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FOOD TYPE AND LIGHT COLOUR AS FACTORS AFFECTING POPULATION GROWTH OF *Sancassania berlesei* (MICHAEL) (ACARI : ASTIGMATA)

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ABSTRACT

Food type and light colour significantly affected population growth of *Sancassania* (= *Caloglyphus) berlesei* (Michael). It was found that when fertilized female of *S. berlesei* was fed on Baker's yeast, fish meal, meat meal, poultry feed and Rass cheese and exposed to a 14L : 10D h. photoperiod (L= light , D= Dark) of blue, green, red and yellow light colours during 40 days after treatment, Rass cheese and Baker's yeast harboured the highest numbers of mite individuals, while meat meal and fish meal gave significantly lower ones. The lowest value was recorded with poultry feed. Counts of *S. berlesei* on Rass cheese, Baker's yeast, meat meal, fish meal and poultry feed for 40 days after treatment were 8199.10, 7198.90, 725.70, 683.20 and 658.50, respectively. However, colour of light significantly affected numbers of *S. berlesei* . The highest values were counted with blue light (3730.68), followed by red (3470.36) and green (3403.88) lights, while the lowest value (3367.40) was recorded with yellow light. Formation of hypopial stage of *S. berlesei* as influenced by food type and colour of light during experimental time also was discussed. Generally, these results may be of practical implications in monitoring and management numbers of *S. berlesei.*

Keywords: Acaridae, *Sancassania berlesei*, food type, light colour, population growth, hypopial stage.

INTRODUCTION

Mites in the family Acaridae are among the most important acarine pests attacking agricultural and stored product systems throughout the world (Hughes 1976). Of the various acarines associated with food storages *Sancassania (= Caloglyphus) berlesei* (Michael) a cosmopolitan species and pest of several food products is encountered infesting a large number of stored products, foods , grains and animal feeds (Rao & Prakash, 1987; Corpuz-Raros *et al.*, 1988; Ostovan & Kamali, 1995; Putatunda, 2002 and 2005 ; Palyvos *et al.* 2008).

The necessity of using alternative methods which can be used safety in reducing numbers of these mite pests in stored products became compulsive trend to avoid chemical control problems presented by mites. Pagani & Domenichini, (1989) reported that, the best results in controlling mites of seasoned meats were obtained by superheated air. Ultraviolet radiation showed influence on the survival of the acarid mite *Tyrophagus putrescentiae* (Kumud *et al.* 1989). Zdrakova & Voracek, (1993**)** showed that, mites from the family Acaridae were killed by low pressure of 95 mm Hg after an exposure of only 48 h and after 1h exposure to -15ºC. Also, they mentioned that constant light has unfavourable effects on development and reproduction of the flour mite, *Acarus siro.*

In Egypt , Hashem (2001) reported that *S. berlesei* is one of the most wide spread acarid mite associated with stored products , where it occupy a wide range of habitats including stored grains, foods and other commodities. In this paper the effect of food type on the population growth of *S. berlesei* under four light colours was studied under laboratory conditions.

MATERIALS AND METHODS

Pure cultures of *Sancassania berlesei* were separately established on each of the tested food materials, *i.e*. Baker's yeast, fish meal, meat meal, poultry feed and Rass cheese. The experimental mites fed on each of the tested food materials under a 14L : 10D photoperiod of four colour lights, *i.e.* blue , green, red and yellow (L= Light , D= Dark) (Kasuga & Amano 2000). Wood boxes of 100 x 100 x 100 cm per each, were used for studying the influence of five food materials on population increase of *S. berlesei* under four light colours. A fluorescent lamp of 70 lux as hanged on the ceiling of each box. Plastic sheets of 3 mm thick, with blue, green, red and yellow colours were placed firmly under the lamp to obtain the required light colour (one box for each colour). Mite was reared according to the method described by Hashem (2001), using standard 2.5 x 2.5 cm transparent plastic tins as rearing unit, firmly enclosed with an upper lid and filled to a depth of 1cm with a mixture of characoal and plaster of Parries in a ratio of 1:9 respectively. Newly fertilized females were transferred singly to rearing units, supplied with sufficient quantities of food materials and kept in the above mentioned wood boxes under colored lights. Suitable moisture content was maintained by adding few drops of water as needed. Small pieces of the tested food materials were added daily. Samples of 5 rearing units from each treatment (5 food materials x 4 coloured lights) were taken at four fixed time interval of ten days a long the period of 40 days. Averages of temperature and relative humidity during the experimentation time were 29.28+4ºC and 71.28+6% R.H., respectively. Number of all developmental stages including eggs, immatures and adult stages were counted. Data were subjected to statistical analysis by using F. test (Snedecor , 1966).

RESULTS AND DISCUSSION

I. Population growth of *S. berlesei*:

Data presented in Table (1) show mean numbers of *S. berlesei* during ten days after feeding on Baker's yeast, fish meal, meat meal, poultry feed and Rass cheese . Mites fed on any of tested food materials were exposed to constant photoperiod 14L:10D h. under four coloured lights. *i.e.* blue , green , red and yellow . It was obvious that, all the tested food materials have been found to be suitable for survival and development of *S. berlesei,* but they were significantly differed in their effect on population growth of mite. Rass cheese and Baker's yeast proved to be one of the most favourable food materials as they realized the highest number of mite individuals. On contrary, poultry feed and fish meal were the least preferable food materials, since as they gave the lowest numbers of mite individuals. However, meat meal gave moderate value. Mean numbers of *S. berlesei* on Baker's yeast, fish meal, meat meal, poultry feed and Rass cheese were 35.15, 17.40, 18.95, 16.85 and 37.30 respectively. On the other hand, significant variations were detected between numbers of the mite exposed to four coloured lights. The highest increase was measured under blue light (29.36) followed by red light (27.00), green light (23.08) and yellow light (21.08).

Table (1): Population growth of *Sancassania berlesei* as influenced by food type, ten days after exposure to four light colours.

Food materials	Light colour				Mean	L.S.D.$_{0.05}$
	Blue	Green	Red	Yellow		
Baker's yeast	40.20$\pm$0.58	34.60$\pm$0.51	36.20$\pm$0.58	29.60$\pm$0.51	35.15	1.642
Fish meal	20.80$\pm$0.58	15.00$\pm$0.45	19.80$\pm$0.58	14.00$\pm$0.45	17.40	1.558
Meat meal	24.00$\pm$0.71	15.80$\pm$0.66	21.60$\pm$0.93	14.40$\pm$0.51	18.95	2.151
Poultry feed	20.20$\pm$0.58	14.00$\pm$0.45	19.60$\pm$0.51	13.60$\pm$0.51	16.85	1.543
Rass cheese	41.60$\pm$0.51	36.00$\pm$0.71	37.80$\pm$0.37	33.80$\pm$0.58	37.30	1.669
Mean	29.36	23.08	27.00	21.08	25.13	0.725
L.S.D.$_{0.05}$	1.760	1.669	1.838	1.516	0.811	-

In general, mites fed on Rass cheese and Baker's yeast under blue light recorded the highest populations (41.60 and 40.20), while the lowest number was detected when mites fed on poultry feed under yellow light (13.60).

Population growth of *S. berlesei* for 20 and 30 days after exposure to the aforementioned factors are listed in Tables (2 and 3). It is evident that food type, light colour significantly affected growth population of *S. berlesei.* Rass cheese and Baker's yeast gave the greatest numbers of mites while, lower numbers of mites detected on meat meal, fish meal and poultry feed. Counts of *S. berlesei* twenty days after feeding on Baker's yeast, fish meal, meat meal, poultry feed and Rass cheese were 510.60, 270.90, 281.50, 268.40 and 518.65, respectively. These values were remarkably increased to reach 1313.45, 558.05, 570.80, 537.05 and 1402.30 thirty days after feeding on the aforementioned food materials, respectively.

Table (2): Population growth of *Sancassania berlesei* as influenced by food type, twenty days after exposure to four light colours.

Food materials	Light colour				Mean	L.S.D.$_{0.05}$
	Blue	Green	Red	Yellow		
Baker's yeast	521.20$\pm$1.20	507.80$\pm$1.07	510.20$\pm$1.32	503.20$\pm$1.46	510.60	3.810
Fish meal	284.20$\pm$0.73	265.60$\pm$1.29	281.00$\pm$1.52	252.80$\pm$1.85	270.90	4.224
Meat meal	297.80$\pm$0.80	272.00$\pm$1.30	296.80$\pm$0.66	259.40$\pm$1.57	281.50	3.431
Poultry feed	283.80$\pm$1.53	264.80$\pm$1.24	277.40$\pm$0.93	247.60$\pm$1.50	268.40	3.966
Rass cheese	530.80$\pm$0.73	512.40$\pm$0.93	523.60$\pm$1.21	507.80$\pm$0.97	518.65	2.922
Mean	383.56	364.52	377.80	354.16	370.01	1.553
L.S.D.$_{0.05}$	3.094	3.465	3.440	4.423	1.736	-

Table (3): Population growth of *Sancassania berlesei* as influenced by food type, thirty days after exposure to four light colours.

Food materials	Light colour				Mean	L.S.D.0.05
	Blue	Green	Red	Yellow		
Baker's yeast	1434.20±1.59	1309.00±1.14	1322.20±1.36	1183.40±2.34	1313.45	5.003
Fish meal	589.80±1.98	536.80±1.77	589.00±1.05	516.60±2.44	558.05	5.637
Meat meal	597.20±0.86	545.80±1.66	595.00±1.70	545.20±1.66	570.80	4.527
Poultry feed	584.60±1.33	497.40±1.50	577.80±1.66	488.40±2.34	537.05	5.240
Rass cheese	1459.40±2.06	1365.00±1.79	1445.20±2.27	1339.60±1.63	1402.30	5.856
Mean	933.04	850.80	905.84	815.64	876.33	2.214
L.S.D.0.05	4.800	4.690	4.887	6.227	2.475	-

Regarding the effect of light colour, it was found that colour of light resulted significant effect on population increase of *S. berlesei*. Twenty days after exposure, the highest effect was detected with blue light (383.56) followed descendingly by red light (377.80) , green light (364.52) and yellow light (354.16). However, thirty days after exposure, blue light was superior (933.04) followed by red light (905.84). Green light proved to be moderate (850.80) followed by the lowest yellow light (815.64). Approximately, the same trend were obtained during the fourth inspection with pronouncely increase in the numbers of the studied acarid mite *S. berlesei* (Table 4).

Table (4): Population growth of *Sancassania berlesei* as influenced by food type, fourty days after exposure to four light colours.

Food materials	Light colour				Mean	L.S.D.0.05
	Blue	Green	Red	Yellow		
Baker's yeast	7988.00±1.14	6890.20±2.33	7123.00±1.10	6794.40±1.21	7198.90	4.880
Fish meal	723.20±1.24	680.40±1.33	680.60±1.63	648.60±1.60	683.20	4.375
Meat meal	767.80±0.86	706.20±1.53	727.20±1.85	701.60±1.08	725.70	4.154
Poultry feed	706.00±1.38	639.60±2.04	659.20±1.24	629.20±0.58	658.50	4.224
Rass cheese	8468.40±1.08	8103.00±2.02	8161.80±1.07	8063.20±1.07	8199.10	4.116
Mean	3730.68	3403.88	3470.36	3367.40	3493.08	1.830
L.S.D.0.05	3.242	5.841	4.168	3.405	2.046	-

Generally, mite individuals fed on Rass cheese and Baker's yeast and exposed constant photoperiod 14L:10D h. to blue light daily proved to be one of the most favourable conditions as they gave the highest numbers of mite individuals (8468.40 and 7988.00, respectively), while those fed on poultry feed under yellow light induced the lowest numbers (629.20).

These results nearly agree with the results which were obtained by Maurya *et al.* (1982). They mentioned that dried yeast powder was found to be most favourable for the stored product mites *Caloglyphus berlesei.* Similarly, Timms *et al.* (1982) showed that development of *Sancassania berlesei* from egg to adult at 25ºC lasted 159 h, when mite feed on yeast diet. Significant increase in numbers of *S. berlesei* when exposed to blue light was supported by results obtained by Abdel-Wahab (1993) who showed that blue light highly accelerated period of *S. berlesei* immature stages.

II. Hypopial stage:

According to Corente & Knulle (2003) the heteromorphic deutonymph (hypopus) is a unique characteristic of astigmatic mites. It is non – feeding and facultative instar between protonymph and tritonymph. The hypopus is adapted for dispersal and sometimes also for dormancy as in the stored product mite, *Lepidoglyphus destructor* (Schrank)

Formation of *S. berlesei* hypopi were significantly influenced by food type and light colour. During the first inspection, ten days after exposure to the aforementioned factors hypopial stage was not observed. Number of hypopial stage after 20, 30 and 40 days of feeding on the above mentioned food materials under light colours are listed in tables 5,6 and 7. This stage was not recorded when mites fed on Rass cheese and Baker's yeast. On contrary, the other food materials showed significant effect on the numbers of such stage. Poultry feed resulted in the highest number of hypopi as compared to significantly lower numbers on fish meal and meat meal. Counts of *S. berlesei* hypopi twenty days after feeding on poultry feed, fish meal and meat meal were 15.80, 14.90 and 12.95, respectively. These values were distinctly increased to reach 141.80 & 328.65, 136.70 & 302.50 and 130.15 & 291.95 thirty and fourty days after feeding on the previous food materials, respectively (Tables 5,6 and 7). These results are in agreement with findings of other reports. Woodring (1963) reported that quality of food is important factor for formation of *Rhizoglyphus echinopus* hypopi. Diaz *et al.* (2000) showed that formation of hypopial stage of the bulb mites of the genus *Rhizoglyphus* can be induced by low food quality and quantity, high concentrations of waste products and extremes in temperature and humidity. Corente and Knulle (2003) discussed the relationship between decreasing food quality and increasing hypopus production in the stored product mite *Lepidoglyphus destructor.* They cleared that the higher the proportion of substances with little or no nutritional value, the more hypopodes were produced.

Table (5): Formation of hypopial stage of *Sancassania berlesei* as influenced by food type, twenty days after exposure to four light colours.

Food materials	Light colour				Mean	$L.S.D._{0.05}$
	Blue	Green	Red	Yellow		
Baker's yeast	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00	-
Fish meal	13.40±0.51	16.00±0.71	13.60±1.21	16.60±0.51	14.90	2.361
Meat meal	9.60±0.68	15.40±0.51	10.60±0.51	16.20±0.58	12.95	1.722
Poultry feed	14.60±0.51	16.40±0.51	15.20±0.86	17.00±0.71	15.80	1.989
Rass cheese	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00	-
Mean	7.52	9.56	7.88	9.96	8.73	0.664
$L.S.D._{0.05}$	1.306	1.332	2.069	1.384	0.742	-

Table (6): Formation of hypopial stage of *Sancassania berlesei* as influenced by food type, thirty days after exposure to four light colours.

Food materials	Light colour				Mean	L.S.D.0.05
	Blue	Green	Red	Yellow		
Baker's yeast	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00	--
Fish meal	126.20±0.97	142.80±0.86	131.80±1.07	146.00±1.64	136.70	3.522
Meat meal	119.60±1.72	134.80±1.02	123.00±1.45	143.20±2.20	130.15	4.958
Poultry feed	136.80±1.98	144.20±2.03	138.60±2.34	147.60±1.96	141.80	6.253
Rass cheese	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00	-
Mean	76.52	84.36	78.68	87.36	81.73	1.638
L.S.D.0.05	3.694	3.210	3.891	4.454	1.831	-

Table (7): Formation of hypopial stage of *Sancassania berlesei* as influenced by food type, fourty days after exposure to four light colours.

Food materials	Light colour				Mean	L.S.D.0.05
	Blue	Green	Red	Yellow		
Baker's yeast	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00	-
Fish meal	287.20±1.16	310.00±1.70	294.00±1.30	318.80±1.36	302.50	4.181
Meat meal	272.40±1.50	300.00±1.61	289.60±1.33	305.80±1.93	291.95	4.825
Poultry feed	316.40±1.03	329.80±2.44	325.40±1.63	343.00±1.00	328.65	4.894
Rass cheese	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00	-
Mean	175.20	187.96	181.80	193.52	184.62	1.510
L.S.D.0.05	2.848	4.462	3.264	3.384	1.689	-

± (SE) = standard error.

Concerning the effect of light colour, it was noticed that, light colour resulted significant influence on the hypopial stage of *S. berlesei*. Twenty days after exposure the highest effect was detected with yellow light (9.96), followed descendingly by green (9.56), red (7.88) and blue (7.52). The same results were evident during the third and fourth insepections with increase numbers of hypopial stage. These values averaged 87.36 & 193.52; 84.36 & 187.96; 78.68 & 181.80 and 76.52 & 175.20, thirty and fourty days after exposure the above mentioned colours of light , respectively.

In general, mite individuals fed on poultry feed under the same photoperiod of yellow light proved to be one of the least favorable conditions for *S. berlesei* as it induced the highest numbers of hypopial stage (343).

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تأثير نوع المادة الغذائية ولون الضوء على زيادة تعداد الحلم *Sancassania berlesei* (Michael) (أكاري : أستيجماتا)

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أوضحت هذه الدراسة أن كلاً من نوع المادة الغذائية ولون الضوء يؤثر تأثيراً معنوياً على زيادة تعداد الحلم *Sancassania berlesei* حيث اتضح ذلك عند تغذية أنثى مخصبة واحدة من الحلم على كل من الخميرة البيرة أو مسحوق السمك أو مسحوق اللحم أو علف الدواجن أو الجبنة الرومي تحت فترة ضوئية ١٤ ساعة إضاءة إلى ١٠ ساعات إظلام لكل من اللون الازرق والأخضر والاحمر والأصفر طول فترة الدراسة ٠ سجلت كل من الجبنة الرومي والخميرة البيرة أعلى تعداد من الحلم، بينما سجل مسحوق اللحم ومسحوق السمك تعدادت أقل وبدرجة معنوية، فى حين سجل أقل قيم للتعداد عند تغذية الحلم على علف الدواجن٠ بلغ تعداد الحلم على كل من الجبنة الرومي والخميرة البيرة ومسحوق اللحم ومسحوق السمك وعلف الدواجن عند ٤٠ يوم من المعاملة ٨١٩٩,١٠ ، ٧١٩٨,٩٠ ، ٧٢٥,٧٠، ٦٨٣,٢٠، ٦٥٨,٥٠ فرداً على الترتيب ٠

ومن ناحية أخرى فإن لون الضوء أثر معنوياً على تعداد الحلم حيث لوحظت أعلى قيم للتعداد تحت اللون الأزرق ٣٧٣٠,٦٨ متبوعاً باللون الأحمر ٣٤٧٠,٣٦ واللون الأخضر ٣٤٠٣,٨٨ بينما سجلت أقل قيمة للتعداد (٣٣٦٧,٤٠ فرد) تحت اللون الأصفر ٠

كما تضمنت الدراسة مناقشة تأثير كل من نوع المادة الغذائية ولون الضوء على تكوين طور الحورية الثانية المختلف (الهيبوبس) ٠ بصفه عامه فإن هذه النتائج يمكن استخدامها من الناحية التطبيقية فى خفض تعداد الحلم الأكاريدى *S. berlesei*٠