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A Detailed Study of the Life Cycle of *Tyrophagus putrescentiae*, a Stored Grain Mite

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Abstract

Tyrophagus putrescentiae is an important mite of stored products. The susceptibility of the food grains to mite attack depends upon the high humidity, softness and high nutritive value of the food grains at optimum temperature. This mite directly endanger human health due to allergenic contamination of food, are vectors of toxicogenic fungi and thus indirectly contribute to contamination of food and feed with mycotoxins. It also cause significant grain weight losses and decrease of germinability. Present paper discusses distribution, pest status, host range, preference of food grains, life cycle. Biology of mould mite, *T. putrescentiae* was studied on Wheat flour and Rice flour at mean temperature of 32.2^{o}C and 98% RH in the laboratory. The data regarding durations of developmental stages viz., egg, larva, protonymph, deutonymph, life cycle and adult longevity of both male and female and pre-oviposition, oviposition, post-oviposition periods and fecundity of female.

Keywords: *Tyrophagus putrescentiae*, mould mite, grain, life cycle, stored grain pest

Introduction

Mites act as secondary invaders among storage pests as they cannot infest sound grain instead feed upon broken kernels, debris, high moisture seeds or damaged grain by primary insect pests. These invaders contribute directly to grain spoilage after establishment, just as primary pests do [1]. Stored-grain mites damages usually go unnoticed until the grain is removed from the storage facility.

Worldwide Distribution

These mites are tiny arachnids that are difficult to see and often go undetected until their numbers are significant. Studies on mites infesting stored agricultural products have been conducted in several regions throughout the world [2]. Till date, seventy species of stored product mites have already been reported. The important acarid pest species are Acarus sp., Tyrophogus sp., Suidasia sp., Glycyphagus sp., Lardoglyphus sp. and Lepidoglyphus sp [3].

Materials and Methods

To study the life cycle, one important mite species from each of the two habitats (stored products, roof garden) were selected. The technique for studying the life cycle was followed as per Helle and Sabelis (1985)[4]. In case of stored product mites two types of samples were chosen such as wheat flour and rice flour. The biology was done on *T. putrescentiae.* Laboratory culture of the mite was maintained in Petridishes (9cm in diameter). The mites were cultured, in culture medium made with yeast powder, biscuit dust, dry fish powder as food for mite. The newly laid eggs were separated with fine hair brush into two plastic plates(30×15 cm) with 24 cells (24 replications) with each plate provided with yeast powder, biscuit dust, dry fish powder and one with rice flour and wheat flour. Development was observed daily until maturity. Newly emerged adult females were transferred into new plates and one male added to each cell. The number of eggs laid by each female was recorded every 24 hour until the female died. Thus, the duration of different life stages, pre oviposition, oviposition, post oviposition periods, fecundity, longevity, sex ratio were recorded by taking observation at 24 hours interval.

Results and Discussion

Larva

After emerging from the egg, the active larval period averaged 5.16 ± 0.62 on wheat flour and 6.22 ± 0.78 on rice flour (Table 1). Mostafa *et al.*(2013)[5] worked on four different food types and found different larval stages (in wheat flour 8.0±0.21; in milk powder 9.2±0.41; in granular chicken feed 9.7±0.11; in fish powder 10.0±0.8) respectively. Sarwar *et al.*(2010)[6] studied on three different food types and reported varieties in duration of larval stage, (in Maize 1.8 ± 0.0;in Egg.

Table 1 indicates that there was slightly differences between the egg stage of *T. putrescentiae* female on different food types. This period averaged 5.24 ± 0.62 and 5.17 ± 0.58 for eggs on wheat flour and rice flour, respectively. Mostafa *et al.*(2013) worked on four different food types and found different egg stages (in wheat flour 3.1±0.13; in milk powder 3.3±0.17; in granular chicken feed 3.6±0.11; in fish powder 4.0±0.1) respectively. Sarwar *et al.*(2010) studied on three different food types and reported different egg stages (in Maize 3.2 ± 0.1; in Soybean 3.7 ± 0.0 and in wheat flour 3.2 ± 0.1), respectively.

Protonymph

The active phase of the protonymphal period averaged 6.86 ± 0.78 on wheat flour and 7.45 ± 0.44 on rice flour (Table 2). Sarwar *et al.*(2010) studied on three different food types and reported different protonymphal stages (in Maize 4.6 ± 0.1; in Soybean 5.9 ± 0.1 and in wheat flour 3.0 ± 0.1) respectively. Hajar Pakyari *et al.*(2011) [7]studied protonymphal stage on Mushroom (4.08 ± 0.39).

Deutonymph

The active phase of deutonymphal periods averaged 8.16 ± 0.90 on wheat flour and 9.48 ± 0.97 (Table 1). In the previous study, Sarwar *et al.* (2010) reported different deutonymphal stages on three different food types (in Maize 5.3 ± 0.2; in Soybean 6.9 ± 0.1 and in wheat flour 3.9 ± 0.0) respectively. Hajar Pakyari *et al.* (2011) reported deutonymphal stage on Mushroom (2.96 ± 0.41).

Egg to adult period

The total developmental period of *T. putrescentiae* averaged 26.12±3.24 on wheat flour and 28.32 ± 3.67 on rice flour respectively (Table 1). According to Mostafa *et al.*(2013), the total developmental period of *T. putrescentiae* averaged 11.1 ± 0.14 on wheat flour, 12.5 ± 0.71 on milk powder, 13.3 ± 0.45 on granular chicken feed, 14.0 ± 0.41 on fish powder respectively. According to Sarwar *et al.* (2010), the total developmental period of *T. putrescentiae* average was 15.2 ± 0.2 on Maize, 18.8 ± 0.2 on Soybean and 11.7 ± 0.3 on wheat respectively. According to Hajar Pakyar *et al.*(2011), the total developmental period of *T. putrescentiae* average was 15.87 ± 0.57 on Mushroom.

Oviposition and fecundity

The pre-oviposition, oviposition and fecundi--ty parameters of the *T. putrescentiae* were studied.

Pre-oviposition period

The mean pre-oviposition period averaged 6.44 ± 0.68 on wheat flour and 7.43 ± 0.76 on rice flour respectively (Table 1). Mostafa *et al.*(2013) studied the pre-oviposition period which average was 2.0 ± 0.2, 2.2 ± 0.1, 2.0 ± 0.3 and 1.9 ± 0.2 on wheat flour, milk powder, granular chicken feed and fish powder, respectively. According to Hajar Pakyari *et al.*(2011) the average on pre-oviposition on Mushroom was 2.2 ± 0.20.

Oviposition period

The oviposition period averaged 18.45 ± 1.82 on wheat flour and 16.78 ± 1.37 on rice floor (Table 1). Mostafa *et al* (2013) observed mean oviposition period was 34.6 ± 0.9 on wheat flour, 30.4 ± 0.3 on milk powder, 22.8 ± 0.6 on granular chicken feed and 21.0 ± 0.5 on fish powder respectively. According to Hajar Pakyari *et al.* (2011) oviposition period average was 18.5 ± 0.05 on Mushroom.

Post-oviposition

The postoviposition period averaged 3.55 ± 0.22 on wheat flour and 6.58 ± 0.74 on rice flour (Table 1). Mostafa *et al* (2013) observed mean post-oviposition period average was 2.6 ± 0.4 on wheat flour, 2.1 ± 0.2 on milk powder, 2.6 ± 0.5 on granular chicken feed and 2.2 ± 0.0 on fish powder respectively. According to Hajar Pakyari *et al.*(2011) oviposition period average was 2.5 ± 0.35 on Mushroom.

Fecundity

On an average the total number of eggs laid by a female was 22.2 ± 0.92 on wheat flour and 20.28 ± 0.62 on rice flour (Table 1). Mostafa *et al* (2013) reported mean total fecundity/female 39.0 ± 1.3, 34.0 ± 1.5, 30.0 ± 0.7, 27.8 ± 0.7 on wheat flour, milk powder, granular chicken feed and fish powder respectively. According to Sarwar *et al.*(2010) the mean total fecundity/female 17.1 ± 2.0, 11.4 ± 1.8, 23.8 ± 1.2 on Maize, Soybean and wheat respectively.

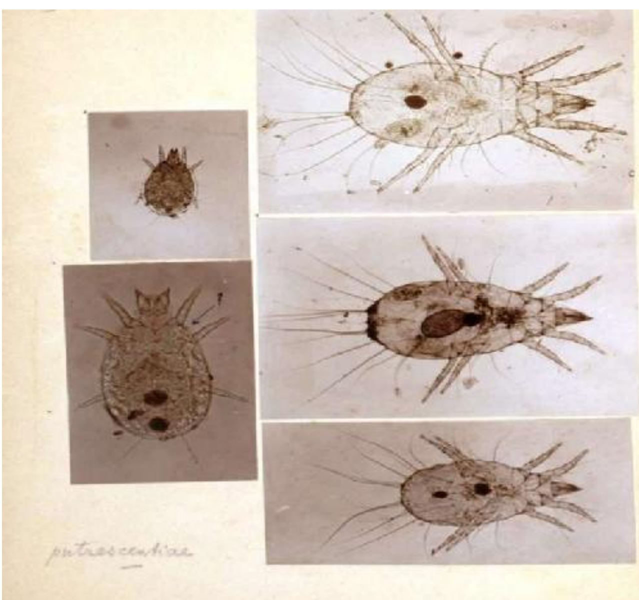
Longevity male

The sexually matured males had a narrow body with a distinctly pointed abdomen when compared to the females. The total period spent after deutonymph till they died (longevity) was averaged 23.11 ± 2.44 on wheat flour and 17.25 ± 0.65 on rice flour (Table 1). According to Sarwar *et al.* (2010) longevity averaged 23.5 ± 1.5 on Maize, 18.7 ± 1.8 on Soybean and 28.7 ± 0.8 on wheat respectively.

Longevity Female

The mean longevity was 28.44 ± 2.82 on wheat flour and 39.45 ± 3.20 on rice flour for female. Mostafa *et al.*(2013) reported average female longevity was 39.0 ± 1.14 on wheat flour, 34.7 ± 0.71 on milk powder, 27.3 ± 0.71 on granular chicken feed and 25.1 ± 0.71 on fish powder respectively. According to Sarwar *et al.*(2010) studied average longevity for female was 34.1 ± 1.5 on Maize, 27.0 ± 2.4 on Soybean and 40.8 ± 0.6 on wheat flours respectively. Also according to Hajar Pakyari *et al.*(2011) the average longevity of female was 23.2 ± 0.90 on Mushroom.

Images of different stages of *Tyrophagus putrescentiae*



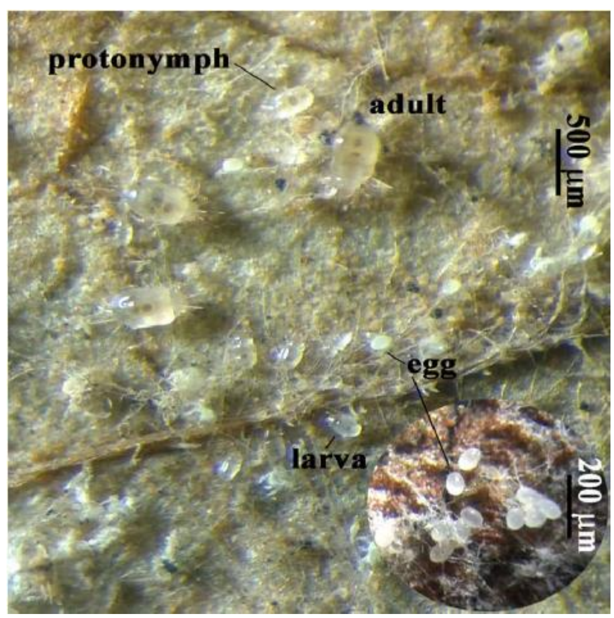


Table : 1 Life Cycle of *Tyrophagus putrescentiae* on stored rice and wheat under laboratory condition

Life cycle of *Tyrophagus. putrescentiae*				
Stages	**Range (in days)**	**Habitat I (Wheat Flour) In days**	**Range (in days)**	**Habitat II (Rice Flour) In days**
Egg	3.5 - 4.5	5.24 ± 0.62	2.0 - 3.5	5.17 ± 0.58
Larva	4.0 - 5.0	5.16 ± 0.62	3.0 - 4.5	6.22 ± 0.78
Protonymph	4.0 - 5.5	6.86 ± 0.78	4.0 - 4.5	7.45 ± 0.44
Deutonymph	3.0 - 4.0	8.16 ± 0.90	2.5 - 3.5	9.48 ± 0.97
Life Cycle		26.12 ± 3.24		28.32 ± 3.67
Preoviposition Period	2.5 - 3.0	6.44 ± 0.68	2.0 - 3.0	7.43 ± 0.76
Oviposition Period	12.0 - 18.5	18.45 ± 1.82	12.0 - 15.0	16.78 ± 1.37
Postoviposition Period	1.5 - 3.0	3.55 ± 0.42	1.5 - 2.0	6.58 ± 0.74
Fecundity	20.5 - 25.0	22.2 ± 0.92	20.0 - 24.5	20.28 ± 0.62
Longivity Female	20.5 - 25.0	28.44 ± 2.82	9.0 - 14.75	39.45 ± 3.20
Longivity Male	20.0 - 22.5	23.11 ± 2.44	14.25 - 17.50	17.25 ± 0.65

Conclusion

We can conclude here that the duration of life cycle in case of habitat II (Rice flour) is slightly higher than habited I (Wheat flour). The longevity of female is higher in case of rice flour but longevity of male is higher in case of wheat flour.

Unpaired *t* test results

P value and statistical significance:

The two-tailed P value equals 0.7253

By conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Group One minus Group Two equals -1.5164
95% confidence interval of this difference: From -10.3923 to 7.3595

Intermediate values used in calculations:

t = 0.3564
df = 20
Standard error of difference = 4.255

Review your data:

	Group One	Group Two
Mean	13.4300	14.9464
SD	8.8933	10.9576
SEM	2.6814	3.3038
N	11	11

Acknowledgments

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References

1. Weaver DK, Petroff AR. Pest Management for Grain Storage and Fumigation. Department of Entomology, Montana State University, 333 Leon Johnson Hall, Bozeman, MT. 2009.
2. Qu SX, Li HP, Ma L, Hou LJ, Lin JS, Song JD et al. Effects of different edible mushroom hosts on the development, reproduction and bacterial community of *Tyrophagus putrescentiae* (Schrank). J Stored Prod Res; 2015; (61):70-75.
3. Chhillar BS, Gulati R, Bhatnagar P. Agrilcultural Acarology, Daya Publishing House, New Delhi: 2007, 355.
4. Helle, W and Sabelis M.W. 1985 — *Spider mites: their biology, natural enemies and control* — Amsterdam: Elsevier Pub.. pp. 405.
5. Mostafa, A. M. Hanem H. I. Sakr , E. M. A, Yassin, Asmaa, R. Abdel-Khalik 2013. Effect of different diets on the biology of the Astigmatid Mite *Tyrophagus putrescentiae*. *Egypt. J. Agric. Res*., 91 (4):1439-1445.
6. Sarwar, M. Xu, X. and Wu, K.2010. Effects of different flours on the biology of the *prey Tyrophagus putrescentiae* Schrank) (Acarina: Acaridae) and the predator *Neoseiulus pseudolongispinosus. International Journal of Acarology*. 36(5):363-369.
7. Pakiyari, H and Maghsoudlo, M. 2011. Development and Life table of *Tyrophagus Putrescentiae* on Mushroom. *Academic Journal of Entomology*. 4(2):59-63.

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