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Research Paper

Damage Status of Lentil Weevil (*Sitona* spp. Herbst.)(Coleoptera: Curculionidae) in Adıyaman Province

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Abstract
The leaf damage caused by Sitona species in Adıyaman province demonstrated significant spatial variability across various villages and districts during the years 2022 and 2023. Damage levels ranged from 21-30% to 71-90%, with the most severe damage occurring in the Samsat district, particularly in the village of Büyükbey, where damage increased from 41-50% in 2022 to 71-90% in 2023. In other areas, such as Vartana, Büyükkavaklı, and Besni, damage levels ranged from 31-50%. Overall, damage was more pronounced in 2023, particularly in the Kahta and Besni districts. The damage to nodosites in lentil fields across 11 locations in Adıyaman province also exhibited variation between 2022 and 2023. In 2022, the highest nodosite damage was recorded in Büyükbey (Samsat) and Şambayat (Besni), both with a damage scale of 5 (31%-40%), while the lowest damage was observed in Vartana (Adıyaman) and the Kahta Central district, where the damage scale was 2 (1%-10%). In 2023, an increase in population density was closely associated with a rise in damage levels. The highest damage was recorded in Büyükbey, Çaybaşı (Samsat), Şambayat (Besni), and Dut (Kahta), all showing a damage scale of 5. The lowest damage was observed in Üçgöz (Besni), with a scale of 2, while other surveyed areas exhibited damage levels ranging from 3 (11%-20%) to 4 (21%-30%).
Key words: *Lentil, Stona spp., Leaf damage, Nodosity damage, Adıyaman*

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I. INTRODUCTİON

Lentil is one of the important legumes cultivated in many countries of the Mediterranean region. It is a significant crop in the arid regions of Western Asia and North Africa (with approximately 35 mm of rainfall). Lentil is a highly protein-rich food and forage crop (Silim et al.). About 70% of the proteins in human nutrition come from plant sources, and 18% of these proteins are obtained solely from legumes (Leguminosae). In developing countries such as India, China, and regions of Central and South America, it has been reported that human nutrition and protein requirements are largely met by plant-based sources (Colonnelli, 2004).

Another agricultural importance of legumes is that while other crops reduce the amount of organic matter in the soil, legumes contribute to increasing organic matter content through the root system they form underground. Furthermore, legumes have a symbiotic relationship with Rhizobium bacteria, which attach to the roots of these plants and form nodules. In these nodules, nitrogen compounds are synthesized by converting atmospheric nitrogen molecules into simple organic nitrogen molecules (Aeschlimann, 1980).

However, lentil crops experience significant yield losses each year due to various biotic and abiotic factors (Literature). One of the major insect pests affecting lentil productivity, particularly in Western Asia and North Africa, is the *Sitona* species. The insects of the *Sitona* genus are important pests of legumes worldwide. In Western Asia (Jordan, Lebanon, Syria, Turkey), *Sitonacrinitus*Herbst is the main pest of lentil (*Lens culinaris*Medik.) (Hariri, 1981; Solh et al., 1986). In northern Syria, adult *S. crinitus* reactivates in early December when lentil crops emerge (Tahhanand Hariri, 1982). Adult beetles feed on cotyledons during the seedling stage, causing damage to the plant due to reduced photosynthesis (Palm, 1996). The pest feeds on leafy plants, especially when growth cones are not suitable, and can cause severe damage to seedlings. Additionally, larvae feed on the nodules, which reduces the plant's ability to fix atmospheric nitrogen, leading to significant losses (Hariri, 1981).

This study aimed to determine the species of *Sitona* present in lentil fields in Adıyaman province and assess the damage caused by *Sitona spp.* on roots and leaves. The findings are expected to contribute to integrated pest management strategies for lentil weevils.

II. MATERIALS AND METHODS

The study was conducted in the central, Kahta, Besni, and Samsat districts of Adıyaman province, in lentil farming areas during March-June 2021 and 2022. Four locations (Table 1) and 11 lentil fields in these locations were selected for the research. If no lentil sowing was carried out in the same field in 2022 and 2023, the study continued in the closest lentil field to the one previously sown in 2022.

Table 1.Leaf damage of Sitona spp. in 11 lentil fields located in 4 locations in the Central, Kâhta, Besni and Samsat districts of Adıyaman province, between March and June 2022 and 2023.

Province	District	Village	Konum
		Vartana	37°44'03"N - 38°16'37"E
	Merkez	Taşpınar	37°42'18"N - 38°17'49"E
	Merkez	Büyükkavaklı	37°42'12"N - 38°15'53"E
Adıyaman	Kâhta	Merkez	37°45'38"N - 38°15'53"E
	Kâhta	Ortanca	37°46'21"N - 38°38'41"E
	Kâhta	Dut	37°43'56"N - 38°33'07"E
Adıyaman	Besni	Üçgöz	37°35'28"N - 37°57'41"E
	Besni	Şambayat	37°40'29"N - 38°21'02"E
	Besni	Taşlıyazı	37°40'29"N - 38°21'02"E
Adıyaman	Samsat	Çaybaşı	37°40'54"N - 38°32'04"E
		Büyükbey	37°42'02"N - 38°33'24"E

To determine the distribution of the pest species, 30 traps (38 cm in diameter) were shaken at three different locations in each selected field, totaling 30 traps. The adult *Sitona spp*. collected from both sampling methods were killed in ethanol and transported to the laboratory after labelling. The specimens were placed in Petri dishes with water-soaked cotton and kept for 24 hours to soften. Afterward, they were glued to identification cards, and identification was done by Prof.Dr.Celalettin GÖZÜAÇIK from the Department of Plant Protection at Iğdır University Faculty of Agriculture. Once the species identification was completed, the specimens were sorted, counted, and the number and percentage distribution of species in the population were determined.

In order to determine the damage status of the pest, surveys were carried out in early April. A scale ranging from 1 to 9 was used to evaluate the percentage of damaged leaves in lentil plants. Accordingly: 1, no damage; 2, 1-10% leaflet damage; 3, 11-20%; 4, 21-30%; 5, 31-40%; 6, 41-50%; 7, 51-70%; 8, 71-90%; 9, more than 90% leaflet damage. Nodule damage was evaluated in samples taken at flowering time (mid-April). Five plants were randomly selected from each plot from the trial areas, the plants were uprooted and brought to the laboratory. The roots were washed in the laboratory and the damage status of the nodosities was determined, and the total and damaged nodule numbers on each plant were determined. In addition, damage on the leaves was evaluated according to the scale measurements and recorded.

III. RESULTS AND DISCUSSION

The damage caused by *Sitona* species in lentil farming areas of Adıyaman province, including the central, Kahta, Besni, and Samsat districts, was evaluated separately for leaf and nodular damage between March and June of 2022 and 2023 across four locations and 11 lentil fields. The results are presented below.

a)- Leaf Damage Evaluation

Leaf damage of *Sitona spp*. in 11 lentil fields located in 4 locations in the Central, Kâhta, Besni and Samsat districts of Adıyaman province, between March and June 2022 and 2023, is given in Table 1.

Table 1.Leaf damage of Sitona spp. in 11 lentil fields located in 4 locations in the Central, Kâhta, Besni and Samsat districts of Adıyaman province, between March and June 2022 and 2023.

Province	District	Village	Leaf Damage			
			2022 Damage Scale Value	Damage (%)	2023 Damage Scale Value	Damage (%)
Adıyaman	Merkez	Vartana	4	21-30	6	41-50
	Merkez	Taşpınar	4	21-30	4	21-30
	Merkez	Büyükkavaklı	4	21-30	6	41-50
Adıyaman	Kâhta	Merkez	5	31-40	7	51-70
	Kâhta	Ortanca	4	21-30	6	41-50
	Kâhta	Dut	5	31-40	7	51-70
Adıyaman	Besni	Üçgöz	5	31-40	7	51-70
	Besni	Şambayat	7	51-70	7	51-70
	Besni	Taşlıyazı	4	21-30	6	41-50
Adıyaman	Samsat	Çaybaşı	7	51-70	7	51-70
	Samsat	Büyükbey	6	41-50	8	71-90

When evaluating the overall leaf damage, in the villages of AdıyamanMerkez, all surveyed areas in 2022 showed a damage scale of 4 (21-30%). In 2023, the damage scale in Vartana was recorded as 6 (41-50%), while Taşpınar and Büyükkavaklı showed damage scales of 4 (21-30%) and 6 (41-50%), respectively. Combining the data from 2022 and 2023, the damage scale in Vartana and Büyükkavaklı was determined to be 5 (31-40%), while in Taşpınar, it remained at 4 (21-30%).

In Kahta district, the damage scale in 2022 showed a value of 5 (31-40%) in Merkez, 4 (21-30%) in Ortanca, and 5 (31-40%) in Dut. In 2023, the damage scales were 7 (51-70%) in Merkez, 6 (41-50%) in Ortanca, and 7 (51-70%) in Dut. When combining the data from 2022 and 2023, the damage scale in Merkez and Dut was 6 (41-50%), while in Ortanca, it was 5 (31-40%).

In Besni district, the leaf damage scale in 2022 was 5 (31-40%) in Üçgöz, 7 (51-70%) in Şambayat, and 4 (21-30%) in Taşlıyazı. In 2023, Üçgöz and Şambayat showed a damage scale of 7 (51-70%), while Taşlıyazı was recorded at 6 (41-50%). When combining both years' data, the leaf damage scale in Üçgöz was 6 (41-50%), in Şambayat it was 7 (51-70%), and in Taşlıyazı it was 5 (31-40%).

The highest level of leaf damage in Adıyaman province was observed in Samsat district. In Çaybaşı, the damage scale was 7 (51-70%) in both 2022 and 2023, while in Büyükbey, the scale was 6 (41-50%) in 2022 and 8 (71-90%) in 2023. When combining the data from both years, the average leaf damage scale in both villages was 7 (51-70%).

These results suggest that leaf damage caused by *Sitona* species is variable across different locations, with certain areas experiencing more significant damage, particularly in Samsat district, where the highest levels of leaf damage were observed.

b- **Evaluations of Damage in Nodosities**

Nodositesdamage of *Sitonaspp*. in 11 lentil fields located in 4 locations in the Central, Kâhta, Besni and Samsat districts of Adıyaman province, between March and June 2022 and 2023, is given in Table 1.

The damage rates in nodosites are presented in Table 2. Upon reviewing Table 2, it has been determined that the highest damage to nodosites occurred in 2022 in the villages of Büyükbey in Samsat district and Şambayat in Besni district. The damage scale for nodosites in these villages was found to be 5 (31%-40%). The lowest damage was observed in the villages of Vartana in Adıyaman and Kahta Central district, where the damage scale was 2 (1%-10%). In other surveyed areas, the damage scale varied between 3 (11%-20%) and 4 (21%-30%).

Table 2.Nodositesdamage of Sitonaspp. in 11 lentil fields located in 4 locations in the Central, Kâhta, Besni and Samsat districts of Adıyaman province, between March and June 2022 and 2023.

Province	District	Village	Leaf Damage			
			2022 Damage Scale Value	Damage (%)	2023 Damage Scale Value	Damage (%)
Adıyaman	Merkez	Vartana	2	1-10	3	11-20
	Merkez	Taşpınar	3	11-20	3	11-20
	Merkez	Büyükkavaklı	4	21-30	3	11-20
Adıyaman	Kâhta	Merkez	2	1-10	3	11-20
	Kâhta	Ortanca	4	21-30	4	21-30
	Kâhta	Dut	4	21-30	5	31-40
Adıyaman	Besni	Üçgöz	3	11-20	2	1-10
	Besni	Şambayat	5	31-40	5	31-40
	Besni	Taşlıyazı	3	11-20	4	21-30
Adıyaman	Samsat	Çaybaşı	4	21-30	5	31-40
	Samsat	Büyükbey	5	31-40	5	31-40

In studies conducted in 2023, it was determined that as the population density increased, the damage rate to nodosites also increased. Accordingly, the highest nodosite damage was observed in the villages of Büyükbey and Çaybaşı in Samsat, Şambayat in Besni, and Dut village in Kahta district, where the damage scale was 5 (31%-40%). The lowest nodosite damage was recorded in the village of Üçgöz in Besni district, where the damage scale was 2 (1%-10%). In other surveyed areas, the damage scale ranged from 3 (11%-20%) to 4 (21%-30%).

The adults of the species feed on the leaves of young seedlings, while the larvae feed on the nodules in the roots, reducing nitrogen fixation from the atmosphere (Hariri, 1981; Weigand andClements 1992). In years of high population density, larvae can destroy more than 90% of the nodules (Tahhan and Hariri, 1982; Cardona, 1983), leading to nitrogen deficiency during the vegetative growth phase of the plants. In cases of severe infestation, losses in stem and grain yields can range from 14.1% to 17.7% (ICARDA, 1983). Additionally, the damage caused by the larvae to the seedlings reduces the plant's growth power and shortens its lifespan, resulting in significant yield losses (Barratt and Johnstone, 1984). *Sitonalineatus* has been reported to cause significant losses in the yield and quality of some leguminous plants (Doré and Meynard, 1995; Williams et al., 1995; Corre-Hellou and Crozat, 2005). Feeding on plant leaves, the adults can cause losses of up to 50% in photosynthetic capacity due to leaf drop (Havlickova, 1982; Williams et al., 1995), while the larvae feeding on root nodules can reduce the nodules by 40% to 98% (El-Dessouki, 1978; Cantot, 2001; Verkleij et al., 1992). *Sitonaconcavirostris* has been reported to feed on *Lens esculenta*, *Viciaervilia*, *V. faba*, and *Medicagosativa* (Lodos et al., 1978), and *Viciasativa* (Velázquez de Castro et al., 2010). After *S. macularius*, it was the second most common species found in lentil plants, although it did not reach a population density that would cause significant economic damage.

LİTERATÜR

[1]. Aeschlimann JP (1980). The Sitona [Col.: Curculionidae] species occurring on Medicago and their natural enemies in the Mediterranean region. BioControl 25 (2): 139-153.

[2]. Barratt, B.I.P. and Byers R.A. (1992). Legume seedling preference of adult Sitona hispidulus (F.) (Coleoptera: Curculionidae). Envirnmental Entomology 21: 103-106.

[3]. Cantot, P. (2001). Influence de quelques Papilionacées sur la ponte et le développement larvaire de Sitona lineatus (L.) (Coleoptera, Curculionidae). Bulletin de la Société Entomologique de Fransa, 106, 441-447.

[4]. Cantot, P., 2001. Influence de quelques Papilionacées sur la ponte et le développement larvaire de Sitonalineatus (L.) (Coleoptera, Curculionidae). Bulletin dela Société Entomologique de France, 106(5): 441- 447.

[5]. Cardona C. 1983. Control of Sitona spp. Entomology. Annual Report, ICARDA Food Legume Improvement Program. ICARDA Publication, Aleppo, Syria, p. 190-192.

[6]. Colonnelli E (2004). Catalogue of Ceutorhynchinae of The World With a Key to Genera (Insecta: Coleoptera: Curculionidae). Argania editio, Barcelona, 124 pp.

[7]. Corre-Hellou, G., Y. Crozat. (2005). N2 fixation and N supply in organic pea (Pisum sativum L.) cropping systems as affected by weeds and pea weevil (Sitona lineatus L.). European Journal of Agronomy, 22, 449-458.
[8]. Doré, T., & Meynard J. M. (1995). On-farm analysis of attacks by the pea weevil (Sitona lineatus L.; Col., Curculionidae) and the resulting damage to pea (Pisum sativum L.) crops. Journal of Applied Entomology, 119, 49-54.
[9]. El-Dessouki, S., El-Awady, S., 1978. Studies on the development and bionomy of Sitona lividipes Fhs. (Col., Curculionidae). Zeitschrift für AngewandteEntomologie, 85(1-4): 275-280.
[10]. Harırı G. (1981). Insect and other pests In: Lentils (Eds: C. Webb and G. Hawtin). (CAB) England, p. 173-190.
[11]. Hariri, G. 1981. Insect and other pests. In: Webb C, Hawtin G (eds.) Lentils. CAB, England, pp 173–190.
[12]. ICARDA. (1983). Food Legume Improvement Program. Annual Report for 1983. ICARDA, Aleppo, Syria. 263pp.
[13]. Lodos N, Onder F, Pehlivan E and Atalay R (1978). [The Study of the Harmful Insect Fauna of Marmara and Aegean Regions.] Publications of Food, Agriculture and Animal Husbandry Ministry of Republic of Turkey, Ankara, Turkey (in Turkish). 301.
[14]. Palm, E. (1996). Nordeuropas Snudebiller 1. De kortsnuede arter (Coleoptera: Curculionidae) med saerligt henblik pa den danske fauna. Danmarks Dyrevliv, 7, 1-356.
[15]. Solh MB, Itani HM, Kawar NS (1986) The effect of sowing date on the growth and yield of lentils and the implication of certain control measures. Lebanese Sci Bul 2:17–27
[16]. Tahhan, O. & Harırı G. (1982). Survey of lentil insects in northern and northeastern Syria. Lens Newsletter 9: 34 -36.
[17]. Tahhan, O., & Hariri, G. (1982). Survey of lentil insects in northern and northeastern Syria. Lens Newsletter, 9,34–36.
[18]. Velázquez de Castro, A. J., Friedman, A. L. L. & Borovec, R. 2010b. Sitonini of Israel (Coleoptera: Curculionidae: Entiminae). Israel Journal of Entomology, 40 (2010): 71-108.
[19]. Verkleij, F. N., P. A. M., & Amelsvoort, V., & Smits, P. H. (1992). Control of the pea weevil (Sitona lineatus L.) (Col., Curculionidae) by the entomopathogenic fungus Metarhizium anisopliae in field beans. Journal of Applied Entomology 113, 183-193.
[20]. Wiech K, and Clements RO (1992). Studies on the Sitona spp. and Apion spp. weevils feding on White clover foliage at a site in S.E. England. Journal of Applied Entomology 113: 437-440.
[21]. Williams, L., Schotzko, D.J., & O"Keeffe L. E. (1995). Pea leaf weevil herbivory on pea seedlings: effects on growth response and yield. Entomologia Experimentalis et Applicata, 76, 255-69.