

The occurrence and abundance of insect pests infesting stored wheat grains in different climatic zones of Turkey

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Abstract

The occurrence and abundance of insect pests infesting stored-wheat grains in three climatic zones of Turkey (southern, south-eastern and central regions) were studied by taking wheat samples in bulk-wheat grains with a spiral grain probe from ten different wheat storages per each region. From June up to and including November 2013, the traps were checked for adult beetles every each month (5 sampling dates in total). The mean temperatures in the bulk were recorded per each sampling date. Eleven species *Tribolium castaneum* (Herbst), *Tribolium confusum* Jaquelin du Val., *Rhyzopertha dominica* (F.), *Sitophilus oryzae* (L.), *Sitophilus granarius* (L.), *Oryzaephilus surinamensis* (L.), *Cryptolestes ferrugineus* (Stephens), *Trogoderma granarium* Evert., *Tenebrio molitor* L., *Lasioderma serricorne* (F.) and *Latheticus oryzae* Waterhouse) belonging to 7 families of Coleoptera were found. The number of insect species varied with the climatic zones of Turkey. While *T. castaneum*, *R. dominica*, *S. oryzae*, *O. surinamensis* and *C. ferrugineus* existed in three climatic zones, *S. granarius*, *T. granarium* and *T. molitor* were found in only central, south-eastern and southern region, respectively. Generally southern region had a higher insect infestation than central and south-eastern region. *Sitophilus oryzae* exhibited the highest infestation rate (74.4%) in the southern region, followed by *C. ferrugineus* (69.2%), *Rhyzopertha dominica* (58.9%) and *O. surinamensis* (53.8%). The density of insect species in southern region was also found to be much higher than that in both central and south-eastern region. In southern region, the total number of the insects per 1 kg wheat grain varied from 5.6 to 54.1 during sampling dates. Whereas, it varied from 0.3 to 2.3 in central region and from 0 to 8.1 in south-eastern region. Consequently, these results indicated that southern region of Turkey, would be at higher risk for stored wheat insect pests compared with central and south-eastern region of Turkey, which could cause significantly higher damage and reduction in wheat grain value.

Keywords: stored wheat, insect density, infestation rate, climatic zone, Turkey

1. Introduction

Turkey is one of the most important grain-producing countries of the world, especially on wheat where it is classified in the top-ten countries globally (FAO Stat, 2009). Stored wheat grains are subject to insect infestation and deterioration from molds and bacteria. The United States estimates that in developed countries the average minimum overall losses from biological degradation are 10% (National Research Council, 1978), while in developing countries that estimate may be up to 20%. Emekçi and Ferizli (2000) reported that Turkey harbours many species of storage pest because of its suitable climatic conditions and pests of grains cause ca. 10 % losses to grains.

High environmental temperatures and moisture, along with dockage and broken kernels, provide conditions that accelerate mold and insect development within the grain mass, increasing grain losses. Determining the specific insect pest species found in wheat grain storages is the first step in understanding and controlling insect problems. Knowledge of the occurrence and abundance of insect pests infesting stored-wheat grains in different climatic regions is necessary for integrated pest management programs. The objective of this study was to determine the occurrence and abundance of insect pests infesting stored-wheat grains in three climatic zones of Turkey (southern, south-eastern and central regions) by taking wheat samples in bulk-wheat grains.

2. Materials and Methods

2.1. The region of wheat grain sampling:

Wheat grain samples were taken in three climatic zones of Turkey (southern, south-eastern and central regions), which are indicated on the map of Turkey (Figure 1). From Southern region of Turkey Kahramanmaraş, Adana and Mersin Provinces were selected for wheat grain sampling, while Şanlıurfa and Konya Province were selected from south-eastern and central regions respectively.

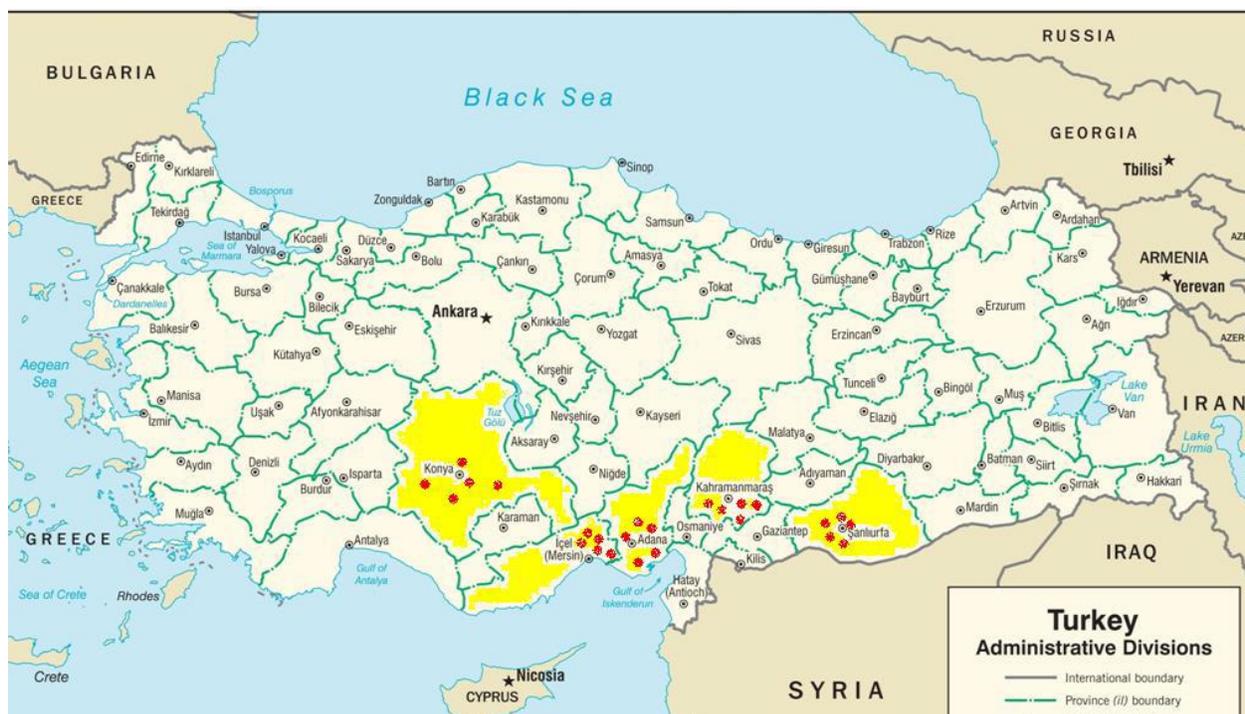


Figure 1 Sampling locations of wheat grains in Turkey.

2.2. Wheat grain sampling process:

Wheat grains were taken in bulk with a spiral grain probe from ten different wheat storages per each region (Figure 2A). Cylindrical plastic probe traps (STORGARD WB Probe II trap, TREECE, USA) were also used to detect or monitor mobile stages of insects in bulk stored-grain (Figure 2B). From June, 2013 up to November 2013, the probe traps were checked for adult beetles every each month (5 sampling dates in total).

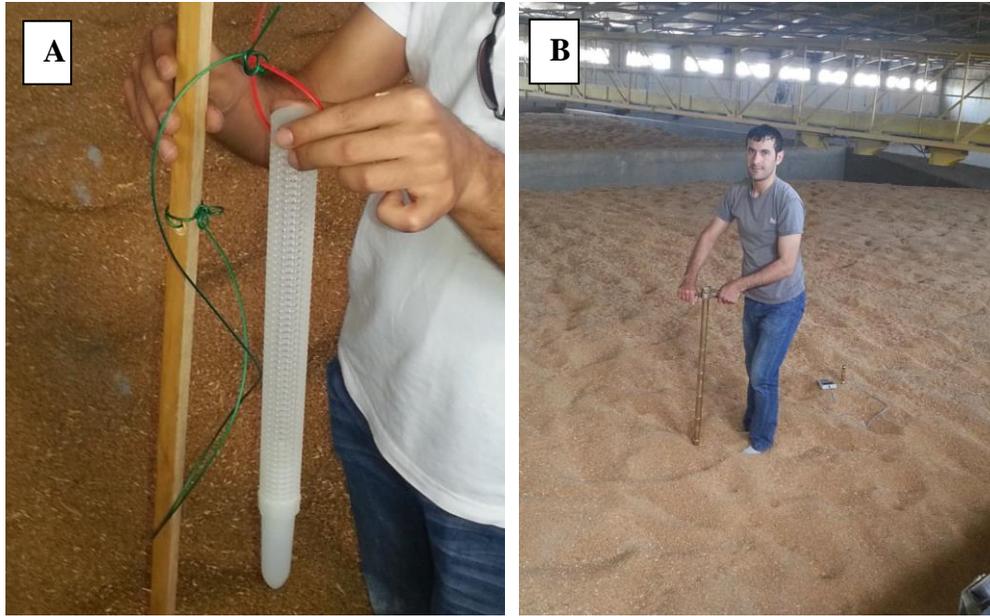


Figure 2 Cylindrical plastic probe trap (A) and spiral grain probe (B) used for wheat grain sampling.

2.3. Frequency of occurrence and the number of insect per kg wheat or probe trap:

We pooled the data for all farms and all sample dates to estimate the frequency of occurrence and number of insect per trap or kg wheat of each species. The frequency of occurrence of a species is the percentage of all possible samples in which the species occurs; it is estimated as the percentage of samples actually taken in which the species is found. The number of insect per trap or kg wheat for each species is estimated as dividing the total number of insect collected for each species by the total number of grain sample or probe trap.

3. Results and Discussion

Eleven species, *Tribolium castaneum* (Herbst), *T. confusum* Jaquelin du Val., *Rhyzopertha dominica* (F.), *Sitophilus oryzae* (L.), *S. granarius* (L.), *Oryzaephilus surinamensis* (L.), *Cryptolestes ferrugineus* (Stephens), *Trogoderma granarium* Evert., *Tenebrio molitor* L., *Lasioderma serricorne* (F.) and *Latheticus oryzae* (Waterhouse) belonging to 7 families of Coleoptera were found. Previous studies carried out to determine the insect species of stored grains in Turkey showed similar insect species to those found in present study (Dörtbudak and Aydın, 1984; Ergül et al., 1972; Özar and Yücel, 1981; Yücel, 1988; Isikber et al., 2005; Bağcı et al., 2014). Isikber et al. (2004) determined seven insect species, namely *T. confusum*, *Palorus subdepressus* (Wollaston), *R. dominica*, *S. oryzae*, *O. surinamensis*, *T. granarium*, and *Plodia interpunctella* (Hübner) on stored wheat in both Kahramanmaraş and Adıyaman province which is located in southern and south-eastern region of Turkey respectively.

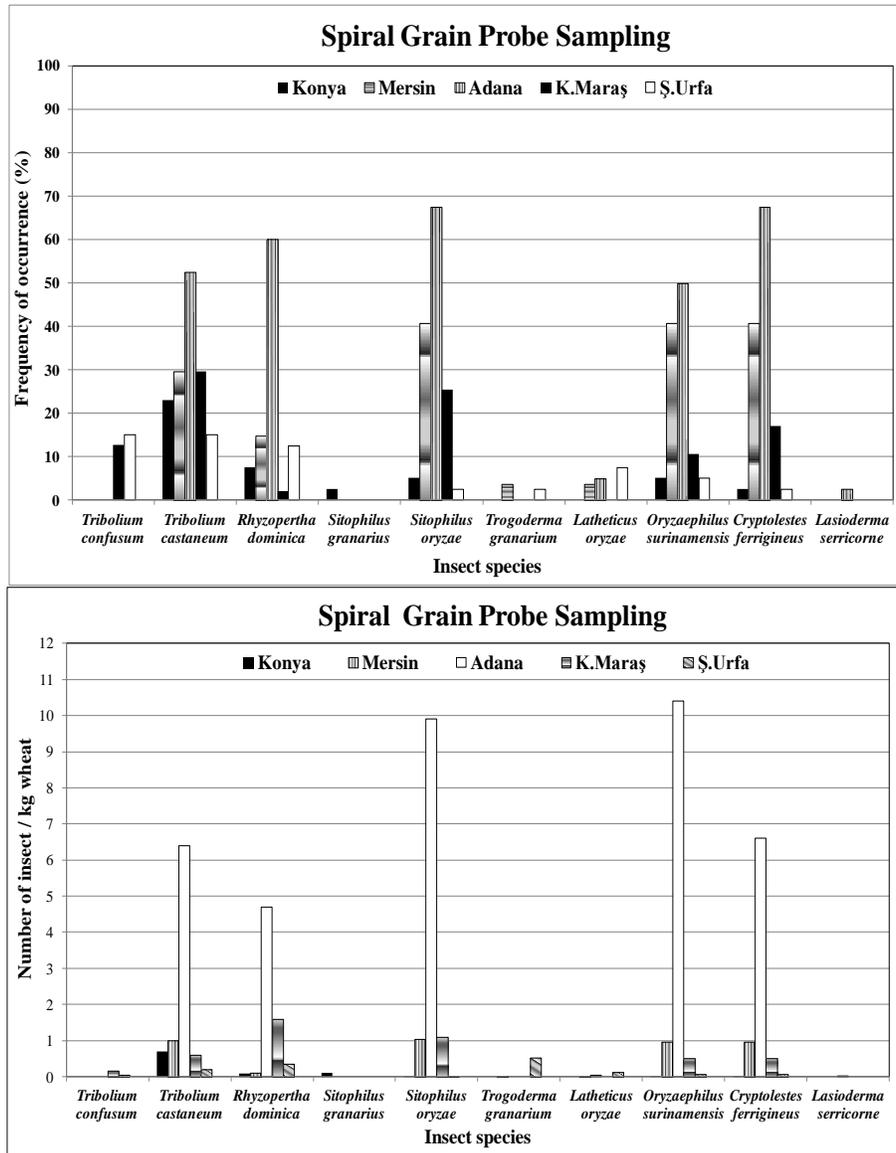


Figure 3 Frequency of occurrence and number of insect per kg wheat for insect species collected from wheat gain taken by spiral grain probe.

While *T. castaneum*, *R. dominica*, *S. oryzae*, *O. surinamensis* and *C. ferrugineus* existed in three climatic zones, *S. granarius* was only found in central, *T. granarium* in south-eastern and *T. molitor* in southern region, *S. oryzae* exhibited the highest frequency of occurrence (74.4%) in the southern region, followed by *C. ferrugineus* (69.2%), *R. dominica* (58.9%) and *O. surinamensis* (53.8%) (Figure 3-4). *T. confusum* had the highest frequency of occurrence (23.1%) in the central region while both *R. dominica* and *T. confusum* (17.6%) had the highest frequency of occurrence in south-eastern region. Similarly Isikber et al. (2004) reported that *R. dominica* and *T. confusum* in Kahramanmaraş and Adıyaman respectively by having the highest infestation ratios throughout sampling periods were the most common insect species. In present study, *T. granarium* that is subject to quarantine was found to be a high infestation rates on wheat samples in Şanlıurfa province which is located in south-eastern region of Turkey. Several studies were

also reported that stored wheat was highly infested by *T. granarium* in southern region of Turkey (Isikber et al., 2004; Yücel, 1988; Ergül et al., 1972). The density of insect species on stored wheat in Kahramanmaraş was found to be higher than that in Adıyaman. The density of insect species in southern region was also found to be much higher than that in both central and south-eastern region. In southern region, the total number of the insects per 1 kg wheat grain varied from 5.6 to 54.1 during sampling dates. In central region it varied from 0.3 to 2.3 and in south-eastern from 0 to 8.1 (Figure 3).

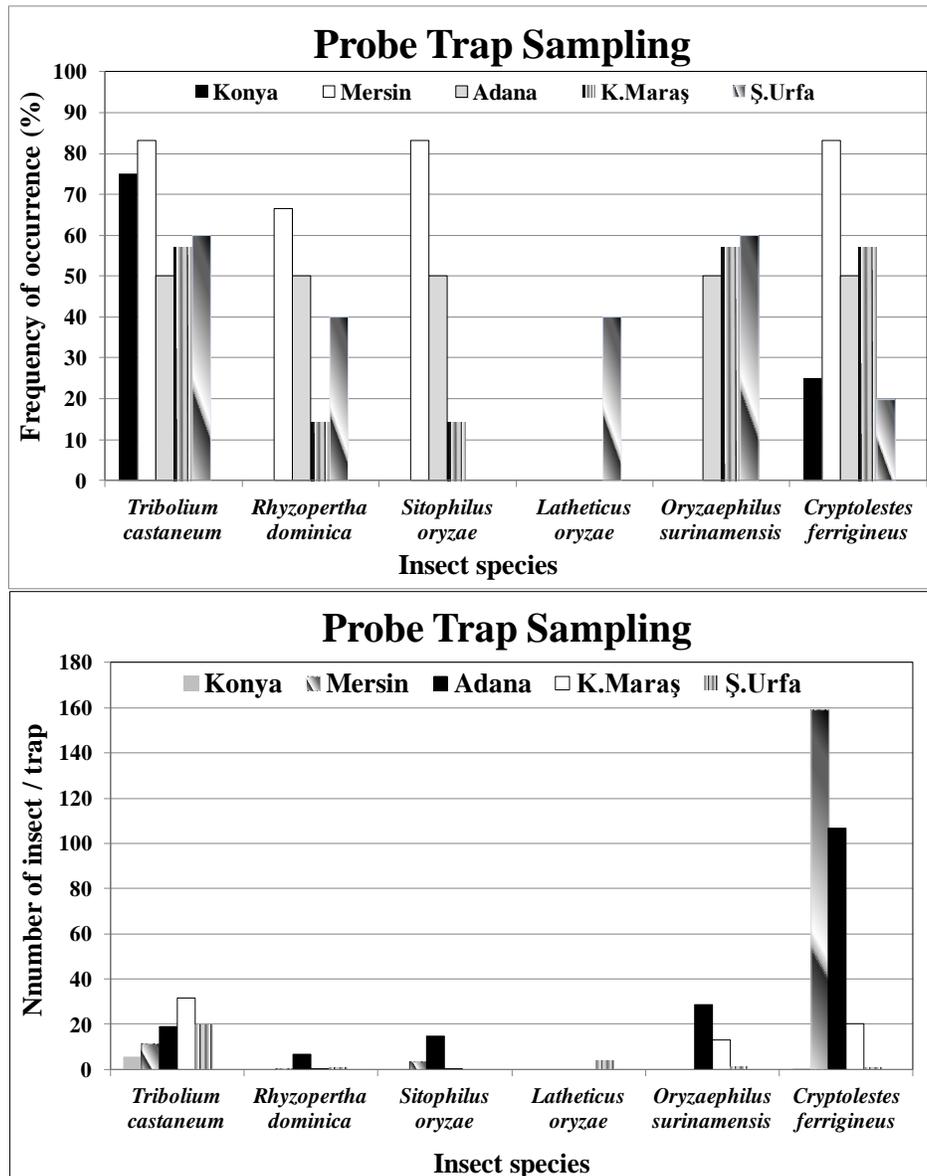


Figure 4 Frequency of occurrence and number of insect per kg trap for insect species collected from probe trap.

4. Conclusions

In this study, it was obvious that the distribution and density of insect species determined on stored wheat varied considerably with geographic regions and climatic zones. Consequently, the

results obtained from present study suggest that southern region of Turkey, would be at higher risk for stored wheat insect pests compared with central and south-eastern region of Turkey, which could cause significantly higher damage and reduction in wheat grain value.

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