

# Death Cap Mushrooms (*Amanita phalloides*)

## BC Prohibited Species Alert

**PRIMARY IMPACT:** The death cap mushroom is **deadly poisonous** if eaten. It can be mistaken for edible puffballs when young or the Asian straw mushroom when older.

### DEATH CAP MUSHROOMS

Death cap mushroom, *Amanita phalloides*, is native to Europe, where it is widespread. It occurs from North Africa to the south coast of Scandinavia and from Ireland to Poland and western Russia. Within this range, the death cap fungus forms mutually beneficial symbiotic relationships, known as ectomycorrhizas, primarily with hardwoods such as oak, beech, chestnut, birch, filbert, and hornbeam, and less frequently with conifers such as pine and spruce. The death cap mushroom was introduced to North America from Europe many decades ago, likely on the roots of imported trees. It is the only known invasive ectomycorrhizal fungus in North America, occurring on both the east and west coasts. The mushroom grows primarily in urban areas with exotic boulevard trees; it is not found in areas without trees nearby.

The death cap mushroom contains toxins that primarily target the liver, but it can also affect other organs such as the kidneys. Symptoms such as nausea and vomiting usually appear 6–12 hours after ingestion. Although a person may then start to feel better, the toxins are at work attacking vital organs. After a delay of several days, the person becomes very ill, experiencing jaundice and seizures, followed by coma, and sometimes culminating in death; however, with prompt hospital treatment the mortality rate is 10–30%. Cooking the mushroom does not inactivate the toxin. Simply handling the death cap mushroom is not considered dangerous. Nevertheless, in an abundance of caution, we recommend wearing disposable gloves to do so.



Young, expanded mushrooms showing (left) skirt-like ring on stem and (right) the top of the volva.

PAUL KROEGER photo



Carefully excavated death cap mushrooms showing skirt-like ring on stem and cup or volva enveloping the base of the stem.

ADOLF CESKA photo

**REPORT PROHIBITED SPECIES:** [www.reportinvasives.ca](http://www.reportinvasives.ca). For invasive plants, download the free *Report-a-Weed* app. Download links at [www.reportaweedbc.ca](http://www.reportaweedbc.ca).

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In Canada, the death cap mushroom was first recorded in 1997. This mushroom was collected in a grove of large European sweet chestnut trees at Lake Errock near Mission, B.C. The second Canadian record was made in 1998 under a large European beech tree in the landscaped grounds of a Victoria, B.C. residence. In 2008, the first death cap mushrooms found in Vancouver were collected from under a European hornbeam boulevard tree, apparently planted in the 1960s. Records of death

cap mushrooms are now numerous in the south-western corner of British Columbia—in the Fraser Valley, in Vancouver and its neighbouring municipalities in the Fraser Delta, in and around Victoria on southern Vancouver Island, and on Galiano Island (see Figure 1). Almost all locations in British Columbia were recorded under non-native broad-leaf tree species (Table 1); however, the death cap is now known to fruit in association with native Garry oak trees.

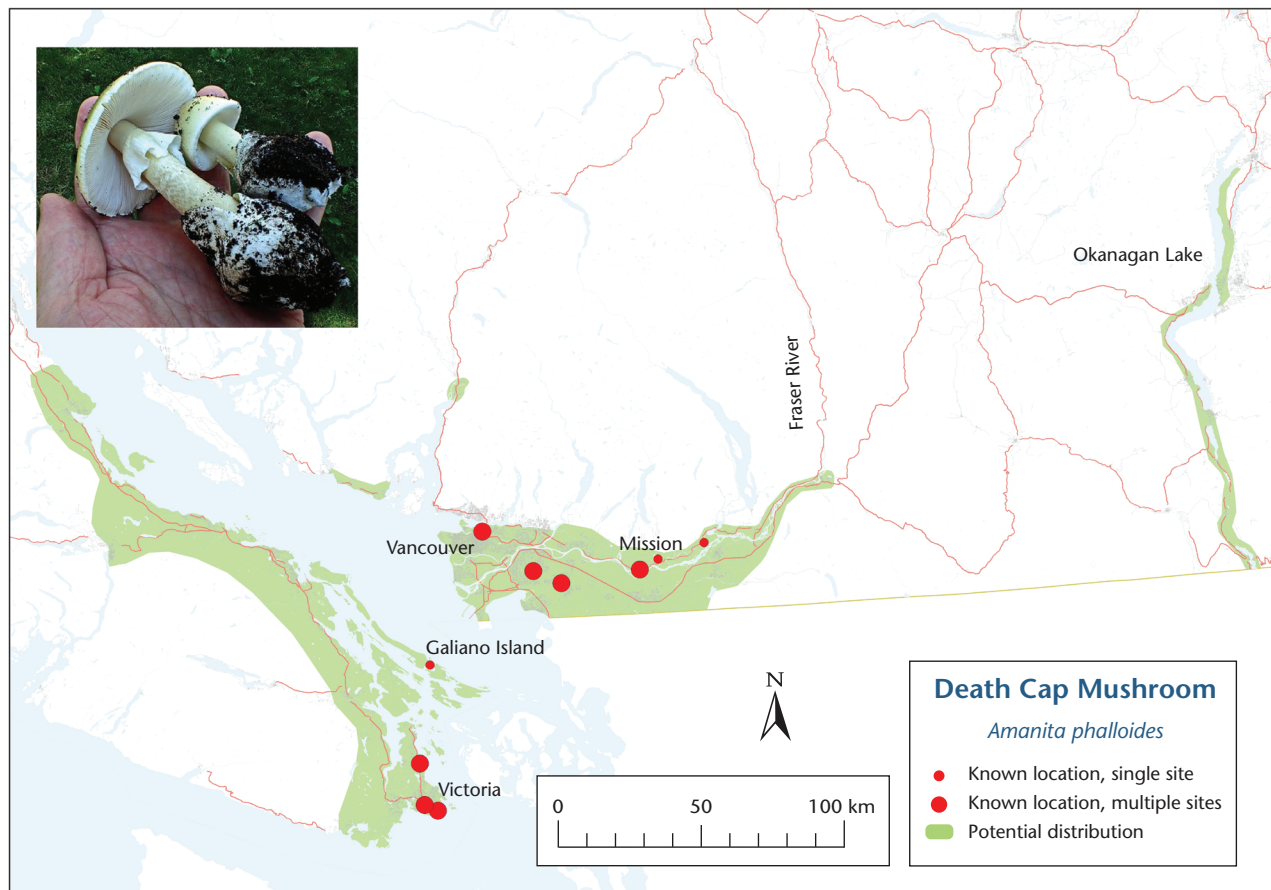


FIGURE 1 Known locations and potential distribution of death cap mushrooms in British Columbia.

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TABLE 1 Status of boulevard trees as hosts for death cap mushroom (*Amanita phalloides*). Modified from list of preferred boulevard trees provided by the Municipality of Saanich.

Common name	Scientific name	Common name	Scientific name
<b>Known<sup>a</sup> host trees</b>			
Hornbeam	<i>Carpinus betulus</i> <sup>b</sup>	Filbert	<i>Corylus avellana</i> <sup>b</sup>
English oak	<i>Quercus robur</i> <sup>b</sup>	Linden	<i>Tilia species</i>
Sweet chestnut	<i>Castanea sativa</i> <sup>b</sup>	Garry oak	<i>Quercus garryana</i>
Beech	<i>Fagus sylvatica</i> <sup>b</sup>	Northern red oak	<i>Quercus rubra</i>
<b>Possible<sup>c</sup> host trees</b>			
Birch	<i>Betula species</i>	Pin oak	<i>Quercus palustris</i>
Scarlet oak	<i>Quercus coccinea</i>		
<b>Non-host<sup>d</sup> trees</b>			
Red maple	<i>Acer rubrum</i>	Maidenhair tree	<i>Ginkgo biloba</i>
Amur maple	<i>Acer ginnala</i>	Honey locust	<i>Gleditsia triacanthos</i>
Paperbark maple	<i>Acer griseum</i>	Golden rain tree	<i>Koelreuteria paniculata</i>
Bigleaf maple	<i>Acer macrophyllum</i>	Sweetgum	<i>Liquidambar styraciflua</i>
Norway maple	<i>Acer platanoides</i>	Magnolia	<i>Magnolia species</i>
Pacific sunrise maple	<i>Acer truncatum</i> x <i>Acer platanoides</i>	Black tupelo	<i>Nyssa sylvatica</i>
Red horse chestnut	<i>Aesculus</i> x <i>carnea</i>	Persian ironwood	<i>Parrotia persica</i>
Eastern redbud	<i>Cercis canadensis</i>	London plane	<i>Platanus</i> x <i>acerifolia</i>
Nootka cypress	<i>Chamaecyparis nootkatensis</i>	Ornamental cherries and plums	<i>Prunus species</i>
Dogwood	<i>Cornus kousa</i> x <i>nuttallii</i>	Oakleaf mountain ash	<i>Sorbus thuringiaca</i>
Hawthorn	<i>Crataegus</i> x <i>mordenensis</i>	Japanese snowbell	<i>Styrax japonicus</i>
Glory ash	<i>Fraxinus excelsior</i>	Western redcedar	<i>Thuja plicata</i>
<b>Probably non-host trees</b>			
Yellowwood <sup>e</sup>	<i>Cladrastis kentukea</i>	Douglas-fir <sup>f</sup>	<i>Pseudotsuga menziesii</i>
Serbian spruce <sup>f</sup>	<i>Picea omorika</i>	Scot's pine	<i>Pinus sylvestris</i>

a Demonstrated host trees in British Columbia.

b Listed in rough order of number of occurrences as host tree in British Columbia.

c Forms ectomycorrhizas and belongs to same genus as known host species.

d These trees do not form ectomycorrhizas.

e Mycorrhizal status not known. Some trees in same family form ectomycorrhizas.

f Forms ectomycorrhizas (and spruce is a known host in Europe), but our west coast North American death caps thus far are reported only from broadleaf trees.

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Totally eradicating this species would be difficult. Although removing all host trees at each location would get rid of the fungus, eliminating big, beautiful street trees that contribute so much to the health and beauty of our cities would create many new problems for municipalities. However, targeting known individual host trees in high-risk areas, such as playgrounds and schoolyards, might be a reasonable option.

Safe removal and disposal of the mushrooms, preferably in the button stage, would help manage the problem. This would require returning to each site every few days. Where lawns are watered, death cap mushrooms can start fruiting in July and continue fruiting right through to the autumn rains, which will also bring on fruiting at non-watered locations.

Municipalities and individuals can select non-ectomycorrhizal or non-host trees for new or replacement planting in parks, boulevards, and private properties; however, opting to plant only non-host trees will also lead to a decline in the wonderful array of other ectomycorrhizal mushrooms that add biological diversity to our cities. Table 1 provides a list of host and non-host boulevard trees.

### RECOGNIZING DEATH CAP MUSHROOMS

Death cap mushrooms emerge from the ground as small, white buttons called “primordia,” which are about the size of small chicken eggs. At this stage, primordia might be mistaken for puffballs, straw mushrooms, or edible Asian *Amanita* species. If the primordia are cut in half from top to bottom, careful examination reveals the cap, gills, and stem of a tiny, developing mushroom.

The mushroom elongates as it matures. The white tissue that envelops the developing mushroom (the “universal veil”) breaks, leaving a membranous white sac (volva) at the base of the stem, which is often partially or fully buried in the soil. Careful excavation is required to keep the mushroom intact for observation. As the stem elongates



*Yellow-green-hued death cap mushroom cap.*

ADOLF CESKA photo



*Brown-hued death cap mushroom cap.*

ADOLF CESKA photo



*Mostly white death cap mushroom caps showing satiny sheen.*

PAUL KROEGER photo

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and the cap expands, a second white tissue, or “partial veil,” tears away from the cap edge, revealing the white gills and leaving a skirt-like veil or ring on the white stem.

Although slippery when moist, the cap develops a satiny or metallic sheen when dry. In mature mushrooms, the cap is 4–16 cm in width and will generally have a distinctive olive or green hue, but overall can appear pale green, pale brown, pale yellow, or sometimes white.

The death cap mushroom usually fruits in autumn, but will fruit in summer if the surrounding soils are irrigated.



*Showing range of colour and form for (left) young and (right) fully expanded death cap mushrooms.*

ADOLF CESKA photo



*Variations in cap colour.*

PAUL KROEGER photo

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### LOOK-ALIKE MUSHROOMS



*Lycoperdon species* puffball sliced open.

SHANNON BERCH photo



Death cap button, or primordium, sliced open to reveal cap and gills of developing mushroom inside.

PAUL KROEGER photo

When death cap mushrooms emerge from the ground as small, egg-shaped primordia, they could be mistaken for puffballs, straw mushrooms, or edible Asian *Amanita* species; however, neither straw mushrooms (*Volvariella volvacea*) nor the edible Asian *Amanita* species (*Amanita princeps* and other species) grow in British Columbia. When young puffballs are cut from top to bottom, the internal tissue is uniform with no stem, cap, or gills as seen in death cap primordia.



Straw mushroom, with (right) developing buttons and (left) more mature mushroom.

FRED NOTZEL photo



White Caesar mushroom (*Amanita princeps*): (lower right) buttons; (upper right) expanded buttons; and (left) more mature mushrooms.

BRITT BUNYARD photo

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### FREQUENTLY ASKED QUESTIONS

*I think I have found death cap mushrooms. What should I do?*

**Follow this four-step procedure.**

1. Confirm that the mushroom has all or most of these features:

- Cap whitish or with green, yellow, or brown hues, and about 4–16 cm in width
- White gills
- Skirt-like ring on stem
- Loose, sac-like cup (volva) at base of stem, often below ground (careful excavation is required to observe)
- Fruiting in the city on the ground near hardwood/broadleaf trees, often in boulevards with street trees

2. If the mushroom has most of these features, then document its occurrence:

- Take photographs of the whole mushroom, including: the carefully excavated base of the stem; top, bottom, and side views; and gills.
- Record your location (city, street address, or intersection).
- Record the number of death cap mushrooms found and the tree they were found with (provide photographs of the tree and its leaves).

3. Report your findings online:

- Fill out the online form for reporting invasive species:  
<https://www.for.gov.bc.ca/hra/invasive-species/reportInvasives.htm>.
- Be sure to have your photographs of the suspected death cap mushroom ready; you will provide these after you have submitted the report.

4. Remove the mushrooms:

- If the death cap mushrooms are associated with boulevard trees on city property, contact your municipality's Parks Department. They may agree to send a crew to remove the mushrooms.
- Or, safely remove all mushrooms and buttons yourself (wear disposable gloves); bag the mushrooms and place them *in the garbage*. Do not put them in the compost, as the fungus could spread.

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#### *Where did the death cap mushroom come from?*

The death cap mushroom is a European native likely introduced to North America accidentally on the roots of imported horticultural trees. Since its initial introduction, it may have been propagated inadvertently in plant nurseries on tree roots (see Table 1) and transferred to boulevards and other locations where these host trees were planted.

#### *Is this mushroom a problem in Europe?*

Yes. This mushroom is the cause of the most frequent and most serious poisonings wherever it is found. It is better known in Europe than it is here and is thus avoided by experienced mushroom foragers there; newcomers unfamiliar with the local mushrooms are at greater risk.

#### *Why is this mushroom a problem here?*

The presence of large numbers of these dangerous mushrooms in populated areas poses a high risk for accidental ingestion by people or their pets. Curious children or pets may encounter and eat them. The severity of the results depends on the amount eaten.

Infants or toddlers and young puppies are especially vulnerable to dire or fatal consequences. In exposures of this sort, it is often difficult to establish whether the suspect mushroom was actually ingested and how much was eaten.

Death cap mushrooms are also a human health problem here when consumed by mushroom foragers. Foragers may mistake the buttons for edible puffballs. Death cap buttons and mushrooms may also be confused with familiar edible species from the foragers' countries of origin. For example, death cap mushrooms may be mistakenly identified as straw mushrooms or edible *Amanita* species from Asia.

Although usually connected with exotic hardwood trees in boulevards, the death cap mushroom has recently been shown to fruit in association with our native Garry oaks. In California, it has spread to native oak species and outside cities into native forests, where it is often the most abundant mushroom found. If death cap mushroom adapts well to Garry oak and spreads outside our cities, it may displace native mushrooms associated with this tree. If it fruits in our Garry oak woodlands, it may surprise and confuse even experienced mushroom foragers who would not expect to find it outside of our cities.

#### *The occurrences in British Columbia are the northern-most spread of this species in North America. Could this mushroom spread further? Is this increase in range related to climate change?*

Since the late 1990s, when the death cap was first found fruiting in British Columbia, it has been noticed at more and more locations (see Figure 1). This may be partially related to the heightened vigilance of local mushroom club members, especially those from the Vancouver Mycological Society and the South Vancouver Island Mycological Society. As a result, more streets and parks are under scrutiny. The fungus may



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also exist for an extended period on host-tree roots but only produce mushrooms when the trees reach a certain age or size.

Nevertheless, the spread of this fungus within our cities will likely mirror its spread elsewhere. A careful check for the death cap mushroom should take place in British Columbia cities with mild climates and plantings of broadleaf boulevard trees but where the mushroom has not yet been reported (e.g., Kelowna, Nanaimo, and Prince Rupert).

The death cap mushroom has been found fruiting with Garry oak, and it might spread through the range of Garry oak. The current range of this tree is predicted to expand with climate change. If this happens, the death cap may move with it (see Figure 1).

Death cap mushrooms might also occur wherever nut trees, such as sweet chestnut or filbert (hazelnut), are cultivated. In British Columbia, this includes parts of southern Vancouver Island and the smaller islands, the lower Fraser Valley, and the Okanagan Valley, although it has not yet been reported from the latter location.

### ***How did this mushroom get onto my property/into my neighbourhood?***

The death cap mushroom most likely arrived on the roots of exotic broadleaf trees that were planted in local boulevards and parks, or on your property. This mushroom forms mutually beneficial, underground, symbiotic relationships (known as “ectomycorrhizas”) with roots of these trees and some conifers.

### ***What effects can this mushroom have on my property, in urban areas, or in natural ecosystems? Why should I worry about the arrival of this species in British Columbia, other than because it is toxic, if eaten?***

The death cap fungus form ectomycorrhizal associations with the roots of certain tree species (see Table 1). Because these associations are generally beneficial to the host tree, the growth of boulevard trees is likely improved by the presence of the fungus. However, as the death cap mushroom spreads to native trees, especially Garry oak, it may displace our native ectomycorrhizal fungi. This could lead to a change in the community dynamics and diversity of our local mushrooms. Research is needed to determine whether this is possible. If the death cap mushroom begins fruiting in our woodlands with Garry oak, it could pose an additional threat to mushroom foragers who might not expect to find this mushroom outside of our cities.

### ***How do I get rid of this mushroom?***

The death cap mushroom forms relationships with living host trees and exists primarily as a perennial mycelium in the soil and in the roots of host trees. Removing the mushrooms will not eradicate the mycelium, which will be very difficult to do. More mushrooms will likely form from the same mycelium in the same year and in future years.

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Removing the host trees could eliminate the fungus. This might be an option for trees on private property, but check with your municipality for the bylaws on tree removal. However, removing big, beautiful trees from boulevards and local parks will likely result in a public outcry. Replacing host trees as they decline with non-host trees could help control the spread of this fungus in the long term.

Safe removal and disposal of the mushrooms, preferably in the button stage, will help manage the problem by getting rid of the immediate threat and perhaps by slowing its spread via spores. Some municipalities instruct staff to remove death cap mushrooms from known fruiting sites. You could also remove all death cap mushrooms and buttons yourself, then bag them and place them in the garbage. To avoid spreading the fungus, do not place them in the compost. Wash your hands with soap and running water after handling the mushrooms or wear disposable gloves.

Mowing the mushrooms will not eliminate the part of the fungus that lives perennially on the host tree's roots. Mowing may also spread the fungus by dispersing spores into the air and onto mowing equipment, which may carry bits of the mushroom to another site if the mower is moved. If death cap mushrooms appear on sites that are routinely mowed, remove all death cap mushrooms before mowing again.

Kicking, stomping, or cutting off death cap mushrooms will not eradicate them because their mycelium lives below ground on the roots of host trees.

Withholding irrigation of known death cap mushroom sites will probably prevent fruiting during the summer, but fruiting will likely commence when the rain returns in autumn.

#### **USEFUL LINKS:**

##### **Death Cap Mushroom Fact Sheet:**

<https://www.for.gov.bc.ca/hra/invasive-species/priority.htm>

##### **The real story behind increased Amanita poisonings in North America:**

[http://www.fungimag.com/fall-2015-articles/LR%20AmanitaPoisonings6\\_9.pdf](http://www.fungimag.com/fall-2015-articles/LR%20AmanitaPoisonings6_9.pdf)

##### **Amanita phalloides: Invasion of the death cap (Bay Area Mycological Society):**

[http://www.bayareamushrooms.org/mushroommonth/amanita\\_phalloides.html](http://www.bayareamushrooms.org/mushroommonth/amanita_phalloides.html)

##### **Report a death cap mushroom:**

<https://www.for.gov.bc.ca/hra/invasive-species/reportInvasives.htm>

##### **BC Drug and Poison Information Centre:**

<http://www.dpic.org/>

1-800-567-8911