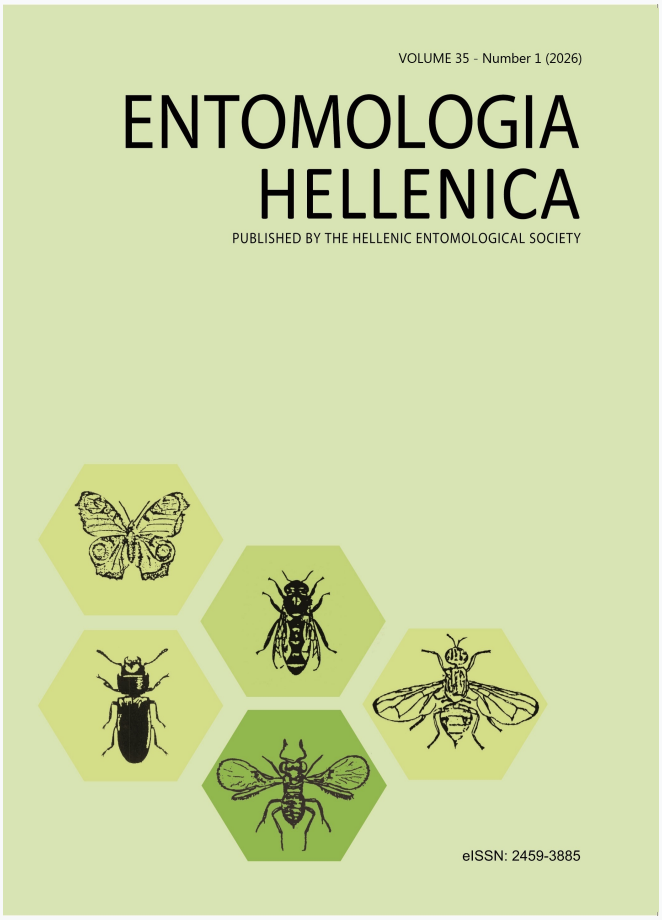
ENTOMOLOGIA HELLENICA

Τόμ. 35, Αρ. 1 (2026)

Entomologia hellenica 35(1)



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Βιβλιογραφική αναφορά:

Nia, B., Elbar, D., Mehenni, M., Roumani, M., Rekis, A., Deghiche-Diab, N., Faci , M., Aksa, A., & Mesnoua, M. (2026). Assessment of date palm susceptibility and fruit damage caused by the date palm mite in Algeria. *ENTOMOLOGIA HELLENICA*, *35*(1), 96–100. ανακτήθηκε από https://ejournals.epublishing.ekt.gr/index.php/entsoc/article/view/43294

ENTOMOLOGIA HELLENICA **35** (2026): 96-100

Received 15 November 2025 Accepted 15 April 2026 Available online 1 May 2026

Assessment of date palm susceptibility and fruit damage caused by the date palm mite in Algeria

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ABSTRACT

The date palm mite (DPM), *Oligonychus afrasiaticus* McGregor, 1939 (Acari: Tetranychidae), is a major pest that negatively affects date palm fruit production. This study investigated the susceptibility of several Algerian date palm cultivars to DPM infestation and assessed its effects on fruit quality in the widely cultivated cultivar Deglet Noor (DN). Field surveys revealed high infestation rates in DN compared with the other cultivars examined. Further analyses focused on the effects of DPM infestation on DN fruits. The results showed that DPM infestation significantly affected fruit moisture content, pH, sugar content, and weight. These findings confirm the pest status of DPM and demonstrate that it reduces fruit quality in ways that may adversely affect both marketability and nutritional value. The study highlights the importance of implementing integrated pest management programs specifically targeting DPM in order to minimize fruit damage and sustain date palm production in Algeria.

KEY WORDS: Boufaroua, Deglet Noor variety, infestation, integrated pest management (IPM), *Oligonychus afrasiaticus*, physicochemical properties, Tetranychidae, Ziban.

Introduction

Date fruits are gaining increasing consumer acceptance worldwide because of their high nutritional value (Alam et al. 2023). In Algeria, the date palm (*Phoenix dactylifera* L.) is widely cultivated, with more than 19 million trees grown across the country.

Date palm cultivation in the Arab region faces significant challenges from pests and diseases. These threats, often well adapted to oasis environments, can cause substantial losses in both yield and fruit quality. Studies estimate that pests and diseases account for roughly 28% of production losses (FAO & AOAD 2023). Among these threats, several harmful mite species can severely affect date palms and cause considerable economic losses for producers (Taha et al. 2019).

To date, eleven species of spider mites (Tetranychidae) have been reported on date palms. Of these, two species, *Oligonychus afrasiaticus* and the Banks grass mite, *Oligonychus pratensis* (Banks) (Acari: Tetranychidae), are considered the most damaging to date palm trees (Al-Atawi 2011; Negm et al. 2015). In Israel, *Eutetranychus palmatus* (Attiah) (Acari: Tetranychidae) was reported as a pest of date palm by Palevsky et al. (2010). According to Elhalawany et al. (2020), two tetranychid mite species were recorded on date palms in the New Valley and Qalyubia governorates of Egypt. The citrus brown mite, *Eutetranychus orientalis* (Klein) (Acari: Tetranychidae), was found in moderate numbers on the upper fronds, whereas the date palm dust mite, *O. afrasiaticus*, was recorded in high numbers on fruits and fronds in the New Valley governorate.

In Algeria, the Old World date mite, commonly known as “Boufaroua”, is a serious pest of dates and has also been reported on other palm species (Palevsky et al. 2003; Al-Atawi 2020).

This date palm spider mite lays its eggs directly on the fruits, where they are firmly attached and protected by a dense white or greyish silken web spun by the adults. The eggs hatch within 2-3 days into small, light-green, oval larvae approximately 0.15 mm in length. The entire developmental cycle, from egg to adult, usually lasts 12-18 days. In general, the life cycle of *O. afrasiaticus* spans 2-3 weeks. A Boufaroua population can double in size within just 2-3 days. With the potential to complete six generations per season, mite populations can rapidly reach alarming levels and cause substantial crop losses (Guessoum 1986; Chaker et al. 2020).

First documented in Algeria by André (1932), this pest had already caused considerable damage in Biskra, Sidi Okba, Aïn Naga, and Zeribet El Oued by 1927. It produces a dense web on the bunches, which promotes the accumulation of dust particles and consequently damages the dates (Mirza et al. 2021). In 1981, losses reached 70%, although the level of damage can vary depending on the year and region. Drought and high temperatures are key factors favouring the spread of the date palm mite (DPM) (Ben Chaaban et al. 2012).

DPM populations exhibit exponential growth during the unripe 'Kimri' stage of fruit development, which is characterized by low sugar content, high acidity, and high moisture.

This period coincides with a peak in the biological activity and feeding behaviour of DPM (Mirza et al. 2021).

Boufaroua primarily feeds on dates, with occasional feeding on leaves. It pierces the fruit epidermis with its stylet-like mouthparts. These numerous punctures create small red spots that spread across the fruit

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surface, giving it a rough appearance. In addition, a whitish silken network containing large numbers of larval exuviae forms on infested fruit. Wind-borne dust and sand adhere to this webbing, often giving it a sandy colour. Such damaged fruits are unsuitable for marketing and may even be rejected by animals. The Deglet Noor (DN) variety is considered particularly susceptible to Boufaroua damage (Guessoum 1986).

Understanding the threat posed by DPM is essential for preserving both the market value and the nutritional quality of date fruits. In addition to assessing the susceptibility of Algerian date palm cultivars to DPM infestation, it is also important to evaluate changes in consumer-relevant fruit quality traits using standardized methods (Al-Yahyai & Manickavasagan 2013).

This study investigated the susceptibility of several Algerian date palm cultivars to DPM infestation. It also examined the impact of DPM infestation on quality parameters of DN, a well-known cultivar, including fruit moisture content, pH, sugar content, and weight. The study was conducted in Biskra, Algeria.

Materials and methods

DPM infestation was assessed in a date palm grove located at the Bioresources Ziban Experimental Station in Lemkimnet (Biskra, Algeria) (34°55'43.5"N, 5°38'54.4"E; elevation 199 m). Nine date palm cultivars planted between 2006 and 2007 were evaluated: Deglet Noor, Ksabba, Deglet Mimoun, Hamray, Guettara, Zagray, Garn El Ghezel, Thouri, and Mech Degla. The plantation was managed without the use of synthetic chemical treatments.

The infestation rate was determined by inspecting all available bunches on each of the nine cultivars. A bunch was classified as infested when the characteristic silken webbing of *O. afrasiaticus* was visually detected on any number of fruits within the bunch. The infestation rate (IR) for each cultivar was calculated as:

$$IR\ (\%) = \left(\frac{\text{Number of infested bunches}}{\text{Total number of bunches per cultivar}}\right) x\ 100$$

Physicochemical analysis of Deglet Noor fruits

A comparative study was conducted to evaluate the effects of *O. afrasiaticus* infestation on the physicochemical properties of Deglet Noor (DN) fruits. To obtain representative samples, dates were harvested from three representative trees. For each tree, fruits were divided into two groups, sound (control) and infested, ensuring that all selected fruits were at the same ripening stage (Tamr) and were of similar size. After harvest, the dates were cleaned, pitted, and homogenized using a manual grinder. The resulting paste was stored in airtight polyethylene containers at 4°C until analysis, following the protocol of Djaoudene et al. (2019). To ensure statistical reliability, all physicochemical measurements were performed in triplicate (n = 3) for both sound and infested groups. The weight of 10 randomly selected dates was determined using an analytical balance (Radwag PS 600/C/2, Poland), whereas pH was measured at 20°C using a digital pH meter (Digimed DM-20, Bante model 920, UK). Moisture content was determined by drying 5 g of homogenized date flesh in a ventilated oven (Memmert, Osterode, Germany) at 105°C until constant weight. Total sugar content was quantified by the phenol-sulfuric acid colorimetric method (Dubois et al. 1956). Briefly, 0.5 mL of diluted sample was reacted with 0.5 mL of 5% phenol and 2.5 mL of concentrated sulfuric acid, and absorbance values were converted to concentrations using a glucose standard calibration curve.

Statistical analysis

To compare susceptibility among cultivars, a chi-square ($\chi 2$) test of independence was performed in IBM SPSS Statistics (version 21.0) to determine whether infestation frequency differed significantly among cultivars ($p < 0.05$). Ninety-five percent confidence intervals were calculated using the Wilson score method. Independent-samples t-tests were used to evaluate differences in fruit properties between sound and infested dates ($p < 0.05$).

Results

Significant differences in infestation rates were observed among the nine cultivars ($\chi 2 = 36.41$, $df = 8$, $p < 0.0001$). Deglet Mimoun and Deglet Noor exhibited the highest susceptibility, whereas Guettara, Zagray, and Hamray were significantly less infested (Table 1).

Comparative analysis revealed that date palm mite infestation significantly altered all measured physicochemical properties of Deglet Noor fruits (Table 2).

Discussion

Our results demonstrate that susceptibility to O. afrasiaticus varied significantly among the nine cultivars studied in Biskra, Algeria. Within the experimental plot, Deglet Mimoun and Deglet Noor showed the highest infestation rates (100% and 94.4%, respectively), confirming their status as highly vulnerable cultivars. This vulnerability may be related to the high fruit moisture content and specific sugar profiles of these cultivars during the Kimri and Khalal stages, which may provide an ideal microenvironment for mite colony development. These findings are consistent with El-Shafie (2022) and Ben Chaaban and Chermiti (2010), who reported that Deglet Noor is among the most susceptible cultivars in Tunisia and elsewhere. In contrast, the lower infestation levels observed in Hamray and Zagray suggest a degree of relative resistance. Such variation in susceptibility has also been reported from other regions; for example, Ali and Aldosari (2007) found that Sokary was highly susceptible in Saudi Arabia, whereas the Cebiky cultivar showed natural resistance.

The significant reduction in moisture content observed in infested Deglet Noor dates (Table 2) can be attributed to the feeding behaviour of DPM. Mites damage the fruit epidermis and weaken the natural wax coating, which is important in preventing desiccation (Aaqil et al. 2024). Our findings agree with those of Zitouni et al. (2018), who also reported significant moisture loss in DPM-infested dates.

TABLE 1. Infestation rates of DPM in nine date palm cultivars, including 95% confidence intervals and statistical groupings.

Cultivar	Infestation Rate (%)	95% confidence interval	Significance group
Deglet Mimoun	100.0%	[0.76 – 1.00]	a
Deglet Noor	94.4%	[0.74 – 0.99]	a
Mech Degla	62.5%	[0.31 – 0.86]	ab
Garn el Ghezel	50.0%	[0.25 – 0.75]	bc
Thouri	50.0%	[0.15 – 0.85]	bc
Ksabba	44.4%	[0.25 – 0.66]	bc
Guettara	22.2%	[0.09 – 0.45]	c
Zagray	22.2%	[0.09 – 0.45]	c
Hamray	12.5%	[0.02 – 0.47]	c

Note: Proportions followed by the same letter do not differ significantly ($p > 0.05$) according to pairwise z-tests with Benjamini-Hochberg correction. CI = confidence interval.

TABLE 2. T-test analysis of the effect of DPM on date palm fruit quality.

Parameters	Mean± SD	Mean± SD	t -test	Sig.
	Sound dates	Infested dates		
Date weight (g)	7.51±0.18	5.75±0.03	17.10	0.04
Moisture (%)	20.88±1.78	14.80±0.27	5.84	0.00
pH	6.07±0.02	5.93±0.06	3.77	0.02
Sugar content	62.03±0.61	20.37±0.47	93.43	0.00

Furthermore, our study showed a significant decline in pH and sugar content in infested fruits. The shift in pH towards greater acidity is particularly important for fruit quality, as pH values less than or equal to 5 are associated with undesirable acidic flavours (Muñoz-Bas et al. 2023). While sound Deglet Noor dates typically maintain pH values above 5.19 (Borchani et al. 2010), our results indicate that mite damage can lower these values toward or below the optimal range.

The observed reduction in total sugars, a key determinant of the commercial value of dates (Al-Yahyai & Manickavasagan 2013), indicates that DPM infestation interferes with carbohydrate accumulation or promotes premature degradation. Our results are supported by Zitouni et al. (2018), who reported a similar decline in sugar content in infested dates. This trend is not unique to date palms and has also been documented in other crops, such as strawberries infested by *Tetranychus urticae* (Livinali et al. 2014).

The significant loss in fruit weight observed in our study confirms that DPM is a major factor contributing to yield deterioration. This is consistent with Yadegar et al. (2022), who found a positive correlation between infestation level and weight loss in Deglet Noor. The deterioration in both yield and quality traits (weight, sugars, and pH) observed in the present study highlights the severe economic threat posed by *O. afrasiaticus* to date production in Algeria, similar to the impacts reported in other major crops such as coconut (Navia et al. 2013) and chili (Nasrin et al. 2020).

The marked reduction in fruit weight observed here further confirms that *O. afrasiaticus* is a major driver of yield deterioration, supporting the findings of Yadegar et al. (2022) for Deglet Noor. Comparable impacts have been reported for other major crops infested by mite pests. In coconut, Navia et al. (2013) noted that the coconut mite, *Aceria guerreronis*, causes major weight loss and premature fruit drop. Similarly, in chili, Nasrin et al. (2020) reported that the yellow mite, *Polyphagotarsonemus latus*, can cause yield losses exceeding 90% along with serious deterioration in fruit quality. Consequently, DPM remains a critical biotic constraint, comparable to other specialist mites, threatening both the commercial value of dates and regional food security.

Conclusion

In conclusion, this study demonstrates marked differences in susceptibility to DPM among date palm cultivars in Algeria. The high infestation rates observed in the 'Deglet' group contrast with the relative

resilience of cultivars such as Hamray and Zagray, which may represent valuable genetic resources for future resistance-breeding programs. Our physicochemical analyses confirm that DPM is a major biotic constraint that degrades the commercial and nutritional value of Deglet Noor dates by significantly reducing weight, moisture content, sugar content, and pH. These findings clearly show that DPM is an important pest affecting both fruit quality and yield in date palms.

Given the economic importance of susceptible cultivars such as Deglet Noor, implementation of a comprehensive integrated pest management (IPM) program is essential. Future research should prioritize the use of highly susceptible varieties as sentinel plants for early detection and should explore the biochemical basis of resistance in less affected cultivars in order to support the long-term sustainability of date production in the region.

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