# *Galerina* fungal toxins and testing

Dr. Jessie Uehling

# OUTLINE

- Background
- Risk of consumption for *Galerina*
- Available testing methodologies for amatoxins
- Discussion for frequency of testing

# Background for *Galerina* conversation

To support implementation of Ballot Measure 109 (2020), Section 8(2)(c):

**Psilocybin Production (333-333-2010)**

(1) A Manufacturer may only cultivate or possess the fungi species *Psilocybe cubensis* on the licensed premises. Incidental possession of other species of fungi associated with employee meals is permitted.

# *Psilocybe* diversity and genomics

- >8 genera of fungi produce psilocybin
- >200 species of fungi produce psilocybin
- ORM109 draft rules focus on *P. cubensis*




**Fig. 1.** *Psilocybe* species diversity. Basidiomata of **(A)** *Psilocybe serbica* (jonagruska, CC-BY-SA 3.0), **(B)** *P. mescalenroensis* (Alan Rockefeller, CC BY-SA 4.0), **(C)** *P. cubensis* (Ricardo Arredondo, CC BY-NC), **(D)** *P. ovoideocystidiata* (Shroomydan, CC-BY-SA 3.0), **(E)** *P. allenii* (Alan Rockefeller, CC-BY-SA 3.0), **(F)** *P. azurescens* (Shroom360, CC BY-SA 3.0), **(G)** *P. cyanescens* (Alan Rockefeller, CC BY-SA 3.0), **(H)** *P. subaeruginosa* (ericos_bob, CC BY-SA 3.0), **(I)** *P. angulospora* (Inski, CC BY-NC-SA), **(J)** *P. baeocystis* (Caleb Brown, CC-BY-SA 3.0), **(K)** *P. pelliculosa* (Scottdarbey, CC-BY-SA 3.0), **(L)** *P. semilanceata* (Alan Rockefeller, CC-BY-SA 3.0), **(M)** *P. hoogshagenii* (Brayan Coral Jaramillo, CC BY-SA 3.0), **(N)** *P. mexicana* (Alan Rockefeller, CC BY-SA 4.0), **(O)** *P. neoxalapensis* (David Morales, CC-BY-NC 4.0), **(P)** *P. zapotecorum* (Alan Rockefeller, CC-BY-SA 3.0). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

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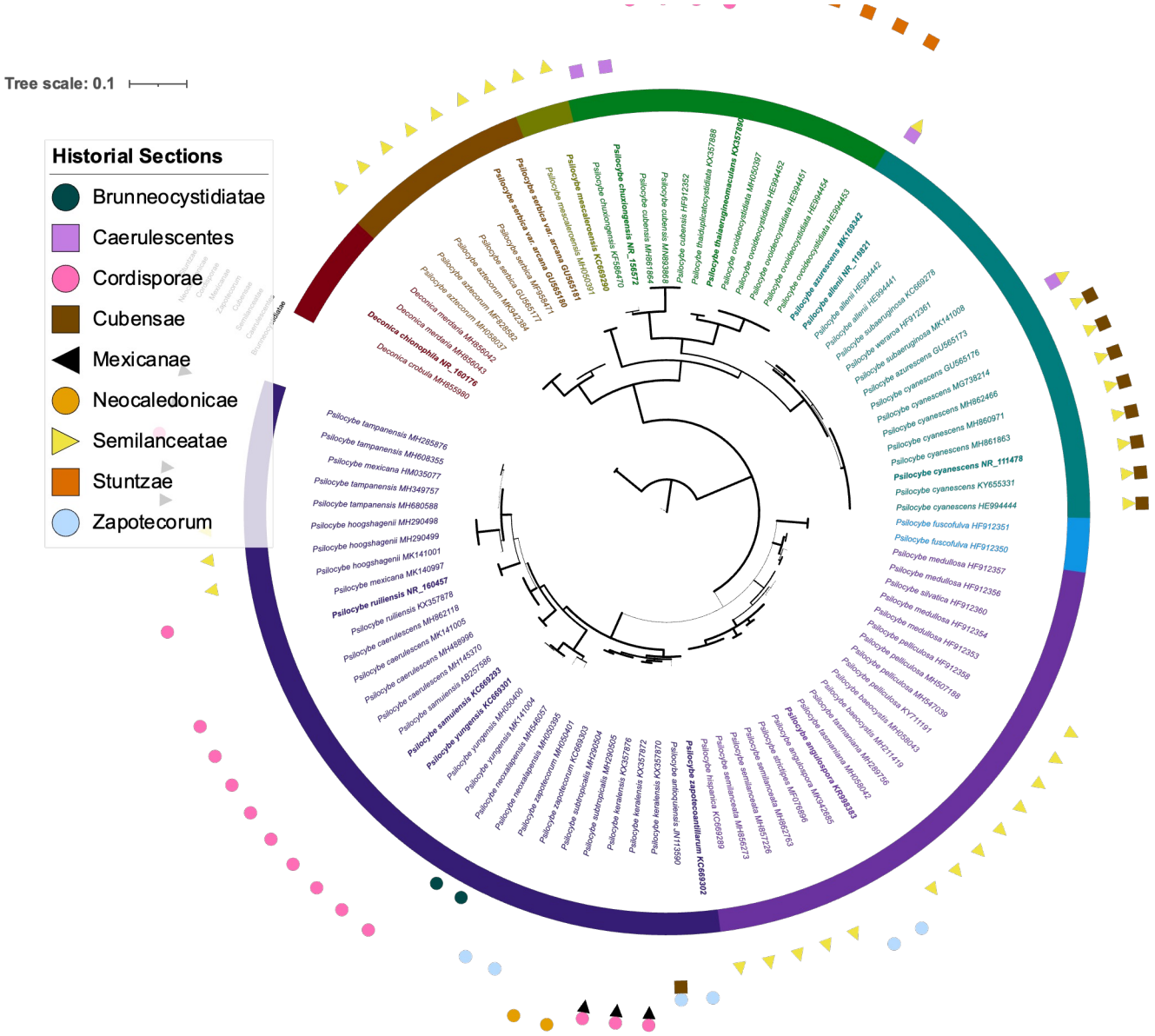
# *Psilocybe* taxonomy

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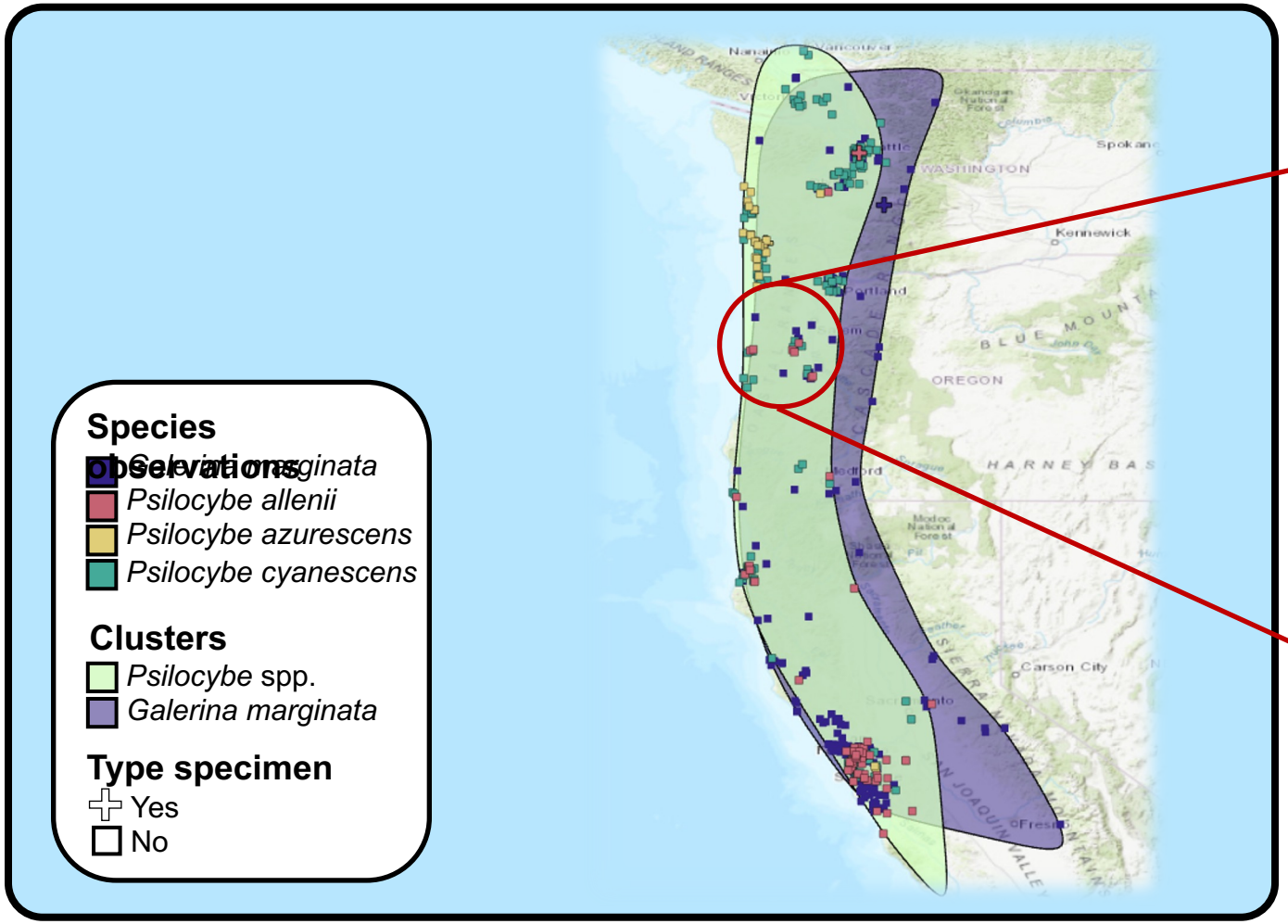
# Risk of consumption of *Galerina* species

# Potential adverse effects to avoid

- Deterring individuals from collecting wild *Psilocybe* species
  - avoiding wood lover's paralysis
- Preventing consumption of misidentified *Psilocybe* species
- Mistaking *Psilocybe* for *Galerina* species
  - avoiding amatoxin consumption

# Similarity in distribution and habitat of *Psilocybe* & *Galerina* species in the PNW





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# Fungal toxins

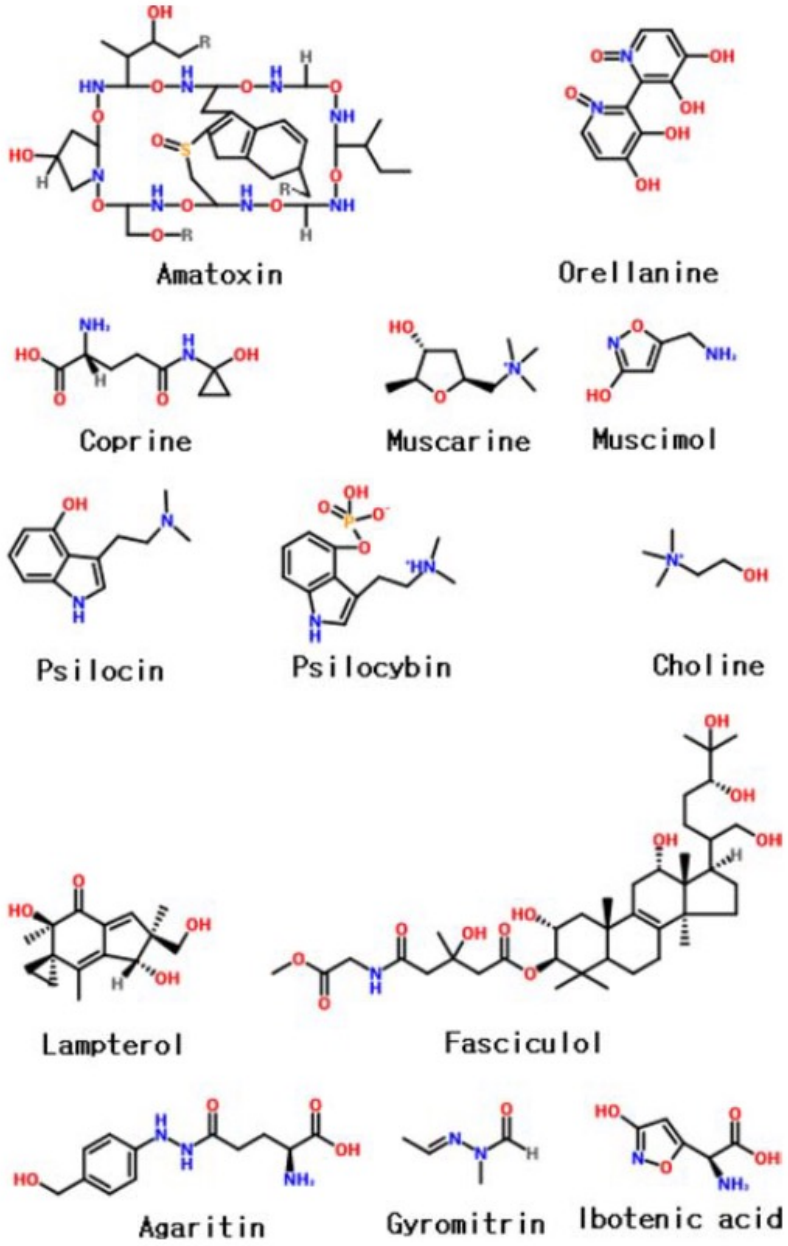
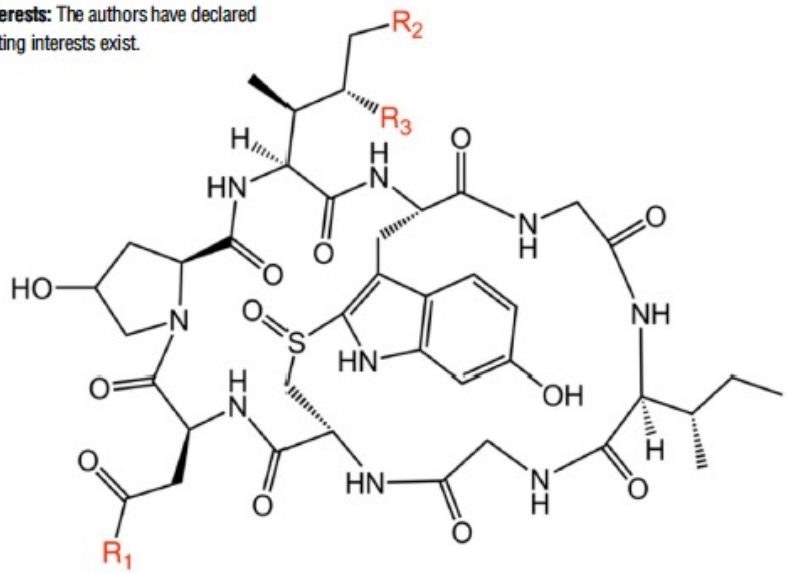



**Fig. 1.** Chemical structures of various mushroom toxins.

# Amatoxins



**Competing interests:** The authors have declared that no competing interests exist.




(a)

| Compound | $R_1$ | $R_2$ | $R_3$ |
|---|---|---|---|
| α-amanitin | $NH_2$ | OH | OH |
| β-amanitin | OH | OH | OH |
| γ-amanitin | $NH_2$ | OH | H |

(b)

**Fig 1. Chemical structures of the amatoxin variants examined in this paper.** (a) molecular structure of amanitin. (b) R-group designations for each variant.

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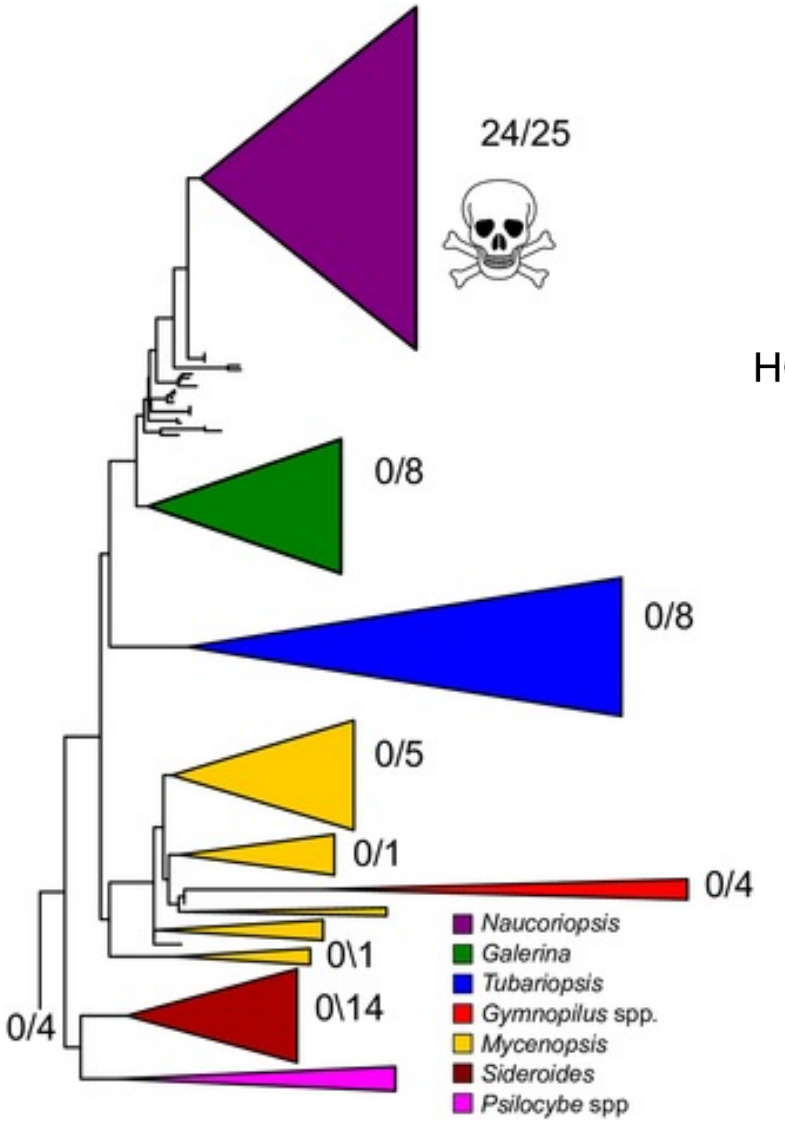
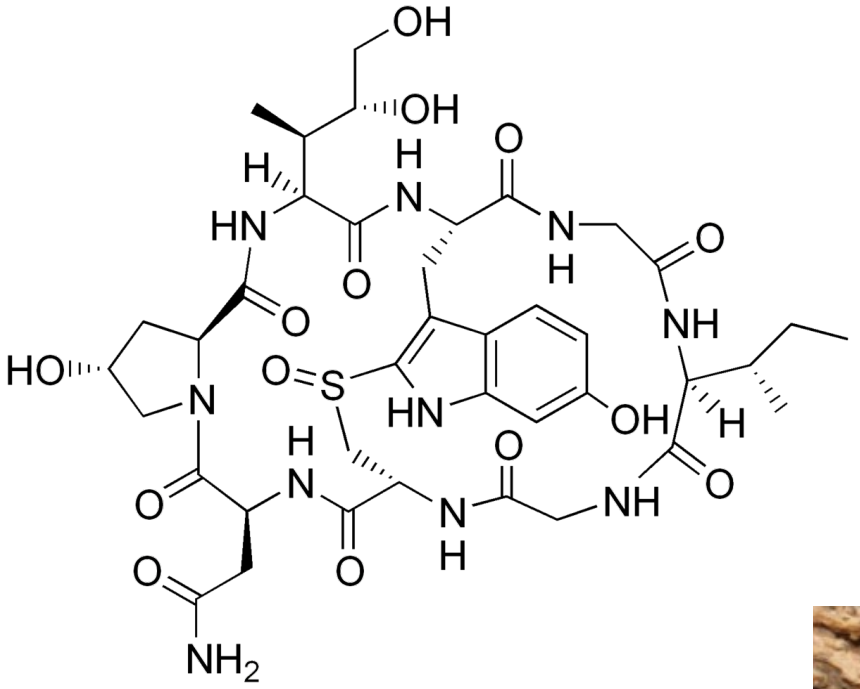
# Amatoxin presence in Galerina




*G. marginata*

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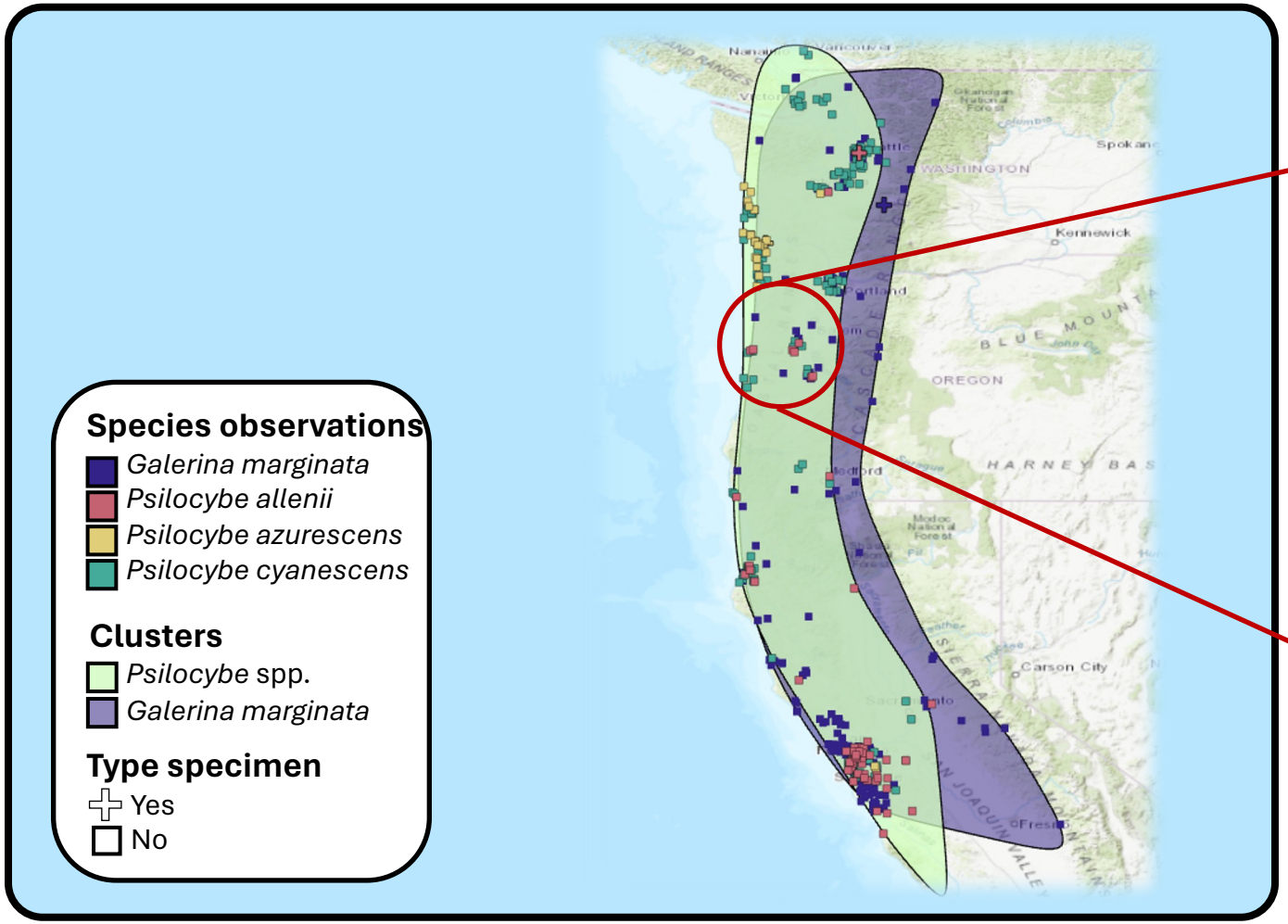
# Similarity in distribution and habitat of *Psilocybe* & *Galerina* species in the PNW





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# Available testing methodology for amatoxins:
## Lateral Flow Immunoassay

# Lateral Flow Immunoassay

## Results and discussion

The LFIA for amatoxin detection was developed and performed in a competitive inhibition assay format. A schematic of the test strip, along with an example of a negative and positive test, is shown in Fig 2. The sample to be tested is added to the sample pad, which interacts

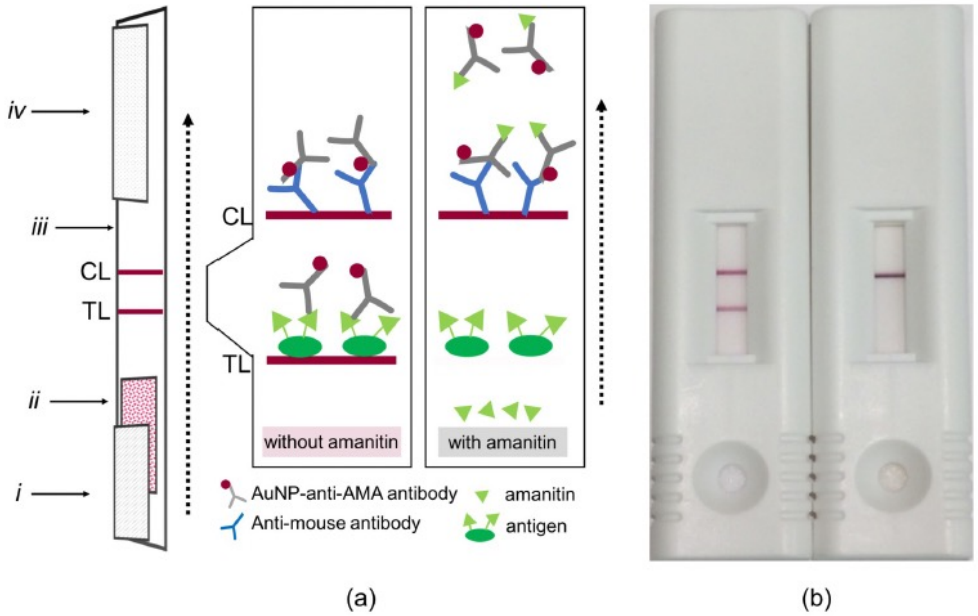


**Fig 2. Depictions of the test strips used in this study.** (a) Schematic diagram of the lateral flow strip along with a diagram of the reagents on the control line (CL) and test line (TL). (b) A view of the strips when used in a cassette. The left cassette is an example of a sample without amatoxins (negative) and the right cassette is an example of a sample with amatoxins (positive). (*i*) sample pad, (*ii*) conjugate pad, (*iii*) nitrocellulose membrane, (*iv*) wicking pad, and the arrow indicates the flow direction.

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PLOS ONE

RESEARCH ARTICLE

## Lateral flow immunoassay (LFIA) for the detection of lethal amatoxins from mushrooms

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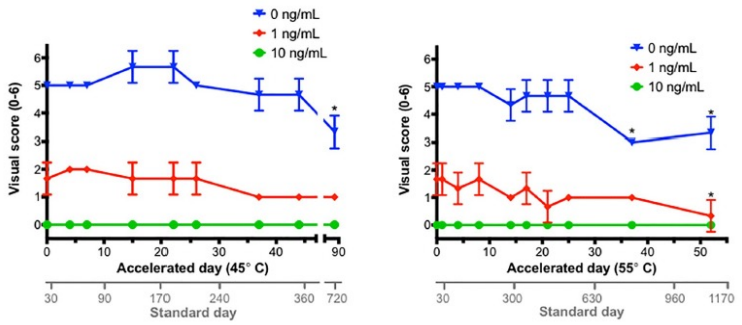


**Fig 5. Shelf-life testing of the LFIA stored at (a) 45 °C and (b) 55 °C.** Minimal loss of signal was observed over the course of 25 days for those tested at 55 °C and over the course of 44 days for those tested at 45 °C. The LFIA performance was tested using 3 different concentrations of α-AMA (0, 1, and 10 ng/mL) in PBS.

https://doi.org/10.1371/journal.pone.0231781.g005

# Frequency of testing

- How much will testing cost?
- How often should products be tested and why?
- How these relate to over all costs and balance with safety

# Thank you for your attention

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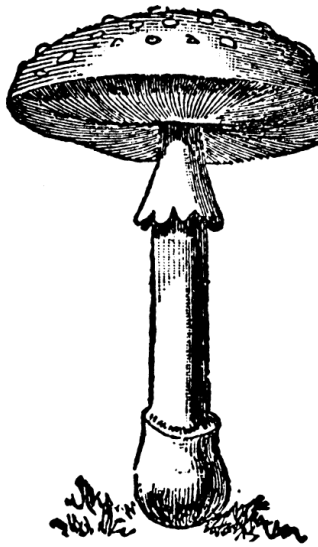

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