

The Determination of Infection and Damage Rates of the Alfalfa Seed Chalcid, *Bruchophagus roddi* Gussakovskiy, 1933 (Hymenoptera, Eurytomidae) in Alfalfa Seed Stored in the Eastern Region of Turkey*

Celalettin GÖZÜAÇIK¹, Abdullah İREÇ²

ABSTRACT: This study was conducted to determine the infection and damage rates of the alfalfa seed chalcid, *Bruchophagus roddi* Gussakovskiy, 1933 (Hymenoptera, Eurytomidae) in alfalfa seeds stored at 22 locations in İğdır, Kars and Van provinces of the Eastern Anatolia region in 2013-2014 years. In the study carried out for the first time in Turkey, the total 230 samples were collected in the average amount of 100 g from commercial and domestic alfalfa seeds for each location. These seeds were cultivated at 25±1°C and 65±5% RH in the laboratory. With the aim of determining the infection and damage rates, the adult insects emerging, the damaged and non-damaged seeds were counted and weighed for each sample. Consequently, it was determined that 94.8% of those samples collected for the study were infected with *B. roddi* and average 17 060.54 seeds in those samples were damaged at the rate of 0.25% and the infection caused the weight loss of 0.09%.

Keywords: Stored of alfalfa seeds, *Bruchophagus roddi*, infection and damage rates, Eastern Region, Turkey

Doğu Anadolu Bölgesinde Depolanmış Yonca Tohumlarında Yonca Tohum Kalsidi *Bruchophagus roddi* Gussakovskiy, 1933 (Hymenoptera, Eurytomidae)'in Zararı ve Bulaşma Oranlarının Belirlenmesi

ÖZET: Bu çalışma Yonca tohum kalsiti *Bruchophagus roddi* Gussakovskiy, 1933 (Hymenoptera, Eurytomidae)'nin bulaşma oranları ve zararını belirlemek amacıyla, 2013 ve 2014 yıllarında İğdır, Kars ve Van illerinde 22 farklı yerde yerde yürütülmüştür. Çalışmalarda ortalama 100 g ağırlığında ticari ve çiftçilerden 230 tohumluk yonca toplanmıştır. Toplanan tohumlar 25±1°C sıcaklıkta ve 65±5% nem ortamında laboratuvarında kültüre alınmıştır. Her bir örnekte ergin çıkışları gözlemlenmiş, bulaşma ve zarar oranlarını belirlemek amacıyla tohumlar tartılarak sayılmıştır. Sonuç olarak, toplanan örneklerin % 94.8'nin bulaşık olduğu belirlenmiş ve ortalama 17 060.54 tohum örneğininin %0.25 oranında zarar gördüğü ve %0.09 ağırlık kaybına uğradığı bulunmuştur.

Anahtar kelimeler: Depolanmış yonca tohumu, *Bruchophagus roddi*, bulaşma ve zarar oranları Doğu Anadolu Bölgesi, Türkiye

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¹ İğdır Üniversitesi, Ziraat Fakültesi, Bitki Koruma, İğdır, Türkiye

² Gıda Tarım ve Hayvancılık Bakanlığı, İlçe Tarım Müdürlüğü, Aralık, İğdır, Türkiye
Sorumlu yazar/Corresponding Author: Celalettin GÖZÜAÇIK, cgozuacik46@gmail.com

INTRODUCTION

Alfalfa, *Medicago sativa* L. is a very significant forage crop throughout the world. It is rich in nutrition value and can be easily consumed by livestock (Elçi et al., 1994). Alfalfa production increased in all areas from the Aegean, Mediterranean and Black Sea coasts to the high plateaus of eastern Turkey (Manga et al., 1995). In Turkey, alfalfa is cultivated over 628 642 ha and the amount of production from these areas was estimated to be 112 616178 tonnes, in addition, 1154 tonnes alfalfa seed is produced (TUIK, 2013).

There are many insects that damage alfalfa growing areas. The alfalfa seed chalcid, *B. roddi*, is a key insect pest of alfalfa seed production of the worldwide (Nielson and Lehman, 1980). It is a member of the family Eurytomidae, order Hymenoptera. A phytophagous pest is the insect that feeds within seeds of alfalfa plant at all the larval stages, and plays a significant role in the seed production of alfalfa, economically. The adult chalcid is a small jet-black insect about 2.0 mm long together with a wing expanse of approximately 2.5 mm. Males are smaller in body size than females and have 11-segmented antennae with whorls of long setae on the 8 proximal segments (Sorenson, 1930). They lay eggs in growing seed of alfalfa, one egg per seed. Each larvae consumes absolutely the interior of the seed and the adult wasp emerges by hollowing out coat of the seed in the form of a small round hole (Figure 2). In the harvest time, seeds containing immature chalcids are generally transferred to the store. Empty seed coats are thrown out with the chaff during harvest period.

There are two or more generations of alfalfa seed chalcid per growing season. The alfalfa seed chalcid overwinters at diapausing period of larva within the seed. In the final fall generation, it overwinters in the interior of seed and adults emerge in the spring (Nielson, 1976). In literature, alfalfa seed chalcid was first reported in 1972 by Tuatay et al (1972) in Turkey. Also, Tamer et al. (1997) addressed to be the harmful effects of *Bruchophagus roddi* Guss. in alfalfa fields of Turkey (Tamer et al., 1997). However, published

reports on the harmful effect of the insect pest on the alfalfa seeds are still scarce. Hence, the present work was conducted to determine the infection and damage rates of the alfalfa seed chalcid, *B. roddi* on the stored alfalfa seeds in Iğdır, Kars and Van provinces of the Eastern Anatolia Region in the years 2013-2014.

MATERIAL AND METHOD

The study was conducted at 22 locations of Iğdır, Kars, and Van provinces of the Eastern Anatolia Region between October and December in 2013 with the aim of determining the infection and damage rates of the alfalfa seed chalcid, *B. roddi* for the stored alfalfa seeds between January and February months of the year 2014. In the study, the total (n=230) samples seed were collected from (n=196) commercial and (n=34) domestic alfalfa seeds for each location between 8 October 2013 and 13 February 2014 (Table 1). These seeds were cultivated separately at the laboratory. After sieving seeds were cultivated as each 50 ml, except a tube (2 x 8 cm) wrapped with aluminum foil in 230 cardboard cups at 25±1°C and 65±5% RH at the laboratory. It was waited until adult emergence ceased in tubes. The adult chalcids within the tubes were counted and recorded. The presence of the chalcids in each cardboard cup was also examined, and then infected and non-infected seeds were counted again and weighed. *Bruchophagus roddi* was identified by Prof. Dr. Halit Çam (Gaziosmanpaşa University, Faculty of Agriculture, Department of Plant Protection, Tokat / Turkey).

RESULTS AND DISCUSSION

In the study conducted to determine the infection and damage rates of the alfalfa seed chalcid, *B. roddi* on alfalfa seeds stored in the Eastern part of Turkey during 2013-2014, a total of 230 seed samples with 196 domestic and 34 commercial samples were collected from three provinces and the obtained results are presented in Table 2.

Table 1. The number of samples from the locations in the years 2013-2014.

Provinces	District	Locations	Number of domestic seed samples (n)	Number of commercial seed samples (n)	Number of sample (n)
İğdır	Center	Center	13	6	19
	Aralık	Karasu mahallesi	6	-	6
		Aşağı Çiftlik	42	-	42
		Yukarı Çiftlik	7	-	7
		Ortaköy	18	-	18
		Yukarı Aratan	22	-	22
		Aşağı Aratan	2	-	2
		Hacıağa	7	-	7
		Tazeköy	12	-	12
		Aşağı Topraklı	2	-	2
		Yukarı Topraklı	1	-	1
		Aşağı Çamurlu	-	3	3
	Karakoyun	Göl mahallesi	4	-	4
		Merkez	4	-	4
	Tuzluca	Karanlıkköy	4	-	4
		Bahçeli Meydan köyü	2	-	2
		Gaziler	18	-	18
Ağabey		4	-	4	
Kars	Digor	Merkez	4	25	29
Van	Erciş	Merkez	7	-	7
		Ağaçören	10	-	10
	Muradiye	Merkez	7	-	7
Total		22	196	34	230

Table 2. Collected samples (for 50 ml) in the Iğdır, Kars and Van provinces in the years 2013-2014

Provinces	Townships	Locations	Average number of seed	Average number of ASC*	Average number of damaged seed	Average rates of infected (%)	Average weight of seed (g)	Average weight of damaged seed (g)	Average rate of damage (%)
Iğdır	Merkez	Merkez	14640.1	0.8	13.1	0.10±0.11	38.77±9.56	0.02±0.01	0.10±0.04
	Aralık	Karasu,	14863.2	0	31.8	0.42±0.40	30.36±6.71	0.03±0.01	0.11±0.07
		Aşağı Çiftlik	20407.2	7.2	36.1	0.18±0.14	43.61±5.71	0.03±0.02	0.10±0.05
		Y. Çiftlik	18666.6	5.3	41.4	0.23±0.13	42.41±7.04	0.04±0.02	0.01±0.05
		Ortaköy	17074.7	11.2	64.6	0.42±0.44	37.36±8.33	0.06±0.06	0.11±0.06
		Y. Aratan	15180.1	6.1	47.3	0.32±0.31	36.00±8.33	0.04±0.04	0.13±0.11
		Aşağı Aratan	15085.0	6.5	25.0	0.17±0.02	37.39±6.70	0.02±0.01	0.05±0.03
		Hacıağa	21724.1	15.7	57.9	0.28±0.10	45.97±4.95	0.04±0.02	0.10±0.05
		Tazeköy,	20860.8	0.8	8.6	0.04±0.03	41.99±2.81	0.01±0.01	0.03±0.02
		Aşağı Topraklı	21699.5	35.0	120.5	0.56±0.01	44.69±0.21	0.07±0.02	0.15±0.05
		Y.Topraklı	7132.0	0	00.0	0.00±0.00	36,94±0.00	0.00±0.00	0.00±0.00
	Kara-koyun	Göl mah.	18727.8	1.0	18.8	0.08±0.06	41.98±2.64	0.07±0.09	0.01±0.02
		Merkez	19985.0	19.5	93.0	0.47±0.36	42.03±7.93	0.07±0.05	0.20±0.12
	Tuzluca	Karanlıkköy	10810.0	0.5	18.8	0.18±0.05	26.59±2.23	0.03±0.01	0.10±0.03
		B. Meydan	16058.0	102.5	203.0	1.29±0.12	40.34±1.32	0.09±0.04	0.21±0.08
		Gaziler	16688.1	5,4	24,6	0.15±0.20	37.57±6.33	0.03±0.02	0.10±0.06
Ağabey		20091.3	0	3,0	0.02±0.02	52.86±11.3	0.01±0.01	0.01±0.02	
Kars	Digor	Merkez	14143.9	6.0	19.8	0.15±0.08	38.03±5.64	0.02±0.02	0.10±0.05
Van	Erciş	Center	22158.7	19.9	69.1	0.32±0.20	44.80±3.04	0.04±0.02	0.01±0.04
		Ağaçören	20948.9	2.9	15.5	0.07±0.03	43.44±4.43	0.01±0.02	0.04±0.03
	Muradiye	Merkez	18329.9	2.3	20.6	0.11±0.07	39.87±3.53	0.03±0.02	0.10±0.03
Average			17060.54	11.3	42.6	0.25±0.28	40.13±5.39	0.035±0.02	0.088±0.06

* ASC: Alfalfa Seed Chalcid

As also understood from Table 2, the adult alfalfa seed chalcids emerged with an average of 11.3 number (min.0, max.102.5) in laboratory during Mart and April months of the year 2014. No adult chalcids were obtained for 12 samples of native seeds. Of all the evaluated seed samples, 218 emerged as the adult insects (Figure 1). Under the investigation, alfalfa seed chalcids could not be found in Karasu (n=6), Aşağı Çamurlu (n=3) and Ağabey (n=4) locations, whereas the chalcids were available in all other locations. No alfalfa seed chalcid and damaged seed were determined in Yukarı Topraklı (n=1) among the examined locations. In the study, the infection rate of samples from only Iğdir province was 93.2 (%), but all the samples of Kars and Van provinces were found to be infected. Eventually, It was concluded that *B. roddi* was common in all three provinces with overall infection rate of 94.8%.

In the western USA, seed growers obtained the infection rate with the wide range of 5% to 83% (Urbahns, 1920; Sorenson, 1934; Bacon, *et al.*, 1959). Similar rates have also been reported from Russia (Kolobova, 1950). Of 17103.14 seeds evaluated in the study, 17060.54 were non-infected, and only 42.6 seeds were determined to be infected. The rate of the infected seeds was 0.25. With Table 2, it was suggested to be 40.13 g non-infected, 0.035 g damaged, and

0.09 damaged rate of 40.165 g seeds. Therein, these low results may be ascribed to various operations like blowing and sieving made by farmers before the store.

Hanson (1962) referring to McAllister (1958) reported that the chalcids at larval and pupal stages of the fall generation overwinter within seeds, and emerged as adults in the following spring, as well as proved that loss rate due to the seed chalcids was roughly 80 % for the alfalfa seeds produced in Oklahoma. In fact, the loss was mostly indiscernible due to the fact that the seeds were very small (Soroka and Otani, 2011).

The present results supported those obtained by Soroka and Spurr (1998), who referred that winter hardy cultivars becoming dormant early in the Autumn season had lower levels of the chalcid-damaged seeds (Figure 3) compared with less hardy cultivars maintaining growth later in the season. In the earlier study, it was reported by Peterson *et al.* (1991) that high variability was observed in the damage owing to trefoil seed chalcids between years. Previously, De Barro (2001) has mentioned that alfalfa seed chalcids led to the economically significant losses. Further studies on the loss of the chalcids and the effective factors on the loss should be conducted under various conditions due to economic causes.



Figure 1. Adult of *Bruchophagus roddi*

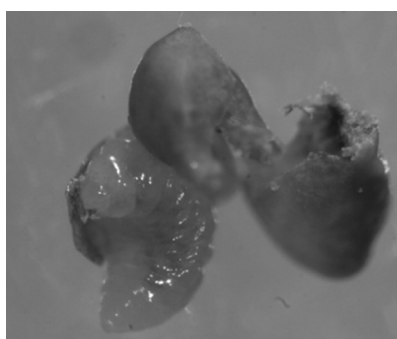


Figure 2. Larvae

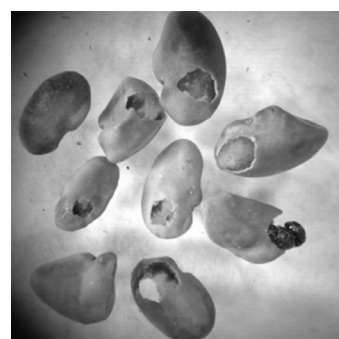


Figure 3. Damage

CONCLUSION

This study was the first report on determining the infection and damage rates of the alfalfa seed chalcid, *B. roddi* on alfalfa seeds provided from the stores of 22 locations in Iğdir, Kars and Van provinces of the Eastern Anatolia region during 2013-2014 years. It was determined that 94.8% of the studied samples were infected with *B. roddi* and average 17060.54 seeds in all the samples were damaged with the very low rate

of 0.25% and the infection caused the weight loss of 0.09%. The rates of infected and damaged seeds were found very low as a result of sieving and seed cleaning. Thus, the damaged seeds were lighter in weight. More detailed studies should be conducted about distribution, biology, damage and control methods of the insect which can cause economic losses at big rates. In conclusion, we recommend that alfalfa producers sowing with infected seeds should be avoided.

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