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Commercial detergent to counteract *Dactylopius coccus*

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Abstract

The cochineal *Dactylopius coccus* has been responsible for devastating large extent of *Opuntia ficus indica* implantations around the Mediterranean Sea. In this paper we tested the efficacy of commercial of washing liquid soap as insecticide against *D. coccus*. The diluted (1:10 soap/water) product was pulverized at a raison of 1 liter per m², in situ, on hosted *O. ficus indica*. Our results revealed quasi-total mortality of *D. coccus*, within one month after a unique pulverization of the product, as testified by the absence of the wax filament and desiccated females' bodies. It is concluded that house-used detergent exert potent insecticidal effect against *D. coccus* and might be useful in managing the pest and preserving the vegetal patrimony.

1. INTRODUCTION

Opuntia ficus-indica, commonly known as prickly pear cactus, was introduced into North Africa as early as the sixteenth century. Since then, this species has acquired considerable socioeconomic importance in the region, serving both as a food resource and as a forage crop, particularly because of its high adaptability to arid, dry, and hot climatic conditions (Amani et al., 2025; Naorem et al., 2024; Patti et al., 2025). Several recent scientific studies have also demonstrated its preventive and therapeutic potential against a range of pathological conditions.

In recent years, plantations of the genus *Opuntia*, a prominent member of the Cactaceae family, have been increasingly threatened by a specialized insect pest, *Dactylopius coccus* (Costa, 1845), in several regions worldwide. *D. coccus* is a scale insect belonging to the family Dactylopiidae (order Hemiptera), commonly known for its production of carminic acid, an anthraquinone compound highly valued as a

natural colorant and widely used in various industrial sectors, including textiles, food processing, cosmetics, and pharmaceuticals.

This piercing-sucking insect feeds exclusively on cacti, particularly *Opuntia ficus-indica*. From the second nymphal instar onward, females become sessile, feeding on the sap of cactus cladodes and reproducing sexually, with each female capable of producing several hundred offspring. Adult males are winged and have a very short lifespan, generally lasting only a few days, compared with adult females, whose survival may reach approximately 40 days. The complete life cycle lasts, on average, approximately 2.5 months, although considerable variation may occur depending on environmental conditions and season. Males undergo an additional developmental stage, namely the pupal stage, before reaching adulthood.

Once established on the cladodes of *O. ficus-indica*, females produce a waxy protective covering that shields them from adverse climatic

conditions, particularly the high temperatures prevailing during summer, as well as from natural enemies (Palafox-Luna et al., 2018).

The damage caused by this scale insect has increased dramatically in Tunisia and other southern Mediterranean countries. The factors underlying this recent expansion remain poorly understood but may be associated, at least in part, with global climate change (Mazzeo et al., 2019; Moussa et al., 2017; Nefzaoui et al., 2018). The control measures currently available are largely ineffective and, in severely affected areas, may involve the complete uprooting and incineration of infected plants.

2. MATERIAL AND METHODS

In this study, we evaluated the efficacy of a commercially available detergent, commonly used for laundry washing, as a potential control treatment against *D. coccus*. The liquid soap was formulated primarily from olive oil, sodium lauryl

measurements recorded before treatment and one month after treatment.

3. RESULTS ET DISCUSSION

Our results revealed a significant reduction in the cladode surface covered by the waxy secretion produced by *D. coccus*, decreasing from $3.5 \pm 1.40\%$ before application of the diluted detergent to $0.01 \pm 0.01\%$ one month after treatment ($p < 0.001$). As shown in the figure, the detergent completely inhibited the development of *D. coccus* colonies on *Opuntia ficus-indica* cladodes.

Macroscopic examination of the insects revealed pronounced body desiccation, accompanied by the loss of part of their carminic pigment content and almost complete disappearance of their protective waxy covering. Previous studies have also reported similar control effects against this type of pest using other types of detergents (Azzouzi et al., 2024; Deveoglu, 2020; Fitiwy et al., 2016; Ramdani et al., 2021). The mechanisms

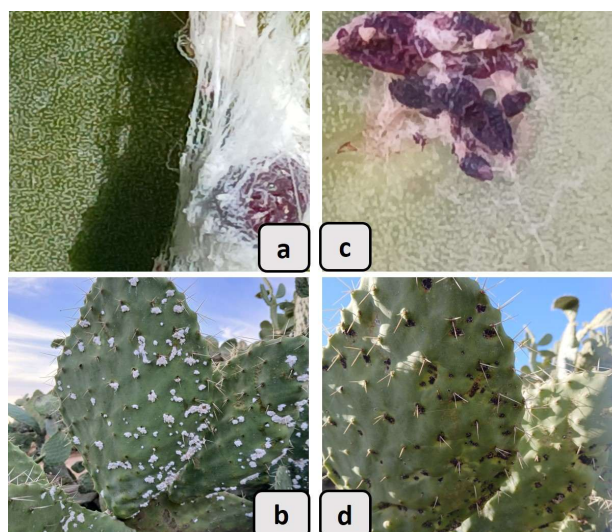


Fig. 1. Effect of detergent treatment on the survival of *D. coccus* infesting *O. ficus-indica* cladodes before treatment (a and b) and one month after detergent application (c and d).

sulfate, glycerin, water, and other compounds (Finesse, JMAL Company, Tunisia). It was diluted at a ratio of 1:10 with tap water and manually sprayed once, at an application rate of 1 L m^{-2} of cladode surface, onto *D. coccus*-infested cladodes under field conditions (*in situ*).

Treatment efficacy was assessed based on the proportion of the cladode surface covered by the characteristic white waxy secretion produced by *D. coccus*, relative to the total surface area of each cladode. The resulting data were compared using a paired-samples t-test (SPSS for Windows, version 17.0; IBM Corporation) by comparing

underlying the observed toxicity against *D. coccus* may potentially involve disruption or removal of the protective waxy covering produced by the females, thereby exposing them to lethal environmental conditions, as well as inducing respiratory impairment or suffocation.

Although the precise mechanisms of action remain unclear, the use of commercially available detergents could represent a potentially effective emergency intervention to limit the spread of *D. coccus* infestations in prickly pear plantations. Further investigations into this approach are warranted to assess its efficacy, optimize application conditions, and determine its

potential as a practical pest-management strategy for protecting this important plant resource.

4. CONCLUSION

Dactylopius coccus is a specialist scale insect pest of *Opuntia ficus-indica*, responsible for severe damage to this plant, which holds considerable socioeconomic importance throughout the Mediterranean region. In this study, we demonstrated that a commercially available laundry detergent exhibits insecticidal activity against *D. coccus*, thereby offering a potentially accessible approach for protecting this valuable plant resource.

Further comprehensive studies are required to elucidate the underlying mechanisms of action, determine the optimal application rates and conditions, and evaluate the efficacy and environmental safety of such commercially available products as potential insecticides for the management of scale insect pests.

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