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Article

Evaluation of different treatments in control of *Oligonychus afrasiaticus* in date palm orchards of Iran

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ABSTRACT
Oligonychus afrasiaticus is a major pest of date palm orchards in Iran and Middle East countries. Effects of amitraz, fenpropathrin, fenpyroximate, fenazaquin, propargite), tetradifon, and hexythiazox were evaluated in southern part of Iran. The complete randomized block designed with three replications used on Mordarsang, Kabkab, Barhi, Mazafati, and Halileh major date varieties cultivated in Hormozgan, Bushehr, Khuzestan, Kerman and Sistan and Baluchistan provinces, respectively. Two small date clusters randomly were detached from each replicate and number of spider mite mobile stages were counted on epidermis of 20 date fruits at intervals one day before, 3, 7, 14 and 20 days after treatments. Mean mite densities before treatments found varied from 1.4–69 mites among treatments, provinces and year of studies. Mean mortality analysis variance was found significant ($p > 0.01$) in all factors. First and last sign of web span around date fruits cluster observed in Khuzestan, and Sistan and Baluchistan in April–May and July–August, respectively. High, medium and weak treatment mortality percentage during 3rd day sampling time in two years recorded for Hormozgan, Kerman, Khuzestan, Bushehr, and Sistan and Baluchistan provinces. Absolute mite pest control obtained at 20th day sampling time during 2nd year in Kerman and imperfection mortality in other places in two years. Date spider mite treated with tetradifon has a half century history in Iran and fenazaquin with low dose (0.3%), caused high mortality rate in most of provinces. Absolute mite controlled (100%) and prolongation effects recorded by water sprayed during 20th day sampling time in the 1st and 2nd year in Hormozgan and Kerman provinces, respectively.

KEY WORDS: Acaricides; control; date palm varieties; different provinces; mortality.

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INTRODUCTION

Date palm (*Phoenix dactylifera* L.) of the family Palmaceae, is the oldest domesticated plant with 5000–10000 years history in Middle East countries and is the God gifted heaven fruit to man. Date fruit is one of the richest food sources of energy for the people living in southern parts of Iran, Middle East, north of Africa and elsewhere in the world. Date palm with different bioproducts, serves additional income sources for many date producers. Iran date cultivation area exceeded 218000 hectares in 14 provinces which more than 1750000 hectares are productive and distributed in more

than 60% of the country area (Pejman 2001). Iran date production stand first with one million tons and 20% world productions. More than 32 countries with 80 million date palms, producing over 5 million tones date in the in world, which about 70% only happened in Iran, Egypt, Iraq, Saudi Arabia and Pakistan (Triki *et al.* 2003). Date palm also is a key element of the oasis ecosystem according to FAO (1998).

Date mite pests review showed that spider mite for the first time identified as a *Paratetrancychus afrasiaticus* by McGregor in 1939, more taxonomic work explored this species into the genus *Oligoncychus* (Pritchard and Baker 1955). Few species from this genus collected on date palm like *O. pratensis* Banks (Dowson 1982), *O. senegalensis* Guttierrez and Etienne (Palevsky *et al.* 2003), *O. tylus* Baker and Prichard from Middle East countries (Pritchard and Baker 1955), *O. calicicola* a new species from Australia (Knihinicki and Flechtmann 1999), *O. coffeae* from India (Gupta 1985). Other mite pests like *Raoeilla indica* Hirst and *Dolichotetranychus* sp., also reported with injurious role on leaf of date palm in Iran (Arbabi *et al.* 2002), India (Gupta 1985) and other Persian Gulf countries and the world.

Earliest *O. afrasiaticus* damages reported from Algeria and Iraq (Buxton 1921). Screening this spider mite incidence showed widely scattered in Middle East, Africa (Ben Chaaban *et al.* 2011), America, central Asian countries (Bolland *et al.* 1998) and Elche in Spain (Triki *et al.* 2003). Feeding and injury of this mite in Iran mostly observed on commercial date varieties like Mazafati, Shokeri, Kabkab, Barhi, Mordasank and Halieleh (Arbabi and Paknazer 2000). Tetradifon EC 18.5% was evaluated about 50 years ago in Khuzestan province of Iran for control of this mite (Gharib 1979, 1991). Few efforts reported with acaricides to control date palm spider in Iraq (Hussain 1969), Libya (Endongali *et al.* 1988) and Saudi Arabia (Al-Doghairi 2004).

MATERIAL AND METHODS

Efficacy of different pesticides (acaricides/insecticides) including amitraz 20% EC, fenpropathrin 10% EC, fenpyroximate 5% SC, fenazaquin 20% SC, propargite, 57% EC, tetradifon 18.5% EC, hexythiazox 10% EC with doses, 2, 2, 0.3, 0.5, 1, 2, 0.5 ml/L respectively, in comparison with water spray treatment were evaluated on date palm spider mite (DPSM) in natural conditions. Treatments evaluated on Mordarsang, Kabkab, Barhi, Mazafati, and Halileh as a major date varieties cultivated in Hormozgan, Bushehr, Khuzestan, Kerman, and Sistan and Baluchistan provinces in southern parts of Iran during 2001–2002. Complete randomized block designed with three replications selected, each replicate consisted of 20 date fruits which randomly collected from two date clusters of each date palm. Amount of each treatments and water in control treatment applied equally to avoid excess of error in control of mite pest population. Time treatments selected when light span of web made around date fruit clusters by date spider mite (Figs. 1–2). Mite mortality of each treatments and duration of their effects evaluated through sampling interval, one day before and 3, 7, 14 and 20 days after treatments. Henderson-Tilton formula was used to convert raw collected data of the treatments into mortality rate. Analysis of variance on mean control rates of the treatments done by SAS software version 9.1 and Duncan's test employed to evaluate the significance of differences ($p > 0.01$).

RESULTS

Active densities of mite stages among treatments found varied according date varieties, provinces and year of incidence (Table 1). Mean active DPSM from south western to south eastern in a more than 1100 kilometers distances resulted Min. and Max. 0.6 and 69.2 mites on Halileh and Barhi date varieties date fruit into years of studies in Khuzestan and Sistan and Baluchistan provinces, respectively (Table 1, Figs.1–3). Mean of DPSM incidence according to provinces observed also varied, Min. 3.62 and Max. 47.62 mites recorded during year of 2001 and 2002 in Khuzestan and

Sistan and Baluchistan provinces (Table 1). The lower and higher mean of DPSM in two year recorded 1.84 mites and 35.31 mites in Bushehr, and Sistan and Baluchistan provinces while the lowest mean differences of DPSM population among the treatments recorded in Kerman province (Table 1).

Figures 1–2. Close up of light and heavy spanning web on and around date fruits and clusters by *Oligonychus afrasiaticus*.

Table 1. Mean active stages of *Oligonychus afrasiaticus* recorded before treatments on a date palm fruit in different provinces during 2001–2002.

Place, variety, date / Treatments	Hormozgan (Mordarsang var.) (May–June)		Bushehr (Kabkab var.) (May–June)		Sistan and Baluchistan (Barhi var.) (July–Aug.)		Kerman (Mazafati var.) (July–Aug.)		Khuzestan (Halileh var.) (April–May)	
	2001	**2002**	**2001**	**2002**	**2001**	**2002**	**2001**	**2002**	**2001**	**2002**
amitraz	7.81	12.78	8.73	19.91	18.93	19.55	3.95	5.28	0.84	3.84
fenpropathrin	4.08	9.15	13.20	9.20	9.25	61.00	3.41	5.93	6.64	4.12
fenpyroximate	8.26	4.46	12.20	9.26	6.18	52.08	3.15	5.83	1.12	9.44
fenazaquin	1.11	7.43	13.75	10.97	8.50	69.41	3.51	5.15	9.72	4.80
propargite	1.40	7.98	11.37	22.24	10.43	22.60	3.16	5.25	0.60	6.68
tetradifon	10.51	10.13	23.97	11.48	17.87	56.25	4.25	5.90	0.88	8.60
hexythiazox	6.41	14.03	11.13	24.58	6.25	55.75	2.93	6.26	3.64	4.72
water spray	7.08	18.60	14.90	16.48	13.62	42.75	2.66	5.76	2.08	6.92
mean	5.83	10.57	13.67	15.51	11.38	47.42	3.38	5.68	3.19	6.14

Mean analysis of variances on mortality percentage of DPSM in all treatments and sampling intervals on Mordarsang date variety in Hormozgan province statistically found significant at the level 99% ($p > 0.01$) in two years. Increasing effects of some treatments from 3rd days up to 7 days sampling time with maximum control recorded until 20th sampling days for most of treatments.

Lowest control percentage found 72.30% for amitraz (Table 2). Absolute control except for water treatment with 43.02% in 3rd day of 1st year and fenpropathrin with 34.22% during 7th day sampling in 2nd year caused lower effects (Table 3). Water sprayed treatment decreased 27.5% mite population only. The results indicated that lower mean of DPSM during 1st year (Table 1) provided better control percentage on Mordarsang variety (Table 2) than 2nd year (Table 3).

Spider mite controlled effects by treatments on Kabkab var. in Bushehr province showed that during 3rd day sampling time in year 2001 observed tetradifon was only able to control 89.50% and other treatments effects observed even lower than water sprayed only. Increasing mite mortality for some treatments during 7th day sampling time remained constant up to 14th day and almost ineffective onward (Table 4). Except water spray treatments, rest of treatments caused the mite mortality percentage at increasing rate until 20th day of sampling period (Table 5). Higher mean of 15.51 mites in 2nd year in comparison to mean of 13.67 mites in 1st year (Table 1) may influences control percentage in Bushehr province (Tables 4, 5).

Figure 3. Sign of spanning web covered whole date fruits clusters by *Oligoncyhus afrasiaticus*.

Absolute treatments control on Halileh date var. in Iranshar region of Sistan and Baluchistan province recorded after 3 days during the first year (Table 6). While reversed of that seen with decreasing rate of control from 3rd day on ward and the least control percentage recorded after 7th day observed for hexythiazoxe and without positive control from 14th day until the end of sampling time (Table 6). Water treatment during 20th day sampling time with the highest mite percentage (98.68%) found among treatments in the first year of study (Table 6).

Results of mite mortality percentage during 2nd year on Halileh date variety infested by spider mite in Sistan and Baluchistan province (Iranshar) in south eastern part of Iran showed that with weaker control effects as compared to previous year. The water sprayed with 95.12% mortality among treatments, placed in group of (a) during 7th day of sampling time according Duncan's grouping method (Table 6). Two year treatments effects in control DPSM infestation revealed that lower control percentage during the 2nd year in comparison to 1st year found lower and this difference expected to be under influences of higher mean of mite density in 2nd year (Table 1). Fenpyroximate with 88.82% caused higher control. Water sprayed only was able to suppress 68.3% mite populations

in two year treatments evaluation (Table 6). Treatments effects found at increasing rate up to 14th day and 20th day in the 1st and 2nd year of study, respectively (Table 7).

Table 2. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Hormozgan province during 2001.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	99.84 ± 0.15a	100 a	100 a	98.90 ± 1.10a	75.59 ± 24.41a	79.82 ± 20.16a	74.46 ± 25.53a	99.83 ± 0.17a
7	88.26 ± 10.05a	99.93 ± 0.06a	100 a	100 a	99.54 ± 0.46a	99.99 ± 0.03a	98.65 ± 1.35a	85.88 ± 13.63a
14	97.79 ± 1.26b	100 a	100 a	100 a	99.89 ± 1.06a	100 a	99.53 ± 0.17a	100 a
20	72.30 ± 27.80b	96.68 ± 3.31a	99.59 ± 0.40a	96.08 ± 3.92a	95.55 ± 4.44a	100 a	100 a	100 a

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

Table 3. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Hormozgan province during 2002.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	98.51 ± 1.02a	100 a	99.50 ± 0.50a	99.31 ± 0.69a	100 a	98.93 ± 0.60a	99.77 ± 0.23a	43.02 ± 28.58b
7	53.20 ± 1.96bc	34.23 ± 18.50c	83.63 ± 6.49a	66.69 ± 4.23ab	77.10 ± 1.34ab	82.77 ± 5.59a	70.57 ± 7.69ab	64.73 ± 5.45ab
14	81.53 ± 5.66a	85.93 ± 1.71a	82.30 ± 8.64a	69.30 ± 10.32ab	84.30 ± 10.92a	92.73 ± 3.62a	88.10 ± 4.56a	55.33 ± 8.17b
20	65.4 ± 18.61ab	63.50 ± 21.65ab	100 a	74.97 ± 14.43a	100 a	100 a	100 a	27.50 ± 14.64b

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

Table 4. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Bushehr province during 2001.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	38.8± 8.24c	54.56± 0.38bc	64.8± 2.04b	59.93± 12.34b	60.63± 4.71b	89.50± 2.41a	57.4 ± 0.28bc	66.33± 6.01b
7	25.13± 0.89c	56.00± 25.17bc	58.67± 8.29bc	75.93± 12.17ab	66.17± 8.58ab	97.00± 2.29a	71.00 ± 7.10ab	62.20± 5.40ab
14	89.93± 5.80a	75.60± 12.37ab	59.10± 21.67ab	87.40± 11.02a	33.63± 29.78bc	1.93± 1.93c	3.13 ± 1.59c	3.53± 2.68c
20	6.99± 0.37a	3.93 ± 2.39a	5.30 ± 2.33a	4.96± 1.67a	2.43 ± 1.39a	4.20± 1.55a	3.23 ± 3.23a	9.33± 0.10a

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

All treatments effects on infested Mazafati date variety by DPSM in Bam region of Kerman province found at increasing rate during 1st year, from 3rd day sampling interval, followed by absolute control from 7th day onward. But water treatment up to14th day remained sustain and declined sharply to amount of 5.75% during 20th day sampling time (Table 9). Water treatment effects during 2nd year under higher mean of mite population (Table 1) recorded higher (Table 9) than 1st year of study (Table 8). This result emphasizing that water sprayed treatments under hot and dry condition in Bam region could control DPSM better even than other pesticide treatments (Table 9).

Table 5. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Bushehr province during 2002.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	38.27 ± 12.40a	40.60 ± 6.70a	83.07 ± 9.44a	64.33 ± 17.41a	67.33 ± 8.41a	68.00 ± 17.46a	73.73 ± 9.16a	43.20 ± 17.83a
7	55.20b ± 1.96c	34.23 ± 18.50c	83.63 ± 6.49a	66.60 ± 4.23ab	77.10 ± 1.34ab	82.77 ± 5.59a	70.57 ± 7.69ab	64.73 ± 5.45ab
14	81.53 ± 5.66a	85.93 ± 1.71a	82.40 ± 8.64a	69.30 ± 10.32ab	84.30 ± 10.92a	92.73 ± 3.62a	88.10 ± 4.56a	55.33 ± 8.17b
20	91.13 ± 4.08a	88.70 ± 5.99a	90.36 ± 6.22a	86.96 ± 5.08a	84.56 ± 13.95a	92.26 ± 5.71a	94.53 ± 2.61a	46.46 ± 9.11b

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

Evaluation of mortality percentage of DPSM on Halileh variety provided above 90% control for treatments [except for amitraz (24.79%) and propargite (54.47%)] up to 20th day sampling time in Khuzestan province during the first year (Table 10). Water treatments with 87.57% mortality; stand in group of (a) as other treatments done during 20th sampling time (Table 10). The treatments effects in 2nd year in Khuzestan province except for water sprayed, seen up to 14th day of sampling time increased and followed with lower control percentage (Table 11). Spider mite population under water treatment only received 53.9% control at 20th day sampling time which reduced about 50% in comparison with the 1st year of study (Table 11).

Table 6. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Sistan and Baluchistan province during 2001.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	100 a	100 a	100 a	100 a	100 a	100 a	100 a	91.96 ± 7.00a
7	95.67 ± 2.16a	94.80 ± 3.55a	100 a	71.85 ± 14.13abc	87.50 ± 7.46ab	77.50 ± 22.5abc	33.33 ± 33.33bc	27.00 ± 23.91c
14	79.30 ± 20.70a	100 a	97.03 ± 2.96a	67.83 ± 23.11a	50.40 ± 25.21a	71.27 ± 14.62a	0b	93.50 ± 6.50a
20	69.61 ± 23.09a	91.67 ± 8.33a	83.53 ± 16.46a	97.44 ± 2.56a	95.70 ± 4.30a	80.57 ± 11.29a	0b	98.69 ± 1.31a

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

Table 7. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Sistan and Baluchistan province during 2002.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	66.14 ± 14.93abc	74.43 ± 9.90a	73.46 ± 16.15ab	26.69 ± 11.68c	48.34 ± 19.29abc	51.34 ± 16.31abc	60.13 ± 16.07abc	34.30 ± 24.14bc
7	52.77 ± 7.03a	61.03 ± 14.39a	69.48 ± 24.72a	53.03 ± 19.85a	89.93 ± 9.20a	64.13 ± 23.08a	89.07 ± 6.36a	95.12 ± 4.84a
14	76.42 ± 18.19ab	73.44 ± 13.57ab	94.14 ± 0.93a	76.88 ± 8.42ab	67.21 ± 23.99ab	92.23 ± 5.40a	63.61 ± 19.25ab	32.95 ± 20.74b
20	29.87 ± 12.05b	88.32 ± 4.16a	88.92 ± 6.39a	65.42 ± 19.65a	84.87 ± 9.87a	88.82 ± 1.35a	84.50 ± 4.71a	73.37 ± 13.11a

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

Table 8. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Kerman province during 2001.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	94.49 ± 2.15a	97.13 ± 0.41a	83.68 ± 13.06a	96.95 ± 0.90a	95.16 ± 1.79a	90.36 ± 2.37a	98.29 ± 0.98a	88.46 ± 1.04a
7	99.42 ± 0.57a	100a	99.02 ± 0.98a	99.43 ± 0.50a	98.90 ± 1.09a	95.35 ± 3.44a	99.41 ± 0.59a	79.69 ± 1.05b
14	100a	100a	100a	100a	100a	100a	100a	88.16 ± 5.28b
20	100a	100a	100a	100a	100a	100a	100a	5.75 ± 2.10b

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

Table 9. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Kerman province during 2002.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	96.18± 0.99a	97.58± 1.50a	87.53± 2.71a	86.09± 1.31a	89.92± 3.43a	61.88± 19.47b	82.36± 2.48ab	82.17± 2.80ab
7	97.42± 0.63a	99.41± 0.58a	98.27± 1.27a	99.26± 0.42a	98.57± 0.76a	90.87± 2.33C	99.24± 0.75a	94.06± 2.17b
14	100a	100a	100a	100a	100a	100a	100a	86.43± 2.74b
20	100a	100a	100a	100a	100a	100a	100a	100a

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

Table 10. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Khuzestan province during 2001.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	69.74 ± 25.06a	95.04 ± 4.96a	89.73 ± 7.00a	82.19 ± 3.18a	83.33 ± 10.13a	84.17 ± 8.70a	74.06 ± 12.39a	94.24 ± 3.25a
7	76.32 ± 20.46a	97.43 ± 2.57a	98.81 ± 1.19a	96.60 ± 1.92a	65.36 ± 24.71a	86.33 ± 6.83a	94.76 ± 4.88a	96.12 ± 0.54a
14	28.53 ± 11.51b	88.12 ± 8.13a	99.38 ± 0.62a	89.64 ± 8.19a	8.77 ± 3.67b	83.12 ± 9.10a	89.88 ± 4.07a	89.95 ± 5.02a
20	24.79 ± 5.95c	97.05 ± 1.17a	90.33 ± 7.75a	91.73 ± 7.72a	54.47 ± 16.15b	91.15 ± 4.40a	90.85 ± 6.86a	87.57 ± 1.59a

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

Table 11. Mean mortality percentage of *Oligonychus afrasiaticus* in different treatments and interval times in Khuzestan province during 2002.

Treatments / Days after application	amitraz	fenprop-athrin	fenpyroximate	fenazaquin	propargite	tetradifon	hexythiazox	water spray
3	87.81 ± 3.52ab	82.77 ± 8.94ab	62.43 ± 15.82b	88.45 ± 3.88ab	88.11 ± 6.55ab	93.95 ± 4.48a	91.69 ± 4.33a	79.39 ± 5.68ab
7	91.99 ± 5.82a	83.51 ± 11.08a	85.42 ± 12.08a	86.87 ± 7.76a	89.55 ± 1.63a	100a	99.55 ± 0.44a	90.92 ± 3.10a
14	91.73 ± 5.56ab	86.79 ± 6.02b	92.14 ± 5.98ab	92.34 ± 4.85ab	87.51 ± 0.64ab	100a	100a	83.05 ± 1.10b
20	79.02± 10.89ab	86.35 ± 2.24a	82.66 ± 12.71ab	86.94 ± 4.82a	89.20 ± 3.70a	93.96 ± 0.02a	90.52 ± 3.74a	53.97 ± 21.46b

Mean mortality percentage with same letter in each row statistically are different at the level of one percent ($p > 0.01$).

DISCUSSION

Out of many spider mite species playing economic roles on leaves contents of orchard trees in Iran (Arbabi *et al.* 1998), only *O. afrasiaticus* damages directly seen and noticeable on most commercial date fruits varieties in Iran (Arbabi and Paknazar 2000). Activity and period of damages of DPSM population mostly occurred during late April–September from south west toward south east of the country. First sign of spanning web by DPSM around date fruits (Fig. 1) with mean of 3.19 to 6.14 (Table 1) in two years studies observed during April–May in Khuzestan province in south western part of Iran. Incidence of this mite in Sudan reported to attack fruits in Hababok stage at first week of April and mite population reached the peak (93 adults + 46 nymphs/fruit) during first week of May (Yousof and Mahmoud 2013). While in Tunisia period activity of DPSM, mite mostly outbreak during 1st to 3rd week of July (Ben Chaaban *et al.* 2011). Mean generation time of DSPM during months of May–August in all date orchards in southern part of Iran due to longest photoperiods along with increasing temperature become less and span of web around the date clusters acts as a shelter for mite feeding (Fig. 2). Under this condition, DSPM population completely deprived liquid contents of date fruit on most commercial varieties in those provinces. Pesticides effects in lower mite densities in present study followed with higher mortality percentage and sustainable effects in all provinces (Tables 2–3, 8–11). Mean of DPSM population among treatments, provinces and year of studies were fluctuated between 1.4 to 69 mites on each sampled date fruit (Table 1).The highest mean of 14 mites/date fruit reported during 2006 from Tunisia (Ben Chaaban *et al.* 2011). In Saudi

Arabia, mean of 83.40 and 98.50 mites/date fruit recorded on Sokary and Nabotsif date varieties during July in Riyadh (Aldosari 2009).

High mite control effects during 3rd day sampling found almost identical in Hormozgan and Kerman provinces (Tables 2–3, 8–9). Low and weak mite control effects among treatments recorded in Bushehr and Sistan and Baluchistan provinces (Tables 4–7). Medium to high mite mortality percentage during 3rd day observed in Khuzestan (Tables 10–11). Prolongation control effects up to 20th day by those treatments except for water sprayed observed during 1st year of study in Kerman province (Table 8). The highest mite mortality percentage among examined acaricides/insecticides, recorded 89.5% for tetradifon with half a century history in date orchards of Iran. Higher effects at lowest dose of 0.3 ppm was seen for fenazaquin (Tables 2–11). In Saudi Arabia, comparison of tetradifon with other acaricides showed that after neoron, kelthane, peropal, it controlled DPSM population (Al-Doghairi 2004). Mixing fenpropathrin with hexythiazox acaricide in Libya also gave satisfactory results (Endongali *et al.* 1988). Absolute (100%) with long lasting control of DPSM up to 20th day sampling time, observed for water treatment during 1st year in Hormozgan (Table 2) and in the 2nd year in Kerman provinces (Table 9), while ineffective control of this treatment on DPSM at 20th day between provinces recorded 2.43% during the 2nd year in Bushehr province (Table 5). Screening side effects of those treatments on date leaves and clusters without any phytotoxicity observed in two years studies in all provinces. Moreover, application of hexythiazox on *Anytsis baccarum* (Linnaeus), a predatory mite, found safe and for amitraz and fenpropatrin harmful (Latifian and Arbabi 2004). Toxicities treatments on natural occurrence of *Stethrous* spp. (Coleoptera: Coccinellide) in date orchards found harmless due to continuous activities of this insect predator before and after treatments in all provinces. The results indicating that, low doses of fenpyroximate, fenazaquin and hexythiazox with high mortality rates, make them an alternative for substitution and protect further mite resistance. In a study about effects of different doses of spiromesifen 24% SC on DPAM, dose of 0.3 ppm with maximum mortality percentage reported from Bam region of Iran (Asari and Arbabi 2015). Water sprayed treatment under hot and dry condition in Bam region not only suppressed DPSM population, also recommended a safe method for natural enemies, environment and reducing cost of protection.

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ارزیابی تیمارهای مختلف درکنترل کنه گرد آلود خرما (*Oligonychus afrasiaticus* (McGregor)) در نخلستانهای خرمای ایران

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چکیده

کنهٔ گردآلود خرما مهم‌ترین آفت نخلستان‌های خرما در ایران و کشورهای خاورمیانه است. تاثیر آفت‌کش‌های آمیتراز (amitraz)، دانیتول (fenpropathrin)، اورتوس (fenpyroximate)، پراید (fenazaquin)، اومایت (propargite)، تترادیفون (tetradifon)، نیسورون (hexythiazox)، و آب‌پاشی در کنترل جمعیت مراحل فعال کنهٔ گردآلود خرما مطالعه شد. طرح آماری بلوک‌های کامل تصادفی با سه تکرار و هر تکرار شامل ۱ نفر نخل در ارقام مردارسنگ، کبکاب، هلیله، مضافتی و برهی به ترتیب در استان‌های هرمزگان، بوشهر، خوزستان، کرمان و سیستان و بلوچستان استفاده شد. نمونه‌برداری با جدا کردن دو خوشه از هر تکرار و شمارش جمعیت مراحل فعال کنه روی ۲۰ عدد خرما به ترتیب در فواصل زمانی یک روز پیش، ۳، ۷، ۱۴ و ۲۰ روز بعد صورت گرفت. میانگین جمعیت کنهٔ گردآلود خرما پیش از اعمال تیمارها بین ۱/۴کنه تا ۶۹ کنه متفاوت در مناطق مختلف کشور ملاحظه شد. تجزیه آماری میانگین تلفات کنه گردآلود خرما در میان تمامی فاکتورهای مورد بررسی معنی‌دار ملاحظه شد ($p > 0.01$). نخستین وآخرین نشانه‌های تشکیل شبکه‌های تار در پیرامون خوشه‌های خرما به ترتیب در خوزستان، و سیستان و بلوچستان و طی ماه‌های فروردین–اردیبهشت و تیر–مردادماه مشاهده شد. درصد کنترل زیاد، متوسط و ضعیف جمعیت کنهٔ گردآلود خرما درمیان تیمارها، سه روز بعد و طی دوسال به ترتیب در استان‌های هرمزگان، کرمان، خوزستان، بوشهر و بلوچستان ثبت شد. کنترل کامل جمعیت آفت کنه، در دومین سال بررسی و ۲۰ روز بعد درکرمان مشاهده شد. بیشترین درصد تلفات جمعیت کنهٔ گردآلود خرما برای کنه‌کش تترادیفون با سابقه بیش از نیم قرن در نخلستانهای کشور و کنه کش فنازوکوئین با غلظت مصرفی ۰/۳ در بیشتر نخلستان‌های مورد بررسی ملاحظه شد. کنترل قطعی جمعیت کنه (۱۰۰٪) همراه با تاثیر پایدار در نوبت نمونه‌برداری ۲۰ روز دراستان‌های هرمزگان و کرمان و برای تیمار آب‌پاشی ثبت شد.

واژگان کلیدی: کنه‌کش‌ها؛ کنترل؛ ارقام مختلف خرما؛ استان‌های مختلف؛ مرگ.

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