OBSERVATIONS REGARDING THE STRUCTURE, DYNAMICS, AND ABUNDANCE OF PESTS IN VITICULTURAL AREALS SITUATED IN SOUTHERN REGION OF MOLDOVA

OBSERVAȚII PRIVIND STRUCTURA, DINAMICA ȘI ABUNDENȚA DĂUNĂTORILOR ÎN ZONELE VITICULARE SITUATE ÎN REGIUNEA DE SUD A MOLDOVEI

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Abstract.
Knowledge regarding the patterns of occurrence and evolution in grapevine pests is mandatory for establishing timely control measures. Climate conditions play a vital role in the aggressiveness with which the attack manifests itself. Current trends are limiting the effectiveness of known phytosanitary treatments. We aimed at identifying pests that affect grapevine plantations situated in southern region of Moldova and implementing prevention, control strategies. Our study showed current harmful and useful fauna presence and density, in the face of climate change.
Key words: climate change, pest control

Rezumat.
Cunoașterea tiparelor de apariție și evoluție a dăunătorilor viței de vie este obligatorie pentru stabilirea la timp a măsurilor de control. Condițiileclimaticejoacă un rol vital în agresivitatea cu care se manifestă atacurile. Tendințele actuale limitează eficacitatea tratamentelor fitosanitare cunoscute. Studiul nostru își ropune identificarea dăunătorii care afectează plantațiile de viță de vie situate în regiunea de sud a Moldovei și să implementeze strategii de prevenire și control. Studiul nostru a identificat prezența și densitatea actuală a faunei dăunătoare și utile în contextul schimbărilor climatice.
Cuvinte cheie: schimbări climatice, combaterea dăunătorilor

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INTRODUCTION

Agriculture is an important human activity that affects ecosystem sustainability. Intensification of land use impacts agroecosystem functioning by reducing biodiversity and causing changes in functional composition [Ilan, et al., 2014; Cardinale et al. 2012]. Grapes are a major monoculture crop worldwide, with high levels of habitat disturbance due, e among other things, to the heavy use of agrochemicals [Provost and Pedneault 2016]. Biological pest control is an important ecosystem service and is considered a valuable alternative to chemical control, contributing to the achievement of sustainable viticulture [Samways, 2005; Altieri, 1999]. Insects constitute a crucial component of agroecosystem biodiversity and are essential in maintaining soil structure and fertility, decomposing organic matter, dispersing seeds, pollinating crops and controlling pests [Tscharntke et al., 2005]. Predatory insects are a very important group of natural enemies of pests, and their community structure and composition have substantial impacts on the effectiveness of biological control [Griffin et al.,2013; Liebhold et al., 2016]. Although native generalist predators play an important role as regulators of phytophagous populations in agroecosystems, their importance has only been recognized relatively recently [Allan et al., 2016]. However, their conservation is at the core of conservation biological control (CBC) [Wyckhuys et al., 2013; Rayl et. al. 2018]. Some of these generalist predators, such as ground beetles, are also used as indicators of ecological sustainability due to their clear response to habitat changes, large number of species, ease of capture and wide distribution [Mair et al., 2014; Ehrlén & Morris 2015]. It is noteworthy that both specialist and generalist predators coexist in agroecosystems. For example, in vineyards, ground beetles (*Coleoptera: Carabidae*), wig beetles (*Dermaptera: Forficulidae*), wood beetles (*Coleoptera: Staphylinidae*), ladybirds (*Coleoptera: Coccinellidae*), chrysopids (*Neuroptera: Chrysopidae*), predatory bugs (*Heteroptera*) and other predators have been found [Dos Santos, 2020; Sáenz-Romo et al., 2019].

Our current research focuses on the study of the structure, dynamics, abundance and ecological parameters that influence pest species in grapevine plantations in southern region of Moldova aiming at a phytosanitary status evaluation in viticulture.

MATERIAL AND METHOD

In the climatic conditions of 2022-2023, several pests were observed in the vineyards of Vrancea county (Panciu, Odobești, Cotești) and Galați county (Bujoru) such as: moths and mites.

RESULTS AND DISCUSSIONS

Climate data analysis

During the vegetation period, climate parameters showed that for June, July and August, maximum temperatures are recorded that frequently exceed 32-35 °C.

The distribution of precipitation is heterogeneous, characterized by long periods of pluviometric deficit (dry periods), interspersed with short periods of precipitation.

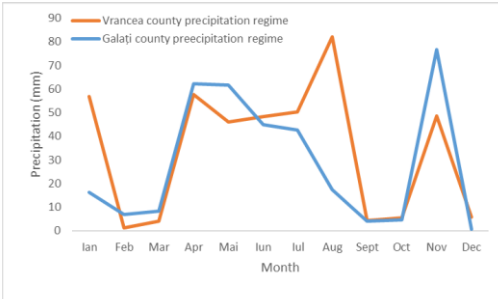

Fig. 1. Comparative precipitation regime for the two regions

Average values of 346.6 mm were recorded consecutively in 2022 and 2023 in Bujoru viticultural areal, representing a reduction by 48.56% when compared to a maximum of 713.1 mm (2013) identified on a ten year precipitation regime analysis (Fig. 1 and 2).

Precipitation values during vegetation periods, is another climatic factor that has a major influence on the vineyard plantations. In this sense, in 2023 water accumulated as a result of precipitation during vegetation periods reached an average value of 233 mm in Bujoru areal. By comparison in Panciu, Cotești and Odobești areal average precipitation values (2023) were by 15.66 % higher whit a total value of 411 mm. A similar trend was seen also during vegetative periods whit values of 293.4 mm (Fig. 1 and 2).

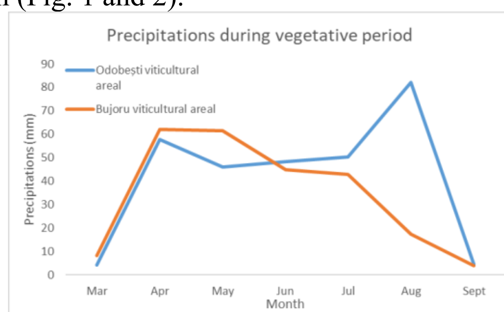

Fig. 2. Comparative precipitation regime for the two regions in the vegetative periods

Temperature regime analysis

In depth analysis revealed a similar temperature pattern regarding temperature value distribution for both areas. Important differences were seen for average yearly temperatures, 12.55 °C Bujoru and 13.55 °C for Odobești, representing a difference 0.75 °C surplus for Odobești areal (Fig.3).

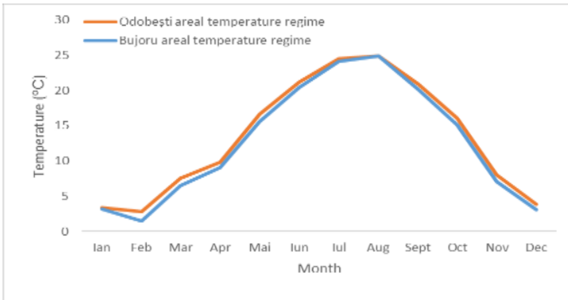

Fig. 3. Temperature regime for the two areals

Main pest species

Specific for Odobești vicultural areal the following species of pests were identified:

-mites (*Eriophyes vitis* Nal. (Gallicol mite or erinosis); *Tetranicus urticae* Koch. (Common red spider mite); *Eotetranychus carpini* Oud. (Yellow grapevine mite)(Fig. 4,5,6,);

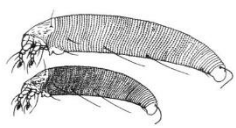

Fig. 4. Adult *Eriophyes vitis* (gall mite)
(http://www.aroatlas.ru/en/content/pests/Colomerus vitis/)

Fig. 5. Adult *Tetranychus urticae* (common red mite)
(https://www.botanistii.ro/blog/paianjenul- rosu- comun-tetranycus-urtice/)

Fig. 6. *Eotetranychus carpini* (**Yellow grape mite**)
(https://bladmineerders.nl/parasites/animalia/arthropoda/acari/actinotrichida/prostigmata/eleutherengona/tetanychoidea/tetranychidae/tetranychinae/tetranychini/eotetranychus/eotetranychus-carpini/)

Statistical are summarized in tables 1, 2 and 3. Acarian species were observed throughout Odobești vicultural areal in 2022-2023.

Table 1

Cotești

No.	**Pest name**	**Period of presence**	**Da %**		**Average Da %**
			2022	**2023**	
1.	*Eriophyes vitis* Nal	May- June	6,2	5,4	5,8
2.	*Tetranychus urticae* Koch	May – Sept	4,2	4,9	4,6
3.	*Eotetranychus carpini* Oud	May– Sept	4,1	4,4	4,3

Table 2

Odobești

No.	**Pest name**	**Period of presence**	**Da %**		**Average Da %**
			2022	**2023**	
1.	*Eriophyes vitis* Nal	May- June	6,2	6,7	6,5
2.	*Tetranychus urticae* Koch	May – Sept	3,7	5,2	4,5
3.	*Eotetranychus carpini* Oud	May– Sept	4,3	5,5	4,9

Table 3

Panciu

No.	**Pest name**	**Period of presence**	**DA %**		**Average DA %**
			2022	**2023**	
1.	*Eriophyes vitis* Nal	May- June	5,4	4,8	5,1
2.	*Tetranychus urticae* Koch	May – Sept	4,8	5,6	5,2
3.	*Eotetranychus carpini* Oud	May– Sept	4,1	4,7	4,4

In Bujoru viticultural areal none of the mentioned acarian species or other acarian specie were documented during the studied interval

The degree of attack of the mites was different from one vineyard to another and from one species to another, depending also on the meteorological conditions. Thus, the highest degree of attack was recorded in the species *Eriophyes vitis* Nal. with Da = 5.8% in the Cotești vineyard and 6.50% in Odobești vineyard. The degree of attack recorded in the species *Eotetranychus carpini* Oud., varied between 4.3% (Cotești vineyard) and 4.9% (Odobești vineyard).*Tetranychus urticae* Koch species followed a similar trend whit values of 4.5% (Odobești vineyard) and 5.2% (Panciu vineyard)

-moths: *Lobesia botrana* Den et Schiff (Grapevine eudemis) and *Eupoecilia ambiguella* Hb (Grape brown moth), vary depending on climatic conditions, being different from one variety to another, from one plantation to another, from one vineyard to another.

Fig. 7. Adult and attack of *Lobesia botrana* on inflorescences

In the vineyards of Vrancea, we frequently encounter two species of grape moths: *Eupoecilia* (*Clysia, Cochylis*) *ambiguella* and *Lobesia* (*Polychrosis*) *botrana* – the grapevine scale insects.

For Bujoru areal only *Lobesia* (*Polychrosis*) *botrana* was documented (Fig.7).

In recent years, a deviation of climatic factors from the multiannual average has been observed (high temperatures, increased and frequent dry periods, aridification), which can cause biological and behavioral changes in the two grapevine pests (the scale insect and the grapevine scale insect) with consequences that are difficult to assess for the integrity of the viticultural ecosystem. To establish the population level and the timing of treatment application, 3 traps/ha with synthetic sexual attractant (Fig. 8) were installed in the vineyard plots for warning and monitoring, for *Lobesia botrana* and ATRAMBIG-Z.9 for *Eupoecilia ambiguella*, as well as an electronic collection and monitoring trap (the "TeraseyaFly" trap).

Fig. 8. Feromon based traps installed in monitored areals (*Lobesia botrana*)

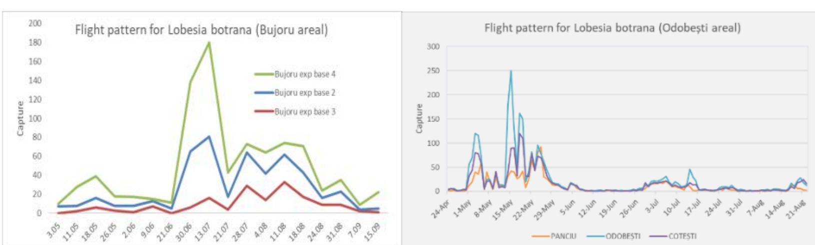

Fig. 9. Flight pattern *Lobesia botrana*

Grapevine moths attack is dependent on vine variety to another, from one plantation to another and influenced on micro-climate conditions. It is known that attack rom these pests favors the appearance and evolution of gray mold in grapes. Flight pattern analysis showed different behavior for the two areals. In Bujoru the maximum number of captures was registered between the end of June and middle of July whit o value of 99 captures (exp. Base no.4), while in Odobești areal the maximum number of captures were registered in the middle of May, 181 captures. Data showed an abundance of these type of pest being more specific for Odobești areal, rate of capture by 54,69% higher (Fig.9).

CONCLUSIONS

Our results confirmed data previously highlighted by scientific literature, regarding the influence of climate change whit direct implications on microclimate change and insect adaptation.

Climate data analysis showed some differences between the two areas studied, whit differences in yearly water input and temperature regime. Whit values that no longer align to known climate characteristics.

Temperature is the most important environmental factor affecting insect population dynamics, the rise in this parameter could trigger an expansion of their geographic range, increased overwintering survival, increased number of generations, increased risk of invasive insect species and insect-transmitted plant diseases, as well as changes in their relation with host plants and natural enemies [Skendžić et al., 2021].

Mites were only present in Vrancea vine plantations being identified the following: *Eriophyes vitis* Nal., *Eotetranychus carpini* Oud., *Tetranychus urticae* Kuch. being reported with different degrees of attack. On the other hand, grape moths: *Lobesia botrana* Den. et. Schiff. was present in all vineyardareals, but the ratio between them was different depending on the vineyard and microclimate specifics. The use of pheromone traps helped both in identification and reduction of the moth population whit better results for Bujoru areal.

Recent studies showed that understanding the probable shifts in the timing and spatial distribution of the plant-insect interactions in a warmer climate and how this may impact their synchrony is vital in risk index damage assessment for this type of pest. Different sites studies and greenhouse gas are forcing trajectories for *Lobesia botrana*. Results suggest an increasing damage risk for *V. vinifera* close to the timing of harvests in northern Europe. It was also pointed out that increasing temperatures will reach the upper thermal limit for insect development [Castex et al., 2023]. Eradication of invasive alien species present or whit a high adaptability rate is considered a paramount objective. Lack of early detection is likely the primary reason for the failure of eradication programs, together with a lack of effective monitoring and control methods. Additionally, the biology of the target species must be considered, species phenology and fecundity, the number of female matings, behavior, associated [Liebhold et al. 2016].

Our study and results represent a first step in the understanding of pest patterns in viticultural areals situated in southern part of Moldova, whit their adaptations to changing parameters of microclimate.

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