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HURRICANE "DONNA" AND ITS AFTER EFFECTS TO A CHATHAM, MASSACHUSETTS, GARDEN

WE have 8 acres here in Chatham, originally covered with native shrubs and trees and later cleared in some portions to allow for planting other material. The land slopes from a hill down to a salt water inlet; beyond is Stage Harbour and the open Atlantic. The southwest hurricane winds of "Donna" on Monday, September 12, 1960, had an unobstructed path to our property direct from the ocean; there is absolutely no cover between.

Wind damage was surprisingly slight; it was much more in evidence in the Middleboro, Bridgewater and Brockton areas. However, large limbs broke off on *Ailanthus altissima* and several tall trees of *Pinus rigida*. Another *Ailanthus altissima* was uprooted and many terminal twigs of *Pinus rigida* were strewn on the ground.

The other hurricanes experienced here, beginning with the hurricane of 1938, were accompanied by deluges of rain. This meant that although salt water spray was deposited on the foliage, the wash-off resulting from the heavy rains prevented any noticeable salt spray damage on this property. Hurricane "Donna," however, brought to Chatham a scant .20 inches of rain. Consequently, when the winds ceased, our windows on the southwest side of the house had the appearance of having been white-washed.

Some plants showed no ill effects whatever from this salt bath. We have 650 plants of *Pinus thunbergii*, most of them from 12 to 16 feet tall, and not a needle turned color. The only exceptions were the 10 trees which are variants from the type and the greater the variation from type, the more needles that were browned.

Following the hurricane, many trees and shrubs whose leaves were 100% browned put out new leaves all over. This was natural in view of the later fall rains and the warm temperatures which we enjoy on Cape Cod in September, October and November. Forsythia and one or two other shrubs even put out a few scattered flowers. Walking over the property in January, I was encouraged to see in general good leaf and flower buds on most plants.

Holly Notes Interesting

Mr. Wilfrid Wheeler of Falmouth and Mr. Louis H. Carter of East Orleans, have compared notes with me on the hardiness of hollies in the Cape Cod area. A surprising number of them can be grown and with an expectancy of complete hardiness, although some survive better at Chatham than they do at Falmouth. Damage was greater there this past winter, not so much because of any vagaries of Hurricane "Donna," but because the winter temperatures there were lower (down to -12°F.) than at Chatham ($+5^{\circ}\text{F.}$).

Ilex opaca showed a general die-back of 1-3", whereas with *I. aquifolium*, presumed to be less hardy, many varieties went through unscathed in my plantings and even though the leaves may have shown a very slight injury, the twigs were in perfect condition, plump up to the end, in May 1961. The *Ilex aquifolium* varieties were badly injured at Falmouth. Some were killed outright, some were killed to the snow line, while others, at best, required severe pruning. The Chatham planting apparently had more salt spray than those at Falmouth. It seems a fair conclusion that *I. aquifolium* will come through a complete salt bath successfully when the following winter's lowest temperature is 5°F. or higher and the soil is good, but severe loss can be expected when salt spray is followed by winter temperatures of much below zero or when plants are growing in extremely poor, sandy soil.

Mr. Wilfrid Wheeler of Falmouth took holly cuttings early in 1961 from plants which had been exposed to Hurricane "Donna" and later observed that never in his long career did he have such difficulty in obtaining rooted cuttings, for only 60% of *Ilex aquifolium* cuttings rooted, in comparison with other years. Of *I. opaca* cuttings, some rooted normally, while others rooted only 15% as well as they had done in other years.

Given good soil and proper culture, it is evident that in an area with Chatham's temperatures a wide selection of *Ilex* species and varieties can be successfully grown, even to the accompaniment of a thorough salt bath. The varieties of *Ilex* in the following lists have been thoroughly hardy at Chatham, year after year, without any winter damage. The varieties of *Ilex opaca* growing at Chatham are:

Aaron	Emily	Pearle le Clair
Aalto #3 and 6	Fallow	Perpetual
Aalto Lunn	Freeman	Polly
Amy	Goldie	Robin Tree
Ashumet	Griscom	Ruth
Barberry	Kate	Sally
Barbosa	Laura Thomas	St. Ann
Betty Ann	Laurie	St. Mary
Big Tree	Lawrence	Vera
Davis	Mt. Vernon	
Elizabeth	Natale	

The following are *Ilex aquifolium* varieties which are growing so successfully here and in Orleans. The asterisks (*) indicate those varieties which, through the years, have also proved hardy at Falmouth :

alcicornis	Father Charles	Lawson
*Alice	Fertilis	Moore
*altaclarensis	Firecracker	ovata
*Ames	*Glory	pendula
Angustifolia	Gold Gem	perado
Arnold	Gold Milkmaid	Pinto
Belgica	Golden Queen	recurva
*Boyce Thompson	*Goliath	Rederly
Brownell's Special	Green Knight	Scotia
*camelliaefolia	Green Maid	Shepherd
*cilata major	*Hazel	Teufel's Dwarf
Echo	Henderson	Teufel's Hybrid
Escort	*James G. Esson	Whitney #2 & 3
fructu-aurantiaco	*Jan Van Tol	Whitney Lunn
fructu-luteo	laurifolia	Wilson

Also 17 other seedlings unnamed.

For those plants of *Ilex* that were damaged this year for the first time, undoubtedly due to salt spray injury, see page 71.

***Ilex crenata*.** All named clones of the species *I. crenata* (Japanese holly) that we have tested thrive well. These include *compacta*, *convexa*, 'Glass,' 'Green Cushion,' 'Helleri,' 'Hetzii,' 'Howardi,' 'Longfellow,' *major*, *microphylla maculata*, *oleafera*, 'Stokes' and 'T 1' (Tingle).

Miscellaneous species. Other species proved perfectly hardy are *cornuta* (Chinese holly), varieties 'Burford,' 'National,' 'Rotunda,' and eleven seedlings and cuttings without names; *glabra* (the native Inkberry), *pedunculosa*, *pernyi* in four different forms, its variety *veitchii*, *verticillata* and the hybrid *aquifolium* × *pernyi*.

General Comments

Here are some general observations as a result of closely examining the plants subjected to this salt spray bath in September, 1960:

If a tree or shrub were in poor condition from whatever cause, it invariably suffered greater damage from salt spray than did healthy specimens of the same species.

Shrubs attempting an existence in what is largely Cape Cod sand were usually hurt more than the same species growing in good soil. Fortunately, our own soil is excellent and our material came through better than that of people whose soil

is chiefly sand. The damage was much more extensive in Falmouth than in Chatham. Because of this, apparently low temperatures in the winter also contributed to the injury, for Falmouth's low reading in the winter 1960-1961 was -15° F., while Chatham's was $+5^{\circ}$ F. Many of our shrubs showing 1-12" dieback were a total loss in Falmouth.

List of Woody Plants Observed

Explanation of symbols: **Bold Face**—Although some may have had the leaves partly or wholly burned with salt spray right after "Donna," these plants showed no injury nine months later.

*—Slight salt browning of foliage after hurricane; not serious.

‡—Leaves of entire shrub or tree browned immediately after hurricane.

If inches or feet are noted after the name, it indicates that the twigs died back just that much in the nine months after the hurricane.

<i>Abelia grandiflora</i> 1-3' (slightly more than usual) *	Calluna vulgaris , 23 varieties
<i>Abies balsamea</i> , few stems 6'' *	" " <i>vulgaris aurea</i> *
<i>Acer palmatum atropurpureum</i> 3-4' ‡	" " <i>pygmaea</i> *
<i>Albizzia julibrissin rosea</i> , one died; another 6''-2' *	" " <i>rubrum</i> *
Amelanchier canadensis	" " 'J. H. Hamilton' *
Arctostaphylos Uva-Ursi	<i>Carya illinoensis</i> , 4'' ‡
Aronia arbutifolia	<i>Caryopteris incana</i> , 8-12''
" <i>melanocarpa</i> , 2-4'	<i>Celastrus scandens</i> , 3-6''
<i>Berberis thunbergii</i> ‡	<i>Cercidiphyllum japonicum</i> , 6''-2' ‡
" " <i>atropurpureum</i> ,	<i>Cercis canadensis</i> ‡ (died)
few twigs, 2-4''	Chaenomeles lagenaria 'Apple Blossom'
<i>Berberis triacanthophora</i> , most twigs, 3-6''	<i>Chionanthus virginiana</i> , 3-6'' ‡
<i>Berberis verruculosa</i> , few twigs, 1-3''	<i>Clematis virginiana</i> , normal dieback only
Berberis thunbergii 'Crimson Pygmy'	Clethra alnifolia
<i>Betula papyrifera</i> , one, no damage; another 10 feet away, 2½'	<i>Cornus alternifolia</i> , most showed 6-18'', some even 3'; a few died. Have about 30 which were native here. ‡
Buxus microphylla compacta	<i>Cornus florida</i> , those in open area died; those protected by screen of pines, no damage; those surrounded by shrubs died above line of shrubs. ‡
" <i>microphylla</i> 'Curly Locks'	<i>Cornus kousa</i> , 6-18'' ‡
" <i>sempervirens</i> (some people whose plants are in sand had complete loss)	" <i>mas</i> , 3-6'' ‡
Buxus sempervirens rotundifolia	" <i>paniculata</i> , 18'' wind side; lee side no damage ‡
" <i>sempervirens</i> , variegated	Cornus stolonifera flaviramea
" <i>sempervirens</i> 'Vardar Valley'	
<i>Callicarpa japonica</i> , normal dieback only	

Cotoneaster apiculata
 “ **divaricata**
 “ **floribunda**, 4-12'' *
 “ **foveolata**, some twigs,
 4'' *
Cotoneaster franchetii, 18'' wind side,
 some in more protected spot un-
 harmed *
Cotoneaster horizontalis, 1'' wind side*
Cotoneaster horizontalis perpucilla
 “ **microphylla buxifolia**
seedling
Cotoneaster multiflora, 4'' *
 “ **racemiflora**, 3-6'' *
 “ **wardii**; some stems 3';
 where more protected, no damage *
Crataegus oxyacantha paulii
 “ **phaenopyrum**
Cytisus kewensis
 “ **praecox**
 “ **praecox alba**, few stems 5''
 “ **purgans**
 “ **scoparius andreanus**, one
 stem only died
Cytisus scoparius var., large, old plants
 died; healthy young stock, 6-24''
Davidia involucrata †
Deutzia gracilis, 3-6'' †
Elaeagnus umbellata, 6-24'' on wind
 side †
Enkianthus campanulatus, 3' wind
 side †
Erica (25 varieties)
Euonymus alatus, 4'' †
 “ **europaeus**, 6-12''; 1 died
 “ **fortunei kewensis**
 “ **fortunei vegeta**
Exochorda grandiflora wilsonii, 4-12'' †
Forsythia intermedia spectabilis, some
 stems 12''; some plants undamaged*
Forsythia 'Beatrix Farrand', 6''-3' *
Forsythia viridissima 'Bronxensis'
 “ **'Spring Glory'**, some stems
 12''; some plants undamaged *

Fothergilla major, 3' wind side †
Franklinia alatamaha, one died in the
 open; one protected by pines 1-3'' †
Gleditsia triacanthos inermis, 6-8''
Halesia monticola
Hypericum 'Hidcote', normal dieback
 “ **'Sun Gold'**, “ “
Ilex aquifolium (24 varieties)
 (A friend in Orleans had 2 5-ft.
 plants really hurt out of a total of
 200.)
Ilex aquipermyi
 “ **cornuta**
 “ **crenata compacta**
 “ “ **convexa**
 “ “ **microphylla maculata**
 “ “ **oleafera**
 “ **glabra**
 “ **opaca** (37 varieties), 2-3'' some
 none *
Ilex pedunculosa, 3-6'' *
 “ **pernyi veitchii**
 “ **crenata 'Glass'**
 “ **aquifolium 'Good Luck'**
 “ **crenata 'Green Cushion'**
 “ “ **'Helleri'**
 “ “ **'Hetzii'**
 “ **opaca 'Howard'**
 “ **crenata 'Longfellow'**
 “ “ **'Major'**
 “ “ **'T 1'**
 “ “ **'Stokes'**
 “ **pernyi**
Juglans cinera, died †
Juniperus virginiana—probably 200 ±
 on the place—remarkable variation
 in results of trees side by side; one
 wholly undamaged, the next show-
 ing complete browning on wind
 side; actual dieback about 4-6''
Kalmia latifolia, few twigs, 6'' *
Koelreuteria paniculata
Kolkwitzia amabilis, 6-12'' †

- Laburnum vossii**
 Lespedeza bicolor ‡
 Ligustrum obtusifolium regelianum,
 3-6'', a few 2' *
- Lonicera japonica halliana**
 " tatarica, some undamaged;
 others 2'
- Magnolia virginiana**
 " soulangiana ‡
 " " 'Alba Superba,'
 pink
- Magnolia loebneri 'Merrill'**
 " soulangiana 'Rustica Su-
 perba'
- Malus baccata seedling**
 " 'Oekonomierat Echtermeyer,'
 12'' ‡
- Malus prunifolia rinki**
 " sargentii (seedling)
 " sargentii
 " 'Hopa'
- Morus alba**, 6-24'' ‡
- Myrica carolinensis**
- Nandina domestica** *
- Oxydendrum arboreum**, 6-36'' ‡
- Pachysandra terminalis**
- Parthenocissus quinquefolia**
- Philadelphus 'Belle Etoile'**, 12-18''
 " 'Minnesota Snowflake,'
 6-18''
- Photinia villosa**
- Picea abies**, few stems 8-14'' *
 " canadensis, few stems 8-14'' *
- Pieris japonica**, few twigs 3''
- Pinus banksiana**, few twigs 4'' *
 " resinosa, few terminals dead,
 but chiefly unharmed *
- Pinus rigida**, some undamaged, others
 nearby 12'', some worse *
- Pinus strobus**, exposed trees dead or
 nearly so, needles totally browned
 on entire southwest side of plants
 by Jan. 9, 1961
- Pinus sylvestris**, many large limbs and
 some whole trees dead where fully
 exposed. Needles totally browned
 on entire southwest side of plants
 by Jan. 9, 1961
- Pinus thunbergii**
 Paulownia tomentosa ‡
- Potentilla fruticosa 'Lemon Drop'**
 " " 'Moonlight'
 " " 'Mt. Everest'
 " " 'Primrose
 Beauty'
- Potentilla fruticosa 'Klondike'**
- Prunus** (peach and cherry) ‡
 " (flowering peaches), died
- Prunus caroliniana**, few stems 3''
- Prunus maritima**
 Pseudotsuga taxifolia, 6'' on wind side
 on badly exposed trees; needles
 totally browned on entire southwest
 side of plants by Jan. 9, 1961. Pro-
 tected tree wholly unharmed.
- Pyracantha coccinea lalandi**, a few
 slightly hurt
- Quercus coccinea**, some stems 12'' ‡
 " palustris ‡
- Quercus pedunculata**
 " rubra, some stems 12'' ‡
 " velutina
- Rhododendron carolinianum** (pro-
 tected spot)
- Rho. dauricum sempervirens**
 (azalea)
- Rho. fortunei**, a few stems 8''
 " molle
 " mucronatum, some branches
 12'' wind side; perfectly OK on
 lee side: some plants no damage
- Rho. obtusum seedling**
 " " arnoldianum, 12''
 wind side; some plants no damage
- Rho. satsuki seedling**
 " schlippenbachii
 " viscosum
 " yedoensis poukhanensis
 " 'Brilliantcy x satsuki'
 " 'Stewartstonian'
- Rosa floribunda**, 24'' compared to nor-
 mal dieback of 8-12''

Rosa hugonis
 “ **spinosissima**
 “ **virginiana**
 “ **rugosa** ‘Agnes’
 “ “ ‘Blanc Double de Combert’
 Rubus ‘Indian summer,’ all canes died to ground
 Rubus ‘Latham,’ $\frac{3}{4}$ of canes died to ground; remainder 6-24" dieback
 Salix alba vitellina, twigs 6-18"
 “ caprea, 6-12"
 Sorbus aucuparia, some twigs 4" †
 Spiraea billardii, 2'
Spiraea thunbergii compacta
 “ trilobata, 4-6"
 Styrax japonica, 12" †
Symphoricarpos chenaultii
 Symplocos paniculata, 12" †
 Syringa persica, 3" †
 “ “ alba, 3"
 “ **velutina**
 “ **vulgaris** ‘Leon Gambetta’
 “ “ ‘Montaigne’
 “ “ ‘Mme. Lemoine’
 “ “ ‘Chas. Joly’
 “ “ ‘Souvenir de Ludwig Spaeth’
 Syringa vulgaris ‘Pres. Grevy’
 “ “ ‘Sensation’
 “ “ ‘Adelaide Dunbar’
 “ “ ‘Blue Hyacinth’
 seedling
 Syringa vulgaris ‘Esther Staley’
 seedling
Taxus baccata repens
 “ **cuspidata** (only 2 plants showed damage)
Taxus cuspidata nana
 “ **media** hatfieldii
 “ “ hicksii
 Tsuga canadensis, burns badly with only normal winter winds unless completely protected.
 Ulex europaeus, 2-3' (normally 18")
 Ulmus americana, 6"-9'
 Vaccinium corymbosum, several hun-

dred on the place; those partially protected show no damage; those in open, range from 3-6" dieback to completely dead on wind side *

Vaccinium vitis-idaea majus and minus

Viburnum carlcephalum

“ **carlesii**

“ cassinoides, completely dead on wind side; badly hurt on lee side. The worst hit of our 17 *Viburnum* varieties. *V. setigerum* was next. †

Viburnum dentatum, several hundred on the place. Of those fully exposed, some are dead and on the wind side most are dead or nearly so. Of those somewhat protected by other shrubs, some are unhurt and others have 4-12" dieback. †

Viburnum dilatatum, 3-6" †

“ “ **xanthocarpum**

“ **opulus**

“ **plicatum tomentosum**

“ **prunifolium**, few stems 4" †

“ **pubescens**, several hundred

on the place. Of those fully exposed, some are dead and most are dead or nearly dead on wind side. Of those somewhat protected by other shrubs some are unhurt and others have 4-12" dieback.

Viburnum rhytidophylloides

“ **rhytidophyllum**

“ sargentii, 4-6" on wind side †

Viburnum setigerum, 6-18" †

“ **sieboldii**

“ **trilobum**, 6-12" †

“ **wrightii**, 3-6"; a few 12" †

Weigela, branches on some 1-2" †

“ **florida variegata**

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