

EFFECT OF DIFFERENT KINDS OF FOOD AND TEMPERATURE ON
THE BIOLOGICAL ASPECTS OF THE ASTIGMATID MITE
CALOGLYPHUS BERLESI (MICHAEL)

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ABSTRACT

In this study, the investigations were carried out under laboratory conditions 25 and 30 °C and 70 % R.H., whereas *C. berlesi* fed on pure and treated maize grains with four different plant extracts namely, curcum, garlic, lemon and dencqar. The obtained results indicated that the highest incubation period of *C. berlesi* was noticed when the mites females fed on pure maize grains at 25 °C, (2.45 days) but the shortest period was noticed for females when fed on denqar treated maize grains at 30 °C, (1.70 days). The development of larval, protonymphal and tritonymphal stages of *C. berlesi* was almost similar on the all types of plant extracts on maize grains. Concerning the life cycle of *C. belesi*, it lasted the highest time to reach the adult about 10.01 days when the female fed on denqar maize grains at 25 °C, while the lowest period noticed when the males fed on curcum treated maize grains at 30 °C (7.69 days). Female longevity (pre-ovipositions, oviposition and post- oviposiition periods) of *C. berlesi* female was significantly affected by different types of food and temperature. The highest longevity of *C. berlesi* was noticed when the females fed on pure maize grains (9.51 days) and the shortest period was noticed for female individuals fed on denqar treated maize grains at 30 °C (6.86 days). The number of deposited eggs by the the adult females of *C.*

berlesi was significantly affected by the state of tested maize grains and temperature. The obtained data indicated that the highest number of deposited eggs was noticed for females fed on pure maize grains at 30 °C (192.0 eggs), while the lowest number of eggs was recorded for the individuals fed on denqar treated maize grains at 25 °C, (149.0 eggs).

INTRODUCTION

Mites are a major cause of qualitative and quantitative losses to several stored products and have a great economic importance which cause variable degree of damage not only, they can consume a large amount of stored products, but also, contaminate food with their bodies and extractions, as well as many species attack and feed on the germ of stored grains and seeds, they can penetrate the hard grains and feed directly on the grain kernels, therefore, they destroy their germination power, change the moisture contents of medium, initiating growth and spread mould, **Sinha (1964), Sinha and Wallace (1977), Mathur and Dalal (1985) and Taha (1985)**. Nutrition is one of the important factors which has a modifying effect on growth and life span of mites, the growth of the mite population is directly related with the biological as well as physical factors operating the ecosystem. The mouth parts and digestive system of the astigmatid and granary mites adapted to bite and assimilation of hard particles with the aid of characteristic enzymes, **Emmanuel et al., (1994)**. The acarid mite, *Caloglyphus berlesei* (Michael) belong to a free living mite species. The mites in soil, feeding on decaying plant materials, e.g. fruits, bulb, root or rhizome vegetables and ornamental plants, potatoes, and mushrooms. This mite often occur in compost, green- and mushroom-houses and field cultivation, in damp stored products, e.g. grain, various plant seeds and food-stuffs (**Hughes, 1976; Turk and Turk, 1957; Zakhvatkin, 1941**). *Caloglyphus berlesei* was also observed as invader of broiler-houses,

colonizing poultry manure and as necrophagous species infesting bodies of dead birds, e.g. chickens, geese. *Caloglyphus berlesii* also utilizes other kinds of animal food; sometimes this species will feed on dead insects, e.g. grubs of scarabeid beetles (**Lipa and Chmielewski, 1966; Chmielewski and Lipa, 1967**). The aim of this study is to study the effect of different types of food and on the acarid mite, *C.berlesi* at different temperature.

MATERIALS AND METHODS

Throughout this study, acarid mite, *Caloglyphus berlesii* of family Acaridae was investigated. For obtaining pure culture of female and male adults were placed in the rearing plastic chamber (5.5 cm diameter x 1.5 cm thick), with a bottom covered with a substrate for 0.5 cm filled with a mixture of (cement: clay: charcoal on ratio of 7:2:1) the rearing plastic chamber contained dry yeast granules and few drops of water as a source of food and humidity, and covered with soft plastic cover. The culture was observed daily and kept in an incubator at 25 °C and 75 % R.H. The effect of different food and temperature degrees on biological aspects, fecundity of the acarid mite, *C. berlesii* will investigate. For rearing the mite, newly deposited eggs were transferred singly using 0.3 mm fine Camel hair brush to circular plastic cells (2 cm long and 2 cm thick). Twenty replicates were used for each sexes of the mite (female and male). The used food sources in this study was powder of maize grain (95 %) and the powder of each of (curcum, garlic, lemon (citric acid) and dencqar) (5 % for each one). In this study, the experiments were carried out under laboratory conditions 25 and 30 ± 2 °C and 75 ± 5 % R.H.

RESULTS AND DISCUSSION

Habitat and behaviour:

The acarid mites, *C. berlesi* was isolated from samples of garlic and wheat bran collected from Sharkia Governorate. The two mites passes through egg, larva, protonymph and tritonymph before reaching maturity. Between protonymph and tritonymph a non-feeding hypopus stage may occur. Hypopus specimens are especially adapted for the spreading and survival of some acrid mite species under unfavorable conditions, **Taha** (2014).The hypopus is a phoretic stage which has involved to facilitate distribution, and also, in some cases, to tide over adverse conditions. Hetermorphic males and hypopi are common occurring of the acarid mites. *C. berlesi*. Another interesting biological feature of these mites is an a parity phenomenon i.e. the development of progeny (various stages, egg, larva, nymphs, including hypopi, except imagines) inside the body of the females individuals to normal development outside the female body i.e. viviparity), **Taha** (2014).

Mating:

Mating is necessary for mites of genus *Caloglyphus* as other mites, whereas, female not deposited any eggs without it. The mating process occurs immediately after mergence of adult female. The male had ability to copulate several females, **Taha** (2014), while she accepted copulating more than once per day during its longevity. Male attaches female and climbs its back from behind in an opposite position in a way, thus the male opisthosoma situated on posterior part of the female, where the bursa copulartix situated then, mating required between 20-25 minutes.

Hatching:

Female of *C. berlesi* deposited there eggs randomly in clarks of rearing cells singly under some substrate particles and food. Eggs of these

species are whitish and slightly longitudinal. During hatching, the eggs rupture longitudinally and the larvae crawled out with its hind legs at first. The hatching process took about 30 minutes.

The hatching larva stayed inactive for a short time and then began to move.

Molting:

When the immature stages of *C. berlesi* (larvae, protonymphs and tritonymphs) full grown, they enter the quiescent time in which it seeks a dry hole or crack in the substrate of rearing cell, ceases feeding and moving completely. The body swelled and enlarged which made the cuticle highly stretched. The legs become shrunken and contracted under the body surface. The quiescent individuals never responds to any disturbance. The old skin ruptured along transversal line between dorsal and ventral surface, the hind legs appear from the old skin at the first, then the new developmental stage crawls backward coming out of the old exuvia. New emerged individuals keeps quite beside its old skin for a short of time, then started to move actively searching for food.

Biological aspects

In this study, the investigations were carried out under laboratory conditions 25 and 70 % R.H., whereas *C. berlesi* fed on four sources, curcum, garlic, lemon and dencqar. *C. berlesi* is as an important mite pest infesting stored products as well as stored grains. This mite found on damp moldy stored products.

Incubation period:

The tabulated data in Tables (1&3) indicated that there was no any significant differences for the influence of different food kinds and temperature on the incubation periods which taken by the mite, *C. berlesi* when fed on maize powder mixed with curcum, garlic, lemon and dencqar, and these periods took 2.33, 2.34, 2.32 and 2.29 days, respectively in

comparison with 2.45 days for the mite individuals who fed on the non-treated maize grains with any plant powders at 25 °C, while at 30 °C, the incubation period of females lasted 2.11, 2.09, 2.0 and 1.89 days on treated maize grains with curcum, garlic, lemon and denqar extracts, respectively in comparison with 2.45 days for non-treated maize grains, Table (4), and lasted 1.88, 1.87, 1.88 and 1.8 days& 2.11 days, for males individuals, respectively at 30 °C, Table (5).

Postembryonic development:

The development of larval, protonymphal and tritonymphal stages of *C. berlesi* was almost similar on the all types of plant extracts on maize grains. The duration of developmental stages was the shortest on dencqar intermediate on curcum and was longest for on non-treated maize powder for both sexes of female and male, Tables (1&3). The total time required for both female and male to complete development formal larval to adult stage on maize treated with curcum, garlic, lemon and dencqar was 6.88, 6.91, 7.07 and 7.71 days foe female individuals and changed to lasted 6.42, 6.68, 6.79 and 6.58 days for male mites, respectively. On the other hand, the immature stages of *C. berlesi* when fed on the untreated maize grains was 7.11 and 6.69 days for female and male individuals, respectively.

Life cycle:

Concerning the life cycle duration of *C. berlesi* (egg, larva, prot-and tritonymphs) as shown in Tables (1&3), this period lasted at these conditions 9.21, 9.25, 9.41, 10.01 days for female individuals when fed on maize powder treated with powder of curcum, garlic, lemon and dencqar at 25 °C, respectively, but it lasted 9.56 days when the mite female fed on pure maize grains Table (1). On the other hand, the male life cycle in this study took 8.75, 9.02, 9.11, and 8.87 days when the individuals fed on the same order of previously mentioned powders in comparison with 9.124

days for the individuals fed in normal state without any treatment, Table (3). On the other hand, the life cycle of the females took at 30 °C, 8.34, 8.44, 8.42, 8.33 days when the individuals fed on the same previously mentioned treatment, respectively in comparison with 8.70 days for the mites fed on non-treated maize grains,

Table (4). However, the life cycle of males lasted 7.69, 7.82, 7.84, 7.87 days for treated grains and 8.04 days for non-treated powder, respectively, Table (5).

Female longevity:

Female longevity (pre-ovipositions, oviposition and post-oviposition periods) of *C. berlesi* was significantly affected by different types of food.

Pre-oviposition period:

The obtained data tabulated in Table (3) proved that this period was affected by different types of food, whereas, female pre-oviposition period lasted 1.39, 1.45, 1.48 and 1.5 days, when female fed on maize powder treated with curcum, garlic, lemon and denqar, respectively, in comparison with 1.35 days when mite fed on non-treated maize powder. As shown in Table (6), there were no any obviously significant differences between the periods of pre-oviposition period of *C. berlesi* at 30 °C, when fed on both normal maize powder and treated ones which recorded 1.15, 1.12, 1.19, 1.32 and 1.20 days, respectively.

Oviposition period:

From the obtained data in Table (3), the oviposition period of *C. berlesi* female was decreased as maize powder treated with different powders of each tested plant. This period took 5.62, 5.46, 1.08 and 5.03 days at 25 °C, when the mites female fed on the maize powder treated with the same order of plant powders, respectively, in comparison with those fed on non-treated maize powder (6.36 days). The highest oviposition period

for *C. berlesi* adult female at 35 °C was (6.16 days) on pure maize grains, while the lowest period durated 4.52 days at 30 °C.

Post-oviposition period:

The influence of different diets on female post-oviposition period revealed that this period lasted the highest period for the females fed on pure maize powder at 25 °C (1.8 days) , while the shortest period was noticed when the mite fed on denqar treated maize powder at 30 °C, (1.14 days).

Male longevity:

As shown in Table (2), male adulthood period of *C. berlesi* durated 8.22, 8.02, 7.58 and 7.42 days when the mites males fed on treated maize powder with powders of curcum, garlic, lemon and dencqar in comparison with 8.51 days in control state (without mixing) at 25 °C, The male longevity of *C. berlesi* when the individuals fed on treated maize powder with curcum, garlic, lemon and denqar powders durated 7.55, 7.2, 6.89 and 6.94 days, respectively, but this period took 7.68 days when the mite fed on pure maize grains at 30 °C, Table (5).

Female and male life span:

The life span of the adult female and male varied considerably by different diets and temperatures. Obtained data showed that these periods were (17.62. 17.61, 17.42 and 17.89 day for female individuals fed on treated maize powder with curcum, garlic, lemon and dencqar powders, respectively, but those fed on non-treated grains increased to recorded 19.11 days, at 25 °C Table (1). Whoever, the tabulated data in Table (2) indicated that this period lasted 16.97, 17.04, 16.69 and 16.29 days when feeding on the same order of treated maize powder, while the period recrded on non-treated maize powder took 17.65 days, at 25 °C, Table (2). The life span of the mites females lasted 15.87, 16.44, 15.62 and 15.19

days for the individuals fed on treated maize powder with curcum, garlic, lemon and denqar powders and 17.22 days for the mites reared on maize powder without any mixing at 30 °C, Table (4). On the other hand, these periods lasted 15.24, 14.84, 14.73, 14.81 and 15.72 days, respectively for male individuals, life span, at 30 °C, Table (5).

Female fecundity:

The different kinds of treated maize grains with different plant extract affect the number of deposited eggs by female of *C. berlesi* at 25 °C, Table (3). Therefore, feeding on maize powder treated with curcum, garlic, lemon and denqar powders 168.0, 160.0, 154.0 and 149.0 eggs, respectively in comparison with 180.0 eggs laid by the adult female in the normal feeding of mites on non-treated maize powder. Considering the number of eggs laid by the adult females at 30 °C, there were significant differences between the deposited eggs in the normal state (without treatment) and the mites fed on maize powder treated with different plant extracts, The number of eggs recorded 173.0, 170.0, 162.0 and 153.0 eggs when maize grains treated with powders of curcum, garlic, lemon and denqar, respectively, in comparison with 192.0 eggs in the normal cases, Table (6). Similar results were obtained by **Taha** (2014) who selected stored food products for feeding the astigmatid mite, *C. berlesi* and found that the most suitable attractive was dry yeast granules, the mite positively attracted to those products soon as initial contact was made with the food. The author mentioned that the oviposition period of this mite was affected by the kind of introduced food and the least time was 10.8 days when the female fed on yeast at 25 °C. and the fecundity of eggs decreased from 297.5 eggs from 25 °C to 208.9 eggs only at 30 °C when fed on yeast granules. The obtained results are not coincided with that obtained results by **Hughes** (1976), **Eraky and Osman** (2008) and **Taha** (2014). There were no

significant differences for the influence of different food kinds on egg incubation period of the acarid mite, *C. berlesi* of both females and males. On the other hand, the obtained results in this study were agreed with **Woodring** (1969), **Hughes** (1976), **Eraky and Osman** (2008). **Taha** (2014), where the life cycle duration for both female and male mites has significant differences when fed on different kinds of foods at different temperature. **Taha** (2014) mentioned that all selected stored food products (dry yeast, crushed wheat and crushed maize) have been found already suitable to some extent for mite, *C. berlesi* survival and development. Out of foods tested against *C. berlesi*, the most attractive was dry yeast granules. The life history of *C. berlesi* fed buckwheat sprouts at room temperature (ca. 20°C) and high relative humidity (95-100%) according to **Chmielewski** (2003) usually lasts about 2-3 weeks (without hypo-pus instar); but if the hypopus stage occurs, the developmental cycle may be prolonged even by several months. Each of the instars has a period of activity (feeding, moving) and also for resting, the quiescent period before molting into the next stage, succeeding the development stage. The author noticed that the longevity of adults was 23.8 days; fecundity of females was 237.4 eggs per life span.

Table (1): Duration of different biological aspects of *Caloglyphus berlesi* female when fed on maize grains treated with different extracts different diets at 25 °C

Stage	Plant extracts					L.S.D.
	Non	Curcum	Garlic	Lemon	Dencqar	
7	2.45±0.41	2.33 ±0.34	2.34± 0.34	2.32±0.33	2.29 ±0.41	0.161
Larva	2.41±0.39	2.25 ±0.35	2.32 ± 0.28	2.34± 0.29	2	0.146
Protonymph	2.54 ± 0.38	2.33 ±0.27	2.34 ±0.33	2.39± 0.34	2.41 ±0.31	0.124
Tritonymph	2.15 ±0.38	2.30 ±0.29	2.35 ±0.30	2.36±0.39	2.38±0.29	0.214
Total immature	7.11±0.85	6.88±0.68	6.91±0.64	7.07±0.71	7.71±0.78	0.364
Life cycle	9.56±0.98	9.21±0.94	9.25±0.68	9.41±0.95	10.01±0.9	0.687
Longevity	9.51±0.89	8.46±0.84	8.36±0.69	8.01±0.77	7.88±0.8	0.748
Life span	19.11±1.3	17.67±2.1	17.61±1.64	17.42±1.87	17.89±2.1	0.964

Table (2): Duration of different biological aspects of *Caloglyphus berlesi* male when fed on maize grains treated with different extracts different diets at 25 °C

Stage	Plant extracts					L.S.D.
	Non	Curcum	Garlic	Lemon	Dencqar	
Incubation period	2.25±0.11	2.11 ±0.31	2.20± 0.38	2.10±0.34	2.09±0.40	0.161
Larva	2.33±0.41	2.15 ±0.19	2.14 ±0.21	2.15 ±0.25	2.09 ±0.22	0.125
Protonymph	2.24±0.37	2.05 ±0.38	2.25 ±0.34	2.33± 0.29	2.18 ±0.29	0.147
Tritonymph	2.12 ±0.36	2.22 ±0.35	2.29 ±0.38	2.31±0.34	2.31±0.41	0.138
Total immature	6.69±0.67	6.42 ±0.58	6.68±0.64	6.79±0.68	6.58±0.77	0.323
Life cycle	8.94± 0.88	8.53±0.61	8.88±0.55	8.89±0.86	8.67±0.77	0.415
Longevity	8.51±0.68	8.22±0.87	8.02±0.78	7.58±0.68	7.42±0.69	0.458
Life span	17.45±1.60	16.75±1.13	16.90±1.63	16.47±1.11	16.09±1.96	0.984

Table (3): Adult female longevity and fecundity of the acarid mite, *Caloglyphus berlesi* when fed on maize grains treated with different plant extract at 25 °C

Diets	Average duration in days			Fecundity
	Preovi Poition period	Ovipositio period	Post Oviposition period	
Non-treated	1.35+0.48	6.36+0.56	1.8+0.21	180.0+11.24
Curcum	1.39 +0.26	5.62+0.57	1.45+0.24	168.0+10.5
Garlic	1.45+0.13	5.46+0.48	1.45+0.18	160.0+9.48
Lemon	1.48+0.19	5.08+0.67	1.44+0.23	154.0+6.34
Denqar	1.5+0.18	5.03 +0.42	1.35 +0.24	149.0+5.6

Table (4): Duration of different biological aspects of *Caloglyphus berlesi* female when fed on maize grains treated with different natural products at 30 °C

Stage	Plant extracts					L.S.D.
	Non	Curcum	Garlic	Lemon	Dencqar	
Incubation period	2.15±0.46	1.88 ±0.55	1.79± 0.44	1.75±0.43	1.70 +0.44	0.149
Larva	2.21±0.39	2.15 ±0.35	2.08 ±0.28	2.11± 0.29	2.10 ±0.26	0.132
Protonymph	2.24 ± 0.38	2.13 ±0.27	2.12 ±0.33	2.15± 0.34	2.21 ±0.31	0.119
Tritonymph	1.80 ±0.38	1.95 ±0.29	2.15 ±0.30	2.16±0.39	2.13±0.29	0.188
Total immature	6.25±0.89	6.23±0.60	6.35±0.61	6.42±0.70	6.44±0.71	0.264
Life cycle	8.40±0.87	8.11±0.84	8.14 ±0.59	8.17±0.70	8.14±0.68	0.527
Longevity	8.71±0.71	7.53±0.79	7.66±0.78	7.20±0.64	6.86± 1.22	0.648
Life span	17.10±2.29	15.64±3.47	15.80±3.21	15.37±1.88	15.00+3.57	0.887

Table (5): Duration of different biological aspects of *Caloglyphus berles* male when fed on maize grains treated with different extracts different diets at 30 °C

	Non	Curcum	Garlic	Lemon	Dencqar	
Incubation period	2.21±0.34	1.88 ±0.26	1.87± 0.28	1.88±0.30	1.80±0.33	0.127
Larva	2.11±0.31	2.05 ±0.18	2.00 ±0.17	2.00 ±0.26	2.02 ±0.11	0.120
Protonymph	2.16±0.35	2.00 ±0.31	1.95 ±0.41	2.00± 0.33	2.08 ±0.20	0.140
Tritonymph	1.56 ±0.22	1.76 ±0.41	2.00 ±0.34	1.96±0.37	1.97±0.44	0.128
Total immature	5.83±0.82	5.81 ±0.51	5.95±0.69	5.96±0.97	6.07±0.96	0.411
Life cycle	8.04± 0.99	7.69±0.94	7.82±0.89	7.84±1.11	7.87±0.75	0.426
Longevity	7.68±0.60	7.55±0.93	7.02±0.68	6.89±0.61	6.94±0.59	0.507
Life span	15.72±1.2	15.24±2.65	14.84±1.66	14.73±1.64	14.81±1.69	0.879

Table (6): Adult female longevity and fecundity of the acarid mite, *Caloglyphus berlesi* when fed on maize grains treated with different plant extract at 30 °C

Diets	Average duration in days			Fecundity
	Pre-oviposition period	Oviposition period	Post-oviposition period	
Non-treated	1.15±0.48	6.16±0.56	1.40±0.21	192.0±9.24
Curcum	1.12 ±0.20	5.16±0.33	1.25±0.18	173.0±9.64
Garlic	1.19±0.11	5.22±0.52	1.25±0.11	170.0±11.23
Lemon	1.32±0.22	4.55±0.43	1.15±0.13	162.0±5.52
Denqar	1.20±0.14	4.52 ±0.33	1.14 ±0.21	153.0±7.12

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تأثير انواع مختلفة من الاغذية ودرجات الحرارة على المظاهر البيولوجية للاكاروس

عديم الثغر (*Caloglyphus berlesei* (Michael)

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اجريت هذه الدراسة لمعرفة تأثير مسحوق الذرة المعاملة ببعض مساجيق بعض المواد النباتية وهى مسحوق الكركم والثوم و الليمون والدنكار على المظاهر البيولوجية للاكاروس الاكاريدى *Caloglyphus berlesei* وذلك عن درجات الحرارة ٢٥ و ٣٠ م° ورطوبة نسبية مقدارها ٧٥%. واتضح من النتائج المتحصل عليها ان فترة حضانة البيض Incubation period قد وصلت لاعلى معدل لها عند تغذية الافراد الاناث على حبوب الذرة الغير معاملة والتي وصلت الى ٢,٤٥ يوما وذلك عند ٢٥ م°. بينما سجلت اقل فترة ممكنة للافراد الاناث ايضا ولكن عند تغذيتها على الحبوب المعاملة بمستخلص الدنكار عند ٣٠ م° حيث سجلت ١,٧٠ يوما. ولقد لوحظ ان طول فترات الافراد الغير بالغة Immature stages والتي تكونت من (اليرقة والحورية الاولى والحورية الثالثة) لم تتاثر بصورة معنوية عالية بنوع المستخلص المستخدم وايضل بدرجات الحرارة. وسجلت اعلى فترة ممكنة لدورة حياة الافراد عند تغذية الاناث على حبوب الذرة المعاملة بمستخلص الدنكار وسجلت زمنا مقداره ١٠,٠١ يوما عند ٢٥ م° وكانت اقلها تسجلا عند تغذية الافراد الذكور عند ٣٠ م° على الحبوب المعاملة بمستخلص الكركم. اما بالنسبة لطول فترة حياة الافراد البالغة Longevity فقد دلت النتائج المتحصل عليها ان اطول فترة لها لوحظت عند تغذية الاناث على حبوب الذرة النقية (الغير معاملة باى مستخلص) مسجلة زمنا مقداره ٩,٥١ يوما بينما سجلت اقل فترة لهذا الاكاروس كان لنفس الافراد الاناث ولكن عند تغذيتها على حبوب الذرة المعاملة بمستخلص الدنكار مسجلة زمنا

مقداره ٦,٨٦ يوما. ولقد اتضح من الدراسة ايضا ان نوع الغذاء ودرجة الحرارة فقد اثروا بصورة عالية المعنية على عدد البيض الموضوع بواسطة الاناث حيث اتضح ان اكبر عدد من البيض قد سجل للاناث التي تغذت على حبوب الذرة النقية وسجلت ١٩٢,٠ بيضة عند ٣٠ م° بينما سجلت الاناث اقل عددا من البيض عند تغذيتها على حبوب الذرة المعاملة بمستخلص الدنكار وسجلت عددا مقداره ١٤٩ بيضة وذلك عند ٢٥ م°.