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Population dynamics of generalist predator Phytoseius finitimus Ribaga during 2016-2017 in Sheshi i bardhë grape cultivar

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Abstract*— From the study conducted during 2016-2017 in autochthonous grape cultivar Sheshi i bardhë, we have followed seasonal population dynamics of *Ph. finitimus*. The samples were taken from May to September for both years. The main objectives were: to follow population dynamics of *Phytoseius finitimus* (Ribaga); to find the most populated and the less populated periods with: phytoseiids, with each phytoseiids stage (adult, larvae, egg); to find the most populated period with tetranychid mites, to see the difference: between life stages, between *Ph. finitimus* and tetranychid mites population, between years. During two years of the study were observed a considerable number of the Ph. finitimus/leaf, especially in the first period of September 2016 (5.87±0.39), whereas during 2017 was the third period of September (3.2±0.19 mites/leaf). The less populated period with phytoseiids was the second period June 2016 and the first period of August 2017. The most populated period with adults was the first period of September 2016, whereas the most populated period with larves was the first period of May 2016. Eggs are found in higher number in the second period of May 2016. Tetranychid mites were found in higher number in the first period of July. During 2017 we have found larves in the highest number than adults and this difference is statistically significant (p=0.002). In 2016 and 2017 the egg stage was found in smaller numbers than adults and larvae stage, this is statistically confirmed. In both years of the study, we have more *Ph. finitimus* than tetranychids. Statistically, we have not a significant influence of the presence tetranychid mites in population of *Ph. finitimus.

***Keywords*— Ph. finitimus; Sheshi i bardhë; period; grape; cultivar; phytoseiids; mites.**

I. INTRODUCTION

The culture of grapevine occupies an important part of the economy of our country (Albania); viniculture can be considered as the "aristocracy of agriculture" [19]. Sheshi i bardhë is an autochthonous cultivar originating from central Albania [20] and results as one cultivar were phytoseiids are present [4]. Grape vines are vulnerable to a range of pests, including mites, which are the most successful and diverse of the chelicerates [27]. Mites of the family *Phytoseiidae* are predators, and some species are used for controlling pest mites and small insects, in various crops all over the world [8;15,25]. In European vineyards, these natural enemies play a key role in plant protection as their presence usually makes the use of acaricides unnecessary, [21].

The family *Phytoseiidae* is the most important family of acarine predators of plant pest mites in agriculture [8, 10] The presence of phytoseiid mites on the grapevine shows a better management from pests and diseases. Most species of this family are generalist predators; they can feed on their prey (especially the families *Tetranychidae* and *Eriophyidae*) but can also develop feeding on pollen, plant exudates, fungi and small insects [14, 23]. Certain phytoseiids consume large numbers of prey and maintain plant-feeding mites at low densities [6]. Phytoseius finitimus is a generalist phytoseiid mite mainly recorded in the Mediterranean region on a variety of both cultivated and non-cultivated plants, such as grapevine, hazelnut, citrus, elm, etc. [16], and is quite common in Mediterranean vineyards [1, 16, 24]. Unfavorable climate conditions and the application of pesticides lead to the decrease of predatory mite because they are generally more susceptible to pesticides than their prey [2], causing population outbreaks of tetranychid mites species [11, 13]. Each mite species has its optimal temperature for development and reproduction [17]. The mites are poikilotherms; temperature is the main abiotic factor influencing their biology, ecology, and population dynamics [12, 7].

The objectives of the study were: to follow population dynamics of *Phytoseius finitimus* (Ribaga); to find the most populated and the less populated periods with: phytoseiids, with each phytoseiids stage (adult, larvae, egg); to find the most populated period with tetranychid mites; to see the difference: between life stages, to see difference between *Ph. finitimus* and tetranychid mites population, between years.

II. MATERIAL AND METHODS

The study was carried during the two years 2016, 2017 in Sheshi bardhë grape cultivar. The vineyard is set on a hill area in a surface 0.3 ha, is located in Radë, Durrës, Albania. Form of cultivation was double Guyot and the age of grape was 20-40 years old. In this vineyard were carried out all the necessary agro-technical services (paring, fertilization, protection from

pests and diseases, etc.). In order to be protected from pests and diseases, the farmer has used fungicides and insecticides during the period of vegetation and also winter treatments. For this study, we have taken leaves during the vegetative period for five months. Sampling was done every ten days, from May to September for two years 2016-2017, three periods per months and in total 30 periods for both years. We have taken 15 leaves [9] per periods, leaves were taken inside the rows and in the middle of the sprig [3] (to avoid the first row and the first three plants in the second row) and were brought to the laboratory in plastic bags. phytoseiid mites and all other mites that are present on the leaves were counted under the stereo microscope. We have mounted in Hoyer's medium on microscope slide only mites of *Phytoseiidae* family, and are prepared 30 Microscope slides with *Ph. finitimus*, specie. To determine the species of phytoseiid mites we have worked with many identification keys for *Phytoseiidae* family [5, 22, 26]. Nomenclatures of the crests were based on the systems of Lindquist and Evans and adopted for the *Phytoseiidae* family from Rowell H. J., Chant D.A. & Hansell R.I.C. [18, 26]. In this case we have worked with keys for identification *Phytoseius* genus [22]. We have used analysis of variance (ANOVA), T-test, regression analysis from Excel. Meteorological data were obtained from Weather Underground, "Tab. I".

TABLE I. TEN DAYS AVERAGE HIGH TEMPERATURE, 2016-2017

Periods	I-May	II-May	III-May	I-Jun.	II-Jun.	III-Jun.	I-Jul.	II-Jul.	III-Jul.	I-Aug.	II-Aug.	III-Aug.	I-Sep.	II-Sep.	III-Sep.
2016	21.5°C	22.4°C	25.4°C	27°C	28.7°C	33°C	33.1°C	32.2°C	34°C	34.3°C	32.2°C	33.8°C	31.9°C	30.3°C	26.8°C
2017	22.3°C	26.4°C	24.7°C	29.4°C	30.6°C	33.7°C	34.3°C	34.5°C	33.8°C	37.2°C	36.1°C	34.3°C	30.6°C	29.2°C	25.9°C

III. RESULTS AND DISCUSSION

During two years of the study (2016-2017), we have identified specie and studied population dynamics of *Phytoseius finitimus*. During this time, we have numbered and recorded also tetranychid mites.

In figure 1 are presented some body parts of phytoseiid mites that are used for identifying *Phytoseius finitimus* species (original photo from Microscope): female dorsal view; a) female ventral surface; b) Spermatheca; c) Female chelicera; d) male chelicera.

Fig. 1.*Some body parts of Ph. finitimus specie, that use for identification.*

During the first year of study, August and September were the months with the highest number of Phytoseius finitimus. In the first period of September (I-Sep.) and in the third period of August (III-Aug) were found the higher number of Ph. finitimus/leaf, exactly we have found 5.87±0.39mites/leaf (I-Sep.) and 5.67±0.39mites /leaf (III-Aug). The less populated month with Ph. finitimus was June, in the second period of June (II-Jun) we have found 0.8±0.39 mites/leaf, "Fig. 3".

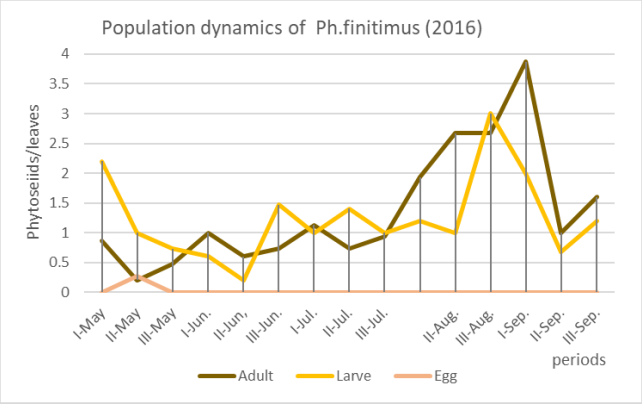

Fig. 2. *Ph. finitimus population dynamics during 2016 (adults, larves, eggs).*

The most populated period with adults was the first period of September (I-Sep.), in this period we have found 3.87 adults±0.26/leaf, whereas in the second period of May we have found the least number of adults per leaf (0.2±0.26). The most populated period

with larves was the third period of August (III-Aug.) in this period we have found 3±0.18 larves/leaf, whereas the least populated period was the second period of June with 0.2±0.18 larves per leaf. Eggs are found only in the second period of May, in this period are found 0.27±0.02 eggs/leaf. “Fig. 2”. During 2016 we have found more adults than eggs and more larves than eggs, these differences are statistically validated, we have a significant difference between adults- eggs (P=0.0002) and larves– eggs (P=0.00001). We haven’t significant difference between adult and larval stages (P=0.72).

From the results of the first year, it results that *Ph. finitimus* was found in higher numbers than tetranychid mites, and we have a significant difference (p=0.0002). In August, we have found the highest number of tetranychids per leaf, especially in the third period of August was the most populated period with tetranychids, in this period we have found 2.2±0.19 mites/leaf. May was the month with the least number of tetranychids per leaf. Statistically, we have not a significant influence of seasonal temperature on populations of *Ph. finitimus* (R^2=0,1409), with equation y=0.1335x-1.3686 (Significance F=0.16). Seasonal temperature has a slight impact on populations of tetranychid mites (R^2=0.27), with equation y=0.906x-2.0445 (Significance F=0.046). The graph in “Fig. 3”. shows that the phytoseiids populations were growing at the same time with the tetranychid populations. Statistically, we have not a significant influence of tetranychid mites in population of Phytoseius finitimus (R^2=0.2125), with equation y=0.9425x-1.989 (Significance F=0.08). This increase in the population of *Ph. finitimus* may be related to the behavior of this predator as a generalist [15] (the possibility of feeding on alternative food).

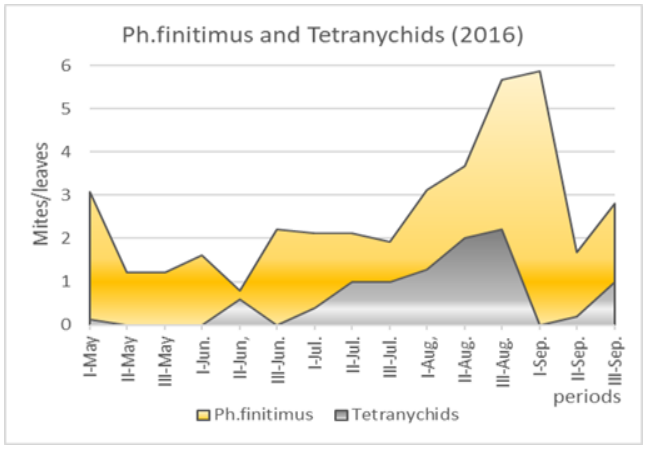

Fig. 3. *Phytoseiids and tetranychid mites present during 2016.*

From the data collected during the second year of study, it results that June and September were the months with the highest number of *Ph. finitimus* per leaf, especially the first period of June and the third period of September were periods with the highest number of Ph. finitimus per leaf. In the first period of June (I-Jun.), we have found 3.07±0.19 phytoseiids/leaf and in the third period of September (III-Sep.) we have found 3.07± 0.19 phytoseiids/leaf. The first period of August (I-Aug.) was the least populated period with *Ph. finitimus*, in this period we have found 0.8± 0.19 phytoseiids/leaf, “Fig. 5”. June and September result the months with the highest number of adults per leaf, especially in the first period of June and in the third period of June we have found the higher numbers of adults per leaf. In the first period of June (I-Jun.) we have found 1.47±0.12 adults of *Ph. finitimus*/leaf, and in the third period of June (III-Jun.) we have found 1.67±0.12 adults of *Ph. finitimus*/leaf. The less populated periods with adults were the first period of May and the first period of August. In both these periods we have found same results 0.2±0.12 adults of *Ph. finitimus*/leaf. The most populated periods with larves were the second period of June (II-Jun.) and the third period of September (III-Sep.). In both these periods we have found same results 2±0.12 larves/leaf. Eggs were found only in three sampling periods in the first and in the second period of May also in the second period of August “Fig. 4”. During 2017 we have found: more adults than eggs, more larves than adults and more larves than eggs, these differences are statistically validated, we have a significant difference between: adults-larves (P=0.002), adults-eggs (P=0.0001), and larves–eggs (P=0.000001).

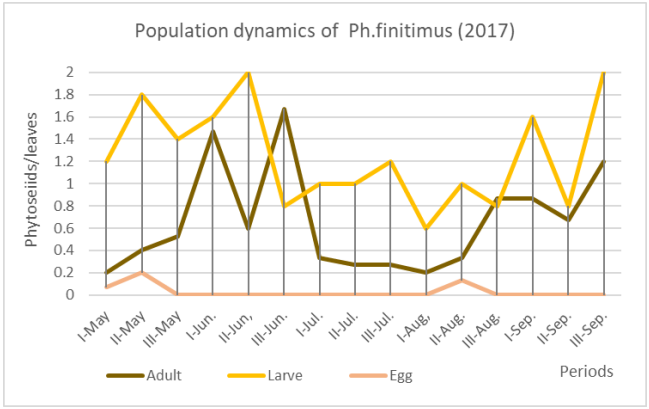

Fig. 4. *Ph. finitimus population dynamics during 2017 (adults, larves, eggs).*

During the second year of study, results that *Ph. finitimus* was found in higher numbers than tetranychid mites, and we have a significant difference (p=0.000001). In July, we have found the highest number of tetranychids per leaf especially, in the first period of July was the most populated period with tetranychids, in this period we have found 2.6±0.17 mites/leaf. June and August were months with the least number of tetranychids per leaf.

Statistically, we have not a significant influence of seasonal temperature on populations of *Ph. finitimus* (R^2=0,1901), with equation y=-0.0697x+4.0647 (Significance F=0.104). Statistically, we have not a significant influence of seasonal temperature in populations of tetranychid mites (R^2=0.315), with equation y=0.0268x-0.5104 (Significance F=0.527). Statistically, we have not a significant influence of tetranychid mites in population of Phytoseius finitimus

(R^2=0.1189), with equation y=0.3659x-2.0274 (Significance F=0.21). This increase in the population of Ph. finitimus may be related to the behavior of this predator as a generalist [15] (the possibility of feeding on alternative food).

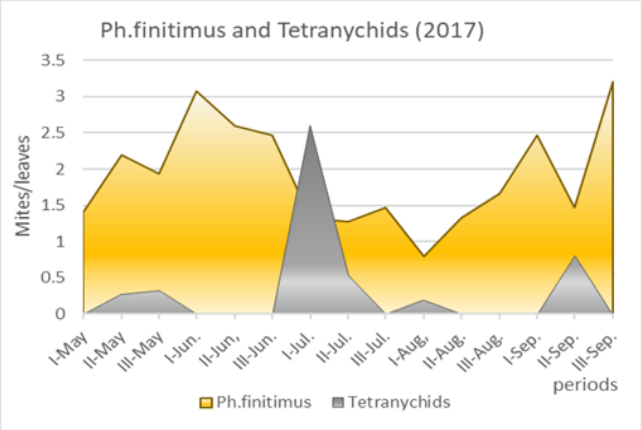

Fig. 5. *Phytoseiids and tetranychid mites present during 2017*

During this study (2016-2017) in the first year, we have found more *Phytoseius finitimus* than the second year, this difference is not statistically significant (P=0.12). We have found more adults during 2016 than 2017; this difference is significant (P=0.02). We haven't any significant difference between larves of *Ph. finitimus*, that are found during 2016 and 2017 (P=0.96). We haven't any significant difference between eggs that are found during 2016 and 2017 (P=0.82).

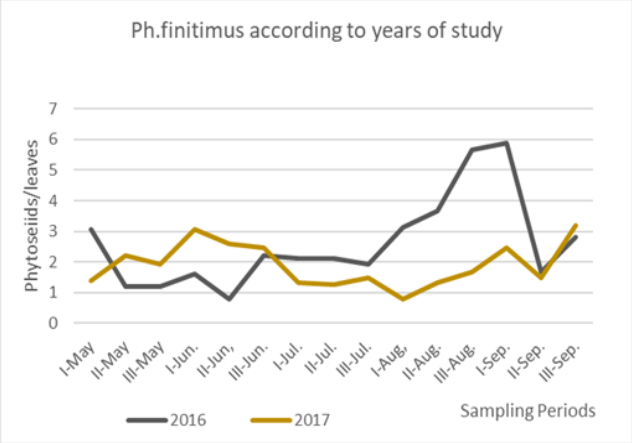

Fig. 6. *Ph. finitimus population during two years of the study*

From the data results that the most populated periods with *Ph. finitimus* per leaf, were the first period of September 2016 (I-Sep. 5.87±0.39.) and the third period of August 2016 (III-Aug. 5.67±0.39). The most populated period with adults was the first period of September 2016. In this period, we have found 3.87±0.26 mites/leaf, whereas the third period of August 2016 was period with higher number of larves per leaf (3±0.18). In the second period of May 2016, we have found a higher number of eggs per leaf (0.27±0.02). The most populated period with tetranychids mites was the first period of August, 1.27±0.19 mites/leaf.

IV. CONCLUSIONS

From data collected during this study of the population dynamics of *Phytoseius finitimus* in Sheshi i bardhë grape cultivar it was observed a considerable number of the predatory mites/leaf, especially in the third period of August and in the first period of September during 2016, whereas during 2017 was the first period of June. The most populated period with *Ph. finitimus* was the first period of September 2016 (I-Sep. 5.87±0.39 mites/leaf.) and the least populated period was the first period of August 2017 and in the second period of June 2016. During 2017 we have found larves in the highest number than adults and this difference is statistically significant (p=0.002). In 2016 and 2017 the egg stage was found in smaller numbers than adults and larvae stage, and this is statistically confirmed. The most populated period with adults was the first period of September 2016, whereas the most populated period with larves was the first period of May 2016. Eggs are found in higher number in the second period of May 2016. Tetranychid mites were found in higher number in the first period of July. In both years of the study, we have more Ph. finitimus than tetranychids. Statistically, we have not a significant influence of the presence tetranychid mites in population of *Ph. finitimus*. The presence of this useful mite during all periods of study and in these quantities, it is a certainty that in the case of the appearance of any pests which is part of the feeding range of this generalist predator we gain a satisfactory biological control and without economical cost.

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