APPLICATION OF NATURAL POLLINATOR *BOMBUS TERRESTRIS* IN CULTIVATION OF THE 'BIO' VEGETABLES

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Abstract

In this study is presented the pollination activity of the *Bombus terrestris L.* Type: *Arthropoda,* Class: *Insecta,* Order: *Hymenoptera,* Family: *Apidae,* Genus: *Bombus Latr.* The aim is presentation of the evidences in the impact on the efficiency and qualitative improvement of the plant cucumber *Cucurum sativum* and the red pepper plant *Capsicum annuum* in greenhouses. The experiments conducted during the period 2009-2010 in the Germenji (Lushnje) related to the cucumber plant and the red pepper plant to the Hamallaj (Durrës). Application of the pollination material in comparison with the control greenhouse, give evidences regarding to the enhancement of the fructifying proportion, with 80.3% to the cucumber plant and 84.1% to the red pepper plant with a confidence level of 97%.

Keywords: greenhouse, pollinator, *Bombus terrestris L,* cucumber, red pepper

1. Introduction

Enhancement of the productivity in the agriculture sector nowadays is related not cultivation only during the heat seasons, but in parallel it is extended in cold periods. Referred to these conditions employment of the greenhouse plantations have enhanced the efficiency and the profitability of the agriculture sector. During last decade production of the agriculture products nominated bio has taken great bonus. Hence, shifting from the conventional products to the 'bio' products has been an interesting opportunity to the farmers. Albania has a long experience in the greenhouse agriculture. Even during the socialism it was applied massively. To support the 'Bio' production the study was conducted in a number of experimental greenhouses of the Lushnja and Durrësi by application of the wild bee, *Bombus terrestris* L. This insect accomplish quite very successfully the natural pollination of the cucumber and red pepper flower, by avoiding the application of the stimulating chemicals [1, 2] consequently assuring increase of the production and the consumer health protection as well as environmental protection [3]. Natural pollination method not only increases the product quality but also it increases the efficiency.

2. Material and Methods

In the first phase of the study were selected the greenhouse stations where the vegetable have to be cultivated and followed by the selection of the appropriate environment sites to install the imported nests as well as the artificial nests.

The experiment was conducted in two sites for the cucumber vegetable with a area of 3000 and 4000 m^2 respectively, in Gërmenji (Lushnja), and two other sites for the red pepper vegetable with area of 4000 m^2 respectively, in Hamallaj (Durrësi).

One greenhouse was used to follow the experiment while the other was selected as control. For each site were recorded the hydro-meteorological conditions during the time of the experiment running. In experimental greenhouses in a time of 3-4 days before staring of the pollination stage where installed three nest of BIOPLANET type of Italian origin which number approximately 80-100 wild bees *(Bombus terrestris* L.). Each colony used in the study was calculated to have an expectancy of life 8-14 weeks. In general, *Bombus terrestris* L. is more active during the first part of the days in the morning hours and in the late hours of the afternoon. Their activity is depended in the flowering model of the studied plant. *Bombus genera* are active in the temperature range of

10-30° C, but the best temperature range is 15-25°C. As consequence the condition of our study were selected in that interval of temperatures. The humidity applied in both greenhouses reached values of 65-70 %, and was controlled automatically [4]. Their installation need to be applied some conditions such as 50-100 cm above the soil, protected from sun rays. Initially they were kept for a period of more than 30 minutes prior to open their door. During its life the plant is grown and consequently the nest is elevated by ensuring the pollination of the flower.

In the experimental greenhouses was avoided use of chemicals because those have direct or indirect impact on the bee's health [5, 6, 7, 8, 9].

The nest were applied in two different periods: May – July 2009 and September – November 2010 in the cucumber vegetable, while in the red pepper vegetable the period of application were: June-September 2009 and August-November 2010.

Observation of the fructification process were realized in ten lines of plants positioned vertically toward three bees nests, approximately 15 m from each other, by selecting randomly 10 plants for each line. In the observation process were examined the number of the flowers that formed fruits compared to the overall numbers related to the observed floors. For the cucumber vegetable the observed floors were II, III, V and VII, while for the pepper vegetable the observed floors were II, IV.VI and VIII. Numbering was conducted once in month during the morning, because in that time the *Bombus terrestris* L. is highly active [10, 11, 12]. Related to the floors under observation were noted the number of the flowers that have realized fructification to each floor related to the overall number of the flowers.

3. Results and Discussions

All the data collected during the experiments are presented in the table 1, analyzed by SPSS 19.0. The data were analyzed by the test T, responsible for the statistical significance among the data of the two, referred to the variance equivalency.

The table 1 presents the data on the cucumber and pepper for the greenhouse where is experimented the *Bombus* and in the control greenhouse according to the SPSS. In the table 2 are presented the data on two vegetables in observation according to the T Test (SPSS 19.0).

Table 1: Results according to the floors for the cucumber and red pepper vegetables

Floor		Group	Nr	Mean	Standard deviation	Mean of the standard error
CUCUMBER	II	Experiment	100	84.1	10.2552	1.025
		Control	100	77.5	8.3273	0.8327
	III	Experiment	100	89.9	13.639	1.76
		Control	100	62.6	20.0753	2.591
	V	Experiment	100	86.4	14.707	1.898
		Control	100	51.8	21.5182	2.778
	VII	Experiment	100	79.8	14.9174	1.925
		Control	100	45.2	24.0628	3.106
RED PEPPER	II	Experiment	100	89.93	13.639	1.76
		Control	100	62.6	20.075	2.591
	IV	Experiment	100	86.47	14.707	1.898
		Control	100	51.88	21.518	2.778
	VI	Experiment	100	70.76	18.245	2.356
		Control	100	38.2	22.127	2.856
	VIII	Experiment	100	63.71	24.896	3.214
		Control	100	31.35	31.161	4.023

Table 2: Cucumber and red pepper results according to the T test

	Group	Nr	Mean	Standard deviation	Mean standard error	% mean interval of the confidence	
						Lower limit	Upper limit
CUCUMBER	Experiment	100	84.1	10.2552	1.0255	79.5661	85.6359
	Control	100	77.5	8.3273	0.8327	76.2327	79.5373
RED PEPPER	Experiment	100	80.3	13.3411	1.3341	76.8078	82.1022
	Control	100	71.3	15.9839	1.5984	63.9534	72.2966

3.1 Anova analysis

In the table 3 is assembled the interpretation of the data that present the significance levels. The significance levels show that the on each group in the experiment and the control greenhouses is lower than < 0.05.

That data give evidence that the variability is not the same for two groups. So the significance difference in the variable linked to each individual of both groups. The T Test presented in the Table 4 gives evidence that among the data of two groups in the experimental and that of control greenhouses has difference in the variance of significance due to the influence of the pollination insects in the enhancement of the fructification percentage.

Table 3: Significance level for each group in the experimental and control greenhouse

Group		Square sum	Df	Mean square	F	Sig.
Cucumber	Among groups	690.43	1.00	690.43	7.91	0.01
	In group	17,276.76	198.00	87.26		
Total		17,967.19	199.00			
Red pepper	Among groups	7,601.45	1.00	7,601.45	35.07	0.00
	In group	42,913.58	198.00	216.74		
Total		50,515.02	199.00			

Table 4: Significance variance difference because of the fructification percentage enhancement

Levene Test related to the symmetry of variables			**T-test related to the mean of symmetry**						
	F	Sig.	t	df	Si. (2-tailed)	Mean alteration	Standard error	95% interval of confidence	
								Lower	upper
Cucumber	7.913	0.005	2.813	198	0.005	3.716	1.321	1.1109	6.3211
Red pepper	60.133	0	7.755	198	0	9.462	1.2202	7.0558	11.8682

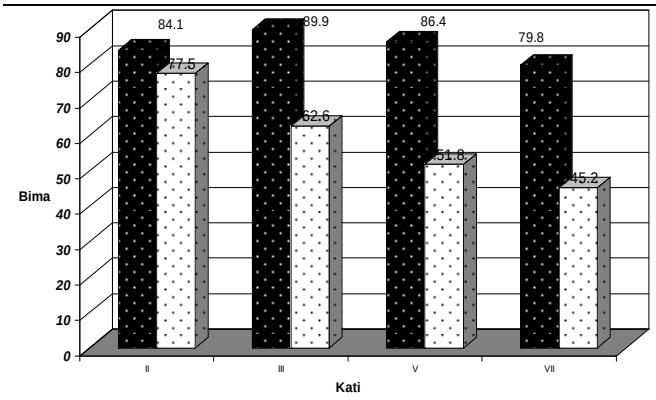

Figure 1: Histogram of the percentage mean values of the fructification in both greenhouses (experiment/control), for cucumber vegetable (*Cucurum sativum)*

The charts are extracted from the data on the T test presented in the tables. In the figure 1 the data presented give evidence that in the experimental greenhouse the fructification percentage is higher compared to that of the red pepper. Until the VII floor is observed a higher fructification in both greenhouses. In the upper floors is observed a dropping trend of the flowering percentage, as consequence of that of fructification.

For these floors the probability for the natural fructification is low, due to the plant height. The insect by frequenting the flowers in the upper floors of the plant gives possibility to the enhancement of the fructification levels in the experimental greenhouse compared to the control greenhouse.

In the experiment greenhouse the pollination insect has influenced in the enhancement of the fructification level by 26.2% compared to that of the control greenhouse, where this insect is not present.

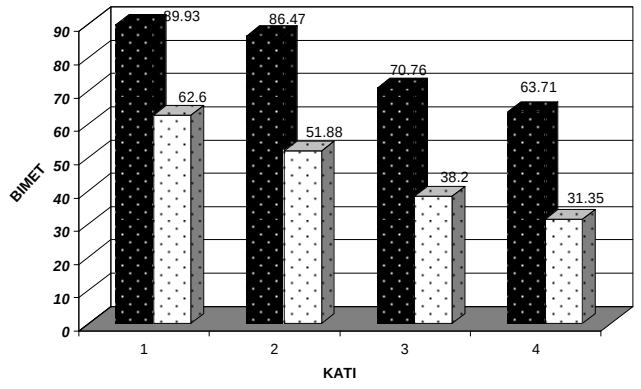

Figure 2: Fructification percentages in both greenhouses for the red pepper (Capsicum annuum).

On these floors the probability of the natural fructification is very low, due to the plant height. The insect by frequenting the flowers in the upper floors gives possibility to the enhancement of the fructification level in the experiment greenhouse compared to the control greenhouse.

On the experimental greenhouse the pollination insect has influenced in the fructification percentage enhancement by 31.3% compared to that of the control greenhouse. The comparison of the study results with other scientific publications (Shipp *et al.* 1994) give evidences on the advantage of this induced pollination method compared with self-pollination methods.

4. Conclusions

The results on every culture under experiment with application of the natural pollinator *Bombus terrestris* L. concluded that cucumber vegetable (*Cucurum sativum)* results with a net increase of 26.2 % of fructification level on the experimental greenhouse compared with control.

The red pepper vegetable **(***Capsicum annuum)* cultivated in the experimental greenhouse, with application of the *Bombus* insects resulted with a total increase of 31.3% fructification level compared to the control greenhouse. Application of the *Bombus* insects together with other beneficial insects, may replace completely the chemical protection with the integrated protection, part of that is also the biological protection. The smaller the application of the insecticides in the greenhouse agriculture, the greater will result the impact on the consumer health protection from the exposure of pesticides and other chemicals.

In conclusion we can underline that *Bombus terrestris* L. is the most suitable pollinator in the greenhouses where is applied the central warming, and it may be considered in some circumstances as irreplaceable both in the case of the cucumber and red pepper vegetables. The results presented are analyzed by statistical analysis. So the flowering and fructification level were accompanied by the weighting of the vegetables. By comparing the mean values of the weight of the vegetables per floor in the experimental greenhouse with that of the control greenhouse it results that the first values are higher. This results give evidence that *Bombus terrestris* L influence considerably in the enhancement of the

mean number of the fruit and consequently in the increase of the mean values of the weigh.

5. References

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