

Dogwood Anthracnose Fungus Threatens Catoctin Mt. Park

By Manfred Mielke and Keith Langdon

Catoctin Mountain Park is a 5,770 acre unit located in the Blue Ridge mountains of north central Maryland. The park contains forests, trout streams and mountain vistas which attract approximately 3/4 million visitors annually.

A major management objective of Catoctin Mountain Park is to protect or rehabilitate the native species, natural features and processes of the Park and to maintain the natural abundance, diversity and ecological integrity of wildlife and plant populations.

Flowering dogwood (*Cornus florida*) is a small, deciduous tree that occurs over most of the eastern United States. It is abundant on the rich, well-drained slopes of the Park where it may form an understory canopy. At many locations, it is the only understory species present. Prolific flower and fruit production occurs where significant amounts of sunlight permit. Dogwood flower in April and the red nutlets ripen in October; the seeds usually germinate the following spring. Many species of birds and mammals feed on the fruits and aid in their dispersal. Large trees are 8 to 10 inches in diameter at breast height — about 60 to 90 years old.

The spring blossoms and red to scarlet autumn foliage attract visitors from the Washington, DC/Baltimore corridor and the Park has been host to the First Family at Camp David. The dogwoods, which contribute significantly to the beauty and privacy of this unique site, are being threatened by dogwood anthracnose.

Dogwood anthracnose was first reported in the New York area in the mid-1970s, and was initially confused among several fungi taxa. Further study revealed the fungus associated with dogwood dieback and mortality to be *Discula* sp., probably in the *D. umbrinella* complex.

Symptoms are first noticed as a small purple leaf spot, later forming larger tan areas with purple rims. The fungus may infect additional leaf surface area causing the leaf to curl and eventually die. The fungus also infects twigs, killing them from the tips back, turning them tan and dry. These symptoms generally start in the lower crown and progress up the stem, resulting in the initial common description as a lower branch dieback. Eventually, all branches become infected and die. Epicormic branches (trunk sprouts) frequently occur on diseased stems which are then attacked back to the main stem, causing stem infections. Numerous stem infections often coalesce to kill the main branch.

The fruiting body (acervulus) of *Discula* sp. can overwinter on fallen leaves, on leaves that remain attached through the winter, and on twigs. As more



Dogwood twig on a dying tree shows dark lesions caused by anthracnose infection. The white water-spots are fungicide.

Table 1. Dogwood stems per acre by dieback class

Size Class	Total $\bar{X}$ Stems per Acre (S/A)	Percent of Total (%)	Standard Error (SE)	Dieback Class					
				0	1	2	3	4	5
				S/A: %	S/A: %	S/A: %	S/A: %	S/A: %	S/A: %
<1"	132	32	33	52:39	37:28	13:10	9:7	9:7	12:9
1-<2"	85	21	18	30:35	23:27	22:25	7:8	4:4	0:0
2-<3"	104	25	13	37:35	10:10	19:18	30:29	8:8	0:0
3-<4"	66	16	9	13:20	9:14	11:17	15:23	15:23	2:3
≥4"	23	6	7	2:9	4:17	4:17	7:30	5:22	1:4
Total	410	100	51	134:33	83:20	69:17	68:17	41:10	15:3



Anthracnose lesion on a diseased dogwood leaf is pointed out by pen. The white waterspots are fungicide.

individuals become infected, the inoculum potential increases to the point where virtually not a single stem can escape attack. Declining dogwoods have been noticed from southeastern New York, southern Connecticut, northern New Jersey and eastern Pennsylvania since 1977 (Daughtrey 1983). When first detected at Catoctin Mountain Park in 1983, it was the furthest south that dogwood anthracnose had been reported, although northern West Virginia and Virginia now have confirmed infections.

Discula sp. has been isolated from leaf spots and twig and branch cankers. Leaf spots and twig cankers have been produced by inoculating isolates onto healthy trees. The pathogen was then reisolated from infected tissue, confirming *Discula* sp. as the causative organism (Hibben, Daughtrey and Hudler 1984). The epidemiology of this disease is not fully understood; however, cool moist spring weather promotes abundant conidial production which, in turn, intensifies the disease and allows it to spread. It is thought that environmental conditions causing winter burn and summer drought trigger dogwood anthracnose development (Daughtry, 1984 and Pirone, 1980). Dogwoods are very shallow-rooted and thus susceptible to drought. No previous record of a foliar disease has been reported to kill flowering dogwood. Trees killed above ground by anthracnose do not resprout.

Methods

A ground survey was conducted in late June and early July 1984. Seventeen survey plots were placed randomly throughout the Park where dogwood populations occur. Each plot consisted of a strip cruise 330 feet long by 8.25 feet wide (5 × .125 chains). Data were collected on all dogwood stems greater than 4.5 feet tall within the strip. Each stem was placed into one of 5 size classes (<1", 1-<2", 2-<3", 3-<4", and ≥4") based on its diameter at 4.5 feet. Each stem was rated for severity of dieback according to the following rating system: Dieback class 0 = Dead; Dieback class 1 = >75 percent of foliage affected; Dieback class 2 = 51-75 percent of foliage affected; Dieback class 3 = 26-50 percent of foliage affected; Dieback class 4 = 1-25 percent of foliage affected; and Dieback class 5 = Healthy.

Results

Dogwood was present throughout the survey area. The mean number of stems per acre greater than 4.5 feet tall was 410. Of these, 32 percent were less than 1 inch dbh, 21 percent were 1"-2", 25 percent were 2"-3", 16 percent were 3"-4", and 6 percent were greater than 4" (Table 1).

Nearly 33 percent of all stems measured were dead (decline class 0). Only 3 percent of stems were completely free of symptoms (decline class 5). Sixty-seven percent of all stems less than 1" dbh were dead or nearly so (decline classes 0 and 1). Forty-three percent of all stems ≥4" were below decline class 3, or had more than 50 percent of their foliage affected. Plots which had a larger number of stems per acre exhibited the most mortality and severity of infection.

Discussion

The disease has been active at Catoctin Mountain Park for several years. In a separate plot of 57 individual trees, rated for 3 years, the decline class ratings for all live trees dropped two levels per year over this period. If this is indicative of disease progress, nearly all dogwoods in the Park will be dead within 3 years.

While the greatest number of healthy individuals were in the <1" size class, those were primarily in areas with fewer stems per acre. In general, the larger stems in any one area were consistently in better condition than the smaller stems. This possibly relates to the position of larger trees in the middle stratum of the forest, an area more likely to be aerated, thus drying foliage and reducing susceptibility of attack. Individuals nearer the forest floor would be more subject to the moist spring conditions that appear to be more favorable to anthracnose.

As might be expected of a newly described pest species, several critical points need further study. Little research has been done on the epidemiology of the disease and more information is needed before definitive conclusions concerning control can be reached.

The origin of this fungus is still unknown; it may be a non-native species spreading from a port of entry for the first time. If so, the impacts on the flowering

dogwood can be both widespread and long-lasting. In a parallel development, a similar disease affecting the Pacific Dogwood (*Cornus nuttallii*) has been reported from the Puget Sound Region (Davidson and Byther, 1984). It is also quite possible that the fungus is a native organism that has gone unnoticed, reaching epidemic proportions only after a complex set of climatic events has occurred. Although flowering dogwood leaves are very high in calcium (Hepting, 1971), the affect of acid precipitation and other pollutants, if any, is unknown.

Regardless of the cause, the loss of most dogwoods in Catoctin Mountain Park will mean significant changes in forest microclimatology, wildlife density and recreational enjoyment for several decades to come.

Management Alternatives for Dogwood Anthracnose

1) *No action*: This will likely result in the short-term loss of nearly all flowering dogwood in the park. Should the disease go into remission soon, chances are the larger, healthier individuals will survive and provide enough seed for the long-term restoration of flowering dogwood.

2) *Sanitation*: Badly diseased individuals probably cannot be saved, and due to the sheer number of trees involved this alternative is limited to developed zones. All dead and severely infected dogwood should be cut, removed and burned. On less infected individuals, any dead and heavily infected limbs should be pruned (during dry weather), removed from the area and burned. All epicormic branches should be pruned since they are very succulent and susceptible to infection. Where practical, foliage on the ground should be gathered and burned.

3) *Application of fungicide*: The most susceptible period to infection by *Discula* sp. is in the spring during and after budbreak. During dry periods, try to achieve complete coverage of foliage with any of several fungicides registered for anthracnose fungi. This must be repeated at regular 7-10 day intervals (or more often if it is rainy) and should be continued until leaves have fully expanded. The best control will be achieved

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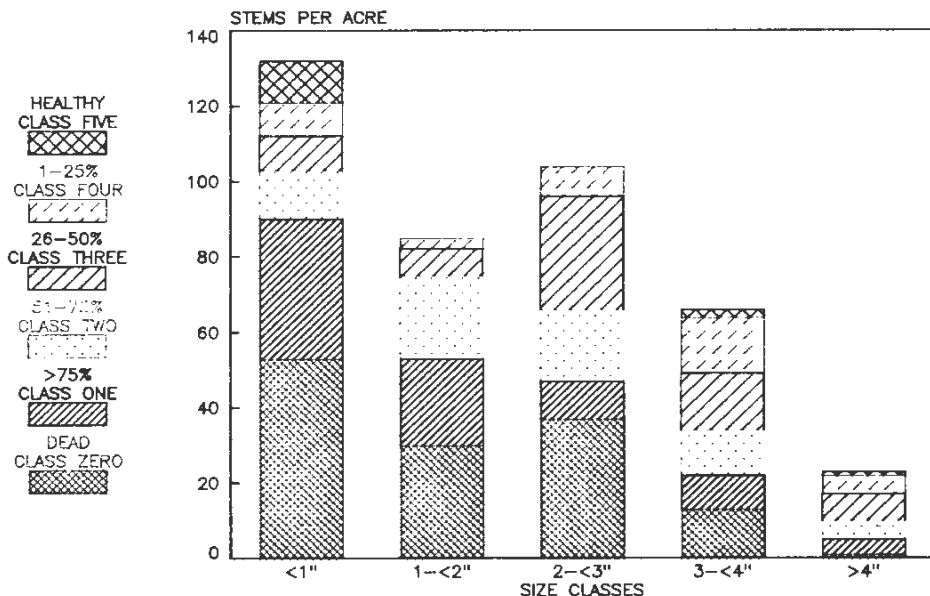


These never got started — dogwood saplings killed by anthracnose at Catoctin Mountain Park in Maryland.



This one is finished — the last surviving sprout makes its appearance on a dying dogwood in the natural zone of Catoctin Mountain Park.

PERCENT OF FOLIAGE INFECTED BY DOGWOOD ANTHRACNOSE IN EACH OF FIVE TREE SIZE CLASSES



if spring weather is warm and dry.

4) *Integrated Pest Management*: Probably the best control is the combination of sanitation together with fungicide application in conjunction with continued monitoring of disease conditions. In addition, fertilizer applied in the fall after dogwood has hardened off together with water during dry periods in the summer will better enable dogwood to resist killing infections. This type of intense effort can only be undertaken for a relatively small number of trees. A strategy for parks with a severe problem would be to protect accessible dogwoods scattered throughout the unit, thereby hastening natural redispersal.

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PERCENT OF FOLIAGE INFECTED BY DOGWOOD ANTHRACNOSE WITHIN ALL TREE SIZE CLASSES

