

Is the use of entomopathogenic fungi a viable option for the control of Red Palm Weevil?

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Abstract

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During the period 2010-2014, a survey of entomopathogenic fungi of red palm weevil (RPW) in the coastal areas of Syria were characterized and their efficacy against RPW was investigated. In addition, the naturally existing endophytes in palm trees were investigated. Promising results for the control of RPW were obtained under semi-field conditions using *B. bassiana* isolates. The big challenge for the different researchers working with entomopathogenic fungi is to have this type of high efficacy in the field where generally temperature is high and relative humidity is low. The potential use of *B. bassiana* endophytes was also discussed.

Keywords: Red palm weevil, date palm, entomopathogenic fungi, endophytes.

Introduction

Red palm weevil (RPW), *Rhynchophorus ferrugineus* (Olivier), (Coleoptera: Curculionidae) is one of the most destructive pests of palm trees worldwide (Dembilio and Jaques, 2015; Faleiro *et al.*, 2016). Several management strategies for the control of RPW have been developed and tried in different parts of the world. However, biological control is the component of integrated pest management (IPM), which has not been fully explored for the control of this pest. Entomopathogenic fungi (EPF) have been found to be promising bioagents in IPM programs against several insect pests. EPF have also been found as endophytes in a diversity of crops (Vega *et al.*, 2009). Colonization of date palm by *B. bassiana* and *Lecanicillium* spp. enhances plant defence and stress response (Gómez-Vidal *et al.*, 2009), and provides plant growth promotion benefits (Jaber and Enkerli, 2016). Using endophytic isolates, in some cases, have resulted in complete control of the target pest (Quesada-Moraga *et al.*, 2006). However, endophytes are still poorly explored as a management option for systemic protection of palms against *R. ferrugineus*.

Survey of RPW Entomopathogenic Fungi

A survey of entomopathogenic fungi of RPW in the coastal areas of Syria in 2010, 2011 and 2012 seasons was carried out. The collected isolates were characterized and their efficacy against RPW was investigated. In 2014, another survey was conducted to investigate the naturally existing endophytes in palm trees. Healthy peripheral leaves from 5-15-year-old palms were cut, surface sterilized and assessed for colonization by EPF. More than 4230 samples of different stages of RPW were collected. These insects were placed in plastic containers and killed by freezing. Dead insects were surface sterilized, incubated for 2 weeks to observe fungal outgrowth and then were identified. Twelve

fungal isolates of *Beauveria bassiana*, and one isolate of *Lecanicillium* sp. were obtained.

Characterization of *B. bassiana* Isolates

The characterization of *B. bassiana* isolates showed that the best fungal growth, in vitro, was at 25°C, and the higher productivity of conidial spores was at 20°C. The pathogenicity test of three *B. bassiana* isolates (BBS, RPWSL₅ and GHA) against red palm weevil adults showed highest insect mortality of 93.75% and 100% after 14 days of application with the RPWSL₅ isolate when concentration 1×10^7 and 1×10^8 conidia ml⁻¹ were used, respectively. Moreover, The LC₅₀ values varied from 2×10^5 to 1×10^9 conidia ml⁻¹, depending on the isolate. The lowest LC₅₀ was 2.12×10^5 (1.3×10^5 - 3.2×10^5) conidia ml⁻¹ when insect was treated with RPWSL₅ compared with 7.1×10^8 (5.1×10^8 - 1×10^9) conidia ml⁻¹ when GHA (commercial isolate) was used. The LT₅₀ values varied from 3.5 to 28.6 days, depending on the isolate. The shortest LT₅₀ value (3.5 days) was obtained with RPWSL₅ at 1×10^7 conidia ml⁻¹. The longest LT₅₀ (28.64 days) was obtained with BBS at 1×10^7 conidia ml⁻¹. Results obtained showed that there are entomopathogenic fungal isolates effective against the different stages of the RPW under laboratory conditions. Similarly, many laboratory studies showed that EPF caused high mortality (80–100 %) of RPW larvae and adults (Francardi *et al.*, 2013; Gindin *et al.*, 2006; Merghem, 2011). Promising results for the control of RPW were also obtained under semi-field conditions using *B. bassiana* isolates (Dembilio *et al.*, 2010; El-Sufty *et al.*, 2009), *Lecanicillium* (*Verticillium*) *lecanii* (Sabbour and Solieman, 2014) and *Isaria fumosorosea* (Sabbour and Abdel-Raheem, 2014). The big challenge for the different researchers working with entomopathogenic fungi is to have this type of high efficacy in the field where generally temperature is high and relative humidity is low. In addition, because the larvae are hidden

within the host, it may be difficult to get them infected by EPF. Other researchers tried using attract and infect strategy of RPW adult (Dembilio *et al.*, 2010; Yasin *et al.*, 2017).

Characterization of *B. bassiana* Endophytes

Three *B. bassiana* endophytic isolates were isolated from healthy palm trees from the coastal area of Syria. Similarly, (Gómez-Vidal *et al.*, 2006) reported the potential of *B. bassiana*, *L. dimorphum* and *L. psalliotae* as endophytes in the young and adult date palm petioles; fungi were detected microscopically inside the parenchyma and sparsely

distributed within vascular tissue without the date palm showing any negative effect. Gomez-Vidal *et al.* (2009), hypothesized that entomopathogenic fungi growing endophytically in palms modulate plant defence and could promote palm growth. The three *B. bassiana* endophytic isolates we identified have not yet been tested for their efficacy against RPW. However, we do believe that more research focus should be placed on endophytic isolates, as they seem to present better potential as biocontrol agents for RPW: delivery systems to the target pest should be easier and might not be exposed to the same harsh climatic conditions compared to entomopathogenic fungi.

المخلص

البوحسيني، مصطفى، عبد الناصر ترسي وطلال قدور. 2019. هل يعدّ استخدام الفطور الممرضة للحشرات خياراً قابلاً للتطبيق لمكافحة سوسة النخيل الحمراء؟. مجلة وقاية النبات العربية، 37 (2): 200-202.

جرى خلال الفترة 2010-2014 تنفيذ حصر للفطور المتطفلة على سوسة النخيل الحمراء في المنطقة الساحلية من سورية حيث تمّ توصيفها واستقصاء فعاليتها إزاء سوسة النخيل الحمراء. إضافة لذلك، فقد تمّ التحري عن وجود ممرضات للحشرات داخل أشجار نخيل التمر بصورة طبيعية. أمكن التوصل إلى نتائج واعدة لمكافحة سوسة النخيل الحمراء تحت ظروف نصف/شبه-حقلية باستخدام عزلات للفطر *B. bassiana*. إنّ التحديّ الكبير الذي يواجه مختلف الباحثين العاملين في مجال الفطور الممرضة للحشرات يتجسّد في امتلاك هذا النوع من الفطريات العالية في الحقل، حيث تكون درجات الحرارة مرتفعة والرطوبة النسبية منخفضة بوجه عام. ونوقشت كذلك إمكانية استخدام الممرض *B. bassiana* المتعايش مع نخيل التمر بصورة طبيعية. كلمات مفتاحية: سوسة النخيل الحمراء، نخيل التمر، الفطور الممرضة للحشرات، متطفلات داخل النبات.

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