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Effect of infestation with acaridid mite, *Tyrophagus putrescentiae* (Schrank) on germination rate of maize grains

Adel M. Mostafa, E.M.A. Yassin, Y.A. Eisa & Noura F. Abou El-Enien
Plant Protection Research Institute, A.R.C., Dokki, Giza, Egypt

ABSTRACT

The infestation of maize grains with the harmful acarid mite, *T. putrescentiae* at the laboratory was conducted after 3, 6 and 9 months. The number of normal, abnormal and analyzed maize grains was conducted. The infestation of maize grains with the harmful acarid mite, *T. putrescentiae* at the laboratory was conducted after 3, 6 and 9 months. The numbers of normal, abnormal and analyzed maize grains were conducted for 50 grains. Generally, it was noticed that the number of normal maize grains increased with decreasing the number of mites infested to grains and also with decreasing the time of infestation, while the number of abnormal maize grains increased with increasing the number of infestation mites and also with increasing the time of exposure to mites.

Keywords: Acaridid mite ,germination rate , maize grains

INTRODUCTION

The mites, being important pests of stored grains, are responsible of both qualitative and quantitative losses in stored grains. These mites feed on embryo thus resulting in germination loss in the grains (Zakhavatkin, 1941) along with deterioration in quality of seed as well as flour prepared from the infested grains which also make it unsuitable for milling and unpalatable for livestock (Wilkin and Stables, 1985). Many commercial farmers are unaware of the damage and losses caused by the stored grain mites mainly due to their minute size (Palyvos and Emmanouel, 2006). The direct damage of mites to stored grains is through contamination and penetration in to seeds/embryo, consumption of the grain germ and some extent, the endosperm (Parkinson, 1990) which consequently decrease the vitality and germination capability of the seeds. The grain becomes useless for seed (Zdarkova, 1996) or brewing purposes and unacceptable to the miller (Solomon, 1946). The cereal, grains and stored products are liable to be attacked not only by insects, but also by mites, which either free living granaries, fungivorous and saprophagous or parasitic or predator on other mites and insects. Mites associated with stored products are of great economic importance, causing injury by feeding and its contamination with dead bodies and excreta makes these sources of food undesirable in addition to its digestion troubles. Damage by insects, fungi, and sprouting cause hundreds of millions of dollars of economic losses to grain producers, merchandisers, and processors each year (Harein and Meronuck, 1995). Haq and Afzal (2007) in Pakistan decided that mites infested grains undergo a series of changes in their chemical composition and affecting the germination capacity, flour prepared from contamination grains is more acidic, fusty smell and bitter taste. In their studies about the relation between the stored product grains and mites on germination of certain cereals. Ashfaq *et al*. (1996) and Zdarkova (1996) mentioned that the stored grain and stored products mites decrease the germination percentage of cereals and also infest and damage other food stuffs as cheese, flour, seed, bulbs, tubers and dried fruits of all kinds and decaying material and other such items are the main factors for habitation of these mites. Ramzan *et al*. (1991) noticed that damage variation in different wheat was from 17.4 to 45.0 % after one year of storage and the weight lost of maize and

maize due to mite infestation differed according to infestation where it consumed the highest amount of grains which in turn affected on the germination of these grains.

MATERIALS AND METHODS

Germ inability was determined by using grains of maize (50 grains). Folded towels of each treatment were maintained in an incubator at 25-30 ºC. A relative humidity of 75-85 % was maintained in the incubator along the period of germination test. The folded towels were also moistened continuously. They needed moisture to the grains at all times. The number of germination grains was recorded after 3, 6 and 9 months of infestation. The number of used mites in infestation was 50, 100, 200 and 300 of *Tyrophagus putrescentiae* adult stage which was already reared in the laboratory conditions on some yeast granules**.** For calculating the germination percentage one hundred grains of each stored commodity were placed and soaked on blotting paper in the Petri dish. Each treatment was repeated six times. After a period of 72 hours, the number of germinated seeds in each Petri dish was counted and germination percentage was estimated by the following formula:

$$\text{Germination \%} = \frac{\text{Number of germinate grains}}{\text{Total No. of grains soaked in each Petri dish}} \times 100$$

RESULTS AND DISCUSSION

Maize (*Zea mays* L.) is one of the most nutritional crops and proper storage of seeds continues to be a challenge for subsistence farmers. In this study, the infestation of maize grains with the harmful acarid mite, *T. putrescentiae* at the laboratory was conducted after 3, 6 and 9 months. The number of normal and abnormal maize grains was conducted**.**

A. After 3 months:

The obtained data in Table (1) denoted that the number of abnormal and analyzed grains was increased by increasing the number of used *T. putrescentiae*. On the other hand, the number of normal grains increased with decreasing the number of mite's infestation. Data in Tables (1 and 2) indicated that the number of normal maize grains after 3 months increased significantly with decreasing the number of mite infested these grains, where the number was 46.5 normal grains but abnormal and analyzed grains was 3.5 grains, respectively. However, in case of 300 mite individuals, the normal of maize grains were 30.5 mites but abnormal and analyzed grains recorded 19.5 grains.

B. After 6 months:

As shown in Table (1) the number of normal grains were increased with decreasing the number of infested mites which decreased gradually by increasing the number of *T. putrescentiae* reaching to 28.5 normal grains when exposed to 300 mite individuals. On the other hand, the highest number of abnormal maize grains (21.5) was noticed when the grains exposed to 300 mite individuals. However, the same trend of observation was recorded in case of analyzed maize grains where the highest number of analyzed grains was obtained when 300 mites introduced. From the obtained data, it was denoted that there were highly significant differences between the number of abnormal and analyzed maize grains and the number of introduced mites, Table (2).

C. After 9 months:

The tabulated data in Tables (1 and 2) showed that the number of obtained normal maize grains significantly decreased with increasing the number of *T. putrescentiae* where the number was reached to the highest healthy grains 42.0 one with introducing 50

mites only, the number decreased to reach to 26.5 grains with 300 mites of *T. putrescentiae*. The highest number of abnormal and analyzed maize grains after infestation with these harmful mites reached to the highest level of damage when the grains infested with 300 mites also where the number of the abnormal and analyzed was 23.5 grains wheat that was infested by each of 3 species of mites, *Lepidoglyphus destructor* (Schrank), *Acarus farris* (Oudemans), and *Aeroglyphus robustus* Banks studied by White *et al*. (1979) to determine the effects of mites on the quality of wheat. *L. destructor* infestation of the grain led to significantly lower fat acidity values ($P<0.01$) and significantly slower loss of seed germination ($P<0.05$) than in the noninfested wheat. The infestation of maize grains with the harmful acarid mite, *T. putrescentiae* at the laboratory was conducted after 3, 6 and 9 months. The numbers of normal, abnormal and analyzed maize grains were conducted for 50 grains. Generally, it was noticed that the number of normal maize grains increased with decreasing the number of mites infested to grains and also with decreasing the time of infestation, while the number of abnormal maize grains increased with increasing the number of infestation mites and also with increasing the time of exposure to mites.

Table 1: Effect of *Tyrophagus putrescentiae* infestation on the germination of maize grains (50) without washing after different exposure times.

No. of mites infested grains	Months after infestation	Normal grains Mean ± S.D.	Average no. of normal grains	Abnormal grains Mean ± SD
50	3	46.5±1.29	(45-48)	3.5±0.96
	6	45.0 ±0.82	(44-46)	5.0±0.81
	9	42.0±0.82	(41-43)	8.0±0.81
100	3	37.4±0.08	(37.3-37.5)	12.6±0.08
	6	32.7±0.08	(32.6-32.8)	17.3±0.16
	9	30.5±0.25	(30.3-30.8)	19.5±0.62
200	3	34.5±0.16	(34.3-34.7)	15.5±0.41
	6	30.0±0.82	(29-31)	20.0±0.81
	9	28.5±0.38	(28.2-29)	21.8±0.16
300	3	30.5±0.08	(30.4-30.6)	19.5±0.41
	6	28.5±0.08	(28.4-28.6)	21.5±0.41
	9	26.5±0.41	(26-27)	23.5±0.41
Control (without mites)	3	48.0±0.82	(47-49)	2.0±0.81
	6	46.5±0.41	(46-47)	3.5±0.41
	9	46.0±0.41	(45.5-46.5)	4.0±0.16

Table 2: Effect of storage time and number of *T. putrescentiae* on the germination of maize grains.

Grain state	Main effect	F	P	L.S.D. at 0.05 level
Normal grains	Storage time	327.424	0.0000 ***	0.3711
	Mite number	2413.14	0.0000 ***	0.4791
	Int. storage time x mites number	13.877	0.0000***	-
Abnormal grains	Storage time	368.67	0.0000***	0.3640
	Mite number	2594.20	0.0000 ***	0.4699
	Int. storage time x mites number	17.4425	0.0000***	-

F. = F test P. = Probability at 0.05 level *** = Highly significant.

In this line, Bashir (2010) mentioned that the mites cause both quantitative and qualitative losses. As a result of their infestation, along with weight reduction, the grain losses the viability. Also, according to Canadian Grain Commission (2010), the grain mites *Tyrophagus putrescentiae* attacks the germ (embryo) of seeds, which reduces

germination, and spreads fungi (moulds), which are also eaten.The present studies can be compared with those of Ashfaq *et al.* (1995) who revealed 15-20 % germination loss in grains of wheat, maize and mung collected from Mansehra District due to mite pests after three months of storage. Generally and based on the obtained results it can be concluded that *T. putrescentiae* mite is mainly responsible for the germination loss in the stored maize grains.

REFERENCES

Ashfaq, M., M.S. Ahmad and A. Pervez (1996): Some studies on correlation between mite population and germination losses of stored wheat. Pak. Entomol., 18(1-2): 102-103.

Ashfaq, M., Z. Parveeb and S.I. Iqbal (1995): The impact of mite population on infestation of wheat, mung and maize stored in private godowns of Mansehra District. Pak. Entomol., 17: 120-122

Bashir, M.H. (2010): Survey and management of mite pests of stored grains in tehsl Toba Tek Singh, Punjab. Univ. of Agriculture, Faisalabad, Pakistan, http://www.uaf.edu.pk/auf_research/prj_50.html

Canadian Grain Commission (2010): Protection of farm-stored grains, oilseeds and pulses from insects, mites and moulds. http://www.grainscanada.gc.ca/storage-entrepose/aafc-aac/pfsg-ngef-8eng.htm

Haq, I.U. and M. Afzal (2007): Mites associated with stored grains and their products in Faisalabad district. African Crop Science Conference Proceedings Vol. 8. pp.2205-2207, El-Minia, Egypt.

Harein, P. and R. Meronuck (1995): Stored grain losses due to insects and molds and the importance of proper grain management, *In* V. Krischik, G. Cuperus & D. Galliart, pp. 29-31. E-912.CES.Div.Agric.Sci.Nat.Res.OSU.USDA. FGIS. ES. APHIS. 242 PP.

Palyvos, N.E. and N.G. Emmanouel (2006): Seasonal abundance and vertical distribution of mites in flat storage containing wheat. Phytoparasitica, 34: 25-36.

Parkinson, C.L. (1990): Population increase and damage by three species of mites on wheat at 20 °C and two humidities. Exp. Appl. Acarol., 8: 179-194.

Ramzan, M., B.K. Judge and P.S. Madan (1991): Losses caused by storage pests in different wheat varieties under normal conditions. J. Res. Punjab, Aric. Univ., 28(1): 63-67.

Solomon, M.E. (1946): Tyroglyphid mites in stored products. Ecological studies. Annl. Appl. Biol., 33: 280–289.

White, N.D.G., L.P. Henderson and R.N. Sinha (1979): Effects of Infestations by Three Stored-Product Mites on Fat Acidity, Seed Germination, and Microflora of Stored Wheat. Journal of Economic Entomology, Volume 72, Number 5, October 1979, pp. 763-766.

Wilkin, D.R. and L.M. Stables (1985): The effects of dusts containing etrimfos, methacrifos or pirimiphos-methyl on mites in the surface layers of stored barley. Exp. Appl. Acarol., 1: 203-211.

Zakhavatkin, A.A. (1941): Fauna of USSR Arachnoidea VI (1): Tryoglyphoidea (Acari). Zool. Inst. Acad. Sci. USSR. New Ser. No. 28. English Translation 1959. (Eds. A. Rateliffe and A.M. Hughes). American Institute of Biological Sciences, pp: 573.

Zdarkova, E. (1996): The effect of mites on germination of seed. Ochrana-Rostlin., 32(3): 175-179.

ARABIC SUMMARY

تاثير الإصابة بالأكاروس الأكاريدى *Tyrophagus putrescentiae* (Schrank) على معدل الإنبات فى حبوب الذرة

عادل محمود مصطفى – عصام محمد عبد السلام ياسين – يونس أحمد عيسى – نورا فرج أبو العينين
معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة – مصر

تصاب الحبوب والمواد المخزونة ليس بالآفات الحشرية فقط ولكن أيضا بالأكاروسات والتي إما أن تكون أكاروسات فطرية التغذية أو متطفلة أو مفترسة على مفصليات الأرجل الأخرى. والأكاروسات التي ترتبط بالحبوب والمواد المخزونة لها أهمية كبيرة حيث أنها تسبب ضررا بالغا لهذه المواد إما بالتغذية عليها أو بنقل الفطريات الضارة لها او بسبب وجود فضلاتها والتي تؤثر بلا شك على طعم ورائحة هذه المواد والحبوب المخزونة ودرجة إنباتها فى حالة زراعة الحبوب والبذور المصابة لذا أجريت هذه الدراسة لمعرفة أهمية هذه الأكاروسات والدور الذي تلعبه على درجة الإنبات فى حبوب الذرة حيث استخدمث ثلاث مجموعات من الأكاروس ٥٠ و ١٠٠ و ٢٠٠ و ٣٠٠ أكاروس على ٥٠ حبة من الذرة حيث اتضح من النتائج المتحصل عليها عند الإصابة بالأكاروس *T. putrescentiae* بعد كل من ٣ و ٦ و ٩ شهور أن عدد الحبوب المصابة قد زاد تعدادها بشكل عام وبصورة معنوية بزيادة عدد الأكاروسات التي تم إطلاقها لإصابة هذه الحبوب حيث كانت الحبوب المصابة بعد ٣ شهور كانت ١٩.٥ حبة عند الإصابة بعدد ٣٠٠ فرد أكاروس. أما بعد ستة أشهر فقد وصل تعداد هذه الحبوب بعد الإصابة بالأكاروس إلى ٢١.٥حبة ذرة غير عادية و متحللة في حالة ٣٠٠ فرد أكاروس أيضا وكانت الأعداد ٢٣.٥ حبة بعد تسعة أشهر من الإصابة بعدد ٣٠٠ فرد من أفراد الأكاروس *T. putrescentiae*.