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Evaluation of Germination Losses Caused by Mites in Seeds of Maize and Mung From Farmer's Holdings in Tehsil Toba Tek Singh

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Abstract.- The present studies were conducted to determine the impact of mite population on germination in seeds of Maize and Mung from farmer's holdings of Tehsil Toba Tek Singh *viz.*, Toba Tek Singh, Janiwala, Dabawala, Jalalpur, Dulum, Rajana, Bairianwala, Pairra and Chatiana. Mite population and germination were recorded at the initial stage of the experiment and after three months of storage. The results revealed highly significant differences between pest mite populations at different localities. In Maize maximum and minimum initial and final population of harmful mites were recorded from Rajana which was 3.33 and 6.66 respectively. In mung, maximum initial and final population of harmful mites was 2.33 and 5.33 respectively, from Rajana. Significant variations were recorded in initial and final germination percentage of the both commodities which ranged 86-91, 74.67-81 respectively, in maize and 85.83-91.83, 75.33-85.33 respectively in mung. Negative correlation was observed between harmful mite population and final germination percentage of maize and mung with correlation coefficients of -0.07 and -0.507 respectively.

Key words: Stored, mung, maize, mites, germination.

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 into 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). These mites cause the indirect damage by producing fusty smell due to secretion of certain lipids (White, 1995) or responsible for spread of fungal spores in the stores (Lacey, 1988; Hubert *et al.*, 2004). They also cause certain allergenic reactions including asthma, rhinitis and eczema particularly in the occupational environment (Marx *et al.*, 1993; Chambers *et al.*, 1999; Kondreddi *et al.*, 2006; Yadav *et al.*, 2006). Contaminated grains, dried fruits and vegetables become useless and harmful for human and animal consumption. The existence of stored grain mites has been reported from all over the world (Mahmood, 1992; Haines, 1997; Kucerova and Horak, 2004; Hubert *et al.*, 2004, 2006; Collins, 2006). From Pakistan the existence of mite pests in different godowns of different localities have been recorded (Ashfaq *et al.*, 1999, 2000; Sher *et al.*, 1991; Sarwar *et al.*, 1998; Ashfaq and Sarwar, 2001; Ashfaq and Sher, 2002; Sarwar and Ashfaq, 2004). They often infest grains in the process of harvesting, transportation, processing and storing. Their occurrence is related to the amount of impurities in the grain. Harmful mites of stored grains belonging to families; Acaridae, Histiostomatidae, Tyroglyphidae, Saproglyphidae and Glycyphagidae pose severe losses and damage to stored grains and stored grain products. Zakhvatkin (1941) reported that the mites consumed up to 3% by weight of the grain and they consumed the wheat germ flakes more rapidly than grain itself in Bermuda Island.

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Considerable literature outlining the susceptibility of cereals and infestation of stored grain mite has been described by Pagliarini (1979), Prickett (1992), Emmanouel *et al.* (1994) and Franz *et al.* (1997).

From Pakistan, the work regarding the germination loss of different stored seeds due to mite pests has been reported by Chaudhri (1989), Ashfaq and Wahla (1989) and Ashfaq *et al*. (1995, 1996a,b), Bhatti and Akhtar (1996) and Bashir *et al.* (2009). The storage mites are responsible mainly for the reduction in the germination due to consumption of the seed germ (Zakhavatkin, 1941) although the seed seems to be healthy. The infested seed is the main cause of the low yield because of less plant population. Keeping in view the importance of the storage mites, the present study was conducted to estimate the germination loss of the seed of maize and mung after a definite period of storage from different localities of Tehsil Toba Tek Singh.

MATERIALS AND METHODS

Various private godowns at nine different localities *viz*., Toba Tek Singh, Janiwala, Dabawala, Jalalpur, Dulum, Bairianwala, Pairra, Rajana and Chatiana of Tehsil Toba Tek Singh were surveyed and six samples each of stored maize and mung (250 g each), from each of 9 localities, were collected. These samples were brought to Acarology Research Laboratory in the Department of Agricultural Entomology, University of Agriculture, Faisalabad. The germination percentage of the collected seeds was determined at the initial stage of the experiment. The Final germination percentage was recorded after three months of storage of the remaining samples under laboratory conditions. 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:

$$\text{Germination \%age} = \frac{\text{No. of germinated seed}}{\text{Total No. of seed soaked in each Petri dish}} \times 100$$

The pest mite population was also recorded at the initial stage of the experiment as well as after three months of storage. For this purpose the samples of 250 gram of each commodity were processed through the Berlese's Funnel for at least 24 hours. The mites were received in the beakers containing 70% alcohol under the funnel. The stored grain mite pests belonging to the family Acaridae were counted in these samples with the help of a binocular microscope. The same procedure was repeated for three times for each of the commodity.

RESULTS AND DISCUSSION

The results regarding the germination of the maize seeds at the initial stage are presented in Figure 1. Highly significant variations were observed between the germination (86-91) of the seeds from dirrerent localities ($F = 4.72$, $df = 8$, $P < 0.0003$). Maximum germination of the seeds was recorded from Toba Tek Singh (91) followed by Janiwala (90.33), Dulum (90.33), Bairianwala (89.83), Jalalpur (89.50), Dabawala (89.17), Rajana (88.33), Pairra (86.83) and Chatiana (86) respectively.

Data regarding the final germination percentage also showed the significant variations among the samples collected from different localities (Fig. 1) ($F = 11.9$, $df = 8$, $P < 0.0000$). Maximum germination was recorded from Jalalpur (81) while minimum was recorded from Paira which was 74.67%. Samples of Toba Tek Singh had 80.17 which is statistically at par with that of Dulum having 80.17%. These results show that during the storage of three months the germination of the seeds was reduced (8-12.16).

Mite population also increased during the three months. Mite population from 250 g grains of maize had significant differences between different localities (Fig. 2) ($F = 7.5$, $df = 8$, $P < 0.0002$). At the initial stage of the experiment the mite population remained low from all the localities. Maximum population was recorded from Rajana (3.33) which was statistically different from all other treatments. Minimum population was recorded from Janiwala which was 0.33. Population from all localities except Rajana was statistically at par.

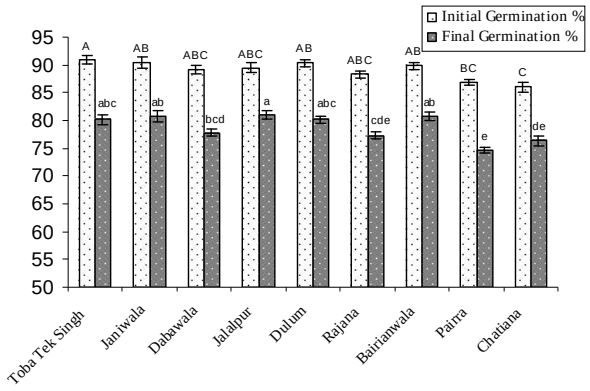

Fig. 1. Initial and final germination of the maize seeds collected from different localities of Tehsil Toba Tek Singh. Means followed by different letters are significantly different from each other according to Tukey HSD Test at P = 0.05. Capital letters represent initial germination % while small letters represent final germination %. Bars represent Standard error of means based on six replications.

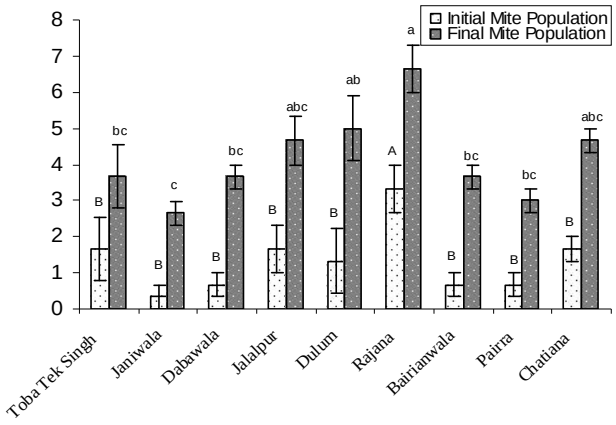

Fig. 2. Initial and final mite population from the sample of maize collected from different localities of Tehsil Toba Tek Singh. Means followed by different letters are significantly different from each other according to Tukey HSD Test at P = 0.05. Capital letters represent mite population at initial stage while small letters represent mite population after 3 months. Bars represent Standard error of means based on three replications.

After three months of storage the mite population increased in all the samples of maize Fig. 2). These populations exhibited significant variations (F = 7.47, df = 8, P < 0.0002). Maximum population was recorded from Rajana (6.66) followed by Dulum (5), Jalalpur (4.66), Chatiana (4.66), Toba Tek Singh (3.66), Dabanwala (3.66), Bairianwala (3.66), Pairra (3) and Janiwala (2.66) respectively. The mite population was negatively correlated with the germination of the maize seeds (-0.07).

Data regarding the initial germination percentage of mung seeds is given in Figure 3. The germination percentage showed highly significant differences between the samples of different localities (F = 5.95, df = 8, P < 0.0000).

Maximum germination was recorded from Janiwala (92.17) followed by Dulum (91.83). these both were statistically at par. Minimum germination was recorded from Rajana (85.83).

After three months of storage the germination of the mung reduced (7.66-13.84) from the samples of different localities. The final germination of the mung seeds showed highly significant variations (Fig. 3) (F = 21.2, df = 8, P < 0.0000). Maximum germination was recorded from Dulum (83.33) while minimum germination was reported from Chatiana (75.33). The germination percentage from the remaining localities varied from 75.83-81.67.

The samples collected from all the localities of Tehsil Toba Tek Singh were found to be infested with stored grain mites at the initial stage (Fig. 4). The population of mites from the samples of different localities showed the significant variations (F = 2.48, df = 8, P < 0.0524).

Maximum population was recorded from Rajana (2.33) while minimum population was recorded from Dulum (0.33). Both these differed statistically. Population recorded from Toba Tek Singh, Janiwala, Dabawala, Jalalpur, Bairianwala, Pairra and Chatiana were 1.33, 1, 1.33, 0.66, 1.33, 0.66 and 1.33 respectively. All these were statistically similar. Data regarding the final population of the mites from the sample of mung drawn from different localities is presented in Figure 4. The population showed significant variations (F = 4.12, df = 8, P < 0.0060). Maximum population was recorded from Rajana (5.33) while minimum was recorded from Jalalpur (2.33). Mite population and germination of mung seeds were negatively correlated (-0.507).

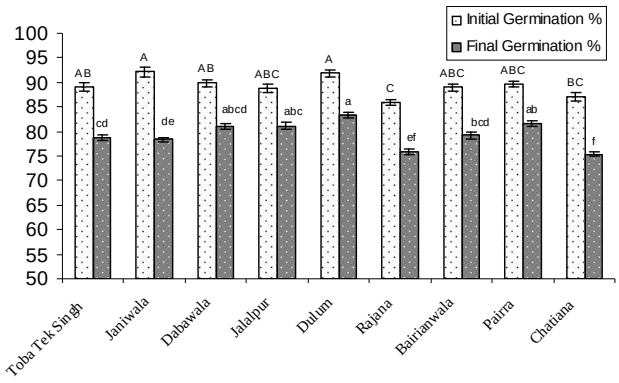

Fig. 3. Initial and final germination of the mung seeds collected from different localities of Tehsil Toba Tek Singh. Means followed by different letters are significantly different from each other according to Tukey HSD Test at P = 0.05. Capital letters represent initial germination % while small letters represent final germination %. Bars represent Standard error of means based on six replications.

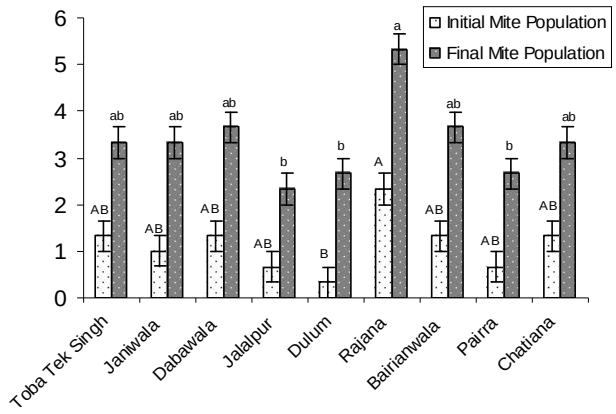

Fig. 4. Initial and final mite population from the sample of mung collected from different localities of Tehsil Toba Tek Singh. Means followed by different letters are significantly different from each other according to Tukey HSD Test at P = 0.05. Capital letters represent mite population at initial stage while small letters represent mite population after 3 months. Bars represent Standard error of means based on three replications.

From the above mentioned results it can be concluded that mite are responsible for the reduction in germination of these commodities. These findings are inline with those of Zakhavatkin (1941) who reported that mite population affects the germination of the grains directly through damaging the growing tips. 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. Similarly negative correlation between mite population and the germination was reported by Ashfaq and Wahla (1989). Based on these results it can be concluded that mites are mainly responsible for the germination loss in the stored grains.

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