# THE BEHAVIOUR OF USEFUL MITES IN AFUZALI GRAPE CULTIVAR DURING FOUR YEARS OF STUDY

**Aris Huqi**
Agricultural University of Tirana
**ALBANIA**

## ABSTRACT

The study was carried out in Afuzali grape cultivar for four years (2014-2017) in Radë, Durrës Albania and we have taken leaves once a month, from May to September. During this study we have identified and recorded 4 species of useful mites of Phytoseiidae family: *Amblyseius(Euseius) stipulatus; Anthoseius rhenanus (Typhlodromus rhenanus); Phytoseius finitimus and Typhlodromus pyri*. We have also recorded mites of *Tydeidae* family. The main objectives of the study were: to identify species that are present in Afuzali grape cultivar during 2014-2017; to see if we have diversity on phytoseiid mite species; to find the dominant species and the most populated period; to find the percentage that occupies each species in the population of phytoseiid mites found in each year and in total, etc. From the results of the study, *Ph. finitimus* results the most common and dominant species. The second dominant species was *A. rhenanus.* According to years of the study, 2014 was the most populated year with phytoseiid mites. In this year we have found 38% of the total of phytoseiid mites. 2016 was the year with the greatest diversity of useful mites. In this year we have found 3 useful mite species from 4 useful mite species present during this study. The most abundant period with Phytoseiid mites was the fifth period of sampling in 2014 (2.2±0.35 phytoseiid mites per leaf.). *Ph. finitimus* was the most common and can be found distributed through the season. *A. rhenanus* when it is present, can be found in all sampling periods. Whereas *A. stipulatus* and *T. pyri* have a different behavior compared with *Ph. finitimus* and *A. rhenanus*. *A. stipulatus* when it is present, can be found in the fourth (August) and the fifth sampling period (September), whereas T. pyri can be found only in the fifth sampling period (September).

**Keywords:** Afuzali, cultivar, *Amblyseius(Euseius) stipulatus*, *Phytoseius finitimus*, mites.

## INTRODUCTION

The family Phytoseiidae includes many species of predators involved in the control of mite pests of crops all over the world [21]. In nature, phytophagous mite populations are kept under the economic damage levels by a considerable number of natural enemies such as predatory mites and insects [4]. Phytoseiidae is an important family of predatory mites as several species in this family are important natural enemies controlling phytophagous mites and small insects in natural areas, open fields and protected crops all around the world [11; 12; 13]. Mites of the family Phytoseiidae are the most common predators of phytophagous mites on most plant species. Some species are widely studied and used for biological control of mite pests [7, 17]. In European vineyards, these natural enemies play a key role in plant protection as their presence usually makes the use of acaricides unnecessary [19; 21]. The presence of phytoseiid mites on the grapevine shows 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 [12; 22]. Each species has its specific

biological features [21]. It is thus of interest to identify the species of useful mites of Phytoseiidae family on different grape cultivars. *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. [15] and is quite common in Mediterranean vineyards [1; 15; 23]. *Amblyseius stipulatus (Euseius stipulatus)* (Athias-Henriot) is the generalist predator type IV; there are more than 200 known species of *Euseius,* few of *Iphiseiodes* and only one *Iphiseius* [13], which feed primarily on pollen, but will also feed on mites, thrips, leaf sap and other small insects [12]. *Amblyseius stipulatus* (*Euseius stipulatus*) is reported in vineyards together with other species in California [8]. It is also reported in European vineyards [10; 21].

*Typhlodromus pyri* are generalist phytoseiids that prey on grapevine pests, including the European red mite *Panonychus ulmi* and the grape rust mite *Calepitrimerus vitis* (Nalepa) [5], but also feed on pollen and fungal spores [2]. *Anthoseius rhenanus* (Oudemans) is a useful mite predator that was found on grapevines in France [10], in Italy [16], and during this study in Albania, etc. The objectives of the study were: to identify species that are present in Afuzali grape cultivar during 2014-2017; to see if we have diversity on phytoseiid mite species; to find the dominant species and the most populated period; to find the percentage that occupies each species in the population of phytoseiid mites found in each year and in total; to find the percentage that occupies each mite in total; to find if temperature has a significant influence in populations of phytoseiid mites.

## METHODOLOGY

The study was carried out for four years from 2014 to 2017, in Afuzali grape cultivar. The vineyard is set on the hill in a surface 0.3 ha, located in Radë, Durrës, Albania (41°40'94.79" N, 19°60'57.14" E). The form of cultivation was double Guyot and the age of grapes 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 (from April to the middle of July) and also winter treatments. For this study, we have taken leaves during the vegetative period, once a month, from May to September 2014-2017.We have taken 15 leaves [9] per period. 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 were present on the leaves were counted under the stereo microscope. We have mounted in Hoyer's medium on microscope slides only with mites of Phytoseiidae family and we have identified species. To determine the species of phytoseiid mites, we have worked with many identification keys for the Phytoseiidae family [6; 14; 20; 21; 24]. 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; 24]. In this case we have worked with keys for the identification of *Phytoseius* genus [20, 21], *Amblyseius* genus [14; 20; 21], and *Typhlodromus* (*Anthoseius*) genus [20].

## RESULTS AND DISCUSSION

From the results of the four years of study that was carried out in Afuzali grape cultivar, we recorded mites of *Phytoseiidae* family, and Tydeid mites. During this study were identified four species of *Phytoseiidae* family: *Amblyseius (Euseius) stipulatus* (Athias–Henriot);

*Anthoseius rhenanus* or *Typhlodromus rhenanus* (Oudemans); *Phytoseius finitimus* (Ribaga); *Typhlodromus pyri* (Scheuten).

**Results of the first year of study 2014**

During the first year of the study in Afuzali grape cultivar, phytoseiid mites were present in all periods of the study. The most abundant period with phytoseiid mites was the fifth period of sampling; in this period we have found 2.2±0.35 phytoseiid mites per leaf. In the population structure of phytoseiid mites in 2014, we have found two species of Phytoseiidae family, *Phytoseius finitimus* and *Amblyseius(Euseius) stipulatus.* From the first period of the sampling to the third period of sampling we have found only *Ph. finitimus*. In the fourth period of the sampling, we have found only *A. stipulatus*, whereas in the fifth period of the sampling we have found both species. In this period *Ph. finitimus* was found in higher numbers than *A. stipulatus.* The most abundant period with *Ph. finitimus* was the fifth period of sampling; in this period we have found 1.73±0.32 *Ph. finitimus* per leaf. The most populated period with *A. stipulatus* was the fifth period of sampling; in this period we have found 0.47±0.32. In the structure of populations of phytoseiid mites species found in 2014, *Ph. finitimus* was the dominant species. This species occupies about 83% of total and *A. stipulatus* occupies 17% of the total. From the results of the study tydeid mites were present from the second period of sampling, reached peak in the third period of sampling (1±0.18 tydeid mites per leaf) and continued to be present till the end of the study. In the structure of mites found during this year phytoseiid mites occupy about 72% of mites present in this cultivar and tydeid mites occupy 28% of total. Statistically, we don't have a significant influence of seasonal temperature on populations of phytoseiid mites ($R^2$=0,3924, with equation y=-0.1447x-4.3047, significance F=0.26, α=0.05) and in population of tydeid mites. ($R^2$=0.1909), with equation y=0.0525x-0.8082, significance F=0.46, α=0.05).

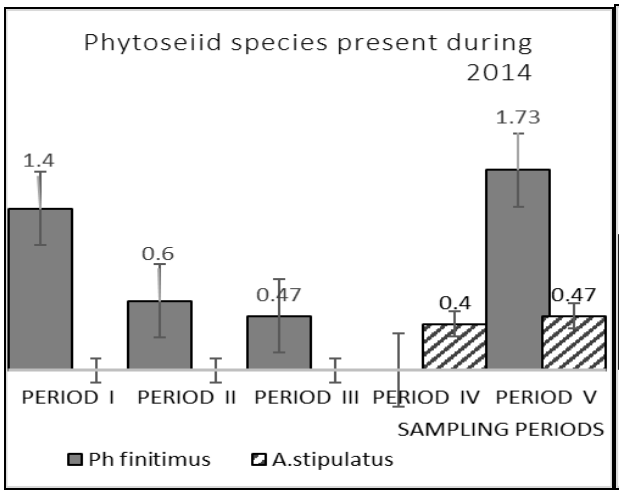


**Figure 1 Phytoseiid mites species found during 2014**

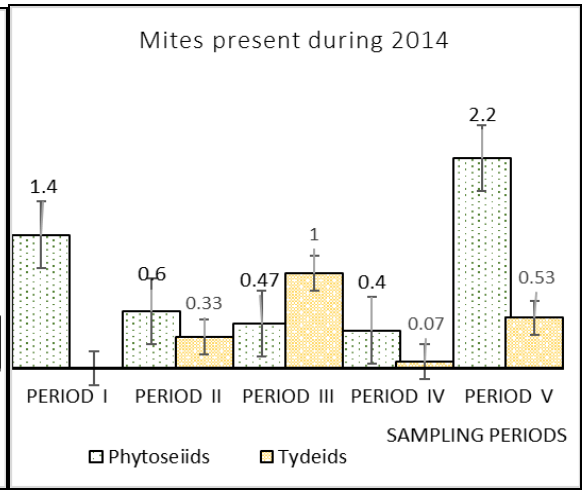


**Figure 2 Mites found during 2014**

**Results of the second year of study 2015**

During the second year of the study in Afuzali grape cultivar, phytoseiid mites are present in all periods of the study. The most abundant period with phytoseiid mites was the fourth period of sampling; in this period we have found 1.67±0.23 phytoseiid mites per leaf. In the population structure of phytoseiid mites in 2015, we have found two species of Phytoseiidae family, *Phytoseius finitimus* and *Anthoseius rhenanus.* From the first period of the sampling to the second period of sampling we have found only *A. rhenanus* . In the third period of the sampling, we have found *Ph. finitimus* and *A. rhenanus*. *Ph. finitimus* was found in low densities (0.2±0.09 phytoseiids per leaf). In the fourth and in the fifth period of the sampling,

we have found only *A. rhenanus*. The most abundant period with *A. rhenanus* was the fourth period of sampling; in this period we have found 1.67±0.25 phytoseiid mites per leaf. In the structure of populations of phytoseiid mites found in 2015, *A. rhenanus* was the dominant species. This species occupies about 95% of total, whereas *Ph. finitimus* occupies about 5%. From the results of the study tydeid mites are present in all sampling periods. The most abundant period with tydeids was the second period of sampling (1.33±0.17 tydeid mites per leaf). In the structure of mites found during this year phytoseiid mites occupy about 51% of mites present in this cultivar and tydeid mites occupy about 49% of total, almost equal. Statistically, we don't have a significant influence of seasonal temperature on populations of phytoseiid mites ($R^2$=0,3652, with equation y=0.0981x-14831, significance F=0.28 α=0.05) and in the populations of tydeid mites. ($R^2$=0.0039), with equation y=0.0072x+6157, significance F=0.92, α=0.05).

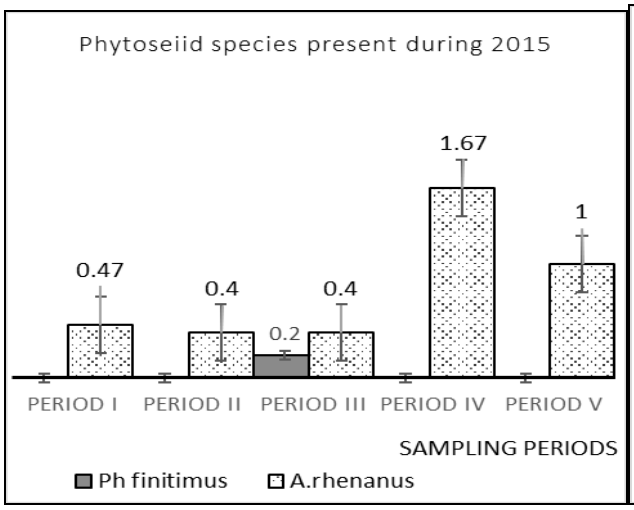


**Figure 3 Phytoseiid mites species found during 2015**

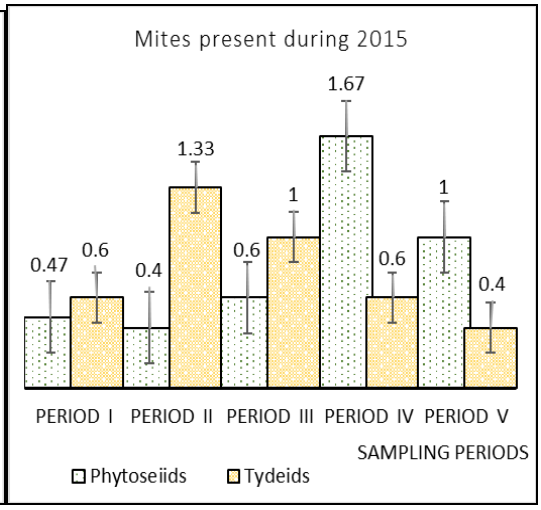


**Figure 4 Mites found during 2015**

**Results of the third year of study 2016**

From the results in the third year of the study in Afuzali grape cultivar, phytoseiid mites are present in the fourth and in the fifth period of sampling. The most abundant period with phytoseiid mites was the fourth period of sampling; in this period, we have found 1.27±0.29 phytoseiid mites per leaf. In the population structure of phytoseiid mites in 2016, we have found three species of Phytoseiidae family: *Phytoseius finitimus*, *Amblyseius(Euseius) stipulatus and Typhlodromus pyri.* In the fourth period of the sampling, we have found *A. stipulatus* (0.27±0.19 phytoseiids per leaf) and *T.pyri* (1±0.2 phytoseiids per leaf). In the fifth period of the sampling, we have found *A. stipulatus* (0.6±0.12 phytoseiids per leaf) and *Ph. finitimus* (0.47±0.09 phytoseiids per leaf).

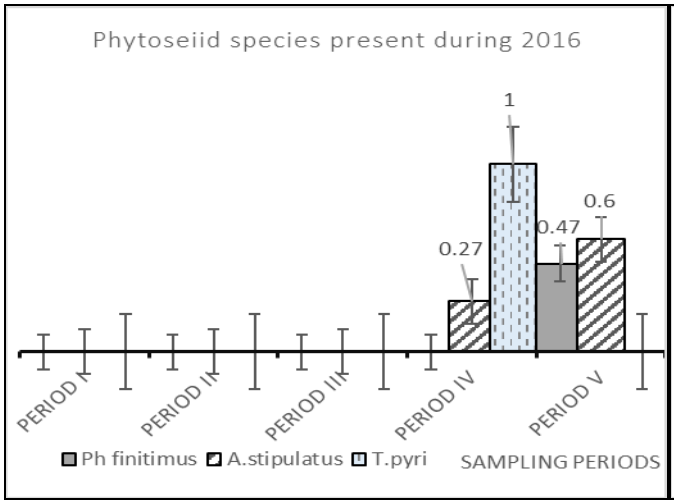


**Figure 5 Phytoseiid mites species found during 2016**

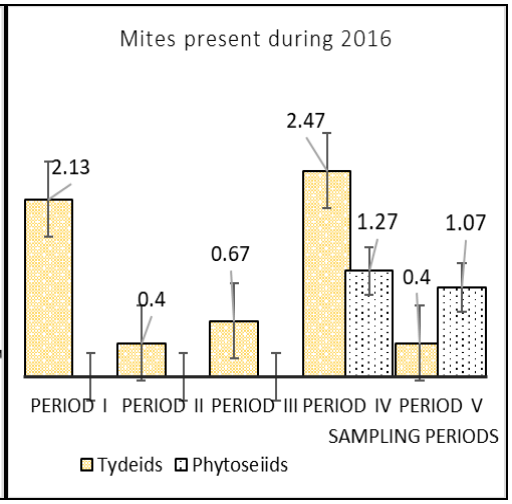


**Figure 6 Mites found during 2016**

In the structure of populations of phytoseiid mites species found in 2016 *A. stipulatus* occupies about 37% of total, *Ph. finitimus* occupies about 20% of total and *T. pyri* occupies about 43% of total found in this year. During 2016, tydeid mites are present in all sampling periods. The most abundant period with tydeid mites was the fourth period of sampling (2.47±0.45 tydeid mites per leaf). In the structure of mites found during this year, tydeid mites are found in higher densities compared with phytoseiid mites and occupy about 78% of the total. Whereas phytoseiid mites occupy about 28% of mites present in this cultivar. Statistically, we don't have a significant influence of seasonal temperature on populations of phytoseiid mites ($R^2$=0,0559, with equation y=0.0451x-0.6119, significance F=0.7, α=0.05) and in the population of tydeid mites. ($R^2$=0.057), with equation y=-0.071x+2.9132, significance F=0.7, α=0.05).

**Results of the fourth year of study 2017**

From the results in the fourth year of the study in Afuzali grape cultivar, phytoseiid mites are present from the third period of sampling to the fifth period of sampling. The most abundant period with phytoseiid mites was the fifth period of sampling; in this period, we have found 0.73±0.15 phytoseiid mites per leaf. In the population structure of phytoseiid mites in 2017, we have found two species of Phytoseiidae family: *Phytoseius finitimus and Typhlodromus pyri.*

*T. pyri* was present only in the fourth sampling period in low densities 0.07±0.01 phytoseiid mites per leaf. *Ph. finitimus* was present from the third period of sampling to the fifth period of sampling. In the third period and in the fourth period of sampling *Ph. finitimus* is found in the same densities (0.53±0.15 phytoseiid mites per leaf), whereas the fifth period of sampling was the most populated period with *Ph. finitimus* (0.73±0.15 phytoseiid mites per leaf).

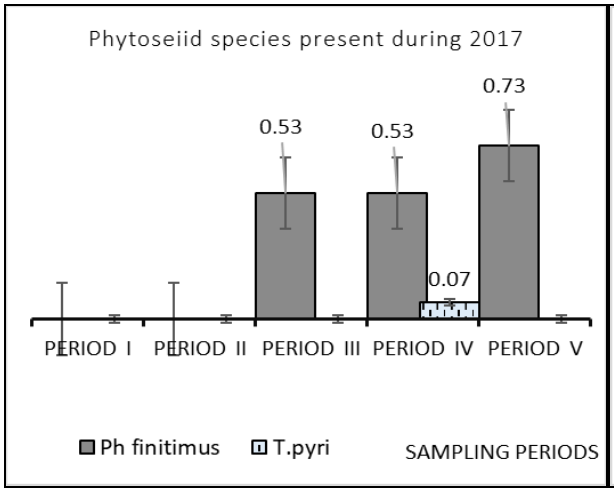


**Figure 7 Phytoseiid mites species found during 2017**

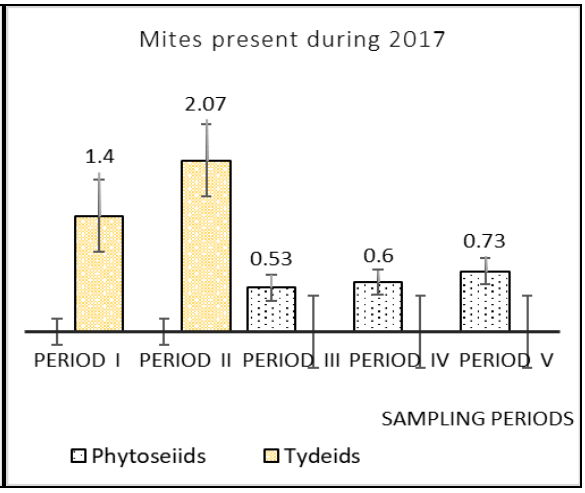


**Figure 8 Mites found during 2017**

In the structure of populations of phytoseiid mites species found in 2016, *Ph. finitimus* was the dominant species and this species occupies about 96% of total. *T. pyri* occupies about 4% of the total found in this year. During 2017, tydeid mites are present only in the first and in the second sampling period. The most abundant period with tydeids was the second period of sampling (2.07±0.43 tydeid mites per leaf). In the structure of mites found during this year tydeid are found in higher densities compared with phytoseiid mites. Tydeid mites occupy about 65% of total, whereas phytoseiid mites occupy about 35% of mites present in this cultivar. Statistically, we don't have a significant influence of seasonal temperature on populations of phytoseiid mites ($R^2$=0.1518, with equation y=0.0364x-0.5507, significance F=0.52, α=0.05) and in the population of tydeid mites ($R^2$=0.1353, with equation y=-0.0971x+3.1522, significance F=0.54, α=0.05).

From the results of four years of study, *Ph. finitimus* results the most common species in Afuzali grape cultivar. This species was present in 9 from 20 sampling periods and was present during all years of the study. *A. stipulatus* species was present in two sampling periods in 2014 and in two sampling periods in 2016. In total, it was present in 4 from 20 sampling periods. *A. rhenanus* was present in all periods only in 2015. *T. pyri* was present in 2 from 20 sampling periods. Only in the fourth period in 2016 and in the fourth period in 2017. In total Phytoseiid mites were found in all years of the study and in 15 from 20 sampling periods. Tydeid mites were present in 16 from 20 sampling periods. From the total of phytoseiid mites species found in this cultivar in four years of study, *Ph. finitimus* occupies about 49.7% of total; *A. stipulatus* occupies about 12.9% of total; *A. rhenanus* occupies about 29.4% of total; *T. pyri* occupies about 8% of total. In the population structure of mites found during this study phytoseiid mites occupy about 46.6% of total and tydeid mites occupy about 53.4% of the total. According to years of the study, in 2014 we found 38% of the total of phytoseiid mites, in 2015 we found 31% of the total of phytoseiid mites. In 2016 we found 17% of the total of phytoseiid mites and in 2017 we found 14% of the total of phytoseiid mites.

## CONCLUSIONS

Based on the results of four years of study in Afuzali grape cultivar, we have identified and recorded 4 species of useful mites of Phytoseiidae family: *Amblyseius (Euseius) stipulatus*; *Anthoseius rhenanus* (*Typhlodromus rhenanus*); *Phytoseius finitimus* and *Typhlodromus pyri*.

Temperature has not a significant influence in populations of phytoseiid mites and in populations of tydeid mites. From the results of the study, *Ph. finitimus* results the most common and dominant species. The second dominant species was *A. rhenanus.* According to years of study, 2014 was the most populated year with phytoseiid mites. In this year we have found 38% of the total of phytoseiid mites. 2016 was the year with the greatest diversity of useful mites. In this year we have found 3 useful mite species from 4 useful mite species present during this study. The most abundant period with Phytoseiid mites was the fifth period of sampling 2014 (2.2±0.35 phytoseiid mites per leaf.). The most abundant period with *Ph. finitimus* was the fifth period of sampling 2014 (1.73±0.32phytoseiid mites per leaf). *A. rhenanus* was found in a higher density in the fourth period of sampling 2015 (1.67±0.25 phytoseiid mites per leaf ). *A. stipulatus* was found in a higher density in the fifth period of sampling 2016 (0.6±0.12 phytoseiid mites per leaf ). The most populated period with T. *pyri*, was the fourth period of sampling 2016 (1±0.28 phytoseiid mites per leaf ). The most populated period with tydeid mites was the second period of 2017. In Afuzali grape cultivar *Ph. finitimus* was the most common and can be found distributed through the season. *A. rhenanus* when it is present, can be found in all sampling periods. Whereas *A. stipulatus* and *T. pyri* have different behavior compared with *Ph. finitimus* and *A. rhenanus*. *A. stipulatus* when it is present, can be found in the fourth and the fifth sampling period exactly in August and September, whereas *T. pyri* when it is present, can be found only in the fifth sampling period, September.

## REFERENCES

1. Ahmad, S., Pozzebon, A., & Duso, C. (2015) Predation on heterospecific larvae by adult females of *Kampimodromus aberrans, Amblyseius andersoni, Typhlodromus pyri* and *Phytoseius finitimus* (Acari: Phytoseiidae), *Experimental and Applied Acarology*, 67, 1-20.
2. Barba al (2019) A QTL associated with leaf trichome traits has a major influence on the abundance of the predatory mite *Typhlodromus pyri* in a hybrid grapevine population. *Horticulture Research,* 6, 87.
3. Duraj, N. (2000) Shpërndarja e këpushave të dobishme në pjesë të ndryshme të lastarit të hardhisë. *Buletini i Shkencave Bujqësore*, 3, 73-77.
4. Duraj, N. (2006), Akarologjia Bujqesore," *Biological control*. Tirana.
5. Duso et al. (2012) Management of Phytophagous Mites in European Vineyards. Arthropod Management in Vineyards: Springer.
6. Faraji, F., Çobanoğlu S., & Çakmak, I. (2011) A checklist and a key for the Phytoseiidae species of Turkey with two new species records (Acari: Mesostigmata). *International Journal of Acarology*, 37, 1, 221-243.
7. Gerson, U., Smiley, R. L., & Ochoa, T. (2003) "Mites (Acari) for Pest Control. *Blackwell Science,* Oxford, UK, 539.
8. Grafton-Cardwell et.al. (2020) Surveys of 12 California crops for phytoseiid predatory mites show changes compared to earlier studies", *California Agriculture*, 74, 3, 129-137.
9. Girolami et al. (1989) Lotta Integrata in viticoltura. Malattie della vite *I.R.I.P.A. Coldiretti*.
10. Kretier, S., Tixier, M., S. & Auger P. (2000) Phytoseiid mites of vineyards in France (Acari: Phytoseiidae). *Acarologia*, 41, 1, 76-96.
11. Kreiter S. *et al.* (2020) Phytoseiid mites of Slovenia (Acari: Mesostigmata): new records and first description of the male of *Amblyseius microorientalis*. *Acarologia*, 60, 2, 203-242.
12. McMurtry, J.A. & Croft, B. A. (1997) Life-styles of phytoseiid mites and their roles in biological control. *Annual Review of Entomology*, 42, 1, 291-321.

13. McMurtry, J.A., De Moraes, G. J. & Sourasso N. F. (2013) Revision of the lifestyles of phytoseiid mites (Acari: Phytoseiidae) and implications for biological control strategies. *Systematic and Applied. Acarology,* 18, 4, 297-320.
14. Papadoulis, G.TH. & Emmanouel, N. G. (1991) The genus Amblyseius (Acari Phytoseiidae) in Greece with the Description of a News, *Entomologia Helenica*, 9, 35-62
15. Pappas et al. (2013), Potential of the predatory mite *Phytoseius finitimus* (Acari: Phytoseiidae) to feed and reproduce on greenhouse pests. *Experimental and Applied Acarology*, 61, 4, 387-401.
16. Peverieri et al.(2009) Effects of variety and management practices on mite species diversity in Italian vineyards. *Bulletin of Insectology* 62, 1, 53-60.
17. Rezaie, M. & Jvannezhad, R (2017) A Dispersion survey of the phytoseiid mites on the basis of region topography in agro ecosystem of several provinces of Iran. *International Journal of Geology, Agriculture and Environmental Sciences*, 5
18. Rowell, H.J., Chant D.A., & Hansell R.I.C. (1978) The determination of setal homologies and setal patterns on the dorsal shield in the family Phytoseiidae (Acarina: Mesostigmata). *The Canadian Entomologist*, 8, 859–876.
19. Talebi, K., Kavousi, A., & Sabahi, Q. (2008) Impacts of Pesticides on Arthropod Biological Control Agents, Pest technology. *Global Science Books*, 87-97.
20. Tixier et.al (2012) Dichotomous key to species of Phytoseiidae mites in European vine fields. http://www1.montpellier.inra.fr/CBGP/phytoseiidae/sitewebvineyards2/index. htm
21. Tixer et al. (2013) Phytoseiidae in European grape (Vitis vinifera L): bioecological aspects and keys to species (Acari: Mesostigmata). *Zootaxa*, 3721, 2, 101–142.
22. Tixer et al. (2014) Phytoseiid mite diversity (acari: mesostigmata) and assessment of their spatial distribution in French apple orchards. *Acarologia*, 54, 1, 97–111.
23. Tixer et al. (2017) Great molecular variation within the species *Phytoseius finitimus* (Acari: Phytoseiidae): Implications for diagnosis decision within the mite family Phytoseiidae. *Acarologia*, 57, 3, 493–515.
24. Toyoshima et al.(2016) Occurrence of *Amblyseius andersoni* (Chant) (Acari: Phytoseiidae) in deciduous fruit tree orchards in Japan. *Journal of the Acarological Society of Japan*, 25, 1, 37-43.