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Biology of the two spotted spider mite, *Tetranychus turkestani* (Acari: Tetranychidae) on four common varieties of eggplant in Iran

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Abstract: Spider mites are important pests for various crops throughout the world. Host plants can exert profound effects on biological and ecological characteristics of tetranychid mites. In the southern provinces of Iran the major tetranychid species is *Tetranychus turkestani*, which is called the strawberry or Atlantic mite. The life history parameters of *T. turkestani* on four aubergine varieties, Esfahani, Qasri (two local varieties), Blackbeauty and Inerash (imported varieties) were studied on the lower surface of eggplant leaves under laboratory conditions. Survival rates of eggs on Qasri and Inerash cultivars were 100%, while on Esfahani and Blackbeatuy they were 93% and 88% respectively. The larval developmental period of T. *turkestani* differed on the four cultivars. Inerash had the shortest development time, while those of the other three cultivars were not significantly different. The pre-oviposition period of the mite was significantly different for Esfahani, Qasri, Inerash and Blackbeauty, with the longest pre-oviposition period relating to Inerash. There were major variations in the total number of eggs laid by each female mite. The total numbers of eggs laid by each female mite on the four cultivars during the oviposition period were 1-67 on Qasri, 3-95 on Esfahani, 2-61on Blackbeauty and 37-104 on Inerash. Given its survival rate and the duration of the development time of its immature stages, the total longevity of adults, and the total number of eggs per female per day, it was concluded that the Qasri cultivar is not as suitable as a host as the other three cultivars in the south of Iran.

Key words: *Tetranychus turkestani*, eggplant, life history parameters

Introduction

Spider mites are important pests for various crops throughout the world (Jepson *et al*., 1975; Carey & Bradley, 1982; Leigh, 1985). The biological characteristics of the spider mite are affected by various factors, for example, with host plants often exerting several profound effects on the biology of tetranychid mites (Henderson & Holloway, 1942; Watson, 1964; Wilson, 1994). These effects may be manifested as differences in developmental rate, survival, reproduction and longevity attributable to differences among plant species, varieties or cultivars (Nemati, 2005). In the southern provinces of Iran, the major tetranychid species is *Tetranychus turkestani* Ugarov & Nikolski, the strawberry or Atlantic mite (Kamali, 1988).

So far, no studies have been carried out on the biological and ecological characteristics of the mite on the eggplant in Iran (Nemati, 2005). As an initial step in our investigation into population biology, we examined the effects of four aubergine varieties (Blackbeauty, Inehrash, Qasri and Esfahani), acting as host plants, on some biological characteristics of *T. turkestani*.

Material and methods

The stock culture of *T. turkestani* used in this study was initiated by mites obtained from the eggplant field of Shahid–Chamran University during the summer of 2002. All experiments were conducted under laboratory conditions at 30±1 °C, 55± 10% relative humidity and with a photoperiod of 16:8(L:D).

To study the life history parameters of *T. turkestani* on four aubergine varieties, the lower surface of a leaf disk was maintained on water–soaked cotton. A water saturated barrier of cello-cotton was placed along the leaf periphery and down the mid-vein of each leaf. This area was then subdivided into 6–8 narrower small rectangular cells using strips of cello-cotton. One female was placed in each of the cells and removed after 8h whether it had laid eggs or not. All but one of the eggs were removed from each cell. Observations were made on a daily basis at 8 a.m., 4p.m. and 8p.m. until each mite had completed its development. Two mature males were confined with each virgin female throughout her pre-oviposition period (Tanigoshi *et al.*, 1975). The number of eggs laid by the mated females was recorded every day (at 24 hour intervals). One–way ANOVA was used for statistical analysis. Means were separated by the Duncan Multiple Range Test (α=0.05).

Results and discussion

Development times for immature stages of *T. turkestani* are shown in Table 1. Analysis of variance showed that the mean egg development time differed significantly among varieties (F=281.28, df=176, P<0.0001). The shortest period was on Qasri and the longest was on Esfahani. Since there was no nutritional relationship between the eggs and the substrate (host leaf), it is probable that the difference was due to females acquiring nutrition from the host plant. Survival rates for eggs on Qasri and Inerash cultivars were 100%, and on Esfahani and Blackbeauty, they were 93% and 88%, respectively (Table 2). The developmental periods for T. *turkestani* larvae on the four cultivars were significantly different (F=281.28, df=176, P<0.0001). Inerash had a shorter development time for larvae than the other three cultivars, while no significant differences were observed among Esfahani, Blackbeauty and Qasri (Table 1).

Table 1: Mean (±SD) development time (days) for *T. turkestani* immature stages on four eggplant cultivars under laboratory conditions (30°C, 55%±10 R.H and16: 8L:H).

	Cultivars			
Life stage	Esfahani	Qasri	Inerash	Blackbeauty
Egg	3.88±0.10	1.59±0.19	1.88±0.30	2.35±0.27
Larva	0.79±0.34	0.76±0.16	0.64±0.11	0.77±0.04
First chrysalis	0.59±0.26	0.62±0.29	0.48±0.18	0.49±0.04
Protonymph	0.69±0.23	0.86±0.25	0.49±0.14	0.57±0.19
Second chrysalis	0.57±0.18	0.58±0.08	0.51±0.14	0.48±0.07
Deutonymph	0.59±0.13	0.87±0.25	0.66=0.20	0.52±0.13
Third chrysalis	0.55±0.12	0.83±0.26	0.55±0.17	0.55±0.06

Development times for the first chrysalis stage on Qasri and Inerash were different, but no significant difference was observed on the other two cultivars. The shortest development

period for the first chrysalis stage and protonymph was on Inerash, and the shortest for the second chrysalis and deutonymph was on Blackbeauty. There was a significant difference in total development time from egg to third chrysalis on all cultivars. However, Blackbeauty and Quasar were in the same statistical group.

Table 2: Percentage survival of T. *turkestani* eggs and immature stages on four eggplant cultivars under laboratory conditions (30°C, 55%±10 R.H and16: 8L:H).

	Cultivars			
Life stage	Esfahani	Qasri	Inerash	Black beauty
Egg	93	100	100	88
Active immature	82	83	92	98
Total immature	75	77	87	83

Table 3 shows the development time of three periods of the adult stage of *T. turkestani* on the four cultivars. Total time for development of the adult stage was also calculated. The pre-oviposition period was significantly different (F=5.15, df=137, P=0.0021) on Esfahani, Qasri, Inerash and Blackbeauty and the longest pre-oviposition period was on Inerash. The oviposition period of adults on three of the cultivars was different, but no significant difference was seen between Inerash and Qasri (Table 3). There was also a significant difference in the post-oviposition period of the mite on the four cultivars. Although there was variation in the total development period of the adult stage, no significant differences were seen in the lifespan of adults living on all cultivars.

Table 3: Mean (±SD) development time (days) of *T. turkestani* adults on four eggplant cultivars under laboratory conditions (30°C, 55%±10 R.H and16: 8L:H).

	Cultivars			
Adult stage	Esfahani	Qasri	Inerash	Blackbeauty
Pre-oviposition	0.77±0.35b	0.86±0.30b	1.12±0.29a	0.67±0.33b
Oviposition	5.88±1.93b	4.41±2.34b	6.47±2.74b	9.30±3.93a
Post-oviposition	0.97±0.38b	0.24±0.24c	0.84±0.20b	1.45±0.93a
Total adult stage	7.03±2.19a	5.52±2.25a	7.85±2.88a	8.88±5.60a

There were large variations in the total number of eggs laid by each mite. The total number of eggs laid by each female on four cultivars during the oviposition period was 1-67 on Qasri, 3-95 on Esfahani, 2-61on Blackbeauty and 37-104 on Inerash. Changes in the total number of eggs per day corresponding to all the female mites used in the experiment and the mean number of eggs per day laid by each female are shown in Figures 1 and 2. Analysis of variance showed a significant difference in total eggs per mite on different cultivars (F=2.92, df=61, P=0.04). The Duncan test indicated that the number of eggs per mite on Qasri was smaller than the number of eggs laid by other mites feeding on the other three cultivars: Esfahani, Blackbeauty and Inerash.

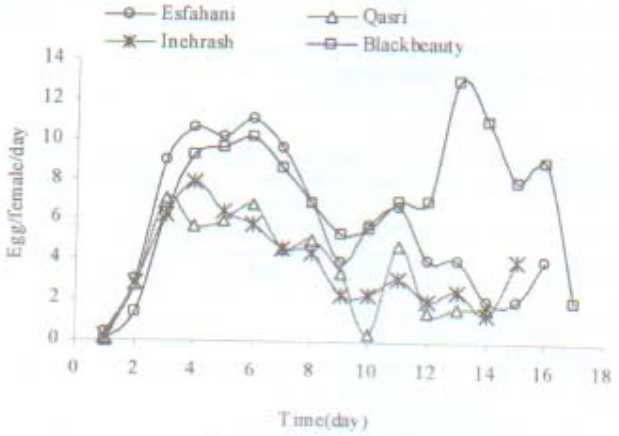

Figure 1. Mean number of eggs laid daily by *T. turkestani* females on four eggplant varieties under laboratory conditions (30°C, 55%±10 R.H and16: 8L: H).

Due to the survival rate and duration of the development time of the immature stages, the total longevity of adults, and the total number of eggs per female per day, it was concluded that the Qasri cultivar is not as suitable a host as the other three cultivars. This was confirmed by comparing demographic parameters of *T. turkestani* reared on different cultivars (Nemati 2005). Cagle (1956) and Andres (1957) (as reported in Carey & Bradley, 1982) were the first researchers to examine the biological and demographical characteristics of *T. turkestani* at different temperatures.

Carey and Bradley (1982) studied the demographic parameters of the Atlantic mite on cotton under different temperature regimes. There were no reports of biological traits of *T. turkestani* on aubergine varieties. Due to the important influence of the host plant on the biological parameters and differences in experimental procedures, we cannot directly compare our results with those of other researchers. However, such studies could be conducted in different parts of the word under varying conditions in order to find varieties resistant to *T. turkestani*, and thereby reduce the need for insecticide applications.

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