

SHORT COMMUNICATIONS

New Record of Insect Pests Infesting Stored Tef [*Eragrostis tef* (Zucc.) Trotter] Grains

Tebkew Damte* and Getachew Belay

Debre Zeit Center Agricultural Research Center, P. O. Box 32, Debre Zeit, Ethiopia

*Corresponding author: tebkew@yahoo.com

Abstract

Two insect species, the cigarette beetle, *Lasioderma serricornis* F. (Coleoptera: Anobiidae) and the confused flour beetle, *Tribolium confusum* J. du Val. (Coleoptera: Tenebrionidae) were identified as storage pests attacking stored tef grains at the National Tef Research Project Laboratory of Debre Zeit Agricultural Research Center. Both species are capable of damaging the embryo of tef grain, and consequently reduce seed germination. However, they failed to reproduce on clean tef. Although the two insect species are not new to Ethiopia, this is the first record to have found them as storage insect pests infesting tef grains under natural conditions. Since seeds are distributed for breeding and other purposes from the research center, careful inspections are required before dispatch, particularly when the seeds are stored for more than a season.

Key words: cigarette beetle (*Lasioderma serricornis*), confused flour beetle (*Tribolium confusum*), tef (*Eragrostis tef*)

Introduction

Tef [*Eragrostis tef* (Zucc. Trotter)] is an indigenous and important cereal crop of Ethiopia grown extensively in different agro-ecologies (Hailu and Getachew, 2006). Compared to the other cereals, relatively few major field insect pests (e.g. shootfly, grasshoppers and crickets, red tef worm, black tef beetle, termites, ants) are known to attack tef (Tadesse, 1969). Besides, tef grains are not attacked by the major cereal storage insect pests such as *Sitophilus granaries*, *S. zeamais*, *S. oryzae* and others (Mekasha *et al.*, 2001). The latter might be associated to the minute size of the kernels (Yemane and Yilma, 1989), ranging from 0.9 to 1.7 mm and 0.7 to 1.0 mm in length and diameter, respectively (Assefa *et al.*, 2001). The

advantage of the non-vulnerability of the grains to these major storage pests of cereals is that tef grains can be easily stored in local storage facilities without the need for chemical protection. However, McFarlane (1969) speculated that tef can be attacked by warehouse moth, *Cadra cautella* (Synonym *Ephestia cautella*), although damaged tef grains by this species were not found. Later McFarlane and Dobie (1972) tested eight storage insect pests and demonstrated that *C. cautella* can successfully reproduce on tef seeds. Abraham *et al.* (2008) also indicated that tef is not attacked by primary storage pests but can be infested by secondary storage pests such as *Tribolium* spp. In this paper, we report two storage insect pests of tef found under natural infestation.

Materials and Methods

Samples of infested tef stored for a year were obtained from the National Tef Research Project Laboratory of Debre Zeit Agricultural Research Center (DZARC), Ethiopia. Adults and larvae were collected using wet camel brush and identified to species level using keys outlined by Rees (2004). To demonstrate whether larvae are able to complete their lifecycle and reproduce on clean tef or not, the larvae of each species were separated and unknown number of larvae were introduced into freshly hand-threshed tef (18 g) in a paper bag. This was replicated three times. Similar procedure was used to investigate if adults were capable of reproducing on clean tef. The infested seed was placed in a cabinet for four months. The grain was checked under microscope for damage symptoms fortnightly. The number of adults and larvae in larvae and adult infested bags, respectively, were recorded four months later.

Germination tests were performed in open laboratory at DZARC on three categories of tef seeds: 1) clump seeds obtained from pupal cells were collected and soaked into water for 2-3 hours, and when the seeds detached from the pupal cell (crushing pupal cell gently between the thumb and the index finger is the easiest way of detaching seeds), the water and the larval waste were removed; 2) infested seeds taken randomly from lots of insect infested tef seeds; and 3) non-infested seeds obtained from freshly hand-threshed tef (one year old). Seeds from each category were counted (93 to 100 seeds) and placed on moist filter paper in a petri-dish (9 cm diameter) and replicated three times. A seed was considered germinated when the radicle and the coleoptile were clearly visible. Germination count was taken two days after the test was initiated and Chi-square test was used to test for differences in percentage of germinated seeds.

Results and Discussion

The cigarette beetle, *Lasioderma serricorne* F. (Coleoptera: Anobiidae), and the confused flour beetle, *Tribolium confusum* J. du Val. (Coleoptera: Tenebrionidae) were identified as the insect pests of the stored tef seed. This is the first record of primary storage insect pest of tef under natural infestation. Both species were recorded as pest of other stored products in Ethiopia and elsewhere (Abraham *et al.*, 2008). Description of these species is found in standard stored product books (Munro, 1966; Rees, 2004) and the internet (e.g. www.fao.org, CABI).

Some larvae of *L. serricorne* attach their pupal cell onto the container (paper bag, plastic bag) and the adults bore small round holes through the container as emergence holes (unlike *T. confusum*, *L. serricorne* which is strong flier). The infested tef was heavily contaminated with dead bodies, frass and pupal cells of the insect. The origin of the infestation is believed to be seed returned from a trade-fair exhibition held in Bihar Dar town in 1999, although it requires further confirmation. No report is known on the presence of the two insect pests in farmers' or traders' storage conditions.

Examination of infested tef seeds under microscope revealed that both *L. serricorne* and *T. confusum* are capable of damaging sound tef grain, although the latter species is known as secondary storage pest (Farrell *et al.* 2002). Other *Tribolium* species particularly *T. castaneum* and *T. destructor* are also capable of infesting and damaging tef seed (McFarlane and Dobie 1972). Four months after infestation only single larva in each of the adult-infested bags was found. But three and 40 adult individuals were found in *T. confusum* and *L. serricorne* larvae-infested bags, respectively. Some of the adult individuals in *L. serricorne* larvae-infested bag were alive (this species play

dead when disturbed). *L. serricornis* breeds successfully at temperatures of 20-35 °C and relative humidity of >25%, and the respective values for *T. confusum* are 19-37.5 °C and >1%, (Rees 2004). Therefore, the absence of the other life-stages (larvae and pupae) of both species in larvae-infested tef indicated that the insects were unable to reproduce on clean tef. The infested tef from tef improvement laboratory was full of dockage. Therefore, the inability of the species to reproduce on tef under this observation might be attributed to the cleanness of the medium (Fig. 1) or perhaps to the resistance of the variety used as adults of both species developed from larvae infested bags were small in body size. However, this requires further investigation. Weed seeds, straw, and chaff in a stored grain increase susceptibility of grain to storage insect

pests and reduce efficacy of insecticides (Evans, 1987; CABI, 2005).

The percentage germination of insect damaged and undamaged tef seed is depicted in Fig. 2. Significantly ($\chi^2=76.91$, 2, $P < 0.0001$) greater number of uninfested tef seeds germinated compared to the greater number of clump or infested seeds which failed to germinate. The germination of clumped seeds indicated that the larvae of *L. serricornis* use both damaged and undamaged grains to construct pupal cell. Examination of damaged seeds under microscope revealed that the insect feeds only on the embryo (germ) of tef seed. Thus, reduced percentage germination of clumped and infested seeds was attributable to the loss of embryo of the damaged tef seeds.

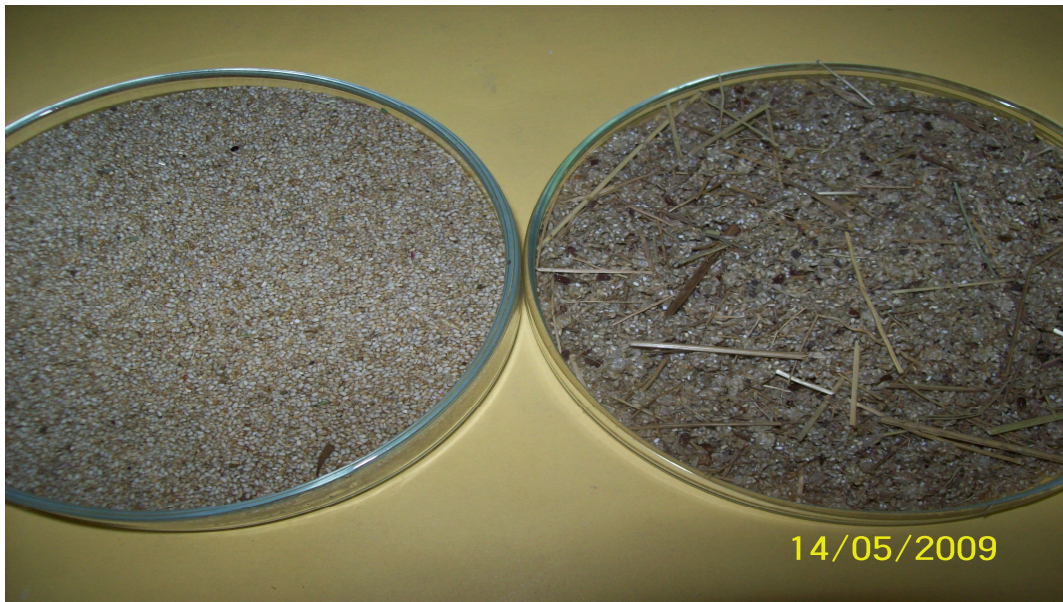


Fig. 1. Healthy tef grain (left) and pupal cell of *L. serricornis* larvae (right)

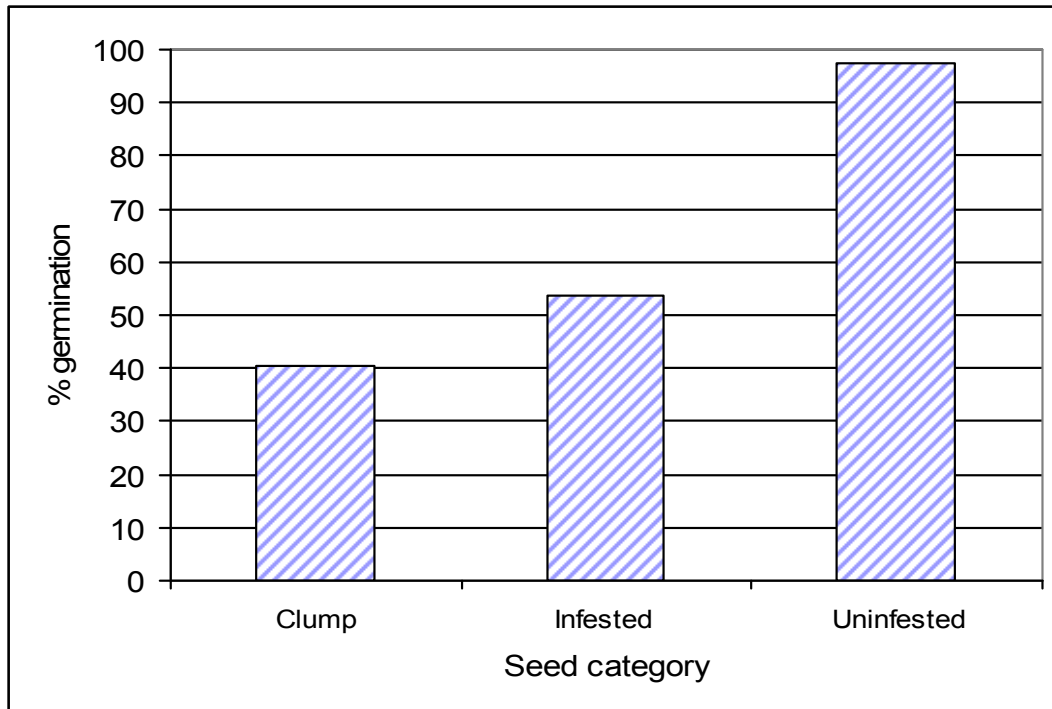


Fig. 2. Effect of storage insect pests on germination of tef seed

Ethiopia has no domestic quarantine system to regulate movement of pests (Fikre Markos, 2008), which enhances the spread of new pests throughout the country. Therefore, all concerned governmental and non-governmental institutions need to closely limit the spread of these new stored tef pests; a starting point could be awareness creation. Since seeds are distributed for breeding and other purposes from the research center, careful inspections are required before dispatch, particularly when the seeds are stored for more than a season. Both species are not cold-hardy (CABI, 2005), and, therefore, tef seeds can be kept in deep-freeze (for about a week at 4 °C) before dispatch, but the effect of deep freezing on germination of tef seed should be investigated.

Good store hygiene plays an important role in limiting infestation by these species. The removal of infested residues from last season's harvest is essential; it is necessary to ensure that all spillage is removed and

cracks and crevices filled (plastered). Once infested, sieving infested tef using normal tef sieve will help to remove larvae, pupal cell, pupae and adults. This contaminant must be destroyed either by burying, burning or feeding to animals. The minuscule frass cannot be removed by sieving.

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