

Tephritid fruit flies are among the major pests of fruits and vegetables worldwide and represent the most economically important group of phytophagous Diptera. Their control has basically depended on the use of chemical pesticides. However, recently publicized problems with chemical pesticides have stimulated an increased interest in the development of fungi as biological control agents as supplements or alternatives to chemicals. The objectives of this study were to explore for and develop fungal entomopathogens that could be used for field control of three species of African tephritid fruit flies, namely *Ceratitis capitata*, *C. cosyra* and *C. fasciventris*.

The pathogenicity of 14 isolates (2, *Beauveria bassiana* and 12 of *Metarhizium anisopliae*) towards adults of the three species was tested in the laboratory. All the isolates tested were pathogenic to the three species although mortalities ranged from 7 to 100% at 4 days post-inoculation. Six isolates (ICIPE 18, 20, 32, 40, 41 and 62) that were highly pathogenic to all the species tested were selected for further studies.

The effect of temperature on conidial germination, mycelial growth, and susceptibility of adults of the three species of fruit flies to six isolates of *M. anisopliae* selected during the screening was studied in the laboratory. Over 80% of the conidia germinated at 20, 25 and 30°C while less than 10% of conidia germinated at 15°C and 35°C with all of the isolates. The optimum temperature for germination and mycelial growth was 25°C. Mortality caused by the isolates against the fruit fly species also varied with temperature. Fungal isolates were more effective at 25, 30 and 35°C than at 20°C.

The potential for the horizontal transmission of *M. anisopliae* spores from treated to untreated flies of all three fruit fly species was investigated in the laboratory. In all the three species males and females exposed to *M. anisopliae* conidia became infected and exhibited 100% mortality 5-6 days post-exposure. Treated males (donors) maintained for 24 hours with recipient females transmitted infection to the females resulting in mortalities ranging between 71% and 83% in all species 15 days post-inoculation. The treated females also transmitted infection to untreated males, resulting in mortalities of 85% to 100%. This experiment confirmed the ability of fruit flies to transmit inoculum to other flies. It was also shown that fly-to-fly transfer of fatal doses of inoculum was possible for a series of at least three flies. Inoculation of female flies resulted in lowered fecundity compared to the control flies.

Laboratory tests were also conducted to assess the effect of *M. anisopliae* infection on courtship behaviour and sexual receptivity of the three fruit fly species. Exposure to fungal infection did not result in the disruption of the normal courtship behaviour of the flies. Mating was successful and the mean duration of copulation was similar in both the treated and control flies. Treated males were also just as competitive for females as untreated ones.

Studies were carried out to determine the effect of host sex and age on the susceptibility of the three species of tephritid fruit flies to *M. anisopliae*. While all three species were susceptible, *Ceratitis fasciventris* succumbed to infection earlier than the other two species. Age accounted for the largest variability in mortality and of the three host ages used the 0 and 7-day-old flies were most susceptible to infection than the 14-day-old flies. Female flies were also generally more susceptible than the males.

Autoinoculative devices for field application of the fungus into the field were developed using plastic mineral bottles. One of the most pathogenic isolates, *M. anisopliae* ICIPE 20, was evaluated against *C. capitata* and *C. fasciventris* under semi-field conditions. Three autoinoculators (maize cob, cheesecloth and a petri dish) were evaluated in the autoinoculators. Mortality of between 70-93% was observed in flies of both species that were recaptured and held under laboratory conditions.

Field experiments were conducted in smallholder mango orchards during the short rains of 2000 and 2000 to evaluate the potential of *M. anisoplia* for field control of the fruit flies. The effect of the fungus (applied using autoinoculative devices) was assessed by monitoring the fly population density in the fungus and malathion treated areas. Studies of persistence showed that the fungus, *M. anisopliae* applied in autoinoculating devices remained active for 5 weeks. These results are indicative of the potential of entomopathogenic fungi in the management of fruit fly species using the autoinoculative technique.

Laboratory studies were carried out to assess the compatibility of 6 *M. anisopliae* isolates with malathion, the most widely used chemical pesticide against adult tephritid fruit flies. Malathion inhibited germination at highest concentration of 0.5% but had no adverse effects at 0.1% and 0.001%. However, the chemical had an adverse effect on growth at 0.5 and 0.1% in isolates ICIPE 18, 32, 40 and 41 although growth occurred albeit at a slow pace compared to controls in ICIPE 20 and 62