



## Research article

## Thysanoptera of date palm: First records from Biskra (Algeria)

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### Abstract

The Algerian province of Biskra accounts for most of the date production in the country, especially high-quality dates for export. This crop is threatened by many pests, but the presence and effects of thrips are unknown. A survey of date palm thrips was conducted in Biskra province, located in an arid zone of Algeria, in four palm groves (two eastern, two western). Ten trees were selected randomly in each grove. Thrips were collected from four fronds (leaves) on each tree, one frond from each of the four cardinal directions, by shaking them over a white plate. Thrips also were collected from inflorescence samples by shaking one floral branchlet from an inflorescence at each cardinal direction over a white plate. Dislodged thrips were gathered into vials containing 60% ethanol and later mounted on slides and identified to the species level. Nine thrips species were collected, all being new records for Algeria and Biskra province: *Aeolothrips intermedius* Bagnall, 1934, *Bolothrips icarus* (Uzel, 1895), *Frankliniella occidentalis* (Pergande, 1895), *Kakothrips pisivorus* (Westwood, 1880), *Liothrips vaneeckei* Priesner, 1920, *Melanthrips fuscus* (Sulzer, 1776), *Odontothrips loti* Haliday, 1852, *Thrips minutissimus* Linnaeus, 1758 and *Thrips tabaci* Lindeman, 1889. *Bolothrips icarus*, a fungal feeder, was the most frequently collected species (>25% of all specimens), followed by *F. occidentalis*, a widespread and polyphagous species that can cause economic damage. Other species were less frequent but still pose a potential threat to date palm production in this region. A key was developed for the thrips species collected in this study.

### Introduction

Algeria possesses more than 17 million date palm trees (*Phoenix dactylifera* L., Arecaceae) of more than 800 varieties (Benzouche and Cheriet, 2012), distributed in 12 provinces. This country occupies an important place in the world in terms of date production and export. Biskra is the most important province in Algeria for date production (more than 60% of total production), with the total number of date palm trees in 2014 estimated at 4,286,354, with 3,894,898 trees producing 377,040 t of dates (Anonymus, 2014). Biskra is known for production of a famous gourmet date called Deglet Nour, generally considered the best production date in the world, with 2,638,253 palm trees belonging to this variety that generated 235,562t in 2014 (Anonymous, 2014).

These tree and production levels demonstrate the economic importance of this crop for Biskra and Algeria. However, date palms can be attacked and damaged by many pests and diseases, some of which are likely still unknown or understudied. Thrips are among these poorly known potential date palm pests and have never been previously studied on Algerian date palm. Their ability to cause significant damage on other crops around the world (Lewis, 1997) warrants their further investigation on this Algerian crop.

Thrips are insects belonging to the order Thysanoptera and 35 species are known as crop pests, either by direct feeding or as vectors of plant viruses (Mound, 1997). For example, in Egypt, *Thrips tabaci* on cotton causes a yield loss of 8–9% (El-Saadany et al., 1975). In Quebec, Fournier et al. (1995) reported that this same species was responsible for the loss of about 43% of onion production in 1988.

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Only a few papers refer to thrips on date palms. In India, Ramakrishna (1939), Tyagi and Kumar (2016) and Rachana and Varatharajan (2017) mentioned one species of thrips (*Palmiothrips palmae*) on date palm. Zur Strassen (1965) mentioned the same species from Europe. Reynaud (2010) stated that the six species of the small family Adiheterothripidae (now synonymized with the Stenurothripidae) were known only from the flowers of date palms. However, almost no published data exist that provide information on the presence of economically important species on date palm.

The goal of this research was to develop data on the presence of thrips on date palms in the Biskra region, to identify them and to form a foundation for future work on their possible economic importance to date production.

## Materials and Methods

The study was carried out during the crop years 2009/2010, 2010/2011 and 2014/2015 at four sites in Biskra province: Sidi Okba and El Hadjeb in the east (Zab El Charki), and Tolga and Sidi Khaled in the west (Zab El Gharbi). The locations of these sites and the names given to the experimental sites are provided in Table 1.

From each site, a palm grove (Fig. 1) was selected, and from each grove 10 trees approximately 2 m high were chosen randomly. To dislodge thrips, four fronds on each tree, one in each cardinal direction, were shaken five times over a white cloth. Similarly, one floral branchlet from an inflorescence in each cardinal direction was shaken over a white cloth. Dislodged thrips were collected with a fine brush into labeled vials containing 60% ethanol.

Sampling was carried out monthly from November to June during each study year. In the laboratory, adult thrips were sorted under a dissecting microscope and mounted on slides (one thrips per slide) in Hoyer's medium according to the Mound and Kibby (1998) protocol, and then identified using appropriate keys in the literature, such as Pitkin (1972), Moritz (1994) and Zur Strassen (2003), according to morphological criteria.

## Results and Discussion

In total, 3,574 adult thrips were collected from the sites. About 400 slides were made for adult thrips identification. Nine thrips species were recognized (Table 2): five species of the Thripidae, one species of the Aeolothripidae, one species of the Melanthripidae, and two

species of the Phlaeothripidae. Rechid (2011) reported all nine of these species on wild plants in this region, demonstrating the potential threat of thrips to date palm production in Biskra.

Five of the nine species collected were in the family Thripidae. Most economically important thrips species belong to this family (Lewis, 1973; 1997) and most species are phytophagous (Parrella, 1995), especially on flowers (Parrella, 1995; Reynaud, 2010). Most of the Thripidae feed on a wide range of plants.

*Aeolothrips intermedius* (Figs. 3A–3C) was common on the Biskra date palms (13.3% of all specimens). This distinctive species is an important predator of other thrips (Bailey, 1940; Derbeneva, 1967; Bournier et al., 1978; Trdan et al., 2005). Bournier (1970) considered *Thrips tabaci* to be the preferred prey of *A. intermedius* and it can also be a predator of whiteflies and psyllids (Bournier et al., 1978). It was presumed that in the Biskra date palm groves *A. intermedius* utilizes a range of prey items since its numbers were higher than those of *T. tabaci*. In this context *A. intermedius* may well be suppressing *T. tabaci* populations and reducing the potential for damage or virus transmission.

The species *Melanthrips fuscus* (Fig. 3D, 7.7% of specimens) was reported from Biskra by Laamari and Hebbel (2006) and by Rechid (2011). It has also been recorded in North Africa, Israel, Cyprus and Europe (Priesner, 1960), where it breeds on the Brassicaceae (Zur Strassen, 2003).

*Odontothrips loti* (Fig. 3E, 11.4% of specimens) and other species of this genus are frequent legume pests (Pitkin, 1972). Benmessouad-Boukhalfa et al. (2010) found it along the coastal region of Algeria. The species is common throughout most of the Holarctic region (Zur Strassen 2003, Mirab-balou et al., 2011). It has been reported to feed on flowers of *Lotus*, *Anthyllis*, *Ononis* and *Trifolium* spp. (Priesner, 1964).

*Thrips minutissimus* (Fig. 3F), collected in very small numbers (2.6% of specimens), is a flower thrips (Alavi et al., 2007) with a preference for blooms of deciduous trees. In Croatia, it has been reported on the Asteraceae, Iridaceae and Oleaceae (Raspudić et al., 2009). In the current study, it was collected from both flowers and leaves.

In this study, *Thrips tabaci* (Fig. 3G) comprised about 10% of the specimens collected from date palm. It was previously reported in Algeria by Bournier (1970), and Laamari and Houamel (2015) collected it in Biskra from tomato. This species is a polyphagous insect (Liu and Sparks, 2003), occurring on all continents except Antarctica and feeding on plants in 29 botanical families (Raspudić and Ivezic, 1999).

**Table 1** Geographic location of study sites

Zone	Commune	Site	Latitude	Longitude	Elevation (m)
Zab El-Charki	El Hadjeb	Hassi Zirari	34°47'15.4"N	5°36'41.4"E	137
	Sidi Okba	Oued Braze	34°46'22.5"N	5°51'13.2"E	53
Zab El-Gharbi	Sidi Khaled	Lehouimel	34°22'10.9"N	4°58'08.2"E	233
	Tolga	El Hrichtet	34°42'05.2"N	5°24'46.1"E	124

**Table 2** Thrips species collected from date palm at Biskra

Suborder	Family	Subfamily	Species
Terebrantia	Thripidae	Thripinae	<i>Frankliniella occidentalis</i> (Pergande, 1895)
			<i>Odontothrips loti</i> (Haliday, 1852)
			<i>Kakothrips pisivorus</i> (Westwood, 1880)
			<i>Thrips minutissimus</i> (Linnaeus, 1758)
			<i>Thrips tabaci</i> (Lindeman, 1889)
	Aeolothripidae	Aeolothripinae	<i>Aeolothrips intermedius</i> (Bagnall, 1934)
	Melanthripidae	Melanthripinae	<i>Melanthrips fuscus</i> (Sulzer, 1776)
Tubulifera	Phlaeothripidae	Idolothripinae	<i>Bolothrips icarus</i> (Uzel, 1895)
		Phlaeothripinae	<i>Liothrips vaneeckei</i> (Priesner, 1920)



Fig. 1 Palm grove at the Tolga site



Fig. 2 Thrips damage on date palm leaves

Also of high abundance was the western flower thrips, *Frankliniella occidentalis* (17.3% of specimens, Fig. 4A). This species is an important worldwide pest and is known on 32 crops in Biskra (Razi, 2017). This thrips should be closely monitored, as it is very polyphagous and can reproduce on at least 200 plant species. *Frankliniella occidentalis*, of South American origin, is now semi-cosmopolitan (Zur Strassen et al., 1997). It was reported from Algeria for the first time by Kirk and Terry (2003).

The common presence of polyphagous species such as *F. occidentalis* and *T. tabaci* on date palms is likely due to the fact that thrips have high dispersal ability and are adapted to a wide range of habitats such as forests, deserts and crops (Lewis, 1973; 1997). In particular, the above two species should be surveyed and monitored more closely on date palm to determine if they are damaging flowers, developing fruit or leaves. Both *T. tabaci* and *F. occidentalis* should be considered potentially serious pests as they can transmit viruses to plants in addition to the direct damage they can cause (Turina et al., 2012; Loebenstein and Lecoq, 2012). In addition, it is important to determine the presence of date palm viruses that might be transmitted by thrips.

The thrips species *Kakothrips pisivorus* (3.2% of collected thrips, Fig. 4B) was regularly collected but was not as abundant as those already discussed. The presence of this species may be explained by the widespread cultivation of their legume hosts in Biskra. This region is known for legume production, especially pea and broad bean crops that are favored by *K. pisivorus* (Alford, 1999). This species favors the Fabaceae and occurs throughout Europe (Jenser, 1993). Fava bean is a preferred host plant (Williams, 1915). Feeding by *K. pisivorus* causes the surface of infested tissue to become silvery. Heavily infested plants are severely stunted and crop yields may be reduced, with most

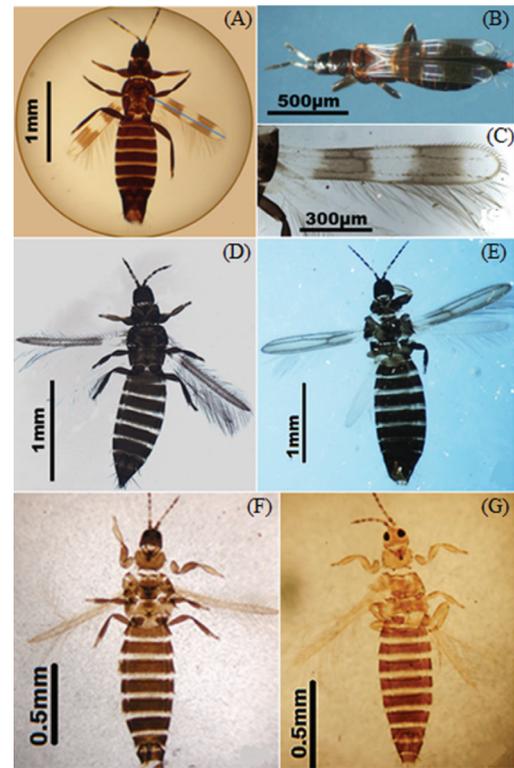


Fig. 3 Thrips on Biskra date palm (A–C) *Aeolothrips intermedius* (female); (D) *Melanthrips fuscus* (female); (E) *Odontothrips loti* (female); (F) *Thrips minutissimus* (female); (G) *Thrips tabaci* (female)

damage occurring under dry conditions. Similar silvery damage was observed on date palm leaves (Fig. 2), but it was not ascertained which thrips, if any, caused it.

The most frequently collected thrips in the current study was *Bolothrips icarus* (Fig. 4C), comprising 27.5% of total collected individuals. This species is mycophagous (Marullo and De Grazia, 2013) and widespread in Europe and the Mediterranean basin (Goldarazena and Mound, 1998). The presence of this species on Biskra date palms is likely due to the substantial fungal growth favored by intercropping and the presence of weeds.

*Liothrips vaneckeai* (Fig. 4D, 9% of specimens) is known from the Mediterranean basin (Goldarazena and Mound, 1998), but has spread on exported lily plants from its original area (Europe) to other continents (Malipatil et al., 2002). This species and all other members of its genus feed on a wide range of plant species. It was mentioned by Razi (2017) on vine trees in Biskra.

None of the species of the Adiheterothripidae (= the Stenurothripidae) mentioned by Reynaud (2010) from the Western Hemisphere on date palm were found in this study. Likewise, *Palmiothrips palmae*, recorded from date palm in India by Ramakrishna (1934), Tyagi and Kumar (2016) and Rachana and Varatharajan (2017), and in Europe by Zur Strassen (1965), was not found in the Biskra palm groves. The current study provides the first reports of their presence on date palm.

Seven of the nine species could potentially threaten date production in Biskra. *Aeolothrips intermedius*, a predator of thrips and other plant pests, has potential as a biocontrol agent, while *B. icarus* feeds on fungi and therefore is not of concern. Thrips studies should be continued in order to determine the biology of these species on date palm, the extent of any plant damage and approaches to the management of harmful species.

**Table 3** Total thrips numbers, frequency of occurrence and mean number per date palm branchlet at Biskra sample sites

	SidiOkba			El Hadjeb			Sidi Khaled			Tolga			Total	Percentage of all thrips
	2009–2010	2010–2011	2014–2015	2009–2010	2010–2011	2014–2015	2009–2010	2010–2011	2014–2015	2009–2010	2010–2011	2014–2015		
<i>Bolothrips icarus</i>	66	85	130	75	38	125	65	48	90	52	61	83	918	25.7
<i>Frankliniella occidentalis</i>	57	78	69	72	55	76	75	38	31	17	19	33	620	17.3
<i>Aeolothrips intermedius</i>	32	53	68	63	24	44	38	25	48	23	17	41	476	13.3
<i>Odonthrips loti</i>	25	23	37	41	43	47	32	29	51	30	26	24	408	11.4
<i>Thrips tabaci</i>	28	34	30	43	23	13	24	38	35	24	26	32	350	9.8
<i>Liothrips vaneeckei</i>	38	33	49	23	14	33	49	31	28	13	0	8	319	9.0
<i>Melanthrips fuscus</i>	28	32	51	25	18	28	12	19	18	19	11	13	274	7.7
<i>Katothrips pisivorus</i>	14	9	25	6	11	14	20	3	1	3	0	10	116	3.2
<i>Thrips minutissimus</i>	2	14	19	12	1	12	8	5	2	3	9	6	93	2.6

**Fig. 4** Thrips on Biskra date palm (A) *Kakothrips pisivorus* (female); (B) *Frankliniella occidentalis* (female); (C) *Bolothrips icarus* (female); (D) *Liothrips vaneeckei* (female)**Key to thrips females collected from Biskra date palm (adapted from Moritz, 1994, Mound and Kibby, 1998 and Zur Strassen, 2003)**

1. Terminal abdominal segment conical (suborder Terebrantia)...2
- 1' Terminal segment tube-shaped (suborder Tubulifera)...8
2. Antennae with 6 to 8 segments (rarely 9); third and fourth antennal segments each with 1 or 2 emergent sensory cones that are forked, cone-like or simple (Thripidae)...4
- 2' Antenna with 9 segments, third and fourth antennal segments each with longitudinal or transverse linear sensoria (not extending above antennal surface)...3
3. Antennal segments V–IX united; abdominal sternite VIII not developed; pronotum without prominent posteroangular setae (Aeolothripidae)...*Aeolothrips intermedius* (Figs. 3A–C)
- 3' Antennal segments VII–IX distinctly separated; abdominal sternite VIII appearing as a pair of posteriorly directed lobes; head with at least 2 pairs of long setae behind the eyes (Melanthripidae)...*Melanthrips fuscus* (Fig. 3D)

4. Tergite VIII with ctenidia; anterior tibia without claw-like processes...5

4' Tergite VIII without ctenidia; anterior tibia with one or two claw-like processes...*Odonthrips loti* (Fig. 3E)

5. Head with one pair of setae around anterior ocellus; ctenidium on tergite VIII medial to the spiracle (*Thrips*)...6

5' Head with two pairs of setae around the anterior ocellus; ctenidia on tergite VIII anterolateral to spiracle...7

6. Ventral surface of sternites II–VII with accessory setae in addition to marginal setae...*Thrips minutissimus* (Fig. 3F)

6' Ventral surface of sternites II–VII smooth, with only marginal setae...*Thrips tabaci* (Fig. 3G)

7. Lateral side of foretarsus with distinct tooth; on pronotum anteromedial and posteromedial margins without setae; ctenidia weak or absent on tergites V–VI; forewings dark brown...*Kakothrips pisivorus* (Fig. 4A)

7' Foretarsus without tooth; setae evenly distributed along anterior and posterior pronotal margins; ctenidia on tergites V–VIII well-developed...*Frankliniella occidentalis* (Fig. 4B)

8. Antennal segment III with two sense cones; maxillary stylets more than 5  $\mu\text{m}$  wide throughout their length...*Bolothrips icarus* (Fig. 4C)

8' Antennal segment III with one sense cone; maxillary stylets only 2–3  $\mu\text{m}$  wide for most of their length...*Liothrips vaneeckei* (Fig. 4D)

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