

Biological control of date palm red mite *Raoiella indica* using organic miticide

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ABSTRACT

The red palm mite *Raoiella indica* Hirst is spread throughout the Caribbean islands, Florida, northern South America, and Mexico, and it negatively impacts palm and banana species. Different acaricides were used to control *R. indica* infestations of date palms in the UAE, but the majority of these acaricides are strong chemicals with high toxicity to non-target pests. The present study was conducted in the UAE on the red palm mite *R. indica* on infected date palms. One of the commercial botanical acaricides, namely M Impact, was tested for the control of *R. indica* in comparison with a market product containing abamectin. *Raoiella indica* mortality was 79.40% after the first spray and 70.23% after the second spray in the treatment of M Impact, with a 58.4% reduction in eggs. In the market product containing 3.5% w/v abamectin, mortality was 46.53% after the first spray and 41.22% after the second spray, with a 34.2% reduction in egg mortality. In this study, it was demonstrated that the organic miticide M Impact outperformed its chemical counterpart, abamectin. Organic miticides have provided significant and long-term control of the date palm red mite, *R. indica*.

Key Words: Date palm, Bio-efficacy, *Raoiella indica*, M Impact, Abamectin, Miticide

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INTRODUCTION

A date palm *Phoenix dactylifera* L. is a flowering plant species of the palm family cultivated for its edible, sweet fruit called dates. Date palm is increasingly popular in the global food industry because it contains large amounts of dietary fibre, carbohydrates, and other nutrients. As per a TMR study, the global date palm market is expected to grow at a compound annual growth rate (CAGR) of 3.1% and will reach over USD 21.5 billion by 2029. The date palm is affected by a large number of pests, including *Batrachedra amydraula*, *Parlatoria blanchardii* Targ., *Phoenicococcus marlatti*, *Oligonychus afrasiaticus*, *Raoiella indica* etc. *Raoiella indica* is a small red mite that is characterised by the presence of long spatulate setae on its dorsum, often with drops of liquid on the end. The red palm mite, *Raoiella indica* Hirst is the most well-known species in this genus. It is

not only found in the Caribbean Islands; it has recently been reported in Florida, USA (FDACS, 2007), Venezuela (Vasquez *et al.*, 2008), Colombia (Carrillo *et al.*, 2011), and Brazil (Navia *et al.*, 2011; Rodrigues and Antony, 2011). The mite is now abundant and negatively impacting palm and banana species throughout the Caribbean islands, northern South America, and Mexico (Pen *et al.*, 2009).

The mites are typically found on the undersides of leaves, often in large numbers (100–300 individuals), and are visible to the naked eye. All life stages are predominantly red, while adult females often exhibit dark areas on the body. In high densities, feeding mites cause localised yellowing of the leaves, followed by tissue necrosis. The exact range of temperature tolerance is not known, but Sakar and Somchodhury (1989) showed that when temperatures increased towards

400 °C *R. indica* tolerance also increased. Yadavbabu and Manjunatha (2007) reported a negative correlation between mite populations and rainfall and humidity, and Moutia (1958) noted a decline in population with the onset of heavy rain. Due to the high fecundity and short lifespan of mites, acaricides are used more often than other pesticides to control mites, but they cause rapid development of resistance (Van Leeuwen *et al.*, 2010). The rotation of acaricides with different mechanisms of action is required to increase mortality (Whalon *et al.*, 2008). Pest control using a single active ingredient will increase rapid resistance (Whalon *et al.*, 2008). Acaricides like Abamectin, Spirodiclofen, and sulphur are approved and authorised by the Federal Commission for Pesticides Protection (Senasica, 2013; Cofepris, 2015). Many of these products are strong chemicals that are highly toxic to non-target pests. Here we present data on the efficacy of M Impact, a botanical acaricide developed using various plant extracts for mite control.

MATERIAL AND METHODS

Study Procedure

In a trial conducted in Al Dhaid, Sharjah, UAE. The presence of red palm mites on date palm trees was predominantly observed on the undersides of leaves, where they were frequently found in significant numbers and were discernible without the aid of magnification. The study encompassed a total fifty-five date palm trees that were categorized into three distinct treatments, each replicated six times. These treatment includes: treatment T1 represent the untreated control group where only plain water spray was applied, T2 involves the use of market product containing 3.5% w/v abamectine applied a concentration of 0.25 ml per liter, and T3 utilized the organic miticide M Impact from Green Vision Life Sciences Pvt Ltd, India, at a concentration of 1 ml per liter. The application of these treatments was executed early in the morning, approximately at 7 am. Each tree had two leaves designated for monitoring purposes, with mite count recorded both before and after application of the treatments.

After an interval of 48 hours post application, the mortality rate of the red palm mites was assessed. Concurrently, any eggs of the date palm mites and deceased mites were meticulously collected using a dampened brush and subsequently enumerated.

RESULTS

The results shed light on the effectiveness of the organic miticide, M Impact, in combatting the red mite, *R. indica* infestation on date palms, encompassing its impact on both mites and their eggs. To ensure a rigorous assessment, the bio-efficacy data underwent comprehensive statistical analysis. This involved computing the mean value of pre-spray and post-spray mite counts across the treatments. Additionally, to gauge the consistency and variability of the results, the standard deviation across the three replications was meticulously calculated. Such statistical measures not only provide an average representation of the mite counts before and after treatment but also offer insights into variability of these counts across the different samples.

The data presented offers a clear comparative insight into the efficacy of M Impact and the market product containing 3.5% w/v abamectine against the *R.indica* mite on date palm.

M Impact Efficacy

After the application of M Impact, there was a notable reduction in the *R. indica* mite population, with a mortality rate of 79.40% post the initial application and 70.23% after the subsequent one. Additionally, there was a substantial reduction in eggs by 58.4%.

Abamectin Efficacy

The market product, which contained 3.5% w/v abamectin, exhibited a mortality rate of 46.53% and 41.22% after 48 hours post the first and second application, respectively. The reduction in eggs was recorded at 34.2%.

Control Treatment Observations

In contrast, untreated plants showed a significant escalation in the population of eggs, nymphs, and adults' mites.

Statistical Significance

Statistically, the data indicates a pronounced difference the bio-efficacy of abamectine and M Impact. This suggest that M Impact offered superior efficacy in controlling the *R. indica* mite compared to the market product containing abamectin, based on the observed mortality rates and reduction in eggs counts.

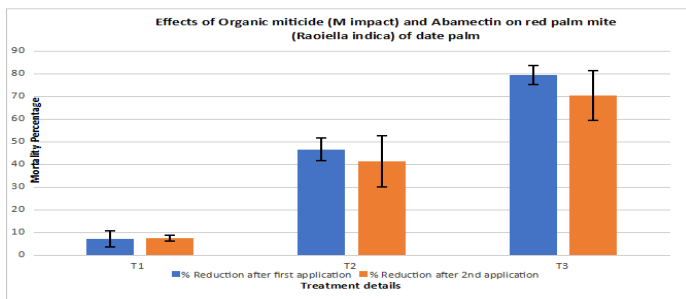


Figure 1. Comparative efficacy of M Impact and Abamectine against Red Palm mites

DISCUSSION

The situation in the UAE presents a significant challenge for date palm farmers, with issues arising from the use of various acaricides to combat red mite of the date palm, *R.indica*. Overreliance and misuse of these chemicals have led to concerns about pesticide residues affecting date exports and public health. To address these challenges, the research conducted to assess the efficacy of the organic miticide, M Impact, derived from multiple botanical extracts, against the date palm red mite, contrasting it with a commercially available product containing abamectin. The results indicated several noteworthy findings.

Superior efficacy of M Impact

M Impact, formulated from multiple botanical extracts, exhibited a superior efficacy against *R.indica*. The mortality rate of the mites and their eggs was notably higher with M Impact compared to abamectine, especially when applied at a concentration of 1 ml per liter of water.

Plant health benefits

An additional advantage observed with M Impact was the absence of leaf discoloration, unlike the slight discoloration observed with abamectin. Plants treated with M Impact maintained their freshness and green appearance.

Rapid action and sustained effectiveness

The rapid onset of action of M Impact, achieving over 79% mortality within 48 hours post-application against 46% mortality of abamectin at the specified concentration, highlighted its efficacy. Notably, there was no mites recovery post-exposure to M Impact, further emphasizing its sustained effectiveness.

Potential factors affecting efficacy of chemicals

The effectiveness of chemical acaricides like abamectin might be influenced by various factors, including potential feeding deterrents or repellent compounds produced by *R. indica*. Research suggests the presence of compounds that could deter or alter the behavior of predators, should be investigated for a better understanding of their role in the biological control of this phytophagous pest (Daniel Carrillo *et al.*, 2012). It is likely that other methods will be required to effectively suppress the populations of this invasive pest. The search for effective natural alternatives should be intensified, and ways to improve levels of control should be further investigated.

Given the challenges posed by *R.indica* and adverse effects of certain chemical treatments, there's a pressing need to explore alternative, effective and environmental friendly method for pest control. The finding underscores the potential of organic miticide like M Impact as a viable solution. Continued research and development in this direction could lead to the formulation of safer, residue-free products for managing *R.indica* infestations, ensuring both crop health and consumer safety.

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