things Can Cause

Belinda’s Dream

Normal

RRD

Unknown white HT

RRD

Celestial Night (courtesy of Heirloom Roses)
Distorted / Premature Bud Formation w/ RRD
Leaf chlorosis (yellowing) may not always be present with RRV – can also be caused by nutrient deficiencies and exposure to saline irrigation water. In Houston, it is common to see in summer months in relation to heat/drought stress; can also be seen if plants overwatered.
Thickened Canes - Caused by Many Things

- Can be caused by over fertilization & weather
- In this case it was caused by RRV
- Note size difference between unique growth and other stems in same plant
- Excessive prickles, strapped leaves plus thickened canes all consistent with RRD
Witches’ Broom

Formation of “witches broom” growth

This is the most common and definitive symptom of Rose Rosette Disease

Nothing else causes this!

Witches’ Broom can look different from rose to rose
Witches’ Broom Has Many Faces

Knock Out  Belinda’s Dream
Witches’ Broom

Hidden deep inside really large bush

1 visibly symptomatic stem in R. multiflora
Witches’ Broom

RRV in Old Blush was not red

Witches’ Broom in Sweet Drift
Petrified Witches’ Broom

We know the Old Blush at this location had RRD for at least 2 years because the witches broom growth in the interior of the plant was dried in place.

It had gotten so large and heavy that it pulled away from the main stem – disrupting the flow of water/nutrients and dried in place.

Normally, this would have fallen off, become part of the leaf litter and RRD gone unnoticed.
Excessive Thorniness - Only RRV Causes This

Thorns become needle-like thinner and more closely spaced (Cherry Parfait)

RRV can produce ridiculous numbers of thorns that may stay green

Thorns may be so excessive that stems look more like a nettle than a rose
Excessive Thorniness

Hundreds of thorns per 1” of stem

Abrupt starting / stopping of excessive thorniness is something to watch for
Excessive Thorniness

If a normal stem has thorns spaced 1” apart – a rose stem infected with RRD may have 50 to 100 thorns in the same distance.

Compare thorn pattern on suspect cane to normal growth on the same bush.

Nothing else is known to cause this in roses. Just because a rose has a lot of thorns – does not mean it has RRD.
Excessive Thorniness

Normal and excessive thorn pattern on same bush
This **IS NOT** Excessive!

Reported as RRD due to 2 thorns in same location – this is not excessive

Red new growth + thorns on new cane caused gardener to think he had RRD

Submitted due to number of prickle stubs
“Red” does not mean RRD

- New growth in roses tends to be red, maroon or bronze that changes to green
- Red = water soluble pigment that determines flower, berry and leaf colors
- Helps protect young stems and leaves from damage by UV rays
- As tissue hardens off, red fades and changes to green

Normal new growth in healthy rose

In roses infected with RRD – red may not change to green
Multiple Things Can Be Going On

This bush tested positive for RRD and the stem that tested positive also has a severe powdery mildew infection.

Same bush has nutrient deficiency.
Good News - Resistance to RRD

- Expand genetic studies (Morden Blush, Morden Fireglow, Lafter, R. setigera)
- Stack resistance genes for RRD with resistance genes for blackspot, Cercospora
- 2 genetic markers for resistance to RRD have been identified
- Roses indicating resistance to RRD (800 plants) planted at RRD-Resistance Plots in Bixby, OK in April 2022
- Goal – confirm level of resistance previously identified
- Search for other sources of resistance (relatives)

Francisco Ochoa Corona; NCPN June 2022
No Symptoms – No Virus
3-Year Trials in TN & Delaware

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<thead>
<tr>
<th>Species</th>
<th>Rugosa hybrids</th>
<th>Cultivars</th>
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<tr>
<td>R. Arkansana</td>
<td>Fuzzy Wuzzy Red</td>
<td>Chuckles (F)</td>
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<tr>
<td>R. Carolina</td>
<td>Purple Pavement</td>
<td>Fair Molly (Poly)</td>
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<td>R. Folialosa</td>
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<td>John Davis (H. Kordesii)</td>
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<td>R. Virginiana</td>
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<td>Morden Blush (S)</td>
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<td>R. Woodsii – bracteate</td>
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<td>R. rugosa</td>
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Windham, NCPN June 2022

Chuckles – only modern rose to perform reasonably well in Houston
## Few to Moderate RRD Symptoms
### 3-Year Trials in TN and Delaware

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<tr>
<th>Few to Moderate RRD Symptoms</th>
<th>3-Year Trials in TN and Delaware</th>
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<tr>
<td>Abbye de Clyny (HT)</td>
<td>Frau Dagmar Hartopp (HR)</td>
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<td>Basye’s Purple (S)</td>
<td>Intrigue (F)</td>
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<td>Brite Eyes (Lg F Cl)</td>
<td>John Cabot (H Kordesii)</td>
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<td>Caldwell Pink (Poly)</td>
<td>Julia Child (F)</td>
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<td>Carefree Wonder (S)</td>
<td>Lafter (HT)</td>
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<td>Charisma</td>
<td>Little Buckaroo (Mini)</td>
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<td>Cherry Parfait (GF)</td>
<td>Love (GF)</td>
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<td>De La Grifferaie (H multi)</td>
<td>Manetti (H Noisette)</td>
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<td>Electron (HT)</td>
<td>Marmalade Skies (F)</td>
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<td>Morden Centennial (S)</td>
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<td>Red Drift (S)</td>
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<td>R. Wichuriana poterfolia</td>
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<td>Sorcerer (Mini)</td>
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<td>Winner’s Circle (LGC)</td>
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Windham, NCPN June 2022
Knock Out® is Not to Blame

- RRD existed 50 years before Knock Out was created
- Knock Out is no more susceptible to RRD than another other rose
- Rosa multiflora is not in the parentage of Knock Out
- Routinely planted in areas where no one looks at the plant regularly – thus if infected, the plant becomes a reservoir of virus and mites

There is no data that supports the premise that Knock Out roses are more susceptible than other cultivars to RRD
BEWARE OF THESE CLAIMS

Decades of research and extensive field testing have gone into creating remarkable varieties, which defy disease and delight consumers. We want you to enjoy growing roses and we also want to do our part in caring for the environment by minimizing the need for toxic sprays.

Top Gun™ resists Rose Rosette disease as well as blackspot, downy mildew, powdery mildew and rust. Its glossy green foliage forms a fortress against disease. New buds fire up in clusters with a rapid repeat. They open up to reveal intriguing deep red blooms, providing a profusion in color. The rounded habit of the plant, makes it ideal for placement in any yard.

If you are looking for carefree self-reliant roses, which are up-to-date with disease protection, you need Top Gun™ roses.

Contact your Salesperson to place an order.

Top Gun Disease Resistance
5 = exceptional, 4 = very good,
3 = above average, 2 = average,
1 = below average.

*Plant keeps some leaves and refreshes after peak bloom season

Blackspot
Poudery Mildew
Downy Mildew
Rust
Rose Rosette

By 2017 Top Gun developed RRD in research plots at Univ of TN and Univ of Delaware
Be skeptical of “cures”

There is **NO CURE** for rose rosette disease at this time......
no matter what you hear from people with products
to sell
The Final Word

- Don’t Panic!!!!!
  - Most cases of suspected RRD in Harris County have ended up being something else that could be cured
- Don’t Overreact!
  - RRD is not the end of the world
- Stay vigilant. Inspect weekly.
- Be smart & obtain plants from sources with clean stock
- Get a second opinion – or a lab test if you think you have it
- Be ready to take immediate action

Dr. Kevin Ong (TAMU) and Gaye Hammond confirm Houston’s first diagnosis of RRD in 2014.
Rose Rosette Resources:

➢ Gaye Hammond, gayeh@LPM-triallaw.com


➢ Combatting Rose Rosette Facebook, https://www.facebook.com/CombatingRoseRosette/

Research on RRV/RRD continues to evolve as funding becomes available for all aspects of research on the disease and its vector. For this reason, older publications may not have the best or most accurate data for management of the virus.
Concern from Industry

Scientists at University of TN interviewed 566+ industry professionals
➢ 147 in TN
➢ 119 in NC
➢ 300+ in SC

Most say RRD hurt their reputations and cost them clients

Majority of landscape professionals say they are bidding fewer jobs with roses

How do we restore confidence in the use of roses in commercial landscapes?
RRD – What to do?

Avoid activity that would dislodge the mite

Remove symptomatic plants early.....

Once the virus becomes systemic in the plant nothing sprayed on the plant will cure the disease
RRD – What to do?

Current recommended method for removal of infected plants:

1. Cover the plant with a large heavy gauge garbage bag (for really large shrubs use a Christmas tree bag)
2. Tightly tie the bag off at the base of the plant
3. Cut or saw through the base of the plant below where the bag is tied. The entire plant with any resident mites should will be inside the bag.
4. Send the bag to the landfill – do not compost RRD-infected plants
5. Dig up the remaining root system and dispose
6. Do not replant at that spot for at least 2 weeks (any mites dislodged need to be starved to death before new plants are installed)
7. Prune off any new growth on adjacent roses
8. Constantly monitor site for reoccurance

THERE IS NO CURE FOR ROSE ROSETTE DISEASE

DO NOT USE LEAF BLOWERS AROUND RRD-INFECTED BUSHES
RRD - Resources

AmericanHort (association of nursery and landscape professionals) website, www.roserosettedisease.com

- Numerous publications on rose rosette disease
- Webinars
- Videos

Specimen samples from plants suspected of having RRD can be sent to the Texas Plant Disease Diagnostic Laboratory at Texas A&M University. Directions on how to take and submit samples along with testing fees are available at www.plantclinic.tamu.edu

Some RRD symptoms mimic symptoms from other causes – Get confirmation of virus before taking action
RRD – Where is it?

Distribution of RRD as of 2002
J. W. Armine, Jr., West Virginia University

RRD currently showing up faster than literature can report
RRD in Houston

And we almost missed this........

Sometimes the reddening is not apparent – even though the plant tests positive for RRD

Relying on one symptom to identify RRD is NOT the best approach
RRD – What to Do?

Call me!

Take a sample

Get a confirmed diagnosis

Before you do anything!
RRD – Research Science Helping You!
RRD – What to do?

Don’t just dig it up!!!

This is the **WRONG** way to remove a bush with a confirmed case of RRD.
RRD – an Emaravirus

➢ Rose Rosette Disease is caused by an Emaravirus …Rose Rosette Virus

➢ First noted in the US in 1941. First noted in TX in 1990

➢ Only affects roses – only in the U.S.
➢ Infection is lethal to plant & contagious
➢ Once infected, virus spreads through plant at the cellular level
➢ Overcomes plants’ antiviral defense system
➢ Has killed hundreds of thousands of plants

Showed up in Texas in +/- 2011 at epidemic levels – prior to that last outbreak was 1990
Laboratory Testing

- Multiple types of diagnostic testing
- Some work better than others
- PCR amplification most reliable but takes a long time
- Virus hard to see under microscopy
- Symptomatic plants can test negative and later positive
- Need reliability, need test that can be done quickly and in the field
The Rose Rosette Disease Task Force

Making great strides in improving the sensitivity and reliability to detect the virus in the plant.

Prototypes of these new techniques are being tested at Texas A&M and Oklahoma State University.

RRD Monitoring Program has hundreds of volunteers from 34 of 48 states reporting the incidences of RRD to identify disease distribution and cultivar susceptibility.

Participants include HRS members.
University of Tennessee is studying the movement of the virus and the mite to develop a set of best control practices.

Trials are underway around the country to identify plants that may be resistant to RRD so that breeders may incorporate the genetics from these cultivars into new breeding programs.
RRD – Where is it (U.S.)?

Roserosette.org distribution map
RRD - Symptoms

Thickened canes
(may not always be present)

Premature bud development
RRD – What to do?

It is impossible to visually tell whether the virus is localized or systemic therefore removal is the best option

For roses with sentimental value

Remove the symptomatic stem well below the point of infection (all the way to the plant base if possible)

Disinfect pruning equipment with 1/4th cup bleach mixed with 2 1/4th cups water between cuts

Carefully monitor plant for recurrence. If symptoms reappear dig up and destroy the plant
RRD – Prevention

Do not plant roses too close together as this increases the chance that mites will move from one plant to another.

Do not use leaf blowers around plantings where RRD has been diagnosed. Rake & bag debris.

Mites travel on tools, gloves and clothing. Do not go from an infested garden to a healthy garden without changing clothes. (Preferably go to the healthy garden the next day.)

Prune roses where RRD has been diagnosed heavily in the early spring to remove any over-wintering mites.

Apply dormant oil after pruning and horticultural oil in spring to reduce mite populations.
RRD – What to do?

The **CORRECT** way to remove a bush with a confirmed diagnosis of RRD

- Tie the bag shut at the bottom
- Saw it off at the base
- Infected plant + mites contained inside the bag
These roses have proven to be resistant to RRD in multi-year virus challenges.
RRD RESISTANCE STUDIES

Little Buckaroo (Miniature)

Fru Dagmar Hastrup (Rosa rugosa)

Sunny Knock Out (shrub)
RRD RESISTANCE STUDIES

Winter Sun (HT)

Hansa (Rosa rugosa)

Moje Hammarberg (Rosa rugosa)
RRD RESISTANCE STUDIES

Rosa setigera (species)
Courtesy of Illinois Wildflowers

Rosa palustris (species)
Courtesy of Illinois Wildflowers
THE PRIMARY VECTORS
ERIOPHYOID MITES

Phyllocoptes fructiphilus

Eriophyes eremus – NEW

Since the mite is the primary means of infection - eliminating the mite makes sense

photos - Gary R. Bauchan and Ronald Ochoa (USDA ARS)
North of Interstate 20 (Dallas & Ft. Worth) has been the epicenter of the current outbreak....Why?

Abundance of vectoring mites at various relative humidity levels has been poorly understood until recently.

Population – number of mites per sepal highest when RH is 60% and lowest at 95%

Symptoms are highest when RH is 95% and lowest when RH is 20%

Monterroso, et al 2021
Shirmat Joseph, NCPN June 2022
Witches Broom

This stem was hiding inside a densely packed bush

Witches’ Broom Can Stand Out or be Subtle
The RRD Affect on Roses

**Localized infection**

- Mite feeds on single cane
- For a short time, virus may be restricted to that one cane
- As feeding continues – more tissue is damaged until plant succumbs

**Systemic infection**

- Affects the entire plant from root to canopy

Plant parts showing no symptoms may actually test positive for the virus and vice versa

There is no way to know if infection is localized or systemic
VIRUS

VARIEGATED FOLIAGE IN ROSES IS NEVER A GOOD THING - ALMOST ALWAYS ASSOCIATED WITH A VIRUS

Rose mosaic virus