

## Risky periods of pesticide (insecticide and fungicide) pollution of vegetables grown in greenhouses

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### Summary

Owing to the need of the population to consume vegetables in winter and spring (December-May), the production of vegetables grown in greenhouses is increasing, covering larger and larger areas. In order to protect vegetables from economically important pests, we often use a wide range of pesticides which are dangerous for the health of consumers. In connection with this, the observations in greenhouses with tomatoes and cucumbers were provided in three regions of the country, namely the following towns: Rakovski, Plovdiv and Perustitsa. During the whole vegetation period, phytosanitary status in the greenhouses was checked every week by reviewing individual plants. By growing-up tomatoes in glass greenhouses during the period from January to July, the following diseases were reported as predominant: *Botrytis cinerea* pers. and *Alternaria porri* f.sp.splani E et M., and pollution of the production was caused by fungicides. During the harvest, significant problems were caused by the pests: *Myzodes persicae* Sulz, *Macrosiphum euphorbiae* Thom., *Liriomyza bryoniae* Kalt. and the pollution was mainly by insecticides. As regards the cucumbers, grown in steel-glass greenhouses during the period from January to July, the problems of phytopathological character predominated: *Fusarium*, *Erysiphe cichoracearum* De Candolle, *Pseudoperonospora cubensis* Rostovzew. This imposed treatments more often and the pollution during that period was caused mainly by fungicides. The results obtained can be used for various technological solutions for the purpose of reducing the risk posed by the residual quantities of pesticides in the vegetables grown.

Key words: vegetables, pests, diseases, pesticides

### Introduction

Growing vegetable crops (tomatoes, cucumbers) in cultivation premises is one of the most intensive sectors of agriculture. The complex consisting of diseases

and pests which deteriorate the quality of the obtained production necessitates the use of a variety of chemical devices.

In order to achieve the goal desired and to avoid the risks of using pesticides, they have to be applied within certain limits, at the exact time and under certain conditions (Sweet et al, 1990)

We know that the incorrect application of pesticides is dangerous for people's health and causes contamination of the environment (Hayes and Laws 1991).

According to Clark et al. (1997), pesticides are mostly used before and during gathering of the crops.

In relation to this, the purpose of this study was to determine the risky periods of contamination of the vegetable crops grown in greenhouses as a result of applying the established plant-protection practice.

## Materials and methods

The research was conducted during the period 2006-2009 in greenhouses planted with tomatoes and cucumbers in the regions of the following towns: Rakovski (180 decares), Plovdiv (60 decares) and Perushtitsa (60 decares). The observations were made once a week from January till July. We identified and registered plant-protection problems, decisions to solve them and phonological development of the cultivated plants.

## Results and discussion

The conducted surveys show that the first several sprayings of tomatoes start within the period February-March (Figure 1). As a result of significant air humidity and inappropriately maintained heat and air regimen, there were favourable conditions for development of grey mould *Botrytis cinerea* Pers and brown leaf spots – *Alternaria porri f.sp.solani* E et.M. In order to prevent the diseases from spreading, 2-3 treatments were applied within 8-10 days using systemic fungicides (thiophanate methyl, benomil, symoxanil+mancozeb).

During the same period of time, we observed an increase in the number of greenhouse whiteflies - *Trialeurodes vaporariorum* Westw. and twospotted spider mites (*Tetranychus urticae* L., *Tetranychus atlanticus \turkestani\* Mc Gregor, *Tetranychus cinnabarinus* Boisd.). In order to fight them, we conducted a number of treatments using nicotine insecticides (tiametoxam, imidacloprid+deltamethrin), synthetic pyrethroids (alpha-cypermethrin, deltamethrin, lambda cyxalothrin) and acaricides (abamectin, bifenthrin, hexythiazox).

The observations show that the preparations used for fighting diseases and pests are within the established levels of biological efficacy regulated on the grounds of the approved doses. This leads to contamination of the environment where tomatoes are grown and people work, due to the fact that the attention has been focused on the efficiency of the pesticides.

Under the established growing scheme, the gathering of tomatoes started at the end of March and the beginning of April. During that period, the main problems

were entomological due to the dynamic nature of their development. Along with pests during the pre-harvest season, aphides also appeared (Peach aphides – *Myzodes persicae* Sulz., Potato aphides – *Macrosiphum euphorbiae* Thom.), tomato leafminer flies – *Liriomyza bryoniae* Kalt.). To fight these pests, we sprayed plants with preparations based on deltamethrin, alpha-cypermethrin, tau-fluvalinate, cypermethrin and abamectin.

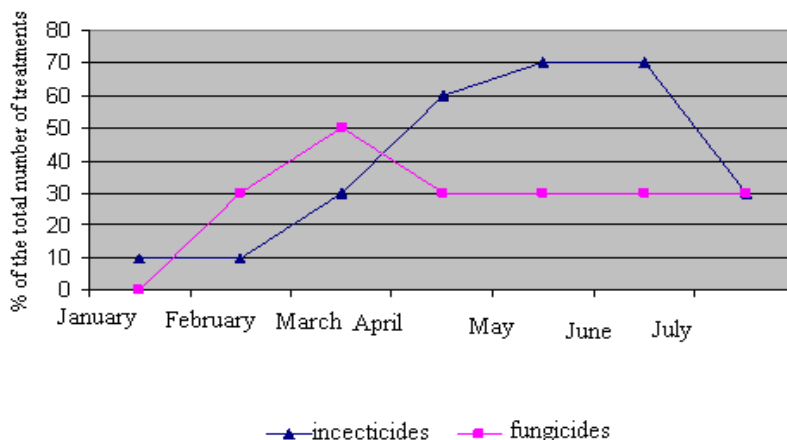


Fig. 1. Conducted treatments with insecticides and fungicides on tomatoes grown in greenhouses during the period from January to July

*Sprovedena tretiranja insekticidima i fungicidima na paradajzu koji se uzgaja u staklenicima u periodu od januara do jula*

In May, June and July, we continued to fight aphides, greenhouse whiteflies, leafminer flies and spider mites. We treated plants with synthetic pyrethroids (alpha-cypermethrin, deltamethrin, lambda cyhalothrin) and acaricides (abamectin, bifenthrin, hexythiazox).

The conducted surveys show that the predominant diseases during the harvest period (January-mid-March) among the tomato plants grown in greenhouses were the following: alternaria and grey mould, whereas the contamination was mainly caused by fungicides. During the harvest period (March-July), the number of pests increased (greenhouse whiteflies, leafminer flies, spider mites), which required a number of treatments with insecticides and the production was mainly contaminated by them.

As a result of a three-year study, the first damages on cucumbers caused by thrips (Tobacco thrips – *Thrips tabaci* Lind., western flower thrips – *Frankliniella occidentalis* Pergande) and twospotted spider mites (*Tetranychus urticae* L., *Tetranychus atlanticus* \turkestani\ Uvarov rt Nikoloski, *Tetranychus cinnabarinus* Boisd.) were detected in February. In order to protect the plants against them, we used neonicotinoid insecticides (thiamethoxam, imidacloprid+deltamethrin),

synthetic pyrethroids (deltamethrin, alpha-cypermethrin, cypermethrin) and acaricides (abamectin, bifenthrin, hexythiazox).

The harvest period of cucumbers grown in steel-and-glass greenhouses started in the second half of March (Figure 2). During that period, we detected damages caused by fusarium - *Fusarium* and powdery mildew – *Erysiphe cichoracearum* De Candolle. In order to restrict the spread of these diseases, we sprayed plants with preparations based on tiophanate - methyl, triadimenol, myclobutanil).

The pests that were active during that period were thrips, spider mites as well as greenhouse whiteflies *Trialeurodes vaporariorum* Westw. To fight these pests, we used neonicotinoid insecticides (thiamethoxam, imidacloprid+deltamethrin), synthetic pyrethroids (deltamethrin, alpha-cypermethrin, cypermethrin) and acaricides (abamectin, bifenthrin, hexythiazox).

As a result of the emergence of aphides that have wings (Peach aphides – *Myzodes persicae* Sulz, Cotton aphides – *Aphis gossypii* Glov.), we established the development of the cucumber mosaic virus CMV – *Cucumber mosaic virus* in May. This required spraying with synthetic pyrethroids and aphicides.

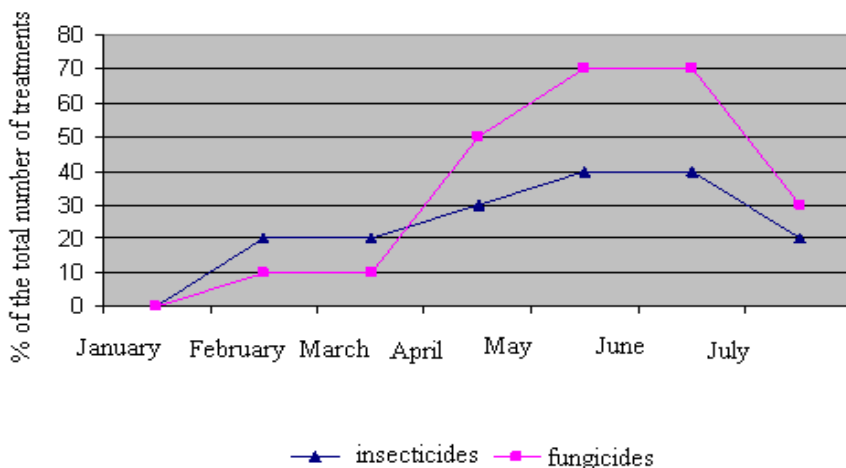


Fig. 2. Conducted treatments with insecticides and fungicides on cucumbers grown in greenhouses during the period from January to July

Sprovedena tretiranja insekticidima i fungicidima na krastavcu koji se uzgaja u staklenicima u periodu od januara do jula

In May, June and July, the main problems related to plant protection were phytopathological. Our priority was the fight against Cuban mildew – *Pseudoperanospora cubensis* Rostovzew and powdery mildew – *Erysiphe cichoracearum* De Candolle. This necessitated a larger number of treatments with short intervals of time between them (5-6 days) and we used systemic fungicides (aluminum fosethyl, dimethomorph, azoxystrobin). One of the main reasons for the

development of these pathogens was low temperature during the night, which caused formation of dew, and inadequately maintained air regimen.

At the same time, there was an increase in the number of greenhouse whiteflies and leafminer flies (*Liriomyza bryoniae* Kalt.) and we conducted a number of sprayings using preparations based on alpha-cymermethrin, cyromazine and deltamethrin.

The increase in the number of pests during that period was lower as a result of cultivation practices applied on cucumber plants – removing the upper leaves which cast a shadow on the plants located along the sprouts and also the lowest leaves of the central stem.

Based on our observations, we concluded that during the pre-harvest period, the density of pests was higher and the fight was mainly against them and the contamination was caused by insecticides. During the harvest period of cucumbers, phythopathogenic problems were more significant and the production was primarily contaminated with fungicides.

## Conclusion

As a result of the conducted observations, we can draw the following conclusions:

- When growing tomatoes in glass-covered greenhouses, during the period from January till July, the main contamination of production and environment during plant-protection activities was caused by fungicides.

- During the harvest period of tomatoes, the contamination was mainly caused by insecticides.

- When growing cucumbers in steel-and-glass greenhouses during the period from January till July, the production obtained from the central stem was mainly contaminated with insecticides whereas the one obtained from the sprouts was contaminated with fungicides.

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# Rizični periodi za zagađenje povrća pesticidima (insekticidi i fungicidi) uzgajanog u staklenicima

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## Sažetak

Zbog potrebe stanovništva da konzumira povrće zimi i na proljeće (od decembra do maja), raste proizvodnja povrća uzgajanog u plastenicima i staklenicima pokrivajući sve veće površine. Da bi se povrće zaštitilo od ekonomski važnih štetočina, često koristimo različite pesticide koji su opasni po zdravlje potrošača. U vezi sa tim, sprovedena su ispitivanja u staklenicima u kojima se uzgajaju paradajz i krastavac u tri regiona koji uključuju gradove: Rakovski, Plovdiv i Perustitsa. Tokom cijelog perioda vegetacije, praćen je fitosanitarni status u staklenicima na osnovu pregleda pojedinih biljaka. Uzgoj paradajza u staklenicima u periodu od januara do jula prati pojava sljedećih dominantnih bolesti: *Botrytis cinerea* pers. i *Alternaria porri* f.sp.splani E et.M., a za kontaminaciju proizvodnje odgovorni su fungicidi. Štetočine koje su predstavljale najznačajniji problem tokom berbe su: *Myzodes persicae* Sulz, *Macrosiphum euphorbiae* Thom., *Liriomyza bryoniae* Kalt, a zagađenje je bilo uzrokovano uglavnom insekticidima. Uzgoj krastavaca u staklenicima (staklo i čelik) tokom perioda od januara do jula ometali su problemi fitopatološkog karaktera: *Fusarium*, *Erysiphe cichoracearum* De Candolle, *Pseudoperonospora cubensis* Rostovzew. Njihova pojava zahtijevala je još češća tretiranja, a zagađenje u ovom periodu uzrokovano je uglavnom fungicidima. Dobijeni rezultati mogu da se primijene u različitim tehnološkim rješenjima u cilju smanjenja rizika do kojih dolazi usljed ostataka pesticida u gajenom povrću.

Ključne riječi: povrće, štetočine, bolesti, pesticidi

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