

**Biological Studies on the Mite *Acarus farris* (Acari: Acaridae)
and its Control by Using the Entomopathogenic Fungus
Beauveria bassiana and Spinosad.**

By

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ABSTRACT

The present experiment was conducted in the laboratory of the Dept. of Economic Entomology of the Faculty of Agriculture, Kafrelsheikh University in 2004/05 & 2005/06. The aim of the investigation was to find out the behaviour, incubation period, larval stage, protonymph, deutonymph stages and the whole life cycle, duration of male and female of the mite, *Acarus farris* fed on the different diet (wheat bran, banana fruits and pollen of *Ricinus communis*. Maximum and minimum duration was also recorded under two circumstances of temperature and R.H. that were tested to find out that effect on different mite stages.

The biological control of *Acarus farris* (Oudemans) was tested using two biocide compounds, i.e., Biofly and tracer on the egg, larvae and nymph stages. In every experiment, four concentrations were tested using the mite fed on wheat bran, fruit and castor pollen. Results are all reported within the article.

INTRODUCTION

Acari is considered as large economic group of arthropods since many species live in soil and organic manure. The role of these animals in nature is greatly important as they vary from harmful to beneficial ones. This order comprises a large group of mites that cause several damages to a wide range of economically important field crops, vegetables and stored products (Van Hage and Johanson, 1992), *Acarus farris* (Oudemans) is one of the most common storage mite species. It can be found infesting a wide varieties of stored products, such as barley, hay, cheese (Hughes, 1976) fruits stored and grain and may cause occupational healthy problems to farmers and workers (Cuthbert *et al.*, 1989) in the grain and milling industry (Musken *et al.*, 2000). Therefore, the aim of this study is to control that pest by using biological control agents

instead of chemicals which cause side effects on stored products and the selected materials were tracers as Biofly.

MATERIALS AND METHODS

1. Culture of wheat bran:

In the present study *Acarus farris* was reared on wheat bran in Egypt for the first time. The bran was prepared then pasturalizes for 24 hours. After that it was distributed in Petri dishes and left for 24 hours before adding the mites. Ten to sixteen organisms males and females were added to every Petri dish. All in all, the used Petri dishes were ten and were kept in desiccators set on 28°C and 90% R.H. till the end of experiment.

2. Culture of banana:

In this experiment, Petri dishes were prepared, set up with banana fruits divided in small portions, then infected with the mites as mentioned in bran culture, reserved in desiccators till the experiment terminated on the same RH and temperature.

3. Castor pollen culture:

In that third culture, castor pollen were used as a diet for rearing *A. farris* and to compare it with the other two mentioned methods, the same procedure in dealing Petri dishes was used. Finally it has been reared on castor pollen-then on banana.

4. The used control measures:

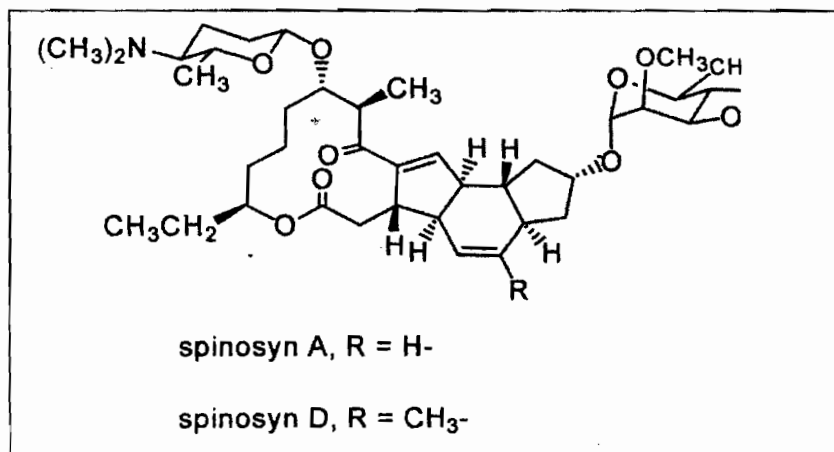
In the present investigation two biocide compounds (Biofly and tracer) were used.

4.1. Biofly:

Biofly is the trade name of the entomopathogenic fungus, *Beauveria bassiana* (Balasamo) as a microbial pesticide liquid containing 3×10^7 conidia. It was supplied by El-Nasser Company for fertilizers and pesticides-Egypt.

4.2. Tracer (24 EC):

Tracer is the trade name of the biocide Spinosad. It was supplied by DOW Agro Sciences.



4.3. Toxicity of Biofly and tracer to *A. farris* stages:

A laboratory experiment was conducted to examine the toxicity of biocides; Biofly and tracer (Ismael and Castanera, 2003) on adults of *A. farris*. The aim of this experiment is to evaluate the residual effect of biocides; Biofly and tracer on adult of *A. farris* under laboratory conditions. Experiment was conducted using the leaf discs that were dipped for seconds in dilutions of tracer with different concentrations of 5 ppm, 10 ppm, 15 ppm and 20 ppm and Biofly with a concentrations of 3×10^2 , 3×10^4 , 3×10^5 , 3×10^6 conidia/ml. Then adults of *A. farris* were transferred to the discs after dipping. Mortality recent counts were recorded 3 days after treatment. The mortality was corrected according to **Abbott's Formula (1925)**, and plotted on a log concentration-probit regression lien was statistically analyzed according to **Litchfield and Wilcoxon (1949)**. The same technique was used to determine toxicity of tracer to larvae and nymph stages to the same mite.

RESULTS AND DISCUSSION

1. Biological studies of *Acarus farris*:

1.1. Habitat and behaviour:

Mite individuals of *Acarus farris* were extracted from barley, bran and corn flour at 28°C and 90% R.H. and at 10°C and 70% R.H. Mites *Acarus farris* were successfully reared in the laboratory on bran, banana and castor pollen. This mite did not feed

on any stage of *Proctolaelaps pomorum*, cannibalism was not observed.

1.2. Incubation period:

Results in Table (1) showed that the incubation period of *A. farris* reared on 28°C and 90% RH ranged in-between 1.6 days as a maximum period fed on *R. communus* and one day a minimum period fed on bran and/or fed on banana.

On the other hand data in Table (2) showed that *A. farris* that was reared on 10°C and 70% RH, the incubation period ranged in-between 4.1 days as a maximum fed on *R. communus* and 3.2 days as a minimum fed on bran, while that fed on banana was 3.8 days.

1.3. Larval stage:

Results as indicated in Table (1) showed that the female larval stage of *A. farris* reared on 28°C and 90% RH ranged in-between 2 days as a maximum fed on *R. communus* and one day as a minimum fed on bran while that 1.5 days fed on banana.

Results also indicated that the male larval stage of *A. farris* reared on 28°C and 90% RH ranged in-between 1.8 days as a maximum fed on *R. communus* and one day as a minimum fed on bran while that 1.3 days fed on banana.

However, results in Table (2) showed that, the incubation period of female *A. farris* that was reared on 10°C and 70% RH ranged in-between 4.3 days as a maximum fed on *R. communus* and 3.4 days as a minimum fed on bran, while that fed on banana was 3.9 days.

However, the incubation period of *A. farris* male that was reared on 10°C and 70% RH ranged in-between 4.1 days as a maximum fed on *R. communus* and 3.1 days as a minimum fed on bran, while that fed on banana was 3.4 days (Table 2).

1.4. Protonymph stage:

Results as indicated in Table (1) showed that the female protonymph stage of *A. farris* reared on 28°C and 90% RH. ranged in-between 1.5 days as a maximum fed on *R. communus* and 0.9 day as a minimum fed on bran, while that fed on banana was 1.3 days.

However, the male protonymph stage of *A. farris* reared on 28°C and 90% RH. ranged in-between 1.3 days as a maximum fed on *R. communus* and 0.9 days as a minimum fed on bran, while that fed on banana was 1.2 days.

Results in Table (2) showed that the female of *A. farris* that was reared on 10°C and 70% RH ranged in-between 4.1 days as a maximum fed on *R. communus* and 3.2 days as minimum fed on bran, while that fed on banana was 3.8 days.

On the other hand, the male of *A. farris* that was reared on 10°C and 70% RH ranged in-between 4.0 days as a maximum fed on *R. communus* and 3.0 days as minimum fed on bran, while that fed on banana was 3.5 days (Table 2).

1.5. Deutonymph stage:

Results as indicated in Table (1) showed that, the female deutonymh stage of *A. farris* reared on 28°C and 90% R.H ranged in-between 1.4 days as a maximum fed on *R. communus* and one days as a minimum fed on bran, while that fed on banana was 1.1 days. While the male deutonymh stage of *A. farris* reared on 28°C and 90% R.H ranged in-between 1.2 days as a maximum fed on *R. communus* and 0.9 day as a minimum fed on bran, while that fed on banana was one days. On the other hand, *A. farris* female and male that were reared on 10°C and 70% RH hypopus and 100% mortality within 7 days.

Table (1): Duration of developmental stages in days of *Acarus farris* reared on three different diets at 28°C and R.H. 90%.

Mite stage	Offered diets			
		Bran	Banana	<i>R. communus</i>
Incubation period of eggs		1±0.2	1±0.2	1.6±0.3
Larva	M	1±0.2	1.3±0.3	1.9±0.4
	F	1.06±0.2	1.5±0.2	2±0.2
Protonymph	M	0.9±0.2	1.2±0.2	1.3±0.2
	F	0.9±0.2	1.3±0.2	1.5±0.2
Deutonymph	M	0.9±0.2	1±0.2	1.2±0.2
	F	1±0.2	1.1±0.2	1.4±0.2
Total life cycle in days	M	3.9±0.5	4.5±0.5	5.9±1.1
	F	4±0.5	4.9±0.6	6±1.1

Table (2): Duration of developmental stage in days of *Acarus farris* reared on three diets at 10°C and RH. 70%.

Mite stage		Offered diets		
		Bran	Banana	<i>R. communus</i>
Incubation period Eggs		3.2±0.4	3.8±0.4	4.1±0.4
Larva	M	3.1±0.6	3.4±0.6	4.1±0.3
	F	3.4±0.4	3.9±0.4	4.3±0.5
Protonymph	M	3.0±0.3	3.5±0.4	4.0±0.5
	F	3.2±0.3	3.8±0.5	4.1±0.5
Deutonymph		Hypopus	Hypopus	Hypopus

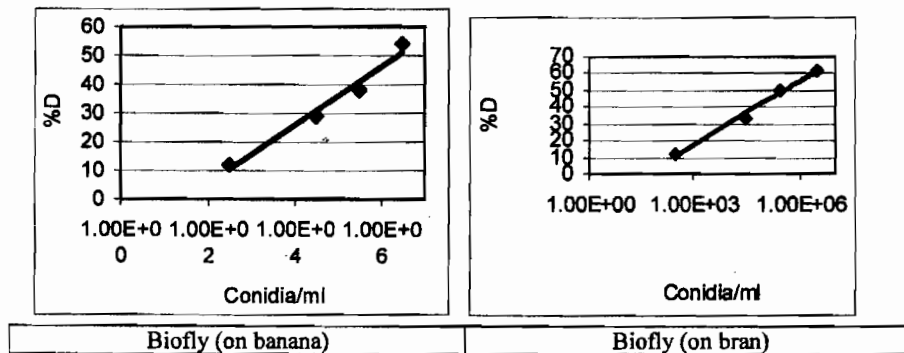
1.6. Life cycle:

Results as indicated in Table (1) showed that the female life cycle of *A. farris* reared on 28°C and 90% RH ranged in-between 6 days as maximum fed on *R. communus* and 4 days as a minimum fed on bran. While that fed on banana was 4.9 days. Results as indicated in Table (1) showed that the male life cycle of *A. farris* reared on 28°C and 90% RH ranged in-between 5.9 days as maximum fed on *R. communus* and 3.9 days as a minimum fed on bran. While that fed on banana was 4.5 days.

2. Biological control of *Acarus farris*:

2.1. Toxicity of biocide, Biofly and tracer to adults of *A. farris*:

Acaricidal activity of the biocide Biofly and tracer is presented in Fig. (1).



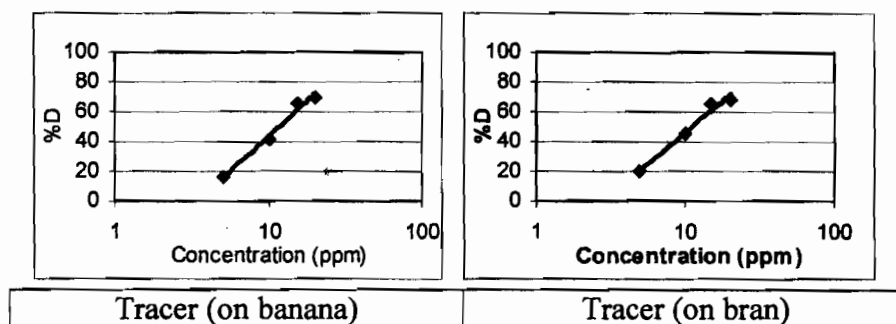
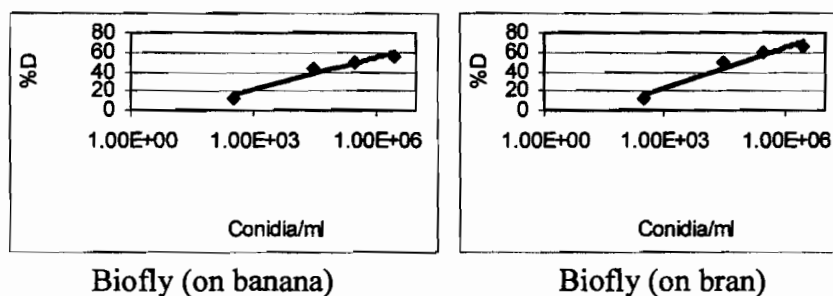


Fig. (1): Toxicity of biocide Biofly and tracer to adult of *Acarus farris*.

Treatment by Biofly to adults of *A. farris* showed that the LC_{50} was 4.5×10^5 conidia/ml. The slope value was (0.3704) and the LC_{50} was 1.5×10^6 conidia/ml on banana. The slope value was (0.3096), on bran diet. On the other hand, tracer on adults reared on adults reared on banana showed that the LC_{50} was 10.7171 ppm while the slope value was (2.6100). The LC_{50} on bran was 11.2747 ppm, while the slope value was (2.9288), respectively.

2.2. Toxicity of Biofly and tracer to nymph stage of the *Acarus farris*:

The toxic effect of biocide Biofly and tracer (Fig. 2) on the nymph of *Acarus farris* that the LC_{50} for Biofly was 3.98×10^4 conidia/ml while The slope value was (0.3444) on banana while LC_{50} was (4.7×10^5) conidia/ml, the slope value was (0.3069) on bran. On the other hand, tracer LC_{50} was 11.2931 ppm, while the slope value was (2.4424) on banana. The LC_{50} was 12.25 ppm. The slope value was (2.8920), on bran.



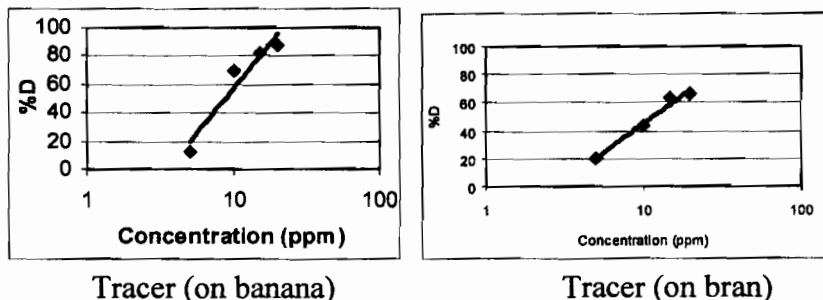


Fig. (2): Toxicity of Biofly and tracer to nymph stage of *Acarus farris*.

2.3. Toxicity of Biofly and tracer to the larval stage of the *Acarus farris*:

The toxic effect of biocide Biofly and tracer on larva of *Acarus farris* as shown in Fig. (3) the LC_{50} to Biofly was 2.2×10^5 conidia/ml while, the slope value was (0.3651) on banana LC_{50} was 3.5×10^5 conidia/ml and the slope value was (0.3548) on bran. On the other hand, tracer LC_{50} was 7.3667 ppm. While, the slope value was (3.6483) on banana. LC_{50} was 7.7683 ppm and the slope value was (3.592) on bran diet.

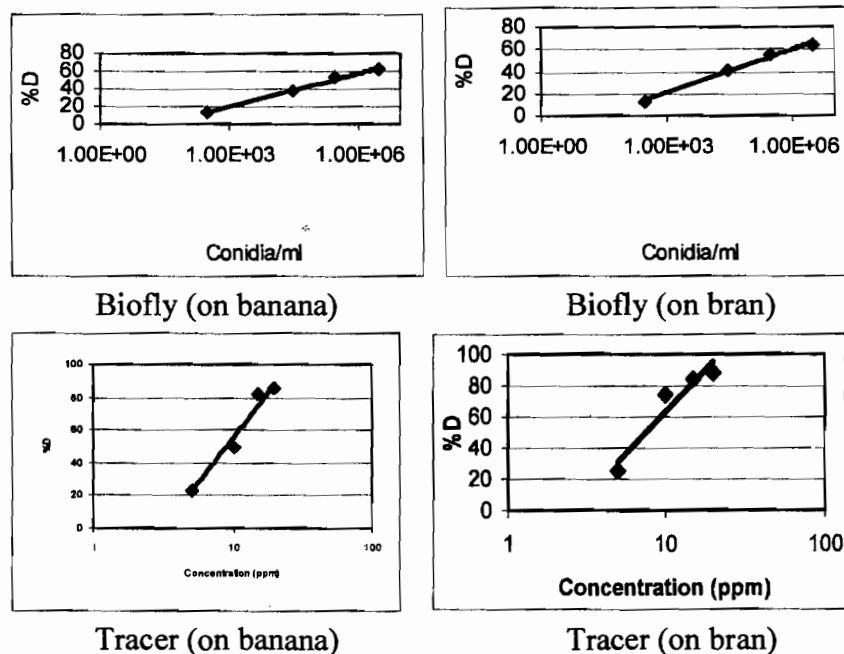


Fig. (3): Toxicity of biocide Biofly and tracer to larval stage of *Acarus farris*

2.4. Toxicity of Biofly and tracer on egg stage of *Acarus farris*:

Concerning the toxic effect of Biofly on the eggs of *A. farris*, (Fig. 4) the LC_{50} was less than 50% meaning that the eggs of the mite might be safe when applying that biocide. On the other hand, tracer LC_{50} was 13.4329 ppm, while the slope value was (2.0870) on bran. LC_{50} was 13.9199 ppm and the slope value was (2.4702) on banana.

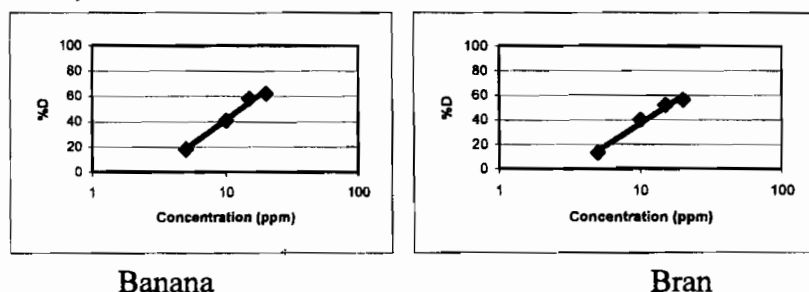


Fig. (4): Toxicity of biocide tracer to egg stage of *Acarus farris* reared on (Bran).

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الملخص العربي

دراسات بيولوجية على الاكاروس *أكاروس فاروس* (أكارينا : أكاريدى) وكذلك طرق المقاومة باستخدام المبيد الحيوى البيوفلاى والتريسر

رضا عبد المنصف ابراهيم ، فرج عبد اللطيف شرشير ، محسن شكرى تادرس ،
يوسف رمضان يوسف الطنطاوى
قسم الحشرات ، كلية الزراعة ، جامعة كفرالشيخ

أجريت الدراسة داخل معمل قسم الحشرات الاقتصادية بكلية الزراعة ،
جامعة كفرالشيخ فى أعوام ٢٠٠٥ ، ٢٠٠٦. وتضمن البحث دراسة النقاط التالية:
أولاً: تم تربية (*A. farris* (Oud) وهو من أكاروسات الحبوب المخزونة ، حيث تم
تربيته على درجتين من الحرارة والرطوبة وهم ٢٨ درجة مئوية ورطوبة نسبية
٩٠% وكذلك حرارة ١٠ درجة مئوية ورطوبة نسبية ٧٠% وقد تم اختيار ثلاث
عوائل غذائية هم الردة wheat bran وثمار الموز banana وحبوب لقاح
الخروع (*Ricinus communis*) وتبين من هذه الدراسة أن الردة هى أنسب
عائل لتربية هذا الاكاروس وذلك على درجة ٢٨ مئوية ورطوبة نسبية ٩٠%
حيث استغرقت دورة حياته أقل وقت مقارنة بالعوائل الأخرى. أما على درجة
حرارة ١٠ ورطوبة نسبية ٧٠% وتحولت جميع الأفراد الى طور الهيبوس
Hypopus وماتت جميعها أثناء التجربة.
ثانياً: دراسات السمية: تمت هذه الدراسة على نوعين من المبيدات الحيوية هما
البيوفلاى Biofly والتريسر Tracer على *A. farris*. ودلت نتائج التجربة على
الآتى:
أظهر المبيدان الحيويان البيوفلاى والتريسر سمية عالية على *A. farris* ولكن
مبيد البيوفلاى كانت سميته منخفضة على البيض.