

## RESISTANCE OF TWO CULTIVARS OF *RICINUS COMMUNIS* L. TO INFESTATION BY *ETRANYCHUS URTICAE*

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**ABSTRACT:** *An laboratory experiment was conducted to investigate the biological aspects of the two spotted spider mites Tetranychus urticae Koch when fed on two different castor bean cultivars. The results indicated that the red cultivar (Hendi 21) prolonged the life cycle of the mite more than the green one (Hendi 12). However, the highest number of eggs 9.97 was observed when the mites female fed on the green cultivar. Studies revealed that most of the anatomical characteristics of red cultivar were exceeded that of the green one. This indicated that the red cultivar is more resistant than the green to infection by mites due to the presence of many poisons glands.*

**Key words:** *Ricinus communis Tetranychus urticae.*

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### INTRODUCTION

Castor bean plant is one of the most important oily crops promising in some medicinal industry. Castor bean plants *Ricinus communis* L. (Euphorbiaceae) is planted either to extract seed oil or to rear Castor silk worms. Jana Kiraman (1961) stated that eri-silk worm *Attacus ricin* Boisdu feed on Castor *Ricinus communis* El-Garhy (1974) demonstrated the possibilities of cultivation of castor plants on the banks of the water streams throughout the Country (Egypt). It is commercially cultivated mainly in Brazil, India, South Africa and several other countries for its industrial and medicinal use (Lamp, 1985, Cooper 1989). Seeds are used to make ornamental neck laces and there are commercially available in plant stores (Kinamore 1980). Host preference in tetranychidae is usually noticed in nature. Some plants are more susceptible for mite infestation than others, and also between the different varieties in the same host. As a result of such preferences, differences in the rate of mite population growth occur. This population increase depends on duration of life cycle and female fecundity. Therefore, experiments were carried out to explain reasons for host-preference in *T.urticae* when fed on the two castor bean *R. Communis* cultivars under the laboratory conditions.

## **MATERIALS AND METHODS**

### **Biological studies**

Stock culture of *T. urticae* was collected from leaves of *R. communis* L. El-Gharbia governorate and used to start culture. The stock colony was maintained on castor bean plants *R. communis* L. grown from seed and transplanted in plastic pots (20 cm in diameter). They were maintained in the laboratory at  $25\pm 1$  C° and  $65\pm 5$ % R.H. Plants were kept until they were severely damaged by the spider mites, newly plants being added when needed. After several generations, mites from the stock colony were used for the tests. Three identified adult females of *T. urticae* were planted and reared on a plant leaf disk taken from the green cultivar (Hendi 12) of castor bean plants. Three of these prepared disks represented the first treatment and a similar treatment was taken their botanical disks from the red cultivar (Hendi 21) of castor plants. The 2 treatment disks were kept at  $25\pm 1$ C° and 70% R.H. Observation concerning the biological aspects were daily recorded till the life span completed. An analysis for cell juice of the green and red fresh leaves using HBLC apparatus was conducted in the stock culture of *T. urticae* and was collected from leaves of *Ricinus communis* L. at EL- Garbia governorate and used to start culture. Plants were kept until they were laboratory analysis in plant pathology Research Institute, Agricultural Research Center, (A. R. C.), Egypt.

### **Histological studies.**

Specimens of the median part of leaf of two cultivars of castor bean plant, (green and red) were killed and fixed for at least 48 hours in F. A.A. (10ml formalin, 5ml glacial acetic acid, 50ml alcohol 95%, 35 distilled water), then washed in 50% ethyl alcohol and dehydrated in a normal butyl alcohol series before being embedded in paraffin wax (Melting point  $25-54$  C°). Transverse sections (20 $\mu$  thick) were cut using a rotary microtome then double stained with crystal violet / Erythrosine combinations, cleared in xylene and mounted in Canada balsam. The counts and measurements in microns of certain histological features in transverse sections through median portion leaf blade.

## **RESULTS AND DISCUSSION**

Host preference might be related to some physical or chemical factors characteristic of plant. The present investigation of such factors showed difference in the structure and chemical constants of the two castor bean leaves. Kuenen (1951), Mohamed (1964), Koukounig *et al* (1972), Sawiren (1978) and Hassan 1986 reported that cuticle thickness might affect mite feeding. Also Sawires, (1978), stated that resistant varieties of soybean possess thicker hairs than the more susceptible. On the other hand, Hassan

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(1986) mentioned that the probable cause of host preference between the two grapevine varieties is the microelements such as Fe, Zn, Cu and Mn

### Biological aspects of *T.urticae* on *R.communis* L.

Table (1) shows the obtained biological parameters which were recorded for the different biological aspects for 3 adult females of *T.urticae* reared on the fresh leaves of the castor bean plants *R.communis* at  $25\pm 1$  C° and 70% R.H. The obtained data showed that there were considerable differences in values of some important parameters, while some others were not affected when the mite reared on the 2 cultivars of castor plants, In case of rearing the mites on the red cultivar of the castor plants, the values of total number of posited eggs, hatchability, fecundity and egg daily rate recorded 17.6, 36015%, 5022 and 2041% respectively.

These 4 important values were lower than the similar values in case of rearing the mites on the green castor cultivar which were 30 , 51.8% , 9.97 and 4.05 respectively. The above mentioned results showed that the red castor bean plants seems to be not suitable enough as a host plant for the mite individuals. This may be due to histological structure differences between the green and red cultivars, in addition to different in cells juice in the 2 cultivars (fig 1, 2 and 3). In the same time the obtained data indicated that there was not noticeable difference in some other characters as longevity period which recorded 7.67 days in the both cases and in oviposition period which recorded 3.0 days in case of rearing the mites on the red cultivar and 3.67 days for the green one Table (1) . However, the life cycle recorded 9.67 and 9.00 days and life span was 17.33 and 17.50 days for the green and red cultivars respectively. HPLC analysis for cell juice in green and red cultivars of castor bean plants proved the same above mentioned trend. Total phenols compound recorded 2.70 mg /mg fresh weight in the green cultivar which it was 3.02 mg/mg fresh weight in case of red cultivar. The same analysis showed that no glycosides were presented in the two cultivars.

### Histological studies:

Data presented in Table (2) revealed that the two local cultivars of Castor plant exhibited a different behavior related to damage with mite and role of internal structure for defense against damage . It is obvious that the red cultivar own some histological features which help to reduce the damage caused by mites than green one (fig 4-5) as following .

Transverse section in leave of the two cultivars cleared that the red one exceeded in most histological measurement and counters compared with green cultivar in addition the red cultivar contained a thick upper cuticle layer than green one. This increasing was 100% over green cultivar, wherease

Table (1): Biological aspects of rearing *Tetranychus urticae* on two different cultivars of castor bean plants.

Parameters	The biological parameters of 3 adult females of <i>Teranychus urticae</i> reared on fresh leaves of the two castor bean cultivars.							
	Green cultivar				Red cultivar			x ± SD
	R1	R2	R3	x ± SD	R1	R2	R3	
Preoviposition (days)	1	1	2	1.33 ± 0.47	1	1	1	1.00 ± 0.0
Oviposition (days)	3	4	4	3.67 ± 0.47	3	2	4	3.0 ± 0.82
Post oviposition (days)	3	3	2	2.67 ± 0.47	2	2	4	2.67 ± 0.94
Longevity (days)	7	8	8	7.67 ± 0.47	6	5	9	6.67 ± 1.70
Total immature (days)	3	5	5	4.33 ± 0.94	7	---	3	5.0 ± 2.0
Number of eggs	46	31	13	30.0 ± 13.50	39	3	11	17.67 ± 15.43
Hatchability	52%	41.9%	61.5%	51.3%	35.3%	---	36.5%	36.15%
Fecundity (eggs /female)	15.30	10.30	4.30	9.97 ± 4.50	11	1	3.66	5.22 ± 4.22
Egg daily rate	6.66	3.87	1.61	4.05 ± 2.06	6.50	0.60	0.12	2.41 ± 2.90
Life cycle (days)	7	11	11	9.67 ± 1.89	11	--	7	9.0 ± 2.0
Life span (days)	14	19	19	17.33 ± 2.36	17	--	18	17.50 ± 0.50

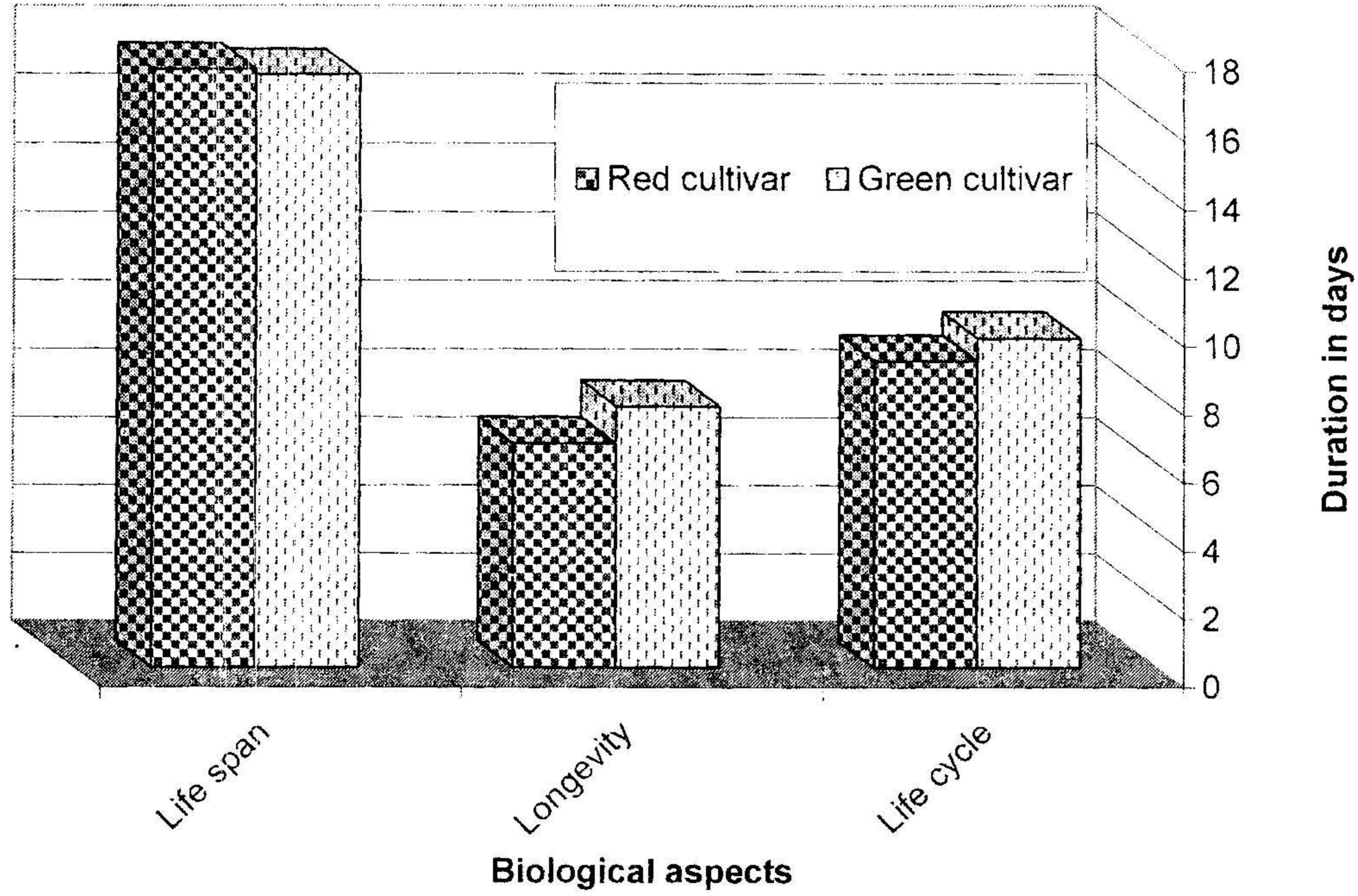


Fig. ( 1 ) : Duration of the two spotted spider mites, *Tetranychus urticae* adult females when fed on two castor cultivars.

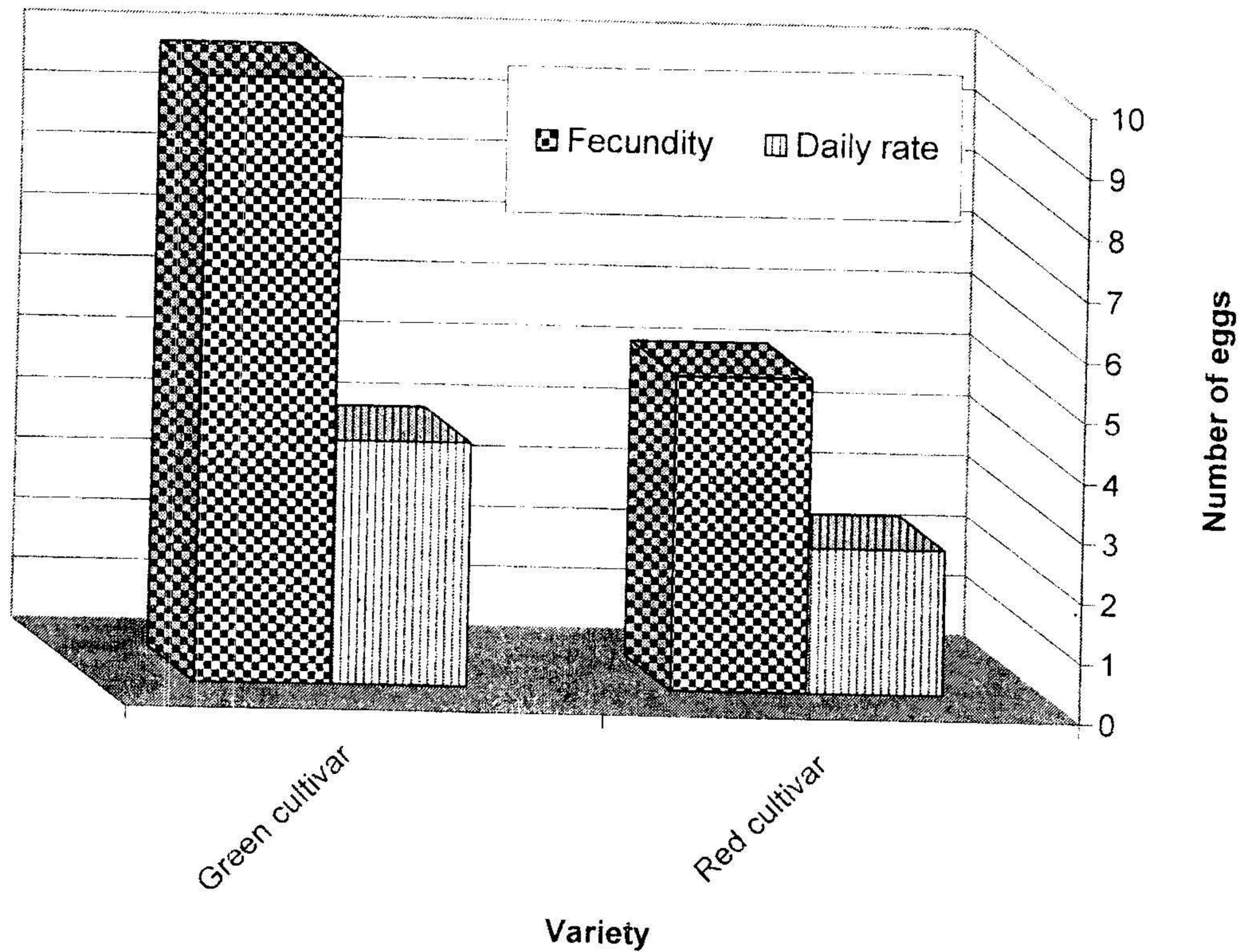


Fig. (2) : Fecundity of adult *Tetranychus urticae* female when fed on two different castor cultivars.

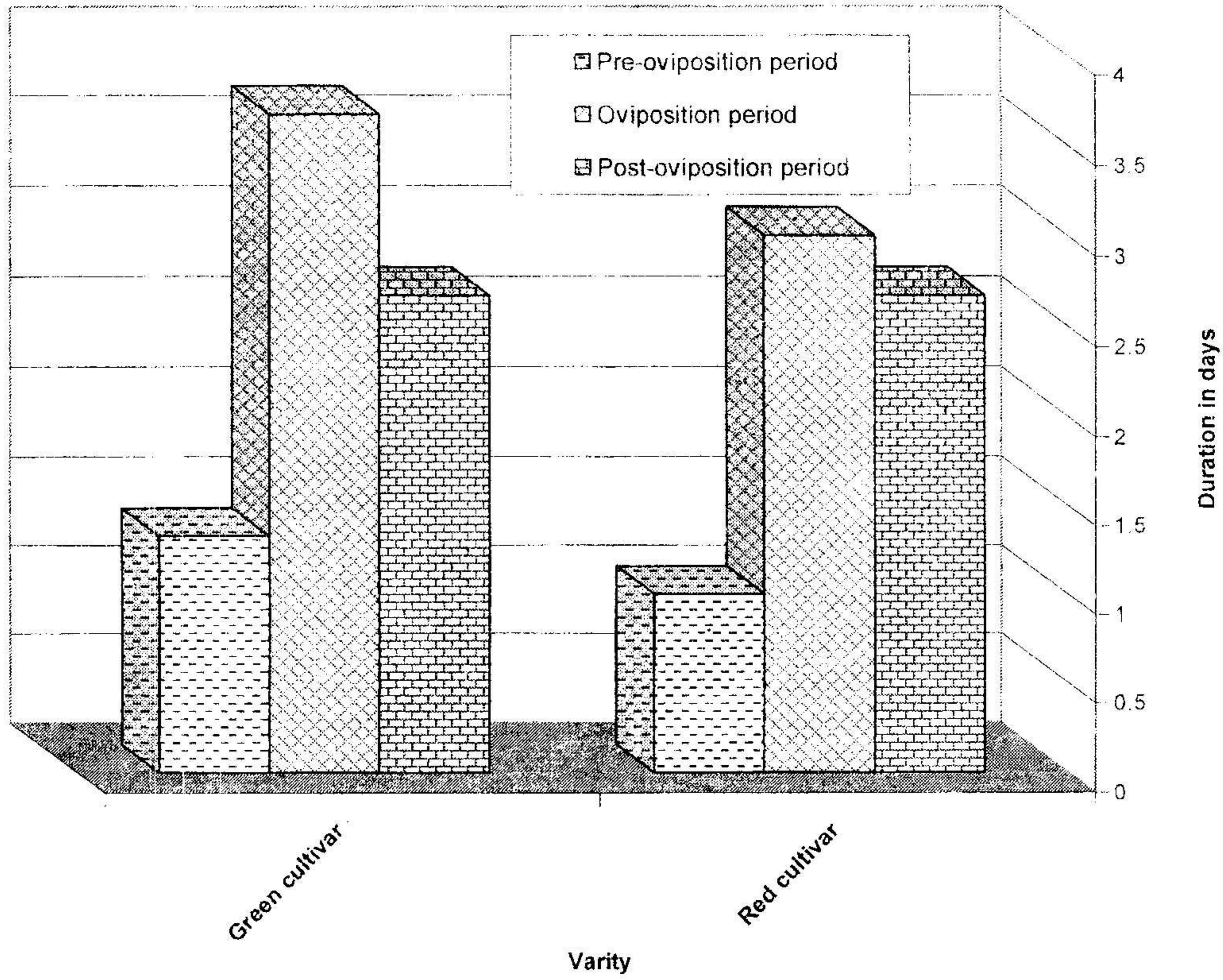


Fig. (3) : Longevity of *Tetranychus urticae* female when fed on two different castor cultivars

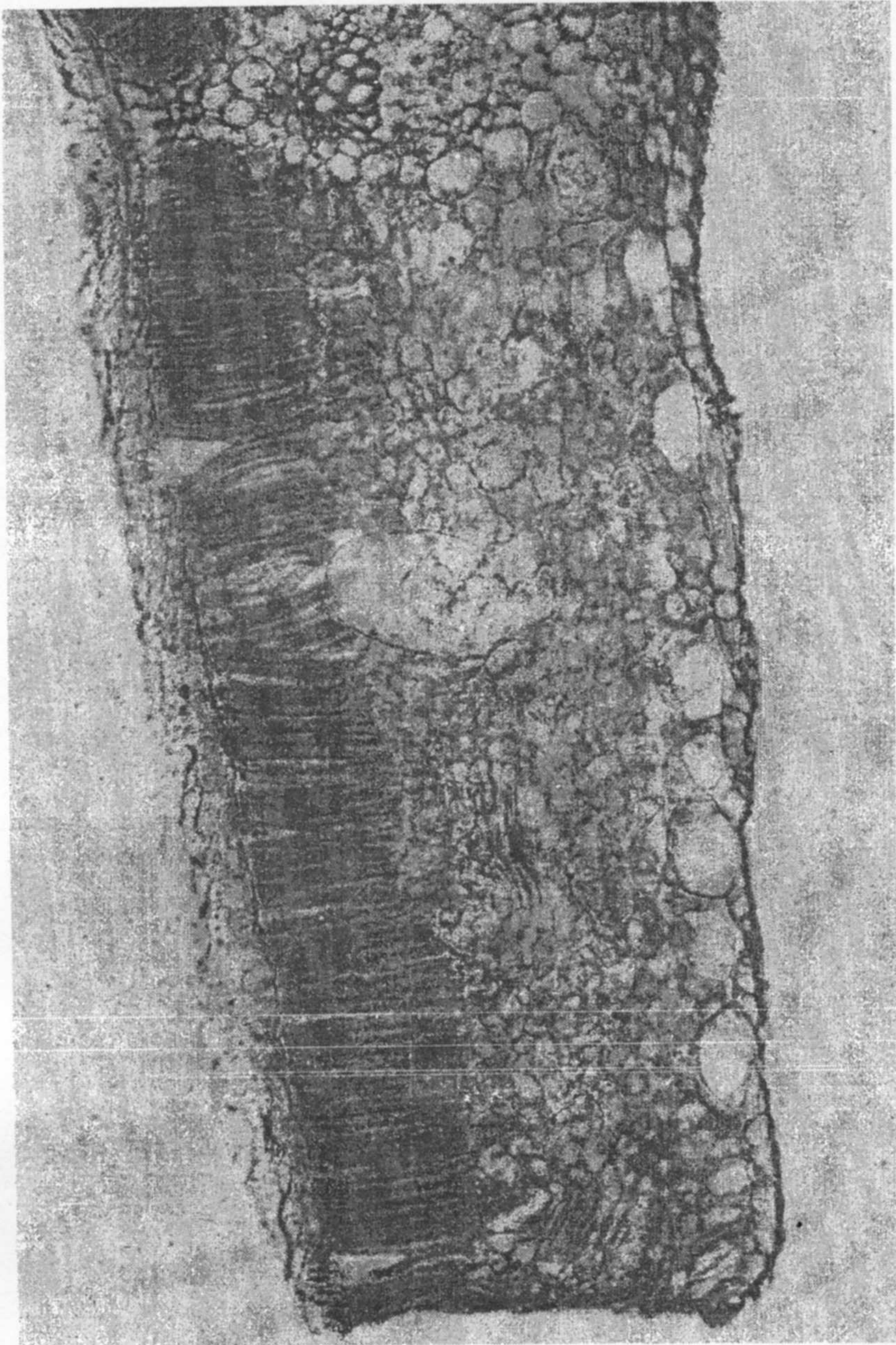
**Table (2): Some measurements and counts in micron of microscopic transverse section through middle part of leaf of two castor bean cultivars.**

Characteristics	Green	Red
Balve thickness	120	250
Thick of upper cuticle	5	10
Thick of upper epic	21	15
Thick of lower epic	20	7.5
Thick of midrib	1210	1900
Thick of collenchymas of upper midrib	110	210
Thick of collenchymas of lower midrib	70	80
Thick of xylem	80	200
Thick of phloem	70	80
Number of vessels	9	17
Number of oil glands	5	8
Dimention of oil glands	27.5	45

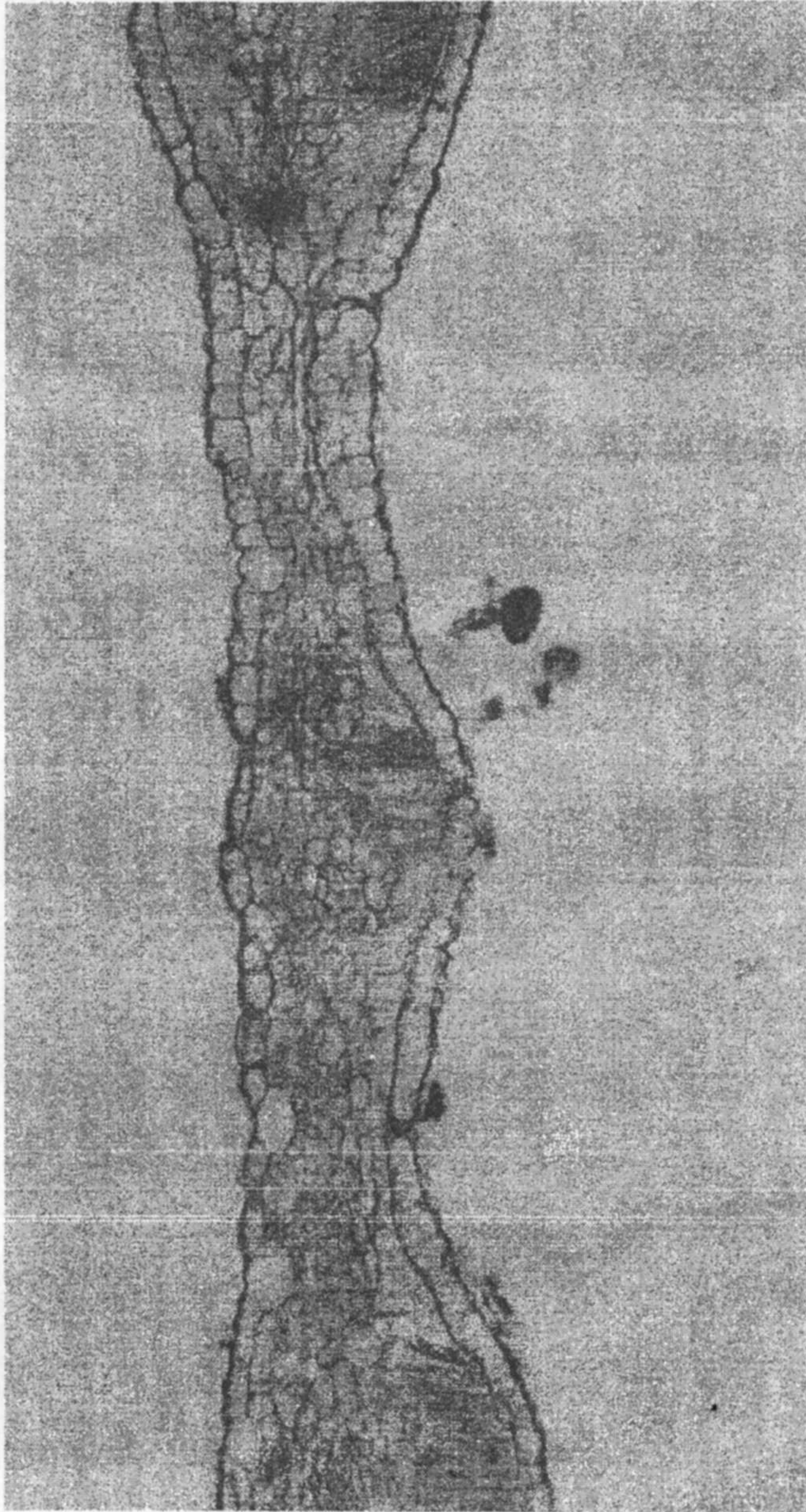
thickness of upper of epidermis red cultivar was thin than green one by 28.57% Collenchyma were tissues thick in the red than the green by 90.9% and 14.28% for upper and lower midribe respectively. Thickness of midribe of red cultivar was bigger than green by 57.2% Vascular bundle was thicker in red than green , the increase in vascular bundle thickness was due to the increase for both xylem and phloem thickness which recorded 50% and 14.28% over green respectively. Number of vessels exhibited a high number for red cultivar than green one which recorded 17 vessels for red compared with 9 vessels for green variety.5- Number of oil glands was increased in red (8 gland) than green (5 glands), also, the dimensions of glands was high in red by 45 $\mu$  than 27.5 $\mu$  in green. it,s obvious from data mentioned before that red castor bean plant own some histological characters which make it more resistance for mites damages which include increase in cuticale thrckness, structure of collenchyma and xylem tissue . Also red castor bean plant own the best histological internal defince aganist mites which was verified by increasing the number and dimentions of oil glands which contain mainly resinolic acid. This occupied high and main value related to other acids in addition, this acid may be very toxic to mites which explain the resistance of red cultivar to mites than green one. Green cultivar very susiptable to inheritance by mites where tumor and malformation, of mesophyll were observed.



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**Fig. 4: Cross section through the middle part of leaf for red cultivar.**



**Fig. 5: Cross section through the middle part of leaf for green cultivar.**

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## مقاومة صنفين من نبات الخروع للاصابة بالعنكبوت الأحمر

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### الملخص العربي

أجريت تجربة لدراسة المظاهر البيولوجية للعنكبوت الأحمر العادي *Tetranychus urticae* Koch. عند تغذية على صنفين من نبات الخروع وهما الصنف الأحمر (هندي ٢١) والصنف الأخضر (هندي ١٢) وأوضحت الدراسة أن الصنف الأحمر قد أطال فترة الحياة للاكاروس أكثر منه في حالة الصنف الأخضر وكانت أعداد البيض الموضوع بواسطة إناث الاكاروس على الصنف الأخضر أعلى منها في حالة التغذية على الصنف الأحمر حيث بلغ عدد البيض ٩,٩٧ ؛ ٥,٢٢ بيضة عند التغذية على الصنف الأخضر والأحمر على التوالي.

أثبتت الدراسات التشريحية تفوق الصنف الأحمر في معظم القياسات التشريحية عن الصنف الأخضر والذي يرجع إليه تفسير السبب في المقاومة عن الصنف الأخضر خاصة عدد وإبعاد الغدد الزيتية والذي لها دور رئيسي في تفضيل التغذية أو المقاومة من عدمه وذلك من طريق إفرازها لبعض الأحماض التي لها تأثير قاتل للاكاروسات.