

Can Super Sniffers Diagnose Tree Decay in a Historic Cemetery?

M.S. Coyne

African Cemetery No. 2 in Lexington KY, USA was founded in 1869 and chartered in 1870. It was the first cemetery in Lexington to be owned and operated by enslaved and freed African Americans. By the 1940's the site was derelict and in the 1960's the cemetery was declared abandoned. A non profit organization, African Cemetery No. 2, Inc., was subsequently chartered in 1970 to maintain the cemetery as a memorial site (which was officially closed to new burials after 1974). Part of that organization's mission is to use the cemetery as a natural environment to promote environmental education in Lexington's east end, a relatively impoverished area in both cultural and economic opportunities. (The majority of children attending the neighborhood elementary school, for example, receive free and reduced lunch.)

Cemetery maintenance involves landscaping in which trees are replanted, pruned, and otherwise managed. Among the 54 different tree species in the cemetery are 148 large trees with diameters greater than 4". Among the largest trees are several examples of Eastern Hackberry (*Celtis occidentalis*). Several of these trees have distinct odors and at least one split in a recent storm to reveal significant internal rot. This raised the question - is the odor of a tree diagnostic of its health and potential internal damage?

There is considerable anecdotal evidence that certain individuals have enhanced senses of smell (i.e. super sniffers) enabling them to detect events that others cannot, such as natural gas leaks. It is also well-known that various microbial products (e.g. geosmins) are actually detected by smell better than by mechanical means. I tested the hypothesis that a panel of individuals varying in their sense of smell could distinguish among Eastern Hackberry trees based on clear or presumed evidence of internal decay and the odors generated therein.

Method

Four mature (> 12" diameter trunk) Eastern Hackberry trees were identified in African Cemetery No. 2 in September 2021. A panel of five "sniffers" were invited to the cemetery and asked to sniff and rank the trees on a 0-10 scale, where '0' reflected no odor and '10' reflected a distinct odor. The panel was escorted from

tree to tree, and ranked each tree prior to evaluating the next. The rankings were double blind in that the evaluators did not share their rankings with others and I was not aware of which individual created each rank.

Results

The evaluations for each tree are in Table 1.

Table 1. Rank evaluation of Eastern Hackberry based on degree of odor.

Panelist	Tree			
	1	2	3	4*
1	8	0	2	8
2	6	0	0	9
3	3	0	0	4
4	3	3	4	7
5	8	1	1	2
Mean Rank	5.6+2.5 ^a	0.8 + 1.3 ^b	1.4 + 1.7 ^{ab}	6.0 + 2.9 ^a

*Tree 4 was split and showed visual evidence of internal rot

Values followed by a different letter are considered to be significantly different.

Conclusion

There was a clear distinction among the panelists as to the odor associated with each tree. Tree 1, which had two conjoined trunks, and Tree 4, which was split, were both ranked highest in terms of odor and significantly more odorous than Tree 2. Tree 2 and Tree 3, each with a single trunk with no evidence of damage, both ranked lowest in terms of odor. My own assessment of Tree 1 was that there is a distinct odor of rot associated with it (which instigated the study to begin with). One panelist (4), admitted to be recovering from exposure to anesthesia that she indicated impaired her sense of smell, was much less able to distinguish the tree odors than other panelists.

Significance

There was a significant difference in the ranking of odor for at least some trees although a non parametric analysis of the data would have been the more appropriate statistical test. If the results from panelist 4 were omitted, the significant differences would have been greater. The test could also have been improved by randomly assigned each panelist to sniff a different sequence of trees, which may have removed some bias. The panelists were also well-known to the investigator.

Nevertheless, the panelists could distinguish the odor of individual trees. Trees with single trunks and no obvious damage were ranked as relatively odor free. A tree with distinct odor clearly showed visual evidence of rot. A similar odor was also associated with a second tree that did not show signs of external damage, but did have conjoined trunks where potential entry of rotting agents could occur. This suggests that despite the general appearance of health in the tree, there is some internal rotting in progress that could lead to tree fall at some indeterminate time. As the likely direction of tree fall is across numerous markers, this is obviously concerning

From these results it appears that at least for this species it is possible to use 'super sniffers' to diagnose potential problems without physically sampling trees. This offers an approach to tree maintenance at the cemetery in which diagnosis of potential structural damage trees can provide early warning for prophylactic treatment.

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