Quest Journals
Journal of Research in Agriculture and Animal Science
Volume 8 ~ Issue 2 (2021) pp: 24-27
ISSN(Online) : 2321-9459
www.questjournals.org

Research Paper

Statistical Evaluation of Damage Status of Important Grasshopper Family in Plants

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ABSTRACT
In this study, it has been provided to reveal the damaging situations of important Grasshoppers families to plant products with statistical values. Grasshoppers have recently shown extremely important effects on agricultural production. They cause serious losses in agricultural production, especially in cultivated plants, both regionally and in wider areas. It is known that the important species covered by certain important grasshoppers families spread over vast areas, destroy the agricultural products produced and cause many people to be starved. It is an important situation that some species of grasshoppers act as a swarm and cause epidemics, thereby threatening food safety. It is an undeniable fact that abiotic factors have an effect on the formation of grasshoppers. It has been determined that especially climatic changes and temperature factors are effective in increasing the life cycle and agricultural damage tendencies. Various forms of agricultural control come into prominence in preventing grasshoppers from harming crop production. Among these, it can be stated that protective measures and biological control practices have an extremely important place in ensuring the continuity of ecological balance and chemical control practices should be avoided as much as possible.
KEYWORDS*: Grasshoppers, Swarm, Statistical Evaluation, Climatic Changes, Plant protection.*

Received 28 Jan, 2021; Revised: 10 Feb, 2021; Accepted 12 Feb, 2021 © The author(s) 2021.
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I. INTRODUCTION

Grasshoppers, which are members of the Orthoptera fauna are among the insect species that most damage agricultural lands and specifically plant species in our country and especially in our region. It is divided into two sub-groups as short and long antenna grasshoppers according to the antenna type. The Ensifera and the Caelifera. Grasshoppers with short antennae lay their eggs in the form of thimbles to a depth of 4-5 cm in the soil. The species that spend the winter in the egg period are hatched in April-May of the year, depending on the climatic conditions. Usually they change five shirts. In this way, they turn from nymph to adult. Mature species mate. Females usually lay their eggs in the ground during the summer months. In this way, they reproduce once a year. However, some grasshoppers breed more than once a year. Long-antenna grasshoppers, on the other hand, lay their eggs one by one in areas that are more inclined and do not hold water. When the climatic conditions are suitable, eggs hatch earlier than the short-antenna grasshoppers. This situation corresponds to the end of March or April. First period grasshoppers called nymphs, the first species that emerge after the egg is opened, are first fed with meadow grasses. The species that develop and mature in the later period move on to other lands and continue to feed there. Grasshoppers, which are nymphs (juvenile), mature in 5-6 weeks on average. Grasshoppers with long antennae give offspring once a year. Typical features of this species belonging to the Acrididae family; it has short antennae and tarsus have three segments. The ovipositor is usually short and protruding. Typanium is located on either side of the first abdominal segment. Members of this family are generally harmful and damage agricultural lands. There are Swarm-forming types. It has an extremely large species capacity. They are generally small or medium sized. The protozona and the metazone are separated from each other. The back is straight. Male species are smaller than females. The posterior femur is very strong, the apex never reaches beyond the abdomen, and the aphalus is disc-shaped. Cercus in males is large, strong, curved, and the apical part is toothed. It is a common species in the region (İlçin, 2015).

Insects, which constitute a large part of the biological diversity on earth, they are an important group in the ecological and economic lives of humans and other living things. The members of this group are scattered in

almost all kinds of environments, which has a lot of varieties from the equator to the poles, from deserts to forest areas, from high mountain areas to low plains, from swamps to caves, from cold springs to hot springs, from agricultural areas to our homes (Gullan & Cranston, 2012).

The spawning period of grasshoppers is 10 days and they are seen 80-180. They reach adulthood in about 6-7 weeks. The most effective factor in the formation of grasshoppers is temperature. The temperature, which is 25-35 degrees in optimum conditions, can rise up to 35 degrees. The annual total loss of grasshoppers is between 5% -65% due to various reasons. 10% of grasshoppers originate from habitat, 3-4% are unable to lay eggs, 40% are hunting and 10% are mold, bacteria, etc. show features. Grasshoppers increase 400 times in summer. It is reported that they have food for 35000 people in 1 day and they travel 150 km in 1 day. It has been reported that the number of cores in 1 km2 is between 40-80 million (FAO, 2020).

It was stated that agricultural pests cause a loss of approximately 58-67% in a product. Classically determined techniques are not sufficient to prevent the damages of creatures harming agriculture. However, combating these pests with only traditional methods, namely chemical control techniques, the harmful organisms will cause in question to emerge resistant to these chemicals in the next stage or years. Practices and efforts in this direction will be lost. Therefore, harm management and prevention against harmful organisms or to carry out biological, cultural, mechanical and finally chemical combat within the framework of legal methods (Singh and Sharma 2014).

Batman province in Turkey, district and wheat cultivated fields in the villages, barley, corn, cotton, lucerne and some horticultural crops has been determined that a large number of grasshoppers found. These grasshoppers are species such as Tettigoniidae Krauss 1902, Gryllidae Laicharting 1781, Gryllotalpidae Leach 1815, Acrididae MacLeay 1821, Cyrtacanthacaridinae Kirby 1910, Calliptaminae Jacobson 1905, Gomphocerinae Fieber 1853, Eyprepocnemidinae Brunner 1893, Pyrgomorphidae Brunner von Wattenwyl, 1874. In other words, 49 species and subspecies in 7 regions and 596 samples representing 5 families of 27 genera were examined. In another study, in various provinces of East and Southeast Anatolia in Turkey the purchase of the *Uvarovistia satunini*, Uvarov, 1934 (Orthoptera) species have been identified. It has been determined that the species is gregarious, moves as a swarm, invades agricultural land, and is harmful in gardens, cultivated plants, fruit trees and other plants (İlçin et al., 2019).

It has been determined that *Dociostaurus (Dociostaurus) maroccanus* Thunberg, 1815 species, have gregarian characteristics, move in herd form and cause serious damage to agricultural lands, gardens, fruit trees, orchards, pastures and other cultivated plants (İlçin & Satar, 2020).

The aim of this study is to determine the effect of important grasshopper species on crop production, to reveal the damage situation and to perform statistical evaluation through various programs.

II. MATERIAL AND METHOD

Material

The identification of the species has also been made by me. In the collection of specimen species, insect trapping tools, traps and pit traps were generally used. Bottles with 60% Ethyl alcohol were provided for the containment of the Insect species caught.

Metot

Finally for the preparation process, Grasshopper: Insecta species were attached to the stretched type specimens to be washed with pure water and placed in small glass tubes. Later, the samples were taken to the collection cabinets. In addition, the grasshopper species collected were brought to the Laboratory for identification. Species names were determined by using the method of species identification-identification keys and the determination and use of the species involved. Identifying the insect species Bei-Bienko and Mistshenko (1951), Ramme (1951), Balamir (1956), Harz (1975), Soltani (1978), Lodos (1983), Willemse (1984, 1985), Naskrecki and Ünal (1995) Considering the species-identification and species-designation keys made by me.

ANOVA (Analysis of Variance) tells us whether three or more means are the same, so it tests the null hypothesis that all group means are equal. An ANOVA produces an F-statistic or F-ratio, which is similar to the t-statistic in that it compares the amount of systematic variance in the data to the amount of unsystematic variance (Field, 2009).

Analysis of Variance, usually abbreviated ANOVA, is a method for comparing the fit of two models, one a reduced version of the other. ANOVA works by partitioning the total variability in the data into parts that mimic the model. The separate means model says that the data are not all equal to the grand mean due to treatment effects and random error (Oehlert, 2010).

$$y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$$

III. RESULTS AND DISCUSSION

In the study, the numbers of locusts in 4 different families were examined. These species are Tettigoniinae Krauss 1902, Gryllidae Laicharting 1781, Acridinae MacLeay 1821 and Pyrgomorphidae Brunner von Wattenwyl, 1874. The number of locusts occurring as a herd was determined according to their species and relevant descriptive statistics are given in Table 1. Whether the number of grasshoppers differed significantly according to their families was examined by one-way analysis of variance (ANOVA).

Table 1. Descriptive statistics

Type	N	Mean	Standard error	Standard Deviation	Minimum	Maximum
Tettigoniinae Krauss 1902	9	17.11	2.92	8.77	7	32
Gryllidae Laicharting 1781	3	11	0	0	11	11
Acridinae MacLeay 1821	30	13.87	2.35	12.88	2	55
Pyrgomorphidae Brunner von Wattenwyl,1874	2	3.5	0.5	0.707	3	4

Table 2. Analysis of variance (ANOVA) results

Source	df	SS	MS	F	p
Grasshopper type	3	334	111	0.82	0.490
Error	40	5425	136		
Total	43	5759			

According to the ANOVA results shown in Table 2, there was no significant difference in the number of grasshoppers in the herds according to the grasshopper species ($p > 0.05$). This means that the numbers of grasshoppers in various plants and different species are close to each other in the area studied. In short, it can be thought that if there are different types of grasshoppers, they will have the ability to infect all kinds of plants under the same conditions. High adaptability may be another reason.

In a variance analysis study on the desert locust, it was determined that the effects of low temperatures on the initiation of copulation, the initiation of ovipositor and the initiation of egg hatching were found. F test values were calculated as 15.6, 22.7 and 6.24, respectively (Tutkun, 1973).

Analysis of variance was applied to determine the differences in enzyme activities in Nymph stages and adults on grasshoppers. The difference between enzyme activities was found to be statistically significant (Özkan et al., 2000). It was found different from the F values calculated in this study.

IV. CONCLUSION

In this study, swarm of Tettigoniidae Krauss 1902, Gryllidae Laicharting 1781, Gryllotalpidae Leach 1815, Acrididae MacLeay 1821 and Pyrgomorphidae Brunner von Wattenwyl, 1874 were determined in cultivated areas in Batman province. These locusts, which have a large population, have damaged many plants and spread too many areas in the region. The most common grasshopper subspecies was Acrididae MacLeay 1821 with 30 species. The difference between the numbers of grasshopper herds according to the species was tested with ANOVA and no significant difference was found as a result of the analysis. It is hoped that the grasshopper herds studied will be compatible in many regions and plants.

Within the framework of the findings obtained in the study, 6 families belonging to the two sub-orders of the Orthoptera fauna and the genera, species and subspecies associated with them were identified and their detailed character features were revealed, and their damage status and distribution were given importance. Firstly, among the sample species obtained from the research, the family, genus, species and subspecies belonging to the Ensifera suborder are given in detail. Tettigoniidae, Gryllidae and Gryllotalpidae were identified, and the organisms belonging to them belonging to the genus and species level were identified and their effects were revealed. As the characteristic features of the Tettigoniidae family; the long antennae, extending over the entire body, and generally having green or yellow colors are given as a few distinctive features, *Tettigonia viridissima* L. type identified and observed from species belonging to the genus *Tettigonia* belonging to this family is a green grasshopper. It is one of the common types and the base color of the body is green, and sometimes it can turn yellowish. This species is more common in lands with plants belonging to the Graminacea family and it has been determined that it lives in different habitats and different heights. In addition, an important feature is that it is a harmful species and it has been determined that it harms cultivated plants such as cotton, beet and legumes, especially wheat from cereals, feeds on them and uses them as hosts. Since *Tettigonia viridissima* L. type does not create populations that will form flocks, it does not cause great damage. Another species belonging to the genus *Tettigonia* is *Tettigonia caudata* C., although it is similar to *T.viridissima* in general, it is distinguished from each other especially in terms of wing length and the shape of the ovopositor. It has been determined that this species is omnivorous, feeds on polyphagous, occurs in different

habitats and is harmful. *Tettigonia caudata* C. species has been observed to damage cotton, wheat and alfalfa plants.

Although it has been revealed in the studies carried out, Acrididae family species are short antenna grasshoppers and are also called field locusts in colloquial language. Species of *Anacridium aegyptium, Aiolopus strepens* and *Aiolopus thalassinus* were found especially in this family. These species are usually the Gramineae plant they do not feed on their species. Although Acrididae family are mostly contain harmful species, it has been observed that they feed on weeds in plant fields that are poaceae. More specifically, it has been determined that *Aiolopus thallassinus* species feeds on oat grass and the adults of this species also feed on poaceae. Again, although the nymphs (offspring) of this species feed mostly on clover It has been determined that they are not fed. It has been observed that the *Aiolopus strepens* species feeds mostly on Poaceae and feeds on it secondarily towards the ore grass. In addition, *Locusta migratoria* and *Dociostaurus moraccanus* species are also the leading and pests of wheat in the Batman region and especially for wheat plants. It has been observed as species that feed on these plant species.

REFERENCES

[1]. FAO, Food And Agriculture Organization of the United Nations, Desert Locust Crisis, Appeal Rapid Response And Anticipatory Action in the Greater Horn Of Africa January-December 2020.

[2]. Field, A. 2009. Discovering Statistics Using SPSS, Third Edition. SAGE Publications Ltd., Los Angeles.

[3]. Gullan, P. J. Cranston P.S. 2012. The Insect an Outline of Entomology, A. John Wiley and Sons, Ltd. Publication.

[4]. İlçin, M., 2015. Batman İli Ekili alanlarda bulunan Orthoptera: Insecta Faunasının Araştırılması ve Tarım alanlarında Zarar oluşturabilecek Türlerin Belirlenmesi, Doktora Tezi, Fen Bilimleri Enstitüsü Biyoloji Anabilim Dalı, Dicle Üniversitesi, Diyarbakır.

[5]. İlçin, M., Satar, A. 2018. On the Orthopteran Fauna (Insecta:Orthoptera) of Agricultural Regions of Batman Province (Turkey). Boletín de la Sociedad Entomológica Aragonesa (S.E.A.), 62:163-166.

[6]. İlçin, M., Satar, A., Tusun, S. 2019. *Uvarovistia satunini* Uvarov, 1934 (*Tettigoniidae: Orthoptera*) türünün sürü oluşturma ve zarar durumunun tespit edilmesi Bingöl, Türkiye. Dicle Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 8(3):69-76.

[7]. İlçin, M., Satar, A. 2020. *Dociostaurus (Dociostaurus) maroccanus* Thunberg, 1815 *(Acrididae:Orthoptera)* türünün sürü oluşturma ve bitkilere zarar durumunun araştırılması. Türk Doğa ve Fen Dergisi, 9(Özel sayı):80-83.

[8]. Oehlert, G. W. 2010. A First Course in Design and Analysis of Experiments. Minitab is a registered trademark of Minitab, Inc.

[9]. Özkan, A., Gündüz, G., Çıplak, B., Fışkın, K. 2000. Kimyasal Mücadele Uygulanmış *Dociostaurus maroccanus* Epidemik Populasyonundan Alınan Örneklerde Antioksidan Enzim Aktiviteleri. Turk. J Biol. (TUBİTAK), 24:141-149.

[10]. Singh, A. & Sharma, A.L. 2014. Agriculturally Important Insect Diversity In Kharif And Rabi

[11]. Crops of Talwandi Sabo, Punjab, Int. J. Sci Andn Res. Pub.

[12]. Symmons, P.M., Cressman, K. Desert Locust Guidelines, Food and Organization of the United Nations Rome, 2001.

[13]. Tutkun, E. 1973. Çöl çekirgesi (*Schistocerca gregaria Forsk*.) erginlerimin olgunluk öncesi dönem sonlarında, düşük sıcaklıklara karşı olan dayanıklılığı üzerinde araştırmalar. Bitki Koruma Bülteni, 13(4):181-201.