Efficacy of insect pathogenic fungi on mortality and development of *Rhynchophorus ferrugineus* (Olivier)

Waqas Wakil¹, Muhammad Usman² and Sehrish Gulzar²

(1) Institute of Agricultural Sciences, University of the Punjab, Quaid-e-Azam Campus, Lahore, Pakistan, email: waqaswakeel@hotmail.com; (2) Department of Entomology, University of Agriculture, Faisalabad, Pakistan

Abstract


Fifteen different isolates of entomopathogenic fungi including *Beauveria bassiana*, *B. brongniartii*, *Metarhizium anisopliae* and *Purpureocillium lilacinum* were tested for their effectiveness against different developmental stages of red palm weevil *R. ferrugineus*. After 21 days of exposure, *B. bassiana* isolates (WG-23 and WG-25) caused 100% mortality in larvae while only WG-25 resulted in 100% mortality against *R. ferrugineus* adults. Furthermore, WG-25 reduced egg hatching up to 81.49% at 1 × 10⁸ conidia ml⁻¹.

**Keywords:** Red palm weevil, entomopathogenic fungi, mortality, horizontal transmission, sub lethal effects, progeny.

Introduction

The invasive red palm weevil *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae) is recognized as one of the most serious threat to date palm plantation (Dembilio and Jaques, 2015; Tagliavia et al., 2014; Wakil et al., 2015). It has been reported in 50% of date producing countries (El-Mergawy and Al-Ajlán, 2011), also it is a serious pest of date palms in Pakistan (Mohan, 1917). The aim of this study is to explore fifteen different isolates of entomopathogenic fungi including *Beauveria bassiana*, *B. brongniartii*, *Metarhizium anisopliae* and *Purpureocillium lilacinum* against different developmental stages of *R. ferrugineus*.

Screening Bioassays

During initial screening bioassays, both developmental stages were found susceptible towards all tested 15 isolates causing 14.9-81.5% and 5.6-51.7% mortality against larvae and adults, respectively.

Virulence Bioassay

The most effective top five potential isolates from screening bioassays were further evaluated against 6th instar larvae and adults of *R. ferrugineus* using four different concentrations (1 × 10⁶; 1 × 10⁷; 1 × 10⁸; 1 × 10⁹ conidia ml⁻¹) and mortality was recorded at 7, 14 and 21 days after treatment. After 21 days of exposure, WG-23 and WG-25 caused 100% mortality in larvae while only WG-25 resulted 100% mortality against adults. The virulence bioassay showed positive correlation with time and concentrations. Our results are in agreement with those of Verde et al. (2015) who showed that *B. bassiana* caused significant mortality against larvae and adults resulting in 88.92% and 20.26% mortality, respectively. Similarly, Francardi et al. (2012) tested the entomopathogenic fungi against the larvae and adults of *R. ferrugineus* and observed 100% and 90% mortalities, respectively. Likewise, Dembilio et al. (2010) verified that *B. bassiana* can significantly infect the 4th instar larvae and laboratory adults with calculated LC₅₀ values of 6.3 × 10⁷ and 7.2 × 10⁸ conidia ml⁻¹, respectively. We also found that potential isolates were not only effective against larval and adult stages, but also showed ovicidal effects, as WG-25 reduced egg hatching up to 81.49% at 1 × 10⁸ conidia ml⁻¹. Similar to our results, Dembilio et al. (2010) confirmed that *B. bassiana* considerably infected the eggs of *R. ferrugineus* (LC₅₀ 1.5 × 10⁶ conidia ml⁻¹). Likewise, Verde et al. (2015) evaluated different *B. bassiana* isolates against eggs of red palm weevil and observed 26.8-41.2% reduction in egg hatching compared with the control.

Auto-dissemination Bioassay

In auto-dissemination bioassay, it was confirmed that fungal infected adults have ability to transmit the disease to healthy ones. The effective isolate (WG-25) reduced the number of eggs per female/day (0.5 eggs/day), fecundity (11.7 eggs/female), eggs survival (11.6%) and larval survival (25.9%) when treated males mated with treated females compared with the control treatment. Similarly, Dembilio et al. (2010) proved that *B. bassiana* can significantly infect eggs of *R. ferrugineus* (LC₅₀ 1.5 × 10⁶ conidia ml⁻¹). Likewise, Verde et al. (2015) evaluated different *B. bassiana* isolates against eggs of red palm weevil and 26.8-41.2% reduction in egg hatching compared with the control among different pairing combinations. The present study revealed that entomopathogenic fungi have a great potential to control the different developmental stages of *R. ferrugineus* and may become an integral part of successful IPM program of date palm insect pests.

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المتخصصة

تم اختبار فعالية 15 عزلة مختلفة من الفطور المتطفلة على الحشرات (B. bassiana، B. brongniartii، Metarhizium anisopliae، Purpureocillium lilacinum) إزاء سوسنة النخيل الحمراء Rhynchophorus ferrugineus خلال اختبارات متميزة في وقت وخصوبة سوسنة النخيل الحمراء. بعد أن اتفرجت عزلات الفطور على سوسنة النخيل الحمراء، بلغت نسبة موت الحشرات 100% عند استخدام العزلة WG-25 من B. bassiana. وعلاوة على ذلك، فقد خفقت الفطرة WG-25 في إنتاج بيوضة بنسبة تصل إلى 98.8% عند استخدامها بتركيز 1×10^8 كونية/مل.

كلمات مفتاحية: سوسنة النخيل الحمراء، الفطور المتطفلة على الحشرات، مو، انتفاخ، تأثير登上بميتة، نسل.

References


