Entomopathogenic Fungi in Mosquito Control

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ABSTRACT: Background. Biological control efficacy of two commercially available formulations of *Beauveria bassiana* and *Metarhizium anisopliae* against laboratory *Culex quinquefasciatus* mosquitoes was determined. Fungi were exposed to conditions in underground storm drain systems (USDS) in the Coachella Valley in two month-long trials during the spring and autumn seasons. Fungi were bioassayed for mosquito infectivity using two methods. In method #1, fungi were applied to filter papers placed in open plastic vials secured in hanging containers within each USDS. After exposure for varying time periods in the field, papers were returned to the laboratory and exposed to colonized *Cx. quinquefasciatus* for 24 hr. In method #2, fungi were sprayed directly on a 1 m^2 USDS concrete wall surface. After varying periods, colonized mosquitoes were transported to the field, exposed *in situ* to the surfaces overnight, and then returned to the laboratory. Filter papers or USDS wall surfaces treated with deionized water served as uninfected controls to monitor natural mortality. Following both methods of exposure, mosquito health was monitored in plastic vials under laboratory conditions for 21 days.

RESULTS

Fungal-linked mortality of mosquitoes differed by fungal species, the length of USDS aging, site location, and method of exposure. Fresh preparations of both fungal species (maximum label-recommended application rates) in laboratory and field exposure methods killed 50% of mosquitoes within 1-2 weeks and greater than 80% of mosquitoes within 3 weeks. Fungal efficacy was markedly reduced after one week of USDS aging in both species; however, *Beauveria bassiana* persisted on USDS walls for up to 4 weeks and on filter paper for up to 11 weeks in the spring trial. *Metarhizium anisopliae* infectivity was minimal after more than 2 weeks of USDS exposure and yet produced greater mosquito mortality in the fall season compared to the spring season. Differences in fungal efficacy among sample seasons could not be explained by differences in environment alone. USDS wall sprays demonstrated higher fungal infection rates at two sites that were deeper (3.7 m) or were flooded continuously (depth of standing water ~ 0.3 m); however, site location did not impact fungal efficacy in aged filter paper exposures.

CONCLUSIONS

Entomopathogenic fungi maintained on different surfaces in the USDS environment effectively killed mosquitoes if specific conditions were satisfied. A delayed onset of mortality and possible sublethal reductions of mosquito fitness point to potential complementary uses of these fungi with other control agents that warrant further investigations targeting underground mosquito sources in abatement programs.

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