

IDENTIFICATION OF MICROBIAL SPOILAGE IN MAPLE SYRUP SAMPLES

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INTRODUCTION

An increasing number of maple syrup samples containing floating masses or surface mold have arrived at the University of Maine Cooperative Extension (Figure 1). These samples have originated from Maine, Minnesota, Rhode Island and Vermont. Conventional practices have been to discard obvious mold growths, reboil and consume the syrup. This practice may be risky, especially with the increasing number of food borne illness outbreaks with other food products. Some mold species are known to produce toxins, called mycotoxins, which are toxic chemicals and can be harmful to human health. Some mycotoxins are heat stable, such as patulin, which cannot be destroyed by cider pasteurization temperatures. Patulin can be produced by several fungal species including *Penicillium* and *Aspergillus*.

The objectives of this research were:

1. To determine if floating masses or "mother" from contaminated syrup samples are fungal in origin and
2. To determine if Brix levels are related to microbial growth (at levels below 66 degrees Brix).

METHODS

Nine maple syrup samples in 2009 and five maple syrup samples in 2010 were submitted to the Somerset County Extension Office and then transported to the University of Maine for analyses. The floating masses were sampled and streaked onto Sabouraud and Malt Extract Agar plates. Plates were then incubated at 20° C. Isolated colonies were then grown further on the same agar. Colonies were then observed under a microscope and identified. Syrup samples were also analyzed for pH, water activity and degrees Brix.

RESULTS & DISCUSSION

Fungal species were detected in 8 of the 14 samples, which include several *Penicillium* species (Figure 2), *Wallemia* (Figure 3), *Aspergillus* (Figure 4), *Trichoderma* and *Zygomycetes* species. The pH levels ranged from 5.78 to 7.21 with a mean pH of 6.28. The water activity ranged from 0.828 to 0.889 with a mean water activity of 0.850. Brix values were mostly above 66 degrees Brix with a mean of 65.6. Three samples out of 14 had Brix levels below 66, and one sample had a Brix level as low as 60.5. Research indicates

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Figure 1. Contaminated syrup samples with floating masses.

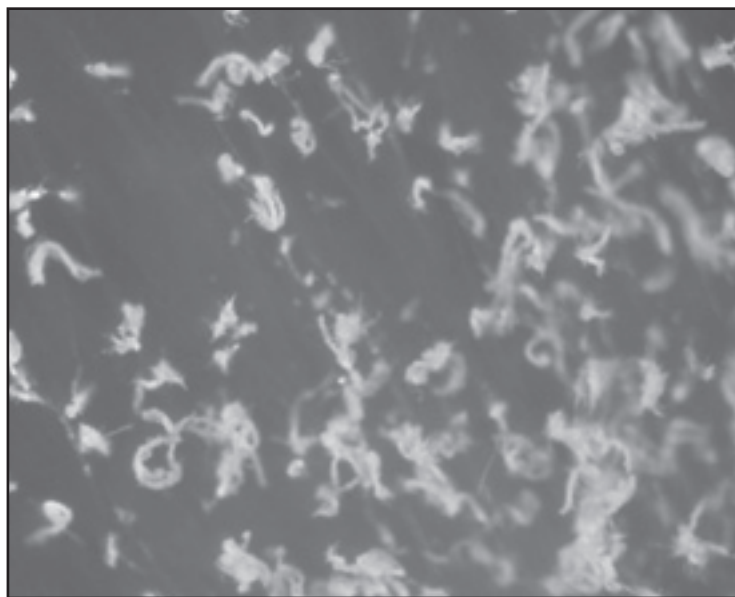


Figure 2. Microscopic view of a *Penicillium* species which originated from a contaminated maple syrup sample.

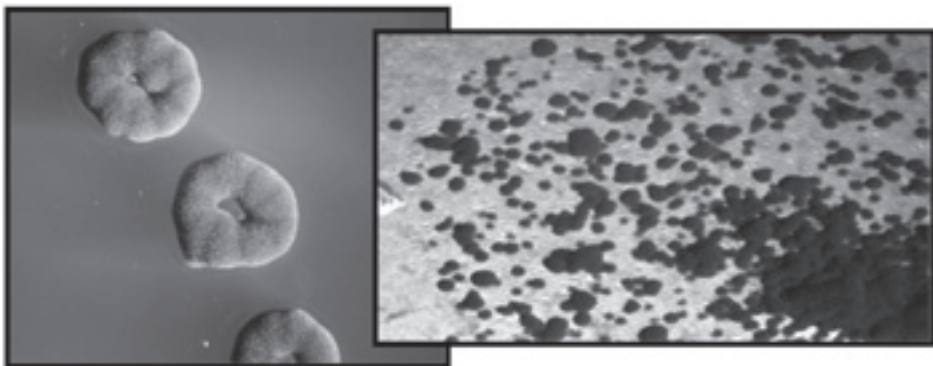


Figure 3. Microscopic views of a *Wallemia* species which originated from a contaminated maple syrup sample.

these fungal species are slow growing, but can persist in processed maple syrup at levels above 66 degrees Brix, which was not previously thought to be possible. However, some fungi, such as *Wallemia* species, are xerophiles in nature which means they can persist in high sugar or high salt concentrations. The pH and water activity values measured are at levels that would support fungal growth.

CONCLUSIONS

These results support that "mother" can be fungal in origin and several fun-



Figure 4. Microscopic view of an *Aspergillus* species which originated from a contaminated maple syrup sample.

gal species have been identified from the contaminated maple syrup samples submitted to the University of Maine Cooperative Extension. *Penicillium*, *Aspergillus* and *Wallemia* are fungi that were identified in some of the contaminated syrup samples and have the potential to produce mycotoxins which are toxic chemicals that have the potential to harm human health.

The previous assumption that syrup boiled to 66 degrees Brix does not support microbial growth is in question. According to our findings, we recommend that contaminated syrup or syrup with questionable floating masses should not be consumed or sold to consumers since there may be a high risk of fungal contamination and possibly the presence of mycotoxins.

FUTURE WORK AND REQUEST FOR CONTAMINATED SYRUP SAMPLES

Future research needs to be conducted to further identify these fungi to determine if they can produce mycotoxins in maple syrup. The North American Maple Syrup Council has funded these future research endeavors which include DNA sequencing and mycotoxin detection. We are currently accepting syrup samples for future research studies. Please contact Kathy Hopkins at the telephone number or email above on how to send in a contaminated maple syrup sample for our next phase of research work. We encourage participation to help ensure the food safety of the maple syrup industry.

ACKNOWLEDGEMENTS

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