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JUNIPER HOSTS OF CEDAR-APPLE RUST AND CEDAR-HAWTHORN RUST

E. B. Himelick and Dan Neely*

Abstract

All species, varieties, and forms of the genus Juniperus observed to be susceptible or resistant to cedar-apple rust, Gymnosporangium juniperi-virginianae, or cedar-hawthorn rust, G. globosum, are listed. This list is based on field observations made at the Morton Arboretum and on lists found in the literature. Two species, J. pinchotti and J. utahensis, and 13 varieties of other Juniperus species not found in previous reports are reported susceptible for the first time to cedar-apple rust. Nine additional varieties are reported susceptible to cedar-hawthorn rust.

Introduction

The injury caused by Gymnosporangium rusts is sufficiently severe in some years that these rusts are considered the most important diseases in commercial nursery and ornamental plantings. Cedar-apple rust, G. juniperi-virginianae Schw., and cedar-hawthorn rust, G. globosum Farl., are the most widespread and injurious rust on junipers in Illinois. Although cedar-quince rust, G. clavipes Cke. & Pk., is present in Illinois, it usually is less conspicuous and causes less injury than the two previously mentioned rusts.

The control of rust diseases in apple orchards by the use of fungicide sprays and by the development of resistant varieties of apples has greatly reduced the necessity for destroying or removing the Juniperus host in the vicinity of orchards. As ornamental trees and shrubs, junipers have an integral part in present-day landscaping designs. There is a definite need for a complete list of Juniperus species and varieties that are known to be susceptible or resistant to cedar-apple and cedar-hawthorn rusts. This list would serve nurserymen, arborists, and home owners as a guide for the selection of the more desirable varieties of junipers.

Field Observations

Observations on the rusts of junipers were made at the Morton Arboretum near Lisle, Illinois, on May 1959. Due to the proximity of Malus and Crataegus hosts and the compactness of the Juniperus collection (150 by 150 feet), all of the junipers were subject to a relatively uniform source of abundant natural inoculum of both cedar-apple and cedar-hawthorn rusts. Many of the susceptible varieties of junipers were so severely affected by rust that their ornamental value was destroyed. Because spore horn development by the rust galls was so pronounced in May of 1959, it was possible to determine the extent and severity of both rusts on the various species and forms of junipers. Data was obtained on the presence or absence of rust galls and the abundance of galls on each species, variety, and form of juniper growing in the Arboretum. Each individual juniper in the Morton Arboretum is permanently tagged with its scientific name. The Morton Arboretum follows the classification of Rehder (11, 12) in naming the species varieties and forms in its juniper collection. However, a number of the juniper specimens in the Arboretum's collection have names which are not given in Rehder's listing or in any other plant listing examined. Rehder's classification is also followed in this publication. Where the forms or varieties were not listed by Rehder, Bailey's classification (2) is followed. Changes resulting from synonomy are incorporated in this list. The horticulture varieties listed without authorities are followed by the word Hort.

Discussion

The susceptibility or resistance of the various species, varieties, and forms of junipers in the Morton Arboretum collection are listed in Table 1. Also listed are the reports on susceptibility and resistance to cedar-apple and cedar-hawthorn rust given by other observers. Extensive lists of Juniperus varieties susceptible to cedar-apple rust were published by Crowell (6) and Boyce (4). In addition, several miscellaneous reports have been made on the susceptibility of junipers to cedar-hawthorn rust (1, 3, 5, 8, 9, 13).

Table 1. Junipers susceptible and resistant to cedar-apple and cedar-hawthorn rusts.

Species, varieties and forms of Juniperus	Cedar-apple rust		Cedar-hawthorn rust
J. chinensis L.	Ra	(R)b	R
f. aureo-globosa Rehd.	R		R
columnaris Hottes	R		R
femina Bailey	R		R
fortunei Hort.	R		R
f. globosa(Hornibr.) Rehd.	S-2c	(R)b	R
f. japonica (Carr.) Lipa	R	(R)b	R
Keteleeri Cornman	R		R
leeana	R		R
f. mas (Gord.) Rehd.		(R)b	
var. oblonga	R		R
f. pendula (Franch) Beiss.		(R)b	
f. Pfitzeriana(Spaeth)Rehd.	R	(R)b(S)d	R
aurea	R		R
f. plumosa (Hornibr.)Rehd.		(R)b	
var. plumosa aurea Hornibr.		(R)b	
f. pyramidalis(Carr.) Beiss.	R	(R)b	R

var. Sargenti Henry	R	(R)b	R
sylvestris plumosa Hort.	R		R
f. variegata (Maxw.) Rehd.	R		R
Watereri Hort.	R	(R)b	R
J. communis L.		(R)b(S)e(S)f	
f. aurea (Carr.) Rehd.		(R)b	
f. aurea-spica (Rehd.) Lipa		(R)b	
f. compressa (Carr.) Rehd.		(R)b	
cracovica Carr.	R	(R)b	R
var. depressa Pursh	R	(R)b	R
var. hispanica Endl.	R		R
var. oblonga Loud.		(R)b	
f. oblongo-pendula Besis.		(R)b	
pyramidalis Hort.		(R)b	
var. saxtatilis Pallas		(R)b	
f. stricta (Carr.) Rehd.	R	(R)b	R
f. Suecica (Mill.) Beiss.	R	(R)b	R
nana Hort.	R		R
J. conferta Parl.	R	(R)b	R
J. davurica Pall.	R		R
J. excelsa f. stricta(R. Sm.)Rehd.	R		R
J. formosana Hayata	R	(R)b	R
J. glauca hetzii	R		R
J. glaucescens Florin	R		R
J. hetzii	R		R
J. horizontalis Moench	R	(S)b	R(S)a
admirabilis	R		R
adpressus	R		R
f. alpina (Loud.) Rehd.	S-2	(R)b	R
argenteus	R		R
f. Douglasii Rehd.	R	(S)b	R
eximius	R		R
filicinus minimus	R		R
f. glomerata Rehd.		(R)b	
hudsonica	R		R
lividus	R		R
petraeus	R		R
f. plumosa Rehd.	R	(S)b	R
compacta	R		R
Subglaucus	R		R
f. variegata Slavin	R	(R)b	R
Wiltoni	R		R
J. japonica nana D. Hill	R		R
J. macroscarpa Sibt. & Sm.	R		R
J. monosperma (Engelm.) Sarg.	R		R
J. Pinchotii Sudw.	S-1		R
J. procumbens(Endl.)sieb & Zucc.	R	(R)b	R
J. rigida Sieb. & Zucc.	R	(R)b	R
J. Sabina L.	R	(R)b	R
f. fastigiata (Beiss.) Voss	R		R
pyramidalis Hort.		(R)b	
f. tamariscifolia(Ait.)Koeh.	R	(R)b	R
f. variegata (West.) Beiss.		(R)b	
J. scopulorum Sarg.	S-2	(S)b	(S)h
funalis	S-2		R
hilli D. Hill	S-2		R
hilli argentea pyramidalis	S-3		R
f. horizontalis(D. Hill) Rehd.	S-2	(R)b	S-3
moffeti Hort.	S-2		R
pendula D. Hill	S-3		R
pillaris D. Hill	S-2		R
f. viridifolia(D. Hill) Rehd.		(S)b	
J. silicicola (Small) Bailey		(S)i	(S)i
J. squamata Lamb		(R)b	
albo-variegata Hort.	R		R
argesii	R		R
var. Fargesii Rehd. & Wils.		(R)b	
var. Meyeri Rehd.	R	(R)b	R
parsoni	R		R
f. Wilsonii Rehd.		(R)b	
J. utahensis (Engelm.) Lemm	S-3		R
J. virginalis Hort.	R		R
J. virginiana L.	S-3	(S)j	S-3(S)j
aurea		(R)b	
Burkii Bailey		(R)b	
f. Canaertii(Senecl.) Rehd.	S-3	(R)b	S-3
f. Chamberlaynii(Carr.)Beiss.	S-3	(S)b	S-1
cinerascens Hort.	S-3	(S)b	S-3
cupressifolia	R		R
f. elegantissima(Hochst.)Rehd.	S-3	(S)b	S-3
fastigiata Hort.		(S)b	
f. filifera (D. Hill) Rehd.		(S)b	
f. glauca (Carr.) Beiss.	S-3	(S)b	S-3
f. globosa (Beiss.) Schn.	R	(S)b	R
f. Kosteri (Beiss.) Lipa	R	(R)b	R
horizontalis Arb. Kew.	R		R
nova D. Hill	S-2		R
f. pendula (Carr.) Beiss.	S-3	(S)b	S-2
f. plumosa Schn.		(R)b	
polymorpha Hort.		(S)b	
pseudocupressus	R		R
f. pyramidalis (Carr.) Beiss.	R	(S)b	R
glauca		(R)b	
pyramidiformis D. Hill	S-3		S-3
f. reptans (Beiss.) Rehd.	S-3	(S)b	R
f. Schottii (Gord.) Beiss.	S-3	(S)b	R
f. tripartita (Senecl.) Beiss.	R	(R)b	R
f. variegata (Laws.) Rehd.	S-2		S-1
f. venusta (Ellw. & Barry)Rehd.		(R)b	

a R-resistant.

b Reported as either resistant (R) or susceptible (s) by Crowell (6). All infection ratings that occur in parentheses are those by other authors.

c S-1, slight infection; S-2, moderate; S-3, severe.

d Reported susceptible by Ray (10).

e Reported susceptible by Kanffman (7).

f Reported susceptible in Pennsylvania by Maclachlan (8).

g Reported susceptible by Brenckle (5).

h Reported susceptible by Martin (9) and by Bliss (3).

i Reported susceptible by Stone (13).

j Reported susceptible to cedar rust in 30 States and Ontario and to cedar-hawthorn rust in 21 States by Arthur (1).

Two species, J. pinchotii and J. utahensis, and 13 varieties and forms of other Juniperus species not found in reports on susceptible hosts to cedar-apple rust are reported here. Nine additional varieties not found in previous host lines are reported susceptible to cedar-hawthorn rust. Of the 116 species, varieties, and forms of junipers listed in Table 1, 36 are susceptible to cedar-apple rust and 14 are susceptible to cedar-hawthorn rust.

A careful selection of resistant species and varieties of junipers will reduce if not eliminate the problem of cedar-apple and cedar-hawthorn rusts. Particular attention should be given when selecting varieties of J. virginiana since 16 forms are susceptible to at least one or both rusts and 10 forms are believed resistant to both. J. Scopulorum and all of its forms and varieties were observed to be susceptible to cedar-apple rust and should be used only if other juniper species are not available.

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* Associate Plant Pathologists, Illinois Natural History Survey, Urbana, Illinois.

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PROPAGATION OF SOFTWOOD CUTTINGS UNDER POLYETHYLENE

by Martin Van Hof, Propagator
Rhode Island Nurseries
Newport, Rhode Island

Softwood cutting time is close at hand and we at the Rhode Island Nurseries propagate most of our softwoods under polyethylene which we prefer over sashes. Polyethylene means less work and a considerable saving in cost, as one can buy a 10½foot by 100 foot roll of polyethylene for about $19 as against one sash at about $13. Of course, the plastic has to be replaced yearly.

We have been propagating under plastic for the last 5 years and I would like to share our experience with the rest of the propagators or other interested persons.

Let us start off by describing the preparation of the propagating beds. Each bed is six feet wide and up to 100 feet long, although the length does not matter, as one can overlap the plastic and the moisture will seal it.

We use 8- or 10-inch boards for the sides of the bed, or if one wants to do it cheaper a 1 inch or 2 inch furring raised to about 10 inches will do the same job. The only difference is that the cuttings have to be inserted from the side of the bed.

It is important to prepare the soil in the bed thoroughly. I prefer a Rotoh to a tiller as the mechanical hoe will not pulverize the soil as much as the tiller will, which means less compaction after watering. A digging fork will do a good job also.

Next, the bed is raked as level as possible and the soil pressed down with a wooden tamper or a light roller. At night the prepared bed is covered with tar paper or discarded plastic to protect it against rain or digging by animals.

Soft cuttings 6 to 10 inches long, depending on the variety, are inserted in the soil. We probably use a different method than most propagators--the men doing the sticking sit on a plank placed across the frame and also use a footboard. A pointed steel dibble about ¼ inch thick and 8 inches long is used to make the hole for the cutting and to tighten it at the base with a slanting movement.

When a 4-foot section of the bed has been completed, the cuttings are watered in (could be called flooded) and are then given temporary protection from silting by a 4 by 6-foot shade covered with burlap which is kept damp. When four of these sections (16 ft.) have been filled, we begin covering that much of the bed with plastic.

A shallow trench is dug just outside the ends and sides of the bed and the shades with burlap are removed; next, four 2 by 2 inch pieces of wood, 2 feet long, are spaced 4 feet apart in the center of the bed and are driven 8 inches into the soil; a 1 by 2-inch furring 16 feet long is then nailed on top of these supports forming a ridgepole for the plastic through the center of the bed. This 16-inch high center has proved to be the best height for providing the correct humidity in our locality.

All sharp corners are padded to prevent tearing of the plastic, which is unrolled over the structure. One side of the plastic is laid in the trench, covered with soil, and tamped down by foot; next the plastic is pulled tight across the frame and fastened with soil in the trench on the opposite side.

Since plastic traps a tremendous amount of heat, specially constructed 7-foot shades with laths ¼ inch apart are used. The extra foot of the 7-foot shade allows enough additional length so that the shades protrude 6 inches beyond the edges of the bed. We use either wooden runners or T-shaped iron stakes to support the shades. They should be high enough to clear the ridgepole by 2 inches.

The overhang of the shades also provides shade for those cuttings near the edges of the bed. The procedure continues until the frame is filled.

The plastic used in covering these cuttings is 4 mils in thickness and comes in rolls 100 feet long and $10\frac{1}{2}$ feet wide. Again, it is used only one year.

Through experience one learns to group cuttings of those varieties that root in approximately the same length of time; if this is impossible because of small numbers of certain varieties, the bed can be sectioned off by bringing the plastic down into the soil to form a wall, thereby separating the varieties which take different lengths of time to root. In propagating a large number of varieties, be sure to keep the slow rooting and the fast rooting ones separate. For instance, Magnolia and some of the Viburnum varieties just would not be practical to stick with fast rooting Deutzia, Weigela and Hydrangea.

Once the frames are closed, the plastic covers should not be removed for at least $2\frac{1}{2}$ or 3 weeks. If at the end of this time it is discovered that the tops of the cuttings are dry, one can be sure that they were not watered sufficiently when originally inserted.

After the cuttings begin to root, I recommend you give them air by opening part of the flap on one side of the plastic covering and just letting it hang down. This allows the air to circulate without drying the cuttings too much, although it starts the hardening off process. After two or three days, the plastic is rolled up on this side and tucked between the lath shade and its supporting runner or stakes. At this time additional watering is necessary.

I should caution you that fungus might set in at this particular stage of development if the cuttings do not get snfficient air in the bed. The plastic is removed entirely after about 1 week or 10 days. The shades are kept on for another 2 weeks and then gradually removed when the cuttings are really hardened off. I, for myself, believe propagating of softwoods is cheaper under plastic than under glass. Of course sashes are not used anymore, but just for the comparison, what a terrific drudgery it used to be to root softwood cuttings.

Taken from Rhode Island Nurserymen's Newsletter. No. 2, June, 1960.

NOTES FOR NURSERYMEN

Walter P. Trampe
Supervisor of Nursery Inspection
Minnesota Department of Agriculture,
Dairy and Food

Proper Arrangement of Nursery Stock

Nursery stock should be arranged in the nursery so as to allow any of it to be reached with a sprayer. Nurserymen have long been aware of the dangers of spider mite infestations on evergreens. Such stock is, in general, within reasonably easy access for spraying. Plant pest problems are perhaps becoming more serious each year. In view of this increasing problem, all trees and shrubs should be accessible for spray equipment. This will allow the proper application of chemical insect and disease controls if the situation requires it.

Scale Insects

Brown elm scale, Lecanium corni, and Fletcher scale, Lecanium fletcheri, are becoming quite troublesome as plant pests. As the common name implies, the brown elm scale is most troublesome on elms. It may also be found on other shade and fruit trees. Fletcher scale is found mainly on arbor vitae and yews. For crawler stage control, the stock should be sprayed as soon as possible. 50% malathion E. C. may be used at the rate of 2 pints per 100 gallons water or 3 pounds 25% W. P. per 100 gallons water.

Mites

Spider mites have long been a pest on evergreens. During the last year a smaller mite, identified as an eriophyid, has made its appearance in Minnesota. It is difficult to see these pests without the aid of a hand lens or a microscope. They are perhaps most troublesome on closely sheared Black Hills spruce. Nurserymen should watch their evergreens carefully for signs of yellowing. Kelthane or Tedion appear to be effective in controlling these pests.

Birch Leaf Miner

Birch leaf miner is making its second generation appearance at this time. Either malathion or lindane is an effective control if applied to the foliage when the larvae are active in the leaves. If a birch block which is infested is going to be grown for another year, a ground treatment may be effective. Such a block should be isolated from other untreated birch trees.

For further information you may write to the Nursery Inspection office.

FIELD DAYS FOR NURSERYMEN AUGUST 5 AND 6

Two field days for nurserymen have been scheduled for August--at Northrup King Trial Grounds August 5 and at Bailey Nursery, Newport, August 6.

All Minnesota Nurserymen are invited to visit the Northrup King Trial Grounds on Highway #169 toward Shakopee. Nurserymen should tour the trial grounds at 10:30 a. m. Friday, August 5. Lunch will be provided by Northrup King. A tour of the Minnesota Landscape Arboretum is planned for the afternoon.

Site of the August 6 tour is the Bailey Nursery located near Newport on Old Bailey Road. Visit the nursery and stay for the noon luncheon.

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