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

Waqas Wakil[1], Muhammad Usman[2] and Sehrish Gulzar[2]
(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

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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 1×10^8 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-Ajlan, 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 (1×10^6; 1×10^7; 1×10^8; 1×10^9 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 LC_{50} values of 6.3×10^7 and 7.2×10^8 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 1×10^8 conidia ml^{-1}. Similar to our results, Dembilio *et al.* (2010) confirmed that *B. bassiana* considerably infected the eggs of *R. ferrugineus* (LC_{50} 1.5×10^8 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* caused >62.6% and 32.8% reduction in fecundity and egg hatching, respectively with overall 78% reduction in progeny 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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الملخص

وقاص، وكيل، محمد عثمان وسيهريش غولزار. 2019. تأثير فطور ممرضة للحشرات في موت وخصوبة سوسة النخيل الحمراء وكفاءتها التناسلية. مجلة وقاية النبات العربية، 37(2): 198-199.

تمّ اختبار فعالية 15 عزلة مختلفة من الفطور المتطفلة على الحشـرات (شـملت: *Beauveria bassiana*، *B. brongniartii*، *Metarhizium anisopliae*، *Purpureocillium lilacinum*) إزاء سوسة النخيل الحمراء *Rhynchophorus ferrugineus* خلال مختلف أطوار نموّها. وبعد انقضاء 21 يوماً من التعريض، فقد تسبّبت عزلات الفطر *Beauveria bassiana* WG-23 و WG-25 بنسبة موت بلغت 100% لليرقات؛ إلّا أنّ العزلة WG-25 كانت الوحيدة التي حقّقت نسبة موتٍ بلغت 100% عند استخدامها على الحشرات الكاملة للسوسة *R. ferrugineus*. وعلاوةً على ذلك، فقد خفّضت العزلة WG-25 نسبة فقس بيوض الحشرة بمقدار وصل حتى 81.49% عند استخدامها بتركيز 1 × 10^8 بوغة كونيدية/مل.

كلمات مفتاحية: سوسة النخيل الحمراء، الفطور المتطفلة على الحشرات، موت، الانتقال الأفقي، تأثيرات تحت مميتة، نسل.

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