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ORIGINAL ARTICLE

Dominant sucker pests on industrial vineyards and protective measures in the regulation of their abundance in the conditions of the northern Black sea

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The paper presents the results of monitoring a complex of sucking pests on grape plantations in the south of Ukraine. In recent years, a large number of scientists point out that the phytosanitary state of grape plantations is characterized by constant changes in the populations of harmful organisms and there is a stable tendency of stable growth in the number of sucking pests that have mass development. Our monitoring data conducted on grape plantations in the south of Ukraine confirm noticeable functional and structural changes in the entomocomplex of sucking pests under the influence of changing environmental conditions. It has been established that the main manifestations of such transformations are sharply changed climatic and anthropogenic factors, since the development of this pests group is closely related to the weather conditions of vegetation and the technology of grapes cultivation, and the violation leads to an expansion of the species diversity of harmful objects in plantations and an increase in the population size of individual harmful species. The results of conducted monitoring indicate that the level of presence and spread of sucking pests on grape plantations in the south of Ukraine is quite high and diverse, which requires the development of more effective measures to regulate their development and harmfulness. Surveys of table and technical varieties of grape every ten days showed that all experimental grape varieties are populated with sucking pests to varying degrees, and it was noted that this group of pests does not show varietal selectivity. Studies on the species composition of sucking pests on grape plantations in the south of Ukraine have shown that cicadas (Cicadinea) and acariform mites – herbivorous gall mites (Eriophyidae)-occupy an important place among phytophages. Thrips (Thysanoptera) have periodic mass development, according to the climatic conditions of the year, and spider mites (Tetranychidae) gradually lose their prevalence and number. A comparative analysis of the development of dominant sucking pests revealed that the greatest damage to plants is observed at the end of the season, which is associated, among other things, with the influence of anthropogenic factors. The terms of phytophage development varies by years and depends on a complex of abiotic and biotic factors. It has been shown that due to prolonged spring temperature drops, the development time of bud and leaf mites has displaced. Among the most commonly spread sucking pests, the expansion of the area of harmfulness for the Japanese cicada, cicada metcalfa and grape erineum mite has been established. Observations of the study of the development and species composition of cicadas, it was found that in the vineyards of the south of Ukraine, the most commonly spread and harmful are such species as buffalo treehopper, yellow cicada, grapevine cicada. On average, during the growing season, sucking pests inhabited more than 87.6% of the surveyed grape plantations with an intensity of damage to the leaf apparatus of plants–on average from 9.5% to 45.5%. It has been determined the technical effectiveness of preparations of chemical and biological origin: Voliam Flexi, Coragen, Proclaim, to limit the spread and development of sucking pests, which is 92.3%, 89.5%, 88.6%, respectively. It was found that against the complex of sucking pests, which allows saving entomoacarophages, it is more effective to use such preparations as Vetrimek, Voliam Flexi, Coragen, Proclaim than preparations from chemical groups of organophosphate compounds and pyrethroids. It is established that the peculiarities of climatic conditions in the south of Ukraine are favorable for overwintering, development, spread and accumulation of the number of sucking pests in vineyards.

Keywords: Grape plantations, vineyards, phytophage, dominant pests, protective measures, insecticides.

Introduction

Currently, modern viticulture is characterized by an exceptionally low stability of the phytosanitary state: outbreaks of mass pests reproduction, epiphytotics of diseases, and the widespread of weeds. Significant changes in improving plant protection from harmful organisms can occur only on the basis of a fundamentally new strategy aimed at general phytosanitary optimization of viticulture (Mizyak, 2011; Volkova, 2013; Matvejkina, 2014; Baranec, 2016; Burdinskaya, 2016). According to the strategy of phytosanitary recovery of agroecosystems, the fundamental feature of the current stage of plant protection development, including vineyards, is a biocenotic approach to building systems of protective measures, based on the use of techniques and methods of regulating the interaction of plants-producers and consumers of all orders in agrobiocenoses. This approach makes it possible to control not only the dynamics of the number of harmful and useful species, but also their adaptive reactions (Yurchenko, 1996; Yurchenko, 2011; Alejnikova, 2016).

The purpose of phytosanitary recovery of ampelocenoses is to increase their potential productivity and resistance, and one of its main components is constant monitoring of harmful objects (consumers of the 1st order), studying the causes of violation of their species diversity (Fedorenko et al., 2015).

Monitoring of phytophages species composition, which has been regularly carried out in the last decade, indicates a change in the pest complex against the background of active import of foreign planting material and the introduction of new technologies for vineyards protection. This is especially acute in the case of representatives of the order fringed winged or thrips (*Thysanoptera*) and the suborder Cicadinea (*Cicadinea*) (Konstantinova, 2017; Konstantinova, 2018).

On the most parts of the industrial vineyards of southern Ukraine, thrips and cicadas were recorded for a long period as species that live in small foci without showing harmfulness (Yurchenko, 1996). These are species such as onion thrips (*Thrips tabaci* Lind.), smaller green leafhopper (*Empoaska viridula (vitis)* Walsh.).

Later, in the 90s, as a result of changes in the strategy of protection against spider mites and successful biological regulation of their number, grapevine thrips (*Drepanothrips reuteri* Uzel.) acquired the status of an economically significant species for grape ecosystems (Yurchenko, 2011; Konstantinova, 2013). In recent years, an analysis of the phytosanitary situation of grape plantations in the south of Ukraine shows that along with such typically dominant species as grapevine moth *(Lobesia botrana Den. et Schiff.)* and phylloxera (*Viteus vitifoliae Fitch*., syn. *Phylloxera vastatrix Planch*.), grapevine thrips remain the most mass and widespread species.

Similarly, in such native thrips species as onion thrips (*Thrips tabaci* Lind.), eastern flower thrips (*Frankliniella intonsa* Trybom), honeysuckle thrips (*Thrips flavus* Schrank), rose thrips (*Thrips fuscipennis* Haliday), pear thrips (*Taeniothrips inconsequens* Usel.), which were not previously registered as pests of grape plantations (with the exception of onion thrips), began to show harm and there was an increase in the number of their populations, sometimes in fairly large foci. Most often, they form mixed populations with the dominant species (grapevine thrips), and their share in these complexes varies depending on the agroecological zone, climatic conditions of the year and grape variety.

The greenhouse thrips (*Heliothrips haemorrhoidalis* Bouche, syn. *Thrips adonidum* Cook.), this is a species that is typical for greenhouse ecosystems and has not been previously found in open agrocenoses in the south of Ukraine. Given the fact that the greenhouse thrips have already been repeatedly found in the nurseries of grapes, it is impossible to exclude the possibility of its partial adaptation in vineyards.

Another problem in recent years is the increasing area and harmfulness of cicadas: these are native species – green leafhopper (*Cicadella viridis* L.) and buffalo treehopper (*Stictocephala bubalus* F.), as well as introduced (Balahina, 2014; Didenko, 2013; Baranec, 2017).

At the beginning of the 21st century, at least two populations of new cicada species for our vineyards – the Japanese or Far Eastern grape leafhopper (*Arboridia*, syn. *Erythroneura kakogawana* Mats.) and the grape leafhopper (*Erythroneura* spp.) were carried to viticulture farms of the south of Ukraine (Evdokimov, 2013; Didenko, 2014; Radionovska, 2014).

If in 2000-2001 these phytophages were noted on the vine only of household farms, now the foci of their settlement and harmfulness are recorded in all grape cultivation zones of Ukraine, including in industrial plantations, without exception (Zueva, 2017). In recent years, the introduction of grape planting material has increased, which has contributed not only to the emergence of new species for the region, but also to an increase in the populations of phytophages familiar to our ampelocenoses–eriophyidae or four-legged (*Eriophyidae*) mites, galls and free-living ones. These are species such as the grape gall mite (*Eriophyes vitis* Pgst.), grapevine bud mite (*Phyllocoptes vitis* Nal.), grape leaf rust mites (*Epitrimerus vitis* Nal., *Calepirimerus vitis* Keifer). Of particular note is the problem of increasing harmfulness that occurs with the import of a pesticide-resistant population of the grape gall mite from other regions, including from abroad (Vlasov, 2014; Konstantinova, 2017).

Thus, the change in the species composition of the arthropod complex in the vineyards of the northern Black Sea region occurs due to species introduced with the planting material of grapes (cicadas-*Erythroneura* spp., greenhouse thrips), and also as a result of adaptations to the conditions of grape ecosystems of local fauna species (thrips mites, phylloxera).

The reasons for this phenomenon are different. Among the main reasons are changes in the system of grape plantations protection from pests. First of all, this is an update of the range of pesticides in the direction of selective and environmentally friendly compounds that are not able to restrain the growing number of harmful arthropods that previously did not dominate the ampelocenoses of the south of Ukraine, as well as new species for our vineyards, for which regulations for the use of chemical or biological controls have not been developed (Fedorenko, 2009).

It should also be noted in this regard that the widespread introduction of a biological method for regulating the number of spider mites has removed the garden spider mite (*Schizotetranychus pruni (viticola)* Reck.) and the Turkmenistan spider mite (*Tetranychus turkestanicus* Ug. *et* Nik.) from the category of typically dominant pests, which significantly freed up the ecological niche they occupy in ampelocenoses, and it began to be occupied by species that are similar in bioecological characteristics. Outbreaks of the number of sucking phytophages indicate the instability of the grape biocenosis and its imbalance even in those plantations where pesticides are not used (Yakushina & Volkova, 2012).

Phytosanitary monitoring in grape plantations, notes noticeable functional and structural changes in the entomocomplex of sucking pests under the influence of changing environmental conditions and the influence of anthropogenic factors, in particular the predominance of chemical method, insufficient use of agrotechnical and selection-genetic methods, laying young vineyards with imported planting material, minimizing all technological operations due to a lack of material and labor resources, significant areas of abandoned vineyards, destabilize grape production, this leads to an expansion of the species diversity of harmful objects, an increase in the population size of individual species and, as a result, an increase in their harmfulness, significantly increasing crop losses.

The situation developed in the ampelocenoses of southern Ukraine once again indicates the need for constant monitoring of the species diversity of arthropods in grape ecosystems in order to identify the most harmful species in their complex. At the same time, it is necessary to monitor the sensitivity of new types of phytophages to the applied control means in order to timely identify preparations to which resistance develops, and protection methods development that inhibit this process.

Aim

To substantiate the factors influencing the peculiarities of the development and growth of dominant sucking pests number on grape plantations, their species composition, review of their harmfulness and development of protective measures for regulating their number.

Materials and Methods

The research was conducted under laboratory conditions on the basis of the National Scientific Centre «V.Ye. Tairov Institute of Viticulture and Winemaking» in the laboratory of molecular genetics and plant protection of the department of molecular genetics and phytopathology.

Under the field conditions, monitoring of the phytosanitary condition of grape plantations regarding the spread and harmfulness of sucking pests in order to create a modern system for predicting their development was carried out on grape plantations of farms in three regions of southern Ukraine: Odessa, Mykolaiv, Kherson.

The research was conducted by the method of route surveys of vineyards, which determined the species composition of pests, their number, presence and degree of damage using methodological approaches that are used in the domestic and international practice of scientific research on viticulture and plant protection. When conducting research, methods of field and laboratory experiments were used, in particular:

- Entomological–when studying the species composition of sucking pests (various types of cicadas, thrips, mites), their biological peculiarities of development, distribution and harmfulness against the background of modern grape plantations protection systems.
- Route surveys–for conducting phytosanitary surveys in order to establish the spread and accumulation of sucking pests of grape plantations (Metodicheskie rekomendacii po primeneniyu fitosanitarnogo kontrolya v zashite promyshlennyh vinogradnyh nasazhdenij yuga Ukrainy ot vreditelej i boleznej, 2006).
- Laboratory–for determining the mites number of all trophic groups types, thrips, cicadas, phylloxera.

- Statistical–for calculating the smallest significant difference between the variants of experiments and the error of the average, when establishing the reliability of the obtained experimental data.

Annual monitoring of the phytosanitary condition of grape plantations for the development of sucking pests was carried out on the basis of the following instructions: "Methodological recommendations for phytosanitary monitoring of cicadas, eriophyid mites, spider mites, plant-eating thrips on grapes. Krasnodar: State Scientific Organization North Caucasian Regional Research Institute of Horticulture and Viticulture, 2012", "Methodological recommendations for the application of phytosanitary control in the protection of industrial grape plantations of the south of Ukraine from pests and diseases".

Field studies were conducted on fruit-bearing grape plantations according to the method "Planning of field experience and statistical processing of its data. Moscow: Kolos Publ., 1979" (Konstantinova, 2013).

The obtained results were processed statistically using A.S. Kuzmenko's computer program to determine the slightest significant difference between variants and errors of the average (computer program for statistical processing of experience results Version Programs 8.00 Copyright (©), 1998-2008) (Kuzmenko, 1998-2008).

Phytosanitary monitoring of herbivorous psylla in grape agrocenoses involves, along with identifying the species composition of these pests, determining the degree of damage to the vine, the population size and the nature of the plantation settlement used (Yurchenko, 2012).

To examine grape plants for the settlement of psyllo (cicadas), the method of catching pests on glue colored traps was used. We used yellow glue traps. Traps were hung at the rate of two traps on each variety.

Traps to determine the time of pests appearance were hung out in the second half of April, along with pheromone traps, on the grapevine moth at the height of the inflorescences. Traps were recorded every ten days. The number of captured individuals was counted and the data was recorded in the field log.

Phytosanitary assessment of the populations state of plant-eating thrips was carried out using route surveys of vineyards, while determining the degree of plant damage and the level of settlement of plantations by these pests. To determine the degree of settlement of grape plantations by thrips, the method of leaf selection was used (Yurchenko, 2012).

To determine the dynamics of the number and degree of settlement of grape plantations with thrips, a selection of leaves of 30 pieces (3 repetitions of 10 pieces in each) of each variety was carried out every ten days (starting from May). To do this, 3 leaves were picked from the upper, middle and lower layers on 10 model bushes located evenly over the entire area of each variety. Then, under laboratory conditions, the total number of active individuals in each sample and their number per unit surface area or one leaf were counted using a binocular microscope.

To determine the degree of damage and the level of settlement of grape plantations by thrips in a vineyard with an area of 10-30 hectares, at least 20 bushes were examined. When assessing the harmfulness of vineyards of more than 30 hectares, 40 bushes were examined–20 bushes in different parts of the plantations. The bushes were examined by visual inspection along permanent routes. Accountings were carried out in the period from the beginning of May to the 3rd decade of June–in the phenophase of active growth of shoots and flowering, which is due to the nature of harmfulness and biological characteristics of herbivorous thrips. Accountings during this period were carried out regularly every 5-7 days, and the leaves of 5 shoots (inflorescences) were examined on each accounting bush. In the future, accountings were carried out once every 15 days, examining the leaves of five to seven internodes of the tops of 5 shoots or stepsons of leaves, at least 10 leaves per shoot.

For a more adequate assessment of the harmfulness of grapes by thrips, separate scales of damage degree adapted for different stages of the grape plant ontogenesis were used. The degree of plant damage by thrips according to the methodological recommendations of Ye. H. Yurchenko (Yurchenko, 2012) was assessed differentially–in the phenophase of initial shoot growth (by shoots in spring), flowering (by inflorescences in summer) and berry growth (by shoot tops in summer), in the phenophase of berry growth and ripening according to point scales of the damage degree.

The number of mites in vineyards was determined during the dormant period of bushes to predict their number for the next year and plan the volume of measures to control them, and during the growing season of bushes – to determine their number and establish the feasibility of protective measures (Yurchenko, 2012). In autumn, after the leaves falling, 30 buds were selected on 10 model bushes located evenly over the entire area of grape plantations, in which the number of mites that went to overwinter was counted using an MBS-9 binocular microscope. Based on the obtained data, the average population of buds with mites was calculated. In spring, before budding (March, April), the same accounting was carried out to determine the condition of mites after overwintering. Samples of buds and leaves were taken in 3 repetitions of 30 pieces in each. To determine the dynamics of mites development and number, surveys were carried out every ten days.

During the growing season of bushes, the number of mites per unit leaf surface (100 cm^2) was determined, which corresponds to 1 medium-sized leaf. To do this, beginning from May, 3 leaves (from the upper, middle and lower layers) were picked every decade on 10 model bushes located evenly over the entire area of each variety. That is, there were 30 accounting leaves in each sample. Using a binocular microscope, the total number of mobile individuals in each sample and their number per unit surface area or one leaf were calculated.

To determine the harmfulness of sucking pests, a point assessment system was used depending on the change in leaf colour (Tribel, 2001). This is a fairly convenient method of observation. This scale can be used as to individual leaves, shoots as the whole grape bush. To determine the biological effectiveness of pesticides, it is obligatory to leave the control area (without treatment); respectively, colonies (groups) of harmful organisms that are not treated with pesticides are separated in the laboratory. Accounting is conducted by repetitions (accounting plants and leaf samples) (Kozar, 2005).

To solve the issues of the necessity and expediency of using chemical plant protection products, it is important to have information not only about the number of pests, but also about the presence of their natural enemies–predators and parasites. To identify and determine the number of entomo and acarophages, special methods of observations and accountings were used in accordance with the guidelines (Omelyuta, 1986).

At the end of the growing season (August, September, October) in relation to the grape variety, as part of the experiment, according to the guidelines (Metodicheskie rekomendacii po agrotehnicheskim issledovaniyam v vinogradarstve Ukrainy, 2004), the experimental plots we have harvested from accounting bushes in order to determine the impact of protective measures against a complex of sucking pests on the quantitative and qualitative indicators of the crop.

Crop accounting was carried out as follows: the entire crop was harvested from each accounting bush, placed in a separate container and marked, then in laboratory conditions, to determine the average mass of the bunch, for each variant (in 3-fold repetition), all collected bunches were weighed on electronic scales and divided by the total number of bunches in the sample. Based on the obtained data, the mass of the crop from the bush and the estimated yield per hectare (c/ha) were determined for each of the experimental options. The total number of bunches in the sample of each of the variants of Sukholymansky white variety was 1324 (control), 2335 (standard) and 1343 in the experimental variant. On experimental variants of Arcadia variety, the total number of bunches in the sample for each variant was 369; 372; and 375 pieces of bunches, respectively.

Results

Over the past five years, under conditions of the south of Ukraine, there has been a sharp increase in the number and intensification of harmfulness with significant damage to grape plants by sucking pest species, which in years of mass reproduction can cause huge damage to grape plantations. The complex of the main sucking pests that damage grape plantations includes: mites of various trophic groups, cicadas, thrips and leaf form phylloxera.

Phytosanitary observations of the development and species composition of mites that inhabit grape plants confirm that in the vineyards of the south of Ukraine, the most common and harmful species of the families: *Tetranychidae* (two-spotted spider mite, garden spider mite, less often European red mite) and *Eriophyidae* (grape erineum mite, grapevine bud mite, grapevine rust mite).

According to the analysis results, the wintering stock of two-spotted spider mite averaged 0.24, with a maximum of 1.2 specimens/bud, grape erineum mite–0.66 and 2.1, grapevine bud mite–0.37 and 1.6 specimens/bud and grapevine rust mite–0.28 and 1.4 specimens/bud, respectively. Although weather conditions during the years of observation were favorable for the development of mites of all trophic groups, the density of their populations on grape plantations was low and does not exceed an average of 2.1-3.2 specimens per 100 cm^2.

Currently, there are more than 17 species belonging to various trophic groups in the vineyards of southern Ukraine (Table 1). The most harmful among them are phytophages belonging to the order acariformes (*Acariformes*) and include four families: four-legged spider mites (*Tetranychidae*), brown mites (*Bryobiidae*), flat mites (*Tenuipalpidae*) and four-legged gall mites (*Eriophyidae*).

S. No	Family Name	The Name of the Mite	The Degree of Distribution
1.	Four-legged spider mites (*Tetranychidae*)	two-spotted spider mite (*Tetranychus urticae* Koch.)	average
		Garden spider mite (*Schizotetranychus pruni* Oud.)	average
		Turkestanian spider mite (*Tetranychus turkestanicus* Ug. et Nik.	low

		Sin. *T. atlanticus* Mc. Gregor))	
		European red mite (*Panonychus ulmi* Koch.)	low
2.	Brown mites (*Bryobiidae*)	**brown fruit mite** (*Bryobia redikorzevi* Reck.)	low
3.	Flat mites (*Tenuipalpidae*)	citrus flat mite (*Brevipalpus lewisi* McGreg.)	low
4.	Four-legged gall mites (*Eriophyidae*)	grape erineum mite (*Eriophyes vitis* Pgst.)	high
		grapevine bud mite (*Colomerus* (*Eriophyes*) *vitigineusgemma* Maltsh.)	high
		grapevine rust mite (*Calepitrimerus vitis* Nalepa)	high

Table 1. The most common phytophage mites on grape plantations in the south of Ukraine and the degree of their distribution.

The most widespread in experimental farms are spider mites and grape erineum mite**s**. Very high harmfulness is characterized by the grapevine bud mite, which spreads in separate foci. In recent years, there has been a significant spread of the grapevine rust mite. There are no mite-resistant varieties, but some grape varieties differ in their response to damage.

Cicadas in the ampelocenoses of Ukraine were constantly present, but they were characterized by a low number, signs of damage to grape leaves were rare, with low intensity and the harmfulness was insignificant respectively. However, in recent years, the results of cicadas monitoring in the ampelocenoses of southern Ukraine indicate that the occurrence and number of some native cicada species has increased, and there is a rapid adaptation of some individuals of invasive species. In this connection, the harmfulness of cicada insects becomes noticeable, which in recent years have been increasing the population density in vineyards (Ciampolini, Grossi & Zottarelli, 1987; Mihajlovic, 2007; Gnezdilov & Sugonyaev, 2009; Gnezdilov, 2012).

According to the scientific literature, more than 690 species of cicadas are distributed in Ukraine, which belong to 13 families. Economically significant species of cicadas belong to six families: cixiidae (*Cixiidae*), delphacidae (*Delphacidae*), cicadidae (*Cicadidae*), pennants (*Cercopidae*), thorn bugs (*Membracidae*) and the most numerous – cicadellids *(Cicadellidae).* Yellow glue traps were used to monitor the species composition, seasonal dynamics of development and the number of cicadas on grape plantations. Currently, 12 species from 5 cicada families have been identified (Table 2).

The Name of the Pest	Latin Pest Name	Occurrence/Number of Species	Family
	Native (Local) Species		
1. Agalmatium bilobum	*Agalmatium bilobum* F.	average / low	Issidae
2. Planthopper	*Hyalesthes obsoletus* Sign.	average / low	Cixiidae
3. Smaller green leafhopper	*Empoasca vitis* Göthe.	average / low	Cicadellidae
4. Eared leafhopper	*Ledra aurita* F.	low / low	
5. Fruit tree leafhopper	*Zygina flammigera* Geoffr.	low / low	
6. Privet leafhopper	*Fieberiella florii Stal.*	average / low	

7. Green leafhopper	*Cicadella viridis* L.	average / low	
8. Yellow leafhopper	*Empoasca pteridis* Dhlb.	average / low	
9. Rose leafhopper	*Edwardsiana rosae* L.	low / low	
invasive (foreign) species			
10. Buffalo treehopper	*Stictocephala (Ceresa) bubalus Fab.,* *(sin. Stictocephala bisonia)*	high / average	Meubracidae
11. Japanese grape leafhopper	*Arboridia kakogowana* Mats.	high / average	Cicadellidae
12. Citrus flatid planthopper	*Metcalfa pruinosa* Say.	high / average	Flatidae

Table 2. The most common types of cicada pests in vineyards under conditions of the northern Black Sea region.

The largest accumulation of cicadas is observed in the second half of summer in the thickened crowns of grape bushes or places where tall weeds grow between bushes (Navrozidis, Zartaloudis & Vartholomaiou, 2008). It is noted that with annual settlements and damage to vineyards by cicadas, their economically significant harmfulness begins to manifest itself–grape bushes are noticeably depleted, plant immunity and the quality of grape products decrease. With a significant lesion, crop losses can reach 25-30% (Souliotis, Papanikolaou, Papachristos & Fatouros, 2008; Preda & Skolka, 2011).

Due to climate change and due to their high adaptive abilities, cicadas are gradually becoming a threat to grape plantations, which makes adjustments to the modern system of protective measures. Therefore, the strategy of chemical protection of grape plantations should take into account the impact of both known pests and new species that have been actively spreading in ampelocenoses in recent years.

In the last few years (2014-2020) in the territory of Odessa region in orchards and vineyards, as well as in parks and homestead land, the citrus flatid planthopper (*Metcalfa pruinosa*), which forms white cotton-like colonies on plants, is found more and more. The pest came to us through a seaport with fruit products from warm countries and acclimatized very well in the seaside climate and quickly spread to the southern regions of the region and is already harming grape plantations. This type of cicada is considered a difficult pest to eradicate due to its omnivorous nature and increased population density of the citrus flatid planthopper (Popova, Gulyayeva, Nemericka & Zhuravska, 2018).

Identification of thrips (*Thysanoptera*) species is difficult due to their small size (from 0.5-2 mm, rarely up to 5 mm) and intraspecific variability. The colour of adult insects is nondescript: black, grey and brown colours predominate. Thrips larvae are white-yellow or grayish.

Currently, three species of thrips from the family *Tripidae* of the suborder *Terebranita* are mainly most common in the grape plantations of southern Ukraine: grapevine thrips (*Drepanothrips reuteri* Uzel.), onion thrips (*Thrips tabaci* Lindemann) and thrips (*Frankliniella intosa* Trybom). Less common are greenhouse thrips (*Heliothrips haemorrhoidalis*) and western flower thrips (*Frankliniella occidentalis*). Focal development of wheat thrips (*Haplothrips tritici*) was also noted.

Grape phylloxera (*Viteus vitifolii* Fitch, or *Phylloxera vastatrix* Planch) belongs to *Phylloxeridae* family, the order Homoptera. The pest belongs to quarantine objects. This is a monophage that damages only the vine. The life cycle of phylloxera includes underground (root form) and aboveground (leaf form).

In the current 2018-2020 year in vineyards, the spread of the leaf form of phylloxera was observed to a large extent, in the foci it was up to 73%, the intensity of gall formation–36%. Thus, as a result of monitoring, it was indicated that the level of presence and spread of sucking pests is quite high and diverse, which requires the development of more effective measures to regulate their harmfulness. As part of the experiment, according to the accepted scientific methods, we studied the biological effectiveness of a new range of preparations in protecting grape plantations from dominant sucking pests against the background of protection which is used in farms (standard version) and the natural development of pests, without protection from them (control version).

The massifs were heavily populated with sucking pests, their number exceeded the economic threshold of harmfulness. Grape erineum mite, grape leaf rust mite, cicadas and the leaf form of phylloxera developed intensively.

The experiment that was laid down in the protection of grape plantations from sucking pests at different times of application showed that the most effective treatments against this group of pests are early spring – during the appearance of wintering fertilized females. The data is shown in Fig. 1.

Thus, monitoring of sucking pests spread in the vineyards of the south of Ukraine, analysis and forecast of the intensity of their development allows adapting the system of protective measures in accordance with the level of their harmfulness by regulating the number of pesticide sprays, which leads to more effective and usually more ecological protection.

It is known that all sucking pests have a common way of nutrition–they suck out cellular juice from plants, which leads to serious pathoanatomic and physiological-biochemical consequences, namely: a decrease in the content of dry matter in the plant; a change in the content of carbohydrates, chlorophyll, yellow pigments in plant tissues; a decrease in the activity of assimilation, transpiration and respiratory processes; a decrease in nitrogen content; a decrease in the activity of enzymes; a change in the number and composition of amino acids; a decrease in photosynthesis processes, etc.

All this negatively affects the productive potential of grape plants of the current year, winter hardiness and laying the future harvest. Therefore, it was advisable to conduct a study on the impact of sucking pests on the grape harvest and its quality, which are the main indicators that characterize the results of taken protective measures.

To obtain reliable data on the impact of grapes protection from sucking pests for all variants of the experiment, accounting bushes were selected for each of the grape varieties, which had the same potential productivity among themselves. Accounting bushes according to the variants of the experiment did not differ significantly in the number of eyes, shoots and inflorescences. The fruiting coefficient (K_1) and the fruitfulness coefficient (K_2) of the accounting bushes corresponded to the ampelographic characteristics of table and technical grape varieties.

As a result of mathematical analysis, there was no essential difference between the average values for the variants of the experiment regarding the indicators of agrobiological grapes development at the 5% level of significance (Table 3). So, the selection of equal accounting bushes according to the variants of the experiment allowed obtaining reliable data on the impact of an improved system for grape plantations protection from the most common sucking pests. So, Table 3 shows the data of the most commonly spread table variety Arcadia and technical variety Sukholymansky white. With the same potential productivity of accounting bushes according to the variants of the experiment, the grape yield harvested from the experimental variants significantly differed in quantitative and qualitative characteristics from the yield harvested on the control variant, as evidenced by the data in Table 4.

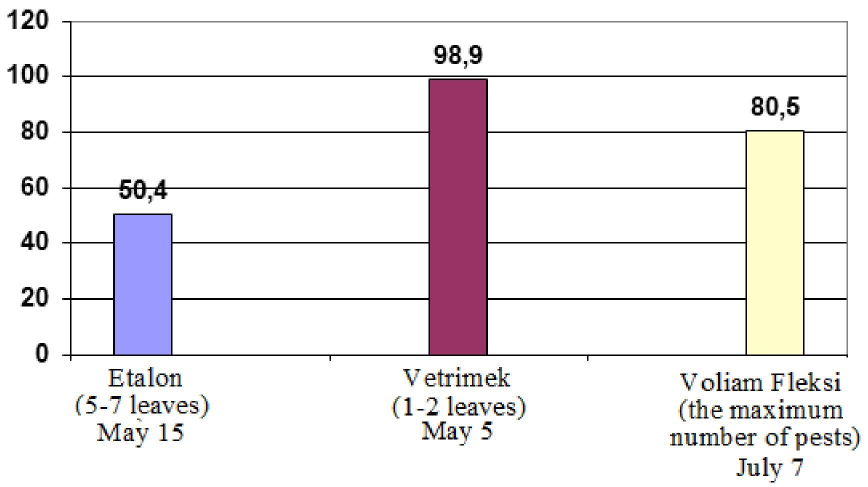

Fig. 1. Effectiveness of preparations in grape protection from a complex of sucking pests at different terms of their application in National Scientific Centre «V.Ye. Tairov Institute of Viticulture and Winemaking», 2018.

Variants of the Experiment	Number Per One Bush						K₁	K₂
	Eyes			Fruit-Bearing Shoots		Inflorescences		
	In total	Those which have Blossomed Out						
		In Total	%	In Total	%			

Table Variety Arcadia								
1. Control	21,9	17,6	80,4	12,4	70,5	16,8	0,96	1,4
2. Standard	21,7	17,7	81,6	12,8	72,3	16,7	0,94	1,3
3. Experi-ment	21,8	17,6	80,7	12,6	71,6	16,6	0,94	1,3
SED_{05}	2,1	1,3	-	1,2	-	1,4	0,02	0,01
technical variety Sukholymansky white								
1. Control	30,4	24,1	79,2	22,1	92,1	37,1	1,54	1,67
2. Standard	31,2	24,5	78,5	21,2	89,4	37,5	1,53	1,71
3. Experi-ment	32,4	25,1	77,5	22,9	91,2	38,8	1,55	
SED_{05}	3,1	2,2	-	3,7	-	6,3	0,02	

Note: * SED-the smallest essential difference.

Table 3. Agrobiological indicators of grape bushes according to the variants of the experiment, National Scientific Centre «V.Ye. Tairov Institute of Viticulture and Winemaking», 2018-2020.

No	Variants of the experiment	The number of clusters, pieces/ bush	Average cluster mass, g	Yield, kg/bush	Calculation of yielding capacity, c/ha	Mass concentration in berry juice	
						sugars, g/100 cm^3	titrated acids, g/ dm^3
Table Variety Arcadia							
1.	Control	16,8	176,2	2,9	64,4	14,3	7,2
2.	Standard	16,7	294,3	4,9	109,2	16,7	6,8
3.	Experi-ment	16,6	383,1	6,4	142,2	18,8	6,6
SED_{05}		1,3	13,1	2,1	14,6	1,3	1,3
Technical variety Sukholymansky white							
1.	Control	43,2	138,9	6,0	133,3	17,6	7,8
2.	Standard	44,4	124,2	6,4	122,5	18,0	7,4
3.	Experi-ment	45,3	145,3	6,6	146,7	18,9	7,1
SED_{05}		1,4	12,8	1,7	15,2	1,2	1,2

Note: *SED-The smallest essential difference.

Table 4. Influence of protective measures against sucking pests on the grape yield and its quality indicators, National Scientific Centre «V.Ye. Tairov Institute of Viticulture and Winemaking», 2018.

Due to the obtained data it has been established a direct dependence of the influence of the degree of sucking pests settlement on the indicators of grape productivity and quality, namely, on the cluster mass, yield from the bush, yielding capacity per hectare, as well as on quality indicators: saccharinity and acidity of juice.

Based on the results of conducted accounts of the quantity and quality of the grape yield and statistical processing of the obtained data, it was found that the improved system of grapes protection from sucking pests has a positive effect on the indicators of the yield mass from the bush, the average cluster mass, sugar content and titrated acid in the juice of grape berries. The yielding capacity increases by 19.8-30.2%, the mass concentration of sugars in berry juice by 4.6-12.6%.

Conclusion

1. Currently, there are more than 17 species belonging to various trophic groups in the vineyards of southern Ukraine. The most harmful among them are phytophages belonging to the order acariformes (*Acariformes*) and include four families: four-legged spider mites (*Tetranychidae*), brown mites (*Bryobiidae*), flat mites (*Tenuipalpidae*) and four-legged gall mites (*Eriophyidae*).

2. According to the scientific literature, more than 690 species of cicadas are distributed in Ukraine, which belong to 13 families. Economically significant species of cicadas belong to six families: cixiidae (*Cixiidae*), delphacidae (*Delphacidae*), cicadidae (*Cicadidae*), pennants (*Cercopidae*), thorn bugs (*Membracidae*) and the most numerous–cicadellids *(Cicadellidae).* Yellow glue traps were used to monitor the species composition, seasonal dynamics of development and the number of cicadas on grape plantations. Currently, 12 species from 5 cicada families have been identified.

3. Currently, three species of thrips from the family *Tripidae* of the suborder *Terebranita* are mainly most common in the grape plantations of southern Ukraine: grapevine thrips (*Drepanothrips reuteri Uzel.*), onion thrips (*Thrips tabaci Lindemann*) and thrips (*Frankliniella intosa Trybom*). Less common are greenhouse thrips (*Heliothrips haemorrhoidalis*) and western flower thrips (*Frankliniella occidentalis*). Focal development of wheat thrips (*Haplothrips tritici*) was also noted.

4. Grape phylloxera (*Viteus vitifolii Fitch*, or *Phylloxera vastatrix Planch*) belongs to *Phylloxeridae* family, the order Homoptera. The pest belongs to quarantine objects. This is a monophage that damages only the vine. The life cycle of phylloxera includes underground (root form) and aboveground (leaf form).

5. Due to the obtained data it has been established a direct dependence of the influence of the degree of sucking pests settlement on the indicators of grape productivity and quality, namely, on the cluster mass, yield from the bush, yielding capacity per hectare, as well as on quality indicators: saccharinity and acidity of juice.

6. Based on the results of conducted accounts of the quantity and quality of the grape yield and statistical processing of the obtained data, it was found that the improved system of grapes protection from sucking pests has a positive effect on the indicators of the yield mass from the bush, the average cluster mass, sugar content and titrated acid in the juice of grape berries. The yielding capacity increases by 19.8-30.2%, the mass concentration of sugars in berry juice by 4.6-12.6%

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