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THE DISTRIBUTION AND POPULATION DENSITY OF THE CEREAL WEEVIL, *PACHYTYCHIUSHORDEI* (BRULLÉ) (COLEOPTERA: CURCULIONIDAE) IN CEREAL FIELDS IN NORTHERN CYPRUS

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Abstract

The Cereal weevil, *Pachytychiushordei* (Brulle) (Coleoptera: Curculionidae) is an important pest of barley and wheat. This study was conducted to determine the distribution areas and the population density of *P. hordei*in Northern Cyprus. The sampling were conducted in 57 cereal fields of 46 villages in Lefkoşa, Girne, Güzelyurt, Gazimağusa and İskele districts in 2012-2013 years. Sweep net were used in samplings. At the end of the study, *P. horde i*has been found common all in regions and the highest population densities were 379 adults/100 sweepnet and 247 adults/100 sweep net in Hisarköy/Girne in the years 2012-2013 respectively. In addition, damage states of *P. hordei*was evaluated.

Key words: Cereal, Cereal weevil, *Pachytychiushordei*, distribution, population density, Northern Cyprus.

Introduction

Cereals are the leading agricultural products in Northern Cyprus agriculture with 84,163 hectares of cultivated land. Barley is cultivated in 92.7% of the total cereal fields, whereas wheat is cultivated in 6.4% and oat and triticale are cultivated in 0.9%, which in total yield 134,149 tons of grain (Anonymous, 2011). Most of the cultivated barley is used as feed in animal farming industry, and wheat is utilized as human nutrition. Thus, cereal production is of utmost importance for North Cypriot farmers, especially the barley. As in any product, there are various species of pests that affect cereals both in pre-harvest and post-harvest periods, causing different levels of harm. One of these pests is the Cereal weevil, *Pachytychius hordei* (Brullé, 1832) (Coleoptera: Curculionidae) that harms the fields before the harvest. It was reported that the Cereal weevil, *P. hordei* which is a prevalent and significant pest in Palearctic region, has two sub-species: *Pachytychius hordei hordei* (Brullé, 1835) and *P. hordei squamosus* (Waltl, 1836) (Caldara, 2010). It was reported that *P. hordeihordei* sub-species exist in Cyprus fauna and spread across the whole island; in addition *Pachytychius basimaculatus* Voss, 1964 sub-species exists as well, albeit limited to Paphos and Larnaca regions (Alziar, 1995; Alziar, 2010). Cereal weevil, *P. hordei* adults are 2-4 mm long, bright black or brown insects with whitish-cream hairs or scales on its elytra (Anonymous, 2008; Alziar, 2010) (Fig. 1a). Adult individuals exit from the soil during the days when weather temperature is 12-14^{0}C and relative humidity is 57-80% in barley and wheat fields and feed on the cereal stem and leaves (Şimşek, 1993). Three adjacent characteristic small round holes similar to staple holes occur on the leaf surface as a result of the feeding of *P. Hordei*adults (Fig. 1b). It was reported that adults also feed on flowers during heading stage, destroying them and preventing fertilization in barley and wheat by 4.4% and 2.7%, respectively (Şimşek, 1998a). While male and female adults feed, they also mate (Fig. 1c) and leave their whitish translucent eggs (Fig.1d) between spikelet husks in the spikes (Fig. 1e). Each female could leave a total of 40-50 eggs, one

per spikelet (Anonymous, 2008). It was reported that young larvae that get out of the eggs in a short period of time gnaw on the barley and wheat grains in milk and dough development stages, harming the crops worse than the adults and the yield loss in barley is more than the wheat (Şimşek (1991; Şimşek, 1998a). As a result, decreases are observed in number of grain, grain weight and germination power in the spikes harmed by *P. hordei*(Anonymous, 2008).

This study was conducted to determine the area of distribution and adult population density of Cereal weevil, *P. hordei*, a cereal pest, in the cereals of Turkish Republic of Northern Cyprus during 2012 and 2013.

Material and methods

The study was conducted during 2012-2013 years at the end of stem elongation and heading stages of cereals in Lefkoşa (Nicosia), Gazimağusa (Famagusta), Girne (Kyrenia), Güzelyurt (Morphou), and İskele (Trikomo) Regions of Northern Cyprus using survey method. Materials used were cereal (wheat, barley, oat, rye, and triticale) fields, sweep nets and plastic bags. The survey was conducted in 46villages and a total of 57 fields, 1-3 fields in each village to determine the area of distribution. To determine adult population density, studies were conducted in 49 fields selected randomly in 36 villages, 1-3 fields per village, and averages were taken for the fields studied in each village. Standard sweep nets (38 cm Ø) were utilized in the study. A total of 100 sweep nets were cast in the form of 10 sweep nets in 10 different points in each field. Cereal weevil, *P. hordei* adult individuals caught by the sweep nets were transferred to closed plastic bags with location labels, and brought to the lab in iceboxes. In the laboratory, adult individuals in the plastic bags for each village were counted and recorded. Areas of distribution of *P. hordei* in the fields were determined as region and village based on the label information and adult population densities were determined as adult individual count/100 sweep nets.

Results and discussion

Barley cultivation areas have a high share of total cereal cultivation in Northern Cyprus; 92.7% (Anonymous, 2011). Thus, the surveys conducted in 2012 and 2013 included mostly barley fields. Distribution areas and adult population density of Cereal weevil, *P. hordei* were identified in the study (Figure 2, Table 1). Figure 2 demonstrates that this insect is common in all cereal fields in the villages in assessed regions of Lefkoşa (Nicosia), Gazimağusa (Famagusta), Girne (Kyrenia), Güzelyurt (Morphou), and İskele (Trikomo). In a previous study conducted in Northern Cyprus cereal fields, it was also reported that *P. hordei* was among the significant pests of the island (Güllü et al., 2014). Alziar (1995; 2010) reported that *Pachytychiushordei*subsp.*hordei* (Brullé, 1832), a sub-species of *P. hordei* (Brullé, 1832) and *Pachytychiusbasimaculatus* Voss, 1964 existed in Cyprus fauna and *P. hordei hordei* sub-species was common in all Cyprus Island, while *P. basimaculatus* species was observed only in Paphos and Larnaca districts. Literature review demonstrates that in addition to Cyprus, these species and sub-species are also common in Greece (Central Macedonia, Crete, Ionian Islands, North Aegean, Peloponnese, South Aegean, Thessaly, West Greece) (Bahr et al., 2011), Middle East (Alziar, 2010), Syria (Weill et al., 2011), Turkey (Karman et al., 1971; Zümreoğlu, 1972; Lodos et al., 1978;Kavut and Kaya, 1979**;** Şimşek, 1991; Şimşek et al., 1996; Şimşek, 1998a,b; Şimşek, 2000; Lodos et al., 2003; Avgın and Colonnelli, 2011), Italy (Abbazzi and Maggini 2009; Abbazzi and Zinetti, 2013), France (Deliry, 2011), Spain (Alonso-Zarazaga, 2002; Alonso-Zarazaga et al., 2006), Portugal (Zipcodezoo, 2011), Malta (Mifsud and Colonnelli, 2010), Sardinia (Colonnelli et al., 2011), Sicily (Stejskal, 2004), and Egypt (Alziar, 2010).

The assessment of adult population densities showed that the highest population density for was found in Girne Region and in the villages on the southwestern slopes of the Kyrenia MountainsRenge. Among these villages, it was observed that there were 379 adults/100 sweep nets and 247 adults/100 sweep nets in average in 2012 and 2013, respectively in the barley + oat field in Hisarköy; and 174 adults/100 sweep nets and 132 adults/100 sweep nets in average in barley fields in Ağırdağ village. Another region where the population density was high was Lefkoşa region. In this region, adult population densities of *P. hordei* were 99 adults/100 sweep nets and 111 adults/100 sweep nets in average in 2012 and 2013, respectively in Serhatköy. These determined

adult population densities are at a level that could cause economic damage. Thus, these areas are considered risky villages and fields. Villages located in the north and south of Lefkoşa-Güzelyurt highway neighbor this risky area and are considered to have potential risk. Chemical pest control is conducted against Cereal weevil, *P. hordei* in Turkey and the recommended economic threshold level was reported as 5 adult/m^2 or 15 adult/10 sweep nets (Anonymous, 2008). In the fields that are above the economic threshold in Northern Cyprus and in those that carry a potential risk, the required pest control should be initiated. Otherwise, the lack of pest control would cause a high possibility of yield losses in extensive amounts. Hence, Şimşek (1998a) reported that in a barley field that contains 61.3 -103.3 *P. hordei* adult density in 10 sweep nets during the heading stage average yield loss of 20.8% occurs due to adult + larvae harm; while in a wheat field with 60.3 - 127.5 adult density, an average yield loss of 14.9% was observed. It was also stated that *P. hordei* adults feed on flowers during heading stage, destroying the heads and preventing fertilization, and thus causing an unfertilized grain rate of 4.4% in barley and 2.7% in wheat (Şimşek, 1998**).**

Figure 1.Cereal weevil, *Pachytychiushordei*:
a) Adult b) Injury on leaf c)Adult mating d)Adults in spikelets e) Egg in spikelets

Table1.Population density of the Cereal weevil,*Pachytychius hordei* in NorthernCyprus cereal fields.

Districts	Villages	Crops	*Pachytychiushordei* Adults number/100 Sweep nets	
			2012	2013
Güzelyurt Morphou	Yukarı Bostancı	Barley	31	
	AşağıBostancı	Barley	9	
	Taşpınar	Wheat+Barley	22	14
	Akçay	Wheat	11	4
Gazimağusa Famagusta	Akdoğan	Barley	45	
	Mağosa	Barley	7	
	Geçitkale	Barley	2	
	Çayönü	Barley	4	6
	Dörtyol	Barley	61	
	Ulukışla	Barley	14	
	İnönü	Barley	40	
	Serdarlı	Barley +Vetch	5	
	Paşaköy	barley	5	17
	Boğaziçi	Barley	7	5
İskele Trikomo	Kalecik	Barley	17	
	Tuzluca	Barley	24	11
	İskele	Barley	10	
	Dipkarpaz	Barley	8	5
	Yeşilköy	Wheat	7	
	Yeni Erenköy	Barley	6	
Girne Kyrenia	Hisarköy	Barley +Oat	379	247
	Tepebaşı	Barley	7	11
	Şirinevler	Barley	35	
	Göçeri	Barley +Wheat	10	
	Ağırdağ	Barley	174	132
	Dağyolu	Barley	135	89
	Lapta	Wheat		9
Lefkoşa Nicosia	Balıkesir	Barley	10	3
	Hamitköy	Barley	12	26
	Gaziköy	Triticale + Oat	8	
	Erdemli	Barley	3	
	Yılmazköy	Barley	10	
	Serhatköy	Barley +Wheat	99	111
	Gönyeli	Barley	10	
	Meriç	Barley	9	
	Alayköy	Barley	6	19

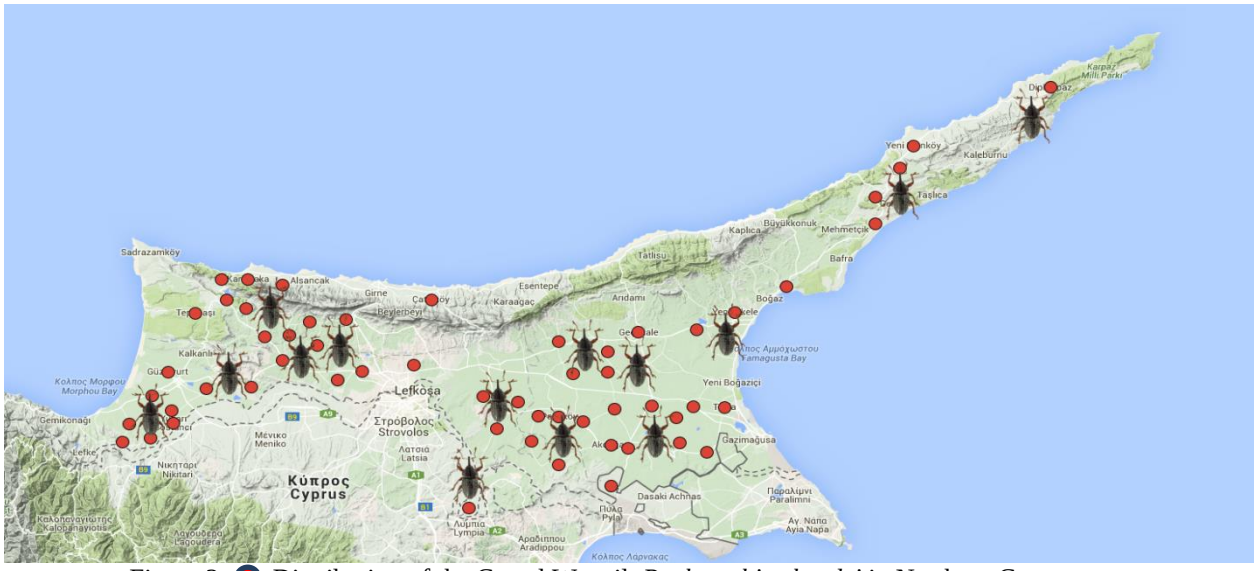

Figure 2. Distribution of the Cereal Weevil, *Pachytychius hordei* in Northern Cyprus.

Conclusions

In studies conducted during the years of 2012 and 2013 in Northern Cyprus, it was determined that Cereal weevil, *P. hordei* was common in all regions in different population densities. The region with the highest population density was the Girne region, and especially the fields at the southwestern slopes of Kyrenia Mountain Range, and this region was considered high-risk areas. The villages in the north and the south of Lefkoşa - Güzelyurt highway, neighboring the risky areas, were considered as potential risk areas. Thus, the farmers in these villages with *P. hordei* risk, should be alert and should be warned whenever necessary. However, it was observed that no studies were conducted previously on Cereal weevil, *P. hordei* and several farmers were not informed about this insect and its harms. Thus, the need for introduction of this insect and providing information about its control to the farmers is a significant matter. To design and implement pest control programs against Cereal weevil, *P. hordei* it is necessary to determine the fundamental biological criteria for pest control such as the time of exit of adults from the soil, time of feeding on spikes and the time the larvae feeding on spikes move from the spikes to the soil, pest control methodology, and the state of yield loss. In brief, it is of utmost significance to conduct studies on *P. hordei* bio-ecology, state of crop loss and control.

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