

The Rose Vine

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Penn-Jersey District of the American Rose Society's Quarterly Newsletter

From the District Director's Desk—Kevin Glaes

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Check out our website:

<http://PennJerseyRose.org>



Crispy – photo of Moondance spray in 106° heat

Crispy is certainly the way the blooms looked in July. No rain for 4 weeks, lots of 90°+ temperatures and a record high 106° one day made it very hard on the blooms. The bushes held up well, just the blooms did not look their best.

The American Rose Society (ARS) 100 Grand campaign is helping get our finances in order. For the first time in a long, long time, all accounts payable are under 30 days past due. Providing an infusion of cash to take care of the accounts payable was the prime reason for the 100 Grand Campaign. The Penn-Jersey District is very close (about 90%) to meeting our commitment and I am confident we will reach our goal of \$4300.00. by the end of the campaign (end of September). I thank all of you, individuals and local societies,

for contributing and making this a success.

The trial memberships continue to be a great source for recruiting new members for the ARS. Local Society leaders need to keep trial memberships in mind when you sign up new member and when you hold special events.

Penn-Jersey District members did quite well at the ARS national show in Winston-Salem in June. See Bill Kozemchak's write up on page (???). Thanks to all our District members who journeyed down to North Carolina and entered a lot of great roses.

Soon it will be September and the Philadelphia and Del-Chester Rose societies have lined up a great District convention and rose show for September 16- 18 at the Great Valley Sheraton in Frazer, PA.

The District Convention is an excellent time to come, hang out in the hospitality room, see some great roses and learn from the exhibitors about some roses that you have never seen before and catch your eye (you need more roses!) Additional information can be found in later pages of this issue. I hope to see all of you there.

Kevin

The Fall Convention of the Penn Jersey District

Join us at the gracious Sheraton Great Valley for a weekend of rose fun, rose education, and our annual District Rose Show. The hotel is located at the intersection of Route 30 and Route 201 about 15 minutes from Valley Forge exit of the PA Turnpike and is convenient to the many cultural institutions and historic attractions of the Delaware Valley. Please make your hotel reservations early – before August 24th – call 888 627-8166 and ask for the American Rose Society Convention.

The weekend will begin on Friday morning, September 16th, with a Horticulture Judging School for those interested in becoming ARS accredited judges, or who just want to learn more about how roses are evaluated. Present judges can attend the afternoon Seminar to update their credentials. A Sandwich buffet lunch will be offered since there is a very limited break between the morning and afternoon sessions. Bruce Monroe, current National Chairman of Judges, will conduct the School and Seminar.

There will be a Social Hour in the Hospitality Room from 6 to 7, followed by a casual dinner in the White Horse Tavern, the original old inn section of the hotel.

The Prep Room will open for exhibitors at 6AM on Saturday – no placement committee – exhibitors place their own roses. Coffee, etc., will be available. The Show Schedule will be posted on the Penn Jersey website www.PennJerseyRose.org or you can request an email from patbilson@yahoo.com or Gus Banks jrsyrose@verizon.net. Entries close at 10:30AM. The Show will open to the public at 1PM.

Two excellent programs will be offered on Saturday afternoon. Pat Shanley, New York District Director, will present “Where do Roses Grow in New York City”. Nicole Juday, Landscape Curator for the Wyck, has entitled her program “A Passion for Roses – The Princess, the Quaker and the flower they love”. A

Penn Jersey tradition, Father Gervase will hold mass at 5:30PM.



Sheraton Great Valley Restaurant

The Awards Banquet will feature musical entertainment by Ken Borrmann and Don and Mary Myers. They were an outstanding hit at our Penn Jersey National Convention in 2002, and we welcome them back.

The Annual District Meeting is scheduled in conjunction with a breakfast on Sunday morning. It has been an eventful year for the American Rose Society and the Penn Jersey District. We hope our members will come and participate in the discussions.

The final event of the Convention is a visit to Michael Bowell's unusual and fascinating garden located a few miles from the hotel. Michael's garden is full of interesting plants often used in unusual ways, and yes, he does have roses. Steve Hutton of Star Roses and William Radler, the KnockOut hybridizer are expected to join us during the afternoon.

We look forward to seeing all of you in September for a wonderful, exciting weekend with roses.

Elaine Adler and Bill Kozemchak, Co-Chairs

2011 PENN-JERSEY DISTRICT CONVENTION REGISTRATION:

Reserve rooms directly with Sheraton Great Valley, 707 E. Lancaster Ave, Frazer PA 19355.

Phone 888 627-8166. Rates are \$99.00/room/night (up to four people per room).

Mention **the America Rose Society** meeting to get the special room rates.

Reserve rooms by August 24, 2011!!!

Registration –Penn-Jersey District Convention on Sept. 16-18, 2011

Name(s): _____ Phone: _____

Address: _____

e-mail: _____

Registration \$40.00 each \$ _____

Judges School (Friday) \$15/ Audit \$5 \$ _____

Lunch \$17 \$ _____

(Lunch is required for judge’s candidates and optional for auditors.)

Dinner (Friday) \$37.00 each \$ _____

Barbecued Brisket of Beef

Grilled Barbecued Breast of Chicken

Vegetarian

Dinner (Saturday) \$40.00 each \$ _____

Roast London Broil

Maple Glazed Salmon

Vegetarian

Breakfast (Sunday) \$15.00 each \$ _____

All-American

Vegetarian

Total Amount Enclosed \$ _____

Anyone with special dietary requirements check box and note requirements on the reverse side.

Make check payable to **Del-Chester Rose Society** and mail to **Kathy Kozemchak**

12 Violet Road, Levittown, PA 19057

KathyKozemchak@aol.com

215-945-8098

Consulting Rosarian School

The York Area Rose Society will host a Consulting Rosarian School and Seminar on Saturday August 27, 2011 in Chambersburg PA. The programs will start at 9:30 am and run until 5 pm, lunch will be included. There is a \$15 fee to cover expenses.

The seminar will serve to renew and update any current CRs. Any one interested in becoming a Consulting Rosarian must attend the school and complete the open book test. There is an additional \$10 ARS fee for individuals taking the CR test. The school is open to anyone who wants to increase their rose growing knowledge. You do not have to be a CR or take the test to become one to attend..

To become an ARS Consulting Rosarian you must:

1. Be an active ARS member for **Three Consecutive Years**.
2. Be an active member of a local society.
3. Must have grown various types of roses for five years and be knowledgeable in rose culture.
4. Must provide three letters of recommendation from current CRs.
5. Must participate yearly in Roses in Review.
6. Must exhibit a continuing willingness to share knowledge and an enthusiasm for the rose and the American Rose Society.

Anyone attending the school for credit must have a copy of the CR Manual. Manuals **will not** be available for purchase at the school. They must be purchased directly from the ARS. Allow at least ten days for shipping when ordering the manuals.

Nancy, Joe, Jim and Mike Redington are hosting the seminar and school at their home, 347 Leedy Way East, Chambersburg, PA 17202.; 717 264-6488; Rosered1@comcast.net. Please make all checks out to the York Area Rose Society and send to Nancy at her address.

Anyone interested in attending the seminar, school or becoming a Consulting Rosarian please contact Gus Banks 609-267-3809 jrsyrose@verizon.net to register for the school.

Did You Know?

Reprinted from the January 2001 edition of the Northwest Rosarian Judy Heath editor where it was reprinted from an article by Sue Tiffany

Rose expert, Paul Zimmerman, has produced an entire series of rose-care videos that are now available on the ARS YouTube channel that is linked on the front page of the ARS website. Paul's easy-going and humorous style make these videos very informative, without being overwhelming, especially to new rosarians. Topics include: Go to www.ars.org and click on the tab, —About Roses. There you will find the link for Paul Zimmerman's videos.

You will also find a new department, **Kidz 'n' Roses**, where you will find video shorts called —Mini Rose Reports hosted by 13 year old Rosarian, Cordelia Sanchez-Walsh. There will be much more content added in the coming months, so please let your kids and grandkids know where to look for that.

Roses in Review

Diane Wilkerson, Penn-Jersey District Roses in Review Coordinator

It is time for the annual Roses in Review (RIR), the American Rose Society's annual survey of roses. Results from the "Garden" evaluations are used as the ratings in the Handbook for Selecting Roses. Participation in the RIR process is open to EVERYONE! Membership in the American Rose Society (ARS) or a local rose society is not required.

The link to the on-line entry form is <http://www.stsrv.com/rir/rirsplsh.htm>. To register to use the site, click on "New User" on your first visit. The ARS will not use the information to SPAM you as the info is used to allow reporters to enter data over a period of time (register once, use the same info to come back and enter more info later), also to assist the RIR coordinators with data tabulation, and is deleted after the end of the survey period. You do not have to complete your entries at one time, you can come back and add more ratings at a later time. Just be sure to use the same information (e-mail and name) the next time you want to enter ratings. Also, remember to hit the "Save" button after entering data. If you participated last year, you will have to register as a "New User" again this year.

The 2011 RIR survey form is also available in the July/August issue of American Rose (the magazine for members of the ARS). There is also a PDF (Adobe reader required) version of the form attached to this e-mail.

On-line and paper forms must be submitted on or before September 26, 2011 in order to be included in this year's results.

This year the survey will include not only recent introductions, but also older roses of interest that do not currently have a rating.

A reminder to all Consulting Rosarians and Judges, you are required to submit a RIR survey.

A personal "Thank You" to the members of the Penn-Jersey District who participated last year!

Remember, the RIR survey process is open to everyone! So, pass along this e-mail, and ask your rose-growing friends to participate! Feel free to e-mail me with questions. Thank you!

ARS 2011 National All-Miniature Rose Show June 25, 2011 Syracuse, NY

From the Summer issue of *The Rose*, the newsletter of the Philadelphia Rose Society, Bill Kozemchak editor

Penn-Jersey members and former members also did very well at the Syracuse Mini Nationals placing 19 entries on the head tables including Miniature Queen- Joy by Richard Anthony & Kristine Vance and Best of Show and Best Miniature Spray- Green Ice by Bill & Kathy Kozemchak. Don & Mary Myers took many of the top Arrangement Honors and Nancy Redington also won 5 classes and 2 of the top honors. "Kristin", hybridized by Frank Benardella and named for his and June's first granddaughter was named to the Miniature Hall of Fame at Syracuse. "Kristin" was a 1993 AOE winner and introduced by NorEast Miniature Roses. June and her daughter Karen, Kristin's mother, accepted the award Saturday night at the banquet.



Best in Show & Best Miniature Spray- Green Ice by Bill & Kathy Kozemchak photos by Bill Kozemchak



Miniature Queen- Joy by Richard Anthony & Kristine Vance

Winston-Salem ARS Spring Nationals

From the Summer issue of *The Rose*, the newsletter of the Philadelphia Rose Society, Bill Kozemchak editor

Many exhibitors, judges and arrangers from our area went to Winston-Salem, NC the first weekend in June for the ARS Spring Nationals. Penn-Jersey members and a couple of our northern Maryland friends who regularly exhibit in Penn-Jersey shows, as well as former members Don & Mary Myers were very successful. Between Richard Anthony & Kristine Vance, Suni & Rafiq Bolar, Ken Borrmann, Peder Heden, Andrew Hearne, Bill & Kathy Kozemchak, Don & Mary Myers, John & Cheryl Smith, JR & Donna Smith, Mike & Sally Wrightstone and Judy Yingling, 4 National Trophies, 31 Horticulture awards and 6 arrangement awards were taken home.

John & Cheryl Smith took 2 National trophies, the Nicholson Perpetual Challenge Bowl and the Herb Swim Memorial Trophy as well as Hybrid Tea Queen & Princess, Matched Pair, Rose in a Frame and Miniature King. Andrew Hearne won the J. Benjamin Williams Miniflora Rose Challenge Trophy as well as both Miniature and Miniflora Queens, Miniature Princess, 2 on the Miniature Court and 3 on the Miniflora Court.

Bill & Kathy Kozemchak won the William H. Mavity Trophy as well as Floribunda Spray Queen & Princess, Genesis Award, Victorian Award, Climbing Rose, Modern Shrub, Special Knockout Class, Fragrance Class, Seedling or Sport, Miniature Spray and Sweepstakes for the most blues.

Ken Borrmann won Hybrid Tea King and had 1 on the court. Peder Heden had one on the Hybrid Tea Court. Mike & Sally Wrightstone won Miniflora Princess. Suni & Rafiq Bolar won Floribunda Palette. Donna & JR Smith won the Mini-Mniflora English Box. Richard Anthony & Kristine Vance won Fully Open Miniature. Unfortunately their weather had been very cool and most of their roses were not in bloom yet, but they still managed to get one on the head table.

In the Design Section Judy Yingling won 3 classes and Artist Rosette, while Don Myers won 2 classes and the Duke Rosette and Silver Medal.

The timing was perfect for our area and we showed our members can grow roses as well as any area of the country.



Above: Andrew Hearne's J. Benjamin Williams Collection, Miniflora Queen- Whirlaway, Miniature Queen- Joy
Below: John & Cheryl Smith's Nicholson and Herb Swim Collections and Bill & Kathy Kozemchak's William H. Mavity winner

Bottom: Kozemchak's Floribunda Spray Queen- Matilda and prep table, Overview of showroom photos by Bill Kozemchak



Look Like a Million Dollars!

The Penn-Jersey District is having a shirt sale. This will be a polo type shirt, white in color with a rose and the society's name embroidery on it. The cost of the shirt is \$30. Having a society shirt helps identify you as a member when you are working at the rose show or speaking at a nursery.

If you have any questions contact Kevin Glaes. 610=926-4428 or glaes1215@comcast.net



Please send your checks made out to **Penn-Jersey District** to:
Kevin Glaes
1215 Cross Keys Road
Reading, PA 19605

And select the type and size shirt you would like.

Mens _____ Ladies _____
S M L XL XXL(\$3 Additional) S M L XL XXL(\$3 Additional)

Number of shirts _____

Mailing \$3 each _____

Amount enclosed _____

Name _____

Address _____

City, State, ZIP _____

Phone _____



Rose Rosette Disease

Chuan Hong, Extension Plant Pathologist, Hampton Roads AREC

Mary Ann Hansen, Extension Plant Pathologist, Department of Plant Pathology, Physiology, and Weed Science,

Susan DeBolt, Extension Agent of Environmental Horticulture, Virginia Tech

Ed's note: We keep hearing reports of roses with rose rosette disease occurring sporadically throughout our District. I had my first case this year – a 10 year only Graham Thomas right in the middle of a group of 6 David Rose roses, pretty well isolated from the rest of my garden. Strange how this disease can pop up in the middle of a bed. I immediately removed it and can only hope that it was an isolated incident. This article is from the Virginia Tech extension agency web site: http://pubs.ext.vt.edu/450/450-620/450-620_pdf.pdf

Rose rosette disease (RRD), a disease believed to be caused by a virus, has been spreading through much of the wild rose population of the midwestern, southern and eastern United States for years, and has now been confirmed in cultivated roses in Virginia. This disease is of great concern to the nursery industry and to many home gardeners because it is known to be lethal to the wild multiflora rose (*Rosa multiflora*) and it is potentially lethal to many ornamental rose species and cultivars.

Symptoms

Symptoms of rose rosette disease are highly variable, depending on the species or cultivar of rose affected. This variability can complicate diagnosis. Some of the more recognizable symptoms include rapid elongation of new shoots (Fig. 1), followed by development of witches' brooms or clustering of small branches (Fig. 2). Leaves in the witches' broom are small, distorted, and may have a conspicuous red pigmentation (Fig. 3), although red pigmentation is not a consistent symptom. Canes on some species or cultivars develop excessive growth of unusually soft and pliable red or green thorns, which may stiffen later (Fig. 4). When this symptom is present, it is diagnostic for rose rosette disease. Symptomatic canes may also be noticeably thicker than the parent cane from which they emerged or they may grow in a spiral pattern. Flowers may be distorted with fewer petals than normal (Fig. 5), and flower color may be abnormal. For example, flowers that are normally a solid color may be mottled. Buds may abort, be deformed, or be converted to leaf-like tissue. Infected rose plants often die within one to two years.

When all of the above symptoms are present, diagnosis is relatively straightforward. However, a diseased plant may exhibit few of these symptoms, especially in the early stages of the disease. By the time symptoms are severe and recognizable, the disease is likely to have already spread to neighboring plants.

Some symptoms, such as leaf coloration, may be subtle. Although some diseased plants develop very obvious red pigmentation, others exhibit a less striking reddish pink color on leaf undersides or along the margins of otherwise green leaves. Since the new leaves of many



Fig. 1. Rapid elongation of shoot with excessive thorniness.

(Photo by S. Debolt)

rose cultivars normally have reddish pigments, it may be difficult to determine whether the reddish color is abnormal or not. Therefore, it is important to continue to monitor symptoms on suspect roses. On RRD-infected plants, the reddish color does not go away, whereas on healthy plants, the reddish color usually disappears as the leaf matures. Witches' brooms on some diseased plants may be an unusual color of green that can be mistaken for symptoms of a nutrient deficiency. However, nutrient deficiency should affect the whole plant. If these symptoms appear only on parts of the plant, they are probably not due to nutrient deficiency, and RRD is more likely.



Fig. 2. Witches' broom.

(Photo by M. A. Hansen)

The witches' broom symptom itself is not necessarily diagnostic for rose rosette disease. This symptom can also occur in response to certain types of herbicide injury. For example, if glyphosate, the active ingredient of the herbicide Roundup, contacts green tissue of rose plants in the fall, it is translocated to the buds, and symptoms do not become evident until those buds emerge the following spring. Witches' brooms with yellow, narrow leaves on clusters of shoots are typical of glyphosate injury (Fig. 6).



fig. 3. Red pigmentation of stunted leaves.

(Photo by M. A. Hansen)

The commonly used broadleaf herbicide 2,4-D can also cause leaf distortion on roses. Unless plants are injured again, symptoms of herbicide injury should disappear by the following year.

Other symptoms of RRD that may be expressed include blackening and death of the canes on some cultivars, short internodal distances, blind shoots (shoots that do not produce a flower) that remain blind, and greater sensitivity of reddish purple tissue to frost. Leaves of diseased plants may have a roughened, "pebbly" texture. Plants with RRD also have increased susceptibility to the fungal disease, powdery mildew. This is especially evident when nearby roses known to be highly susceptible to powdery mildew do not develop signs of this disease.

History of Rose Rosette Disease

Symptoms that were undoubtedly due to rose rosette disease were described in the United States as early as 1941. Spread of the disease in the United States was intimately tied to the history of the multiflora rose, an exotic plant that was introduced from Japan in 1866 as a rootstock for ornamental roses. During the 1930's through 1960's, planting multiflora rose was recommended for erosion control, as a bird sanctuary and food source, as a living fence for cattle, for strip mine reclamation, and as a crash barrier on highways. This recommendation ultimately backfired. Multiflora rose can produce a million or more seeds per plant and can propagate itself vegetatively as well. It quickly spread and is now declared a noxious weed in several states.

Multiflora rose is highly susceptible to rose rosette disease, so much so that the disease was initially considered a potential biological control for multiflora rose. Even now, some people suggest introducing infected plants into areas with multiflora rose to control this weed. Most rose growers, however, are very wary of this recommendation because rose rosette disease can spread quickly from multiflora rose to cultivated roses.

Disease Cycle

Rose rosette disease is caused by a virus or virus-like pathogen yet to be characterized. Because the exact causal agent has not yet been identified, there is currently no laboratory test for confirming rose rosette disease. The disease is diagnosed based on a preponderance of characteristic symptoms or by grafting suspect plant material onto known healthy roses and demonstrating transmission of symptoms after a period of weeks to months.

The disease is known to be transmitted by the eriophyid mite *Phyllocoptes fructiphylus* or by grafting. The wild multiflora rose (*Rosa multiflora*) is very susceptible to the disease and is a common source of inoculum. Cultivated roses planted downwind of infected multiflora rose are especially at risk because the mite vector travels on wind currents from infected to healthy plants. Some growers have observed symptoms on previously healthy plants within four weeks of being planted downwind from diseased multiflora rose.

The causal agent of rose rosette disease is not soil-borne, so it is possible to successfully plant healthy roses in beds where diseased plants have been removed; however, the pathogen may persist in old root pieces that remain in the soil from previous diseased roses. If plants regrow from these old root pieces, as multiflora rose is apt to do, they can serve as an inoculum source for healthy plants. Therefore, it is important to remove old plants thoroughly and ensure that infected plants are not allowed to regrow from old, infected root pieces.

Control

No effective control is available for rose rosette in existing, diseased rose plants, but the disease may be prevented from spreading to healthy plants by using a combination of the following approaches.

Resistance

R. multiflora is the species that appears to be most susceptible to rose rosette disease. However, many species and selections of cultivated roses are also highly susceptible, and no cultivars have been proven to be resistant. Although the native species *Rosa setigera* is reported to be resistant to the disease, one grower has reported increased susceptibility to powdery mildew on plants of *R. setigera*, which could indicate some level of infection by the RRD pathogen. A species called the McCartney rose, which exists as a weed in Texas, is susceptible to RRD but resistant to feeding by the mites that transmit the disease. It may be possible, through breeding techniques, to incorporate this mite resistance into cultivated roses in the future. In the meantime, it would be wise to assume that all cultivated roses are potentially susceptible to the disease and to be on the lookout for symptoms of rose rosette.

Cultural Control

Early detection of the disease is the key to effective cultural control. Any suspect roses should be removed and destroyed immediately or monitored for continued symptoms and removed as soon as presence of RRD is



Fig. 4. Excessive thorniness on thickened stem.

(Photo by S. Debolt)

ascertained. In some areas burning is permitted and can be used to destroy diseased plants. If burning is not allowed in your area, plants should be bagged and removed. Diseased plants that have been uprooted should not be allowed to remain in the vicinity of healthy roses as they can continue to serve as a source of inoculum.



Fig. 5. Deformed flowers.

(Photo by S. Debolt)

If possible, *R. multiflora* plants, which frequently serve as the source of inoculum, should be eliminated from the immediate vicinity (100-meter radius) of rose nurseries and gardens. Locations where individual multiflora rose plants have been removed should be monitored for regrowth and any regrowth should be removed and destroyed. Multiflora rose over larger areas is, however, difficult to control and complete removal may not be practical.

To prevent infection of new transplants, avoid planting cultivated roses on hilltops or downwind of known multiflora rose plantings where the cultivated rose transplants are more susceptible to invasion by the mites.



Fig. 6. Symptoms of glyphosate injury to new growth in spring. (Photo by M. A. Hansen)

Space plants so that canes and leaves do not touch each other. Eriophyid mites do not have wings and must crawl from plant to plant. Proper spacing makes it more difficult for the mites to move within a planting.

Chemical Control

Although there is no compound that will control the causal agent of rose rosette directly, effective control of mites with certain miticides can reduce the risk of spread. Be aware that miticides registered for control of spider mites do not control the eriophyid mites that transmit rose rosette disease. Some researchers have obtained reasonable control with Sevin; however, mites are very small and it can be difficult to get complete coverage. Also, use of Sevin to control eriophyid mites can lead to outbreaks of spider mites. The insecticide, Avid, is registered for control of both eriophyid and spider mites on roses.

Use of miticides in the absence of cultural controls is not recommended. One way to use a miticide as an additional tool in a control program is to focus sprays on plants that surround spots where diseased plants have been removed. These are the most likely plants to which mites from within a planting would have moved. Spraying every two weeks from April until September should significantly reduce the mite population and the risk of transmission. Additional sprays may be needed during hot, dry weather when eriophyid mites are most active.

References

- Amrine, J. W. and D. F. Hindal. 1988. *Rose Rosette: a Fatal Disease of Multiflora Rose*. West Virginia University Circular 147. Morgantown, W. Va.
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- Peck, A. and L. Peck. *Rose rosette: a web book*. Updated, July 2001. <http://web.ntown.net/~apeck/>

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Ethylene, Part-II

Gary Ritchie, Ph.D., Master Rosarian
Olympia Rose Society

Note: This article appeared first in **The Clippings**, the monthly newsletter of the Olympia Rose Society.

Ed's Note: this article is taken from the January 2011 edition of the Northwest Rosarian Judy Heath editor

In the last *Northwest Rosarian* we were introduced to the only known *gaseous* plant hormone. Called ethylene, it tends to inhibit, rather than promote, plant processes.

Just about every plant that has been studied has been shown to produce ethylene – this includes angiosperms, gymnosperms, ferns, mosses, and, yes, roses. Interestingly, ethylene is produced in all plant organs, but its highest production rate occurs in ripening fruits and young, developing leaves. Ethylene is also produced by bacteria and fungi but not by animals.

The way in which plants manufacture ethylene has been well researched. The process begins with an amino acid called methionine. Then the plant converts it to a chemical called ACC (for you chemistry geeks out there, that's 1-aminocyclopropane1- carboxylic acid). This conversion is modulated by an enzyme called ACC synthase. The plant then oxidizes ACC to ethylene by another enzyme, ACC oxidase. Scientists believe that the rate-limiting step in ethylene synthesis is at the point of manufacture of ACC oxidase. Plants require iron to make ACC oxidase – so an iron deficiency may retard the rate of ethylene production.

A wide range of triggers can stimulate plants to synthesize ethyl-ene. Among these are the developmental state of the plant, certain environmental stresses, other hormones and injury. As fruits ripen, the levels of ethylene, ACC and both ACC enzymes increase sharply. Stresses such as low temperature, drought, exposure to ozone and mechanical wounding also stimulate production of ethylene. This is often called stress ethylene and can promote healing, senescence, leaf drop and increased resistance to various diseases.

Strangely, auxin can sometimes induce plants to produce ethylene-like responses. Initially it was believed that auxin was actually causing the response, but careful research revealed that this may not be the case. It seems that auxin can promote the activity of ACC synthase, which in turn stimulates ethylene production. So the observed responses were actually mediated by ethylene – not auxin. Plant hormone research can be tricky.

Ethylene *production* as well as ethylene *action* can be inhibited by various agents. A couple of chemicals with really long names, let's call them AOA and AVG, can block the production of ACC, hence they inhibit ethylene production. Cobalt ions can block the conversion of ACC to ethylene. Ethylene *action* can be inhibited by silver, as silver thisulfate (STS) or silver nitrate. Both have been used to extend the vase life of cut flowers. Here's how it works. When you cut a stem, say a bloom from a rose plant, stress ethylene is produced by the wound. This promotes healing. As the wound heals, the cells at the cut stem base begin to callous over and plug up, preventing water from entering the stem. Application of STS slows down the production of stress ethylene and retards healing – hence keeping the water conducting cells open longer.

High atmospheric CO₂ content can also retard ethylene action. This technique is in use today in the fruit storage industry. By flooding storage rooms with CO₂ it is possible to greatly extend the storage life of the fruits contained therein. A unique ethylene action inhibitor called MCP has recently been discovered. This chemical apparently competes with ethylene on the plant's bind-ing sites, completely blocking its action.

Next time we'll focus on the varied and fascinating physiological effects that ethylene exerts on plants.

PENN JERSEY DISTRICT OFFICERS AND STAFF

Officers Elected and appointed September 2006 for 3 year terms

District Director:

Kevin Glaes
610-926-4428
glaes1215@comcast.net

1st Assistant Director:

Mary Slade
(717)939-6463

2nd Assistant Director:

Joan Singer
717-352-2212
joandrandy@supernet.com

Secretary:

Nancy Redington
717-264-6488
Rosered1@comcast.net

Treasurer: Georgiana

Papale (412)563-6755
msgeorgi@ix.netcom.com

Chairman, Nominating Committee:

Nancy Redington
717 264-6488
Rosered1@comcast.net

District Chairman of Judges:

Elaine L. Adler
610-692-5631
eadler@westtown.org

Chairman of Arrangement Judges:

Patricia A. Bilson
610-644-1860
patbilson@yahoo.com

Chairman of Consulting Rosarians:

Gustave R. Banks
609-267-3809
Jrsyrose@verizon.net

Chairman of Mid-Winter Convention:

Curtis Aumiller
717-612-1575
Caumiller1@verizon.net

District Trophy Chairman:

William Kozemchak
215-945-8098
pinkykoz@aol.com

District Chaplain:

Fr. Gervase Degenhardt
412 682-6430 x240
gervase@capuchin.com

District Membership Chairman:

Iliana Okum
609-298-4160
wjsrose@msn.com

Roses in Review Coordinator:

Diane Wilkerson
732-219-0339
hiptownrose2@aol.com

Historian:

Pat Pitkin
618-477-1817
pitkind@earthlink.net

Webmaster: Kevin Glaes

kevyg@frontiernet.net

The Rose Vine Editor:

Terry Palise
609-896-2011
cpalise@verizon.net



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