Small fungus formulations could make big difference to protect moose from winter ticks

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In the battle to save moose from winter ticks, fungi on small grains of millet could be the ultimate weapon. Morris Animal Foundation-funded researchers at the University of Vermont recently produced granular formulations of insect-killing fungi and successfully tested their efficacy against winter tick larvae under laboratory conditions. The team reported their findings in *Biocontrol Science and Technology*.

"There is a critical need to develop effective, high-quality, fungal-based biopesticides for use against ticks," said Dr. Margaret Skinner, Research Professor at the University of Vermont's College of Agriculture and Life Sciences. "Winter ticks kill too many moose, our icon of the north woods. But right now, the only management strategy we have to lessen the tick burden is through host reduction—killing moose to decrease ticks' food source."

Winter ticks have a one-year life cycle. After they hatch from their eggs over the summer, they cluster on the ground, waiting for the fall to attach to hosts. This is when the ticks are most vulnerable to threats, including insect-killing fungi that occur in the soil of moose habitats. The fungi do not naturally occur in high enough concentrations to eliminate large numbers of ticks.

A commercially available, fungal-based biopesticide was available for ticks, using the fungus *Metarhizium brunneum*. Skinner's team theorized that a product with smaller particles would have a better chance of filtering down into leaf litter in higher amounts, increasing the chances

that ticks would come in contact with its infective spores.

The researchers formulated their own prototype products using *M. brunneum*, as well as three similar fungi from California, South Korea and Vermont, all grown on millet grains.

The team tested the formulations' efficacy on roughly 1,000 winter tick larvae hatched from wild-collected females. The larvae were divided into five groups, one for each formulation and an unexposed control group. The ticks lived in cups full of sand to replicate their natural habitat and researchers sprinkled the granules in them at two different rates.

The team found that 53%-98% of the ticks were killed by the formulations after nine weeks, with no significant difference between the two application rates.

"These results are really significant because they provide proof of concept for a management strategy that could be both safe and effective," said Dr. Janet Patterson-Kane, Morris Animal Foundation Chief Scientific Officer. "Ticks have plagued moose for well over a century and are a burden for many other species. We need to do what we can to protect them."

Skinner said her team's next steps are to identify specific areas of moose habitats with high winter tick concentrations. Then her team can conduct field trials of their products.

Winter ticks are causing significant moose population declines in North America. In Vermont, on average, 47,000 ticks can be found on a single moose. A recent Vermont Fish & Wildlife Department study of collared moose concluded that winter ticks were the main cause in 74% of all mortalities and 91% of winter calf mortalities. While the Department

believes the state's moose population is "relatively stable at around 3,000 animals," this is down from an estimated 4,800 animals in 2005.

More information: Cheryl Frank Sullivan et al, Effectiveness of granular formulations of Metarhizium anisopliae and Metarhizium brunneum (Hypocreales: Clavicipitaceae) on off-host larvae of Dermacentor albipictus (Acari: Ixodidae), *Biocontrol Science and Technology* (2021). DOI: 10.1080/09583157.2021.1926428

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