ORCHARD MANAGEMENT IN SUSTAINABLE FRUIT PRODUCTION

Journal of Fruit and Ornamental Plant Research vol. 12, 2004 Special ed.

ENTOMOPHAGOUS COMPLEXES OF SOME PESTS IN APPLE AND PEACH ORCHARDS IN SOUTHEASTERN ROMANIA

Marioara Trandafirescu[1], Iulian Trandafirescu[1], Corina Gavat[2] and Valentin Spita[2]

[1]Ovidius University Bd. Mamaia 124, 900419 Constanta, ROMANIA
[2]Fruit Research Station, Pepinierei St. 1, 907300 Valu lui Traian, ROMANIA
e-mail: mtrandafirescu@yahoo.com

(Received April 21, 2004/Accepted August 11, 2204)

A B S T R A C T

The subject of the investigation was the influence of entomophages on populations of insect pests in apple and peach orchards. The insects examined were: *Eriosoma lanigerum* Hausm, *Quadraspidiotus perniciosus* Comst., *Dysaphis devecta* Wallker, *D. plantaginea* Passerini, *Cydia pomonella* L., *Haedia nubiferana* Haworth, *Anarsia lineatella* Zell, *Grapholita molesta* Busck and *Myzodes persicae* Sulz.

The population of *Eriosoma lanigerum* was controlled by the parasitoid wasp *Aphelinus mail* Hald.

The population of Quadraspidiotus perniciosus was controlled by the predatory beetles, *Chilocorus renipustulatus* Scriba and *Ch. bipustulatus* L., as well as by two species of parasitoid wasps, *Aphidis diaspidis* and *Prospaltella perniciosi* Tow.

The populations of *Anarsia lineatella* and *Grapholita molesta* were controlled by fourteen species of primary parasitoids and four species of secondary parasitoids.

The population of *Myzodes persicae* Sulz was controlled by ten predators and six primary parasitoids.

Our results help elucidate the trophic relationships between two pests, *Cydia pomonella* L. and *Haedia nubiferana*, and their natural enemies.

Key words: trophic relationships; predators; parasitoids wasps; biological control.

INTRODUCTION

High density planting in apple and peach orchards leads to frequent outbreaks of several important pests, including: *Eriosoma lanigerum* Hausm, *Quadraspidiotus perniciosus* Comst., *Dysaphis devecta* Wallker, *D.*

plantaginea Passerini, *Cydia pomonella* L., *Haedia nubiferana* Haworth, *Anarsia lineatella* Zell, *Grapholita molesta* Busck and *Myzodes persicae* Sulz (Mustata and Mustata, 2001).

Spraying with insecticides eight to ten times a season is needed to keep the populations of these pests below threshold levels. However, frequent spraying can harm the environment and consumers. That is why there has been a great deal of interest in biological pest control over the past few years.

In Romania, entomophages play an important role in limiting populations of pests such as *Pieris brasicae* L., *Pieris rapae* L., *Plutella xylostella* L., *Phyllonorycter blancardella* F., *Leucoptera scitella* Zell. Therefore, it is worth focusing on how natural enemies control these pests in apple and peach orchards.

MATERIAL AND METHODS

The study was carried out from 2000 to 2003 in apple and peach orchards in southeastern Romania.

In the laboratory, eggs, larvae and chrysalis of *Cydia pomonela* L., *Haedia nubiferana* Haworth, *Anarsia lineatella* Zell., and *Grapholita molesta* Busck were identified under a binocular microscope. Mummies of primary parasitoids were also collected in order to obtain the hyperparasitoids under controlled conditions.

In the orchard, natural pest complexes were studied in experimental plots treated with only biological or biotechnical pest control methods, such as:

Biological methods:

Bacillus thuringiensis (Silposan CA 2, Biobit XL, Dipel 2X)
Saccharopolyspora spinosa (Spinosad)
Trichoderma harzianum T 39 (Trichodex 25 WP)

Biotechnical methods:

Pheromone traps (Atrapom, Atranub, Atramol Atralin)
I.G.R.-selective insecticides
Diflubenzuron (Dimilin 25 WP)
Triflumuron (Alystin 25 WP)
Teflubenizuron (Homolt 15 SC)
Fenoxicarb (Insegar 25 WP)
Low-risk fungicides
Fenhexamid (Teldor 500 SC)
Iprodion (Rovral 50 WP)

RESULTS AND DISCUSSION

In experimental plots where biological and biotechnical pest control had been practiced for over four years, several parasitoid and predator species were identified, belonging to four orders and fifteen families.

The population of the woody apple aphid (*Eriosoma lanigerum* Hausm) was reduced by more than eighty percent by the parasitoid wasp *Aphelinus mali* Hald.

The population of San-Jose scale (*Quadraspidiotus perniciosus*) was reduced by more than sixty percent by the predators *Chilocorus renipustulatus* Scriba., *Ch. bipustulatus* L., and *Exochomus quadripustulatus* L., together with the parasitoids *Sympiesis* spp., *Apanteles* spp. and *Holcotorax* spp.

The population of *Phyllonorycter* spp. was reduced by 78 to 97% by *Sympiesis* spp, *Apanteles* spp. and *Holcotorax* spp.

In the experimental orchard, an abundance of natural enemies reduced populations of the aphids *Dysaphis devecta* and *D. plantaginea* to the point where no chemical control was needed. In aphid colonies, high numbers of the predators *Formica rufa*, *Episyrphus balteatus* Degeer, *Chantharis fresca* and *Coccinella septempunctata* L. were recorded in the spring, whereas high numbers of *Aphydoletes aphidimyza* Rondani, *Chrysopa carnea* Steph., *Adalia bipunctata* L. and *Scymnus* spp. were recorded in the summer.

The trophic relationships between the different life stages of the coddling moth (*Cydia pomonella* L.) and its natural enemies were examined in detail and are presented in Figure 1. The eggs were parasitized by *Trichogramma cacoeciae* Marshal., *T. embriophagum* Ntg., *T. evanescens* Westw, and *T. pintoi* Voegele. The larvae were attacked by several parasitoid species, especially *Diadegma fenestralis* Holmgr and *Pristomerus vulneator* Pens. Cydia pomonella was also parasitized by *Ascogaster rufidens* Wesnnel, *Bracon hebetor* Sag., *Macrocentrus thoracicus* Nees, and *Ascogaster quadridentata* Wes. (Braconidae).

The trophic relationships between the different life stages of the leaf roller (*Haedia nubiferana* Haworth) and the complex of parasitoids which keep it in check were also examined in detail and are presented in Figure 2. The eggs were attacked by various species of *Trichogramma*, and the larvae were attacked by parasitoids belonging to the Ichneumonidae, Brachonidae and Microgasterinae.

The trophic relationships between *Anarsia lineatella* Zell. and its natural enemies are presented in Figure 3. *Anarsia lineatella* was attacked by six primary parasitoids: *Acrolyta incisa* Bridgm., *Diadegma defectiva* Kok and *D. armillata* Grav. (Ichneumonidae); *Apanteles anarsiae* Faure et Alab. and *Apanteles longicauda* Wesm. (Braconidae); and *Paralitomastix varicornis* Nees. (Encyrtidae). The wasps *Apanteles anarsiae* and *Paralitomastix varicornis* were especial efficient at controlling *Anarsia lineatella*, reducing the population by ten to sixty percent.

The trophic relationships between the oriental moth (*Grapholita molesta* Busck.) and its natural enemies are also presented in Figure 3. *Grapholita molesta* was attacked by eight primary parasitoid species: *Itoplectis alternans* Grav., *Coccygomimus turionellae* L. and *Lisonota paralella* Grav. (Ichneuminidae); *Apanteles anarsiae* Faure et Alab., *Macrocentrus linearis* Nees., *Ascogaster rufipes* Latr. and *Meteorus ictericus* Nees. (Braconidae); *Dibrachis cavus* Walk. (Pteromalidae); and *Trichogramma cacoeciae* March. (Trichogrammatidae). The whole complex of primary parasitoids reduced population of *G. molesta* by forty to

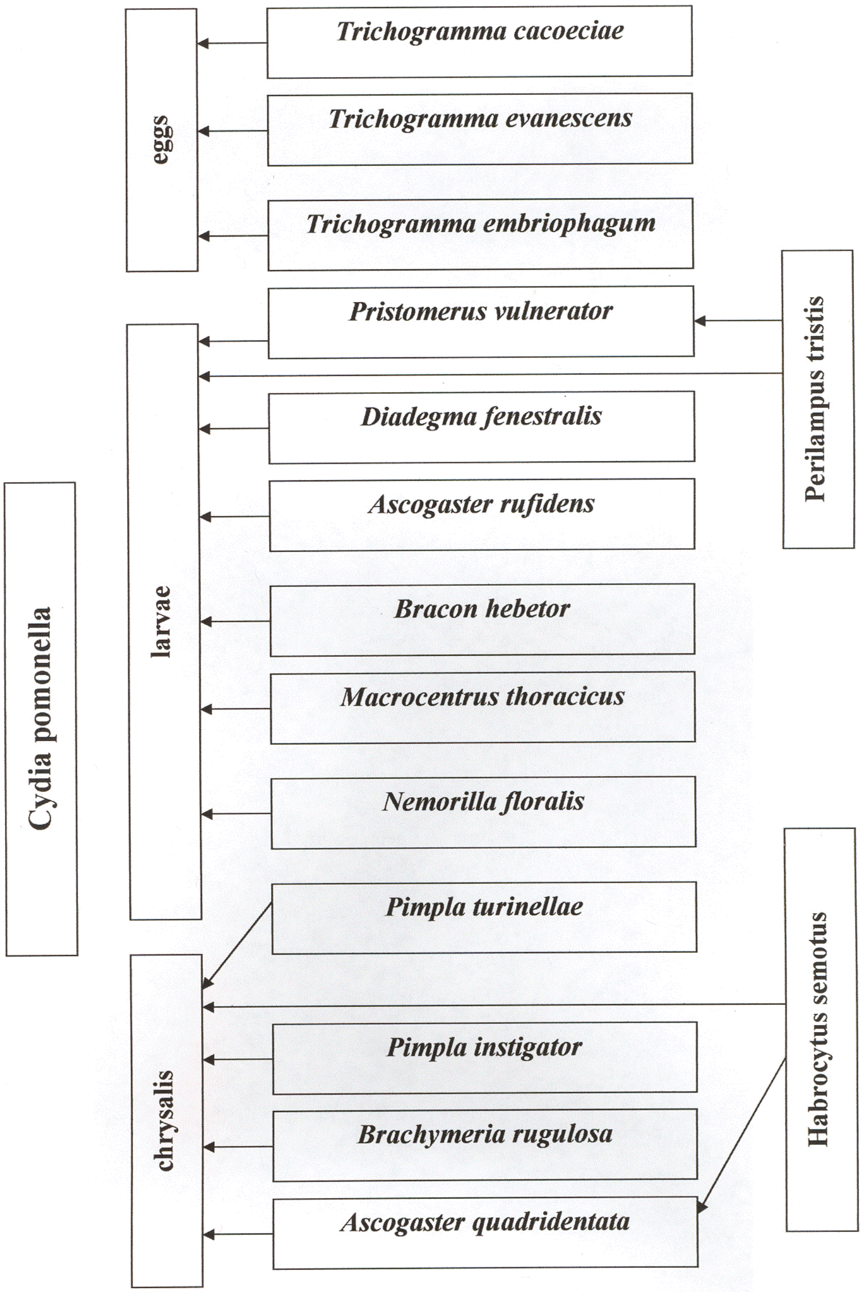

Figure 1. The trophic relationships between the different life stages of the coddling moth (*Cydia pomonella* L.) and its natural enemies

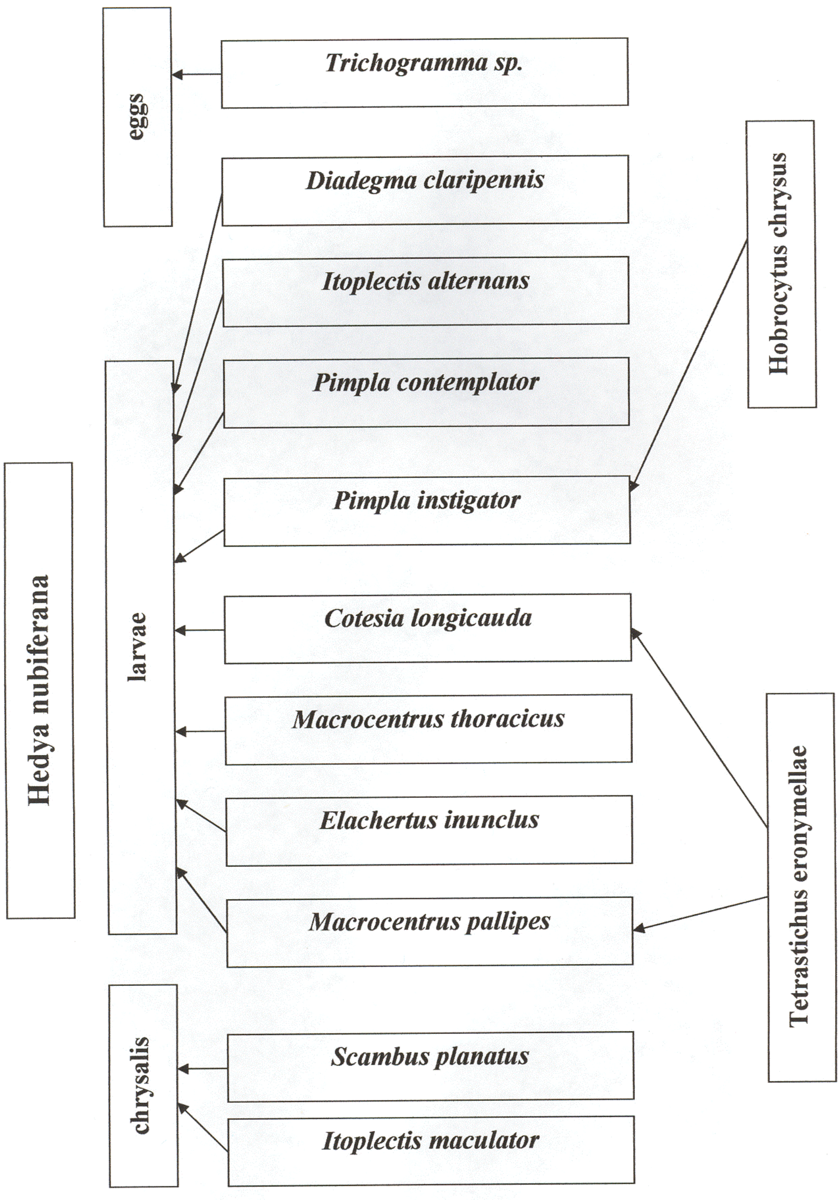

Figure 2. The trophic relationships between the different life stages of the leaf roller (*Haedia nubiferana* Haworth) and its natural enemies

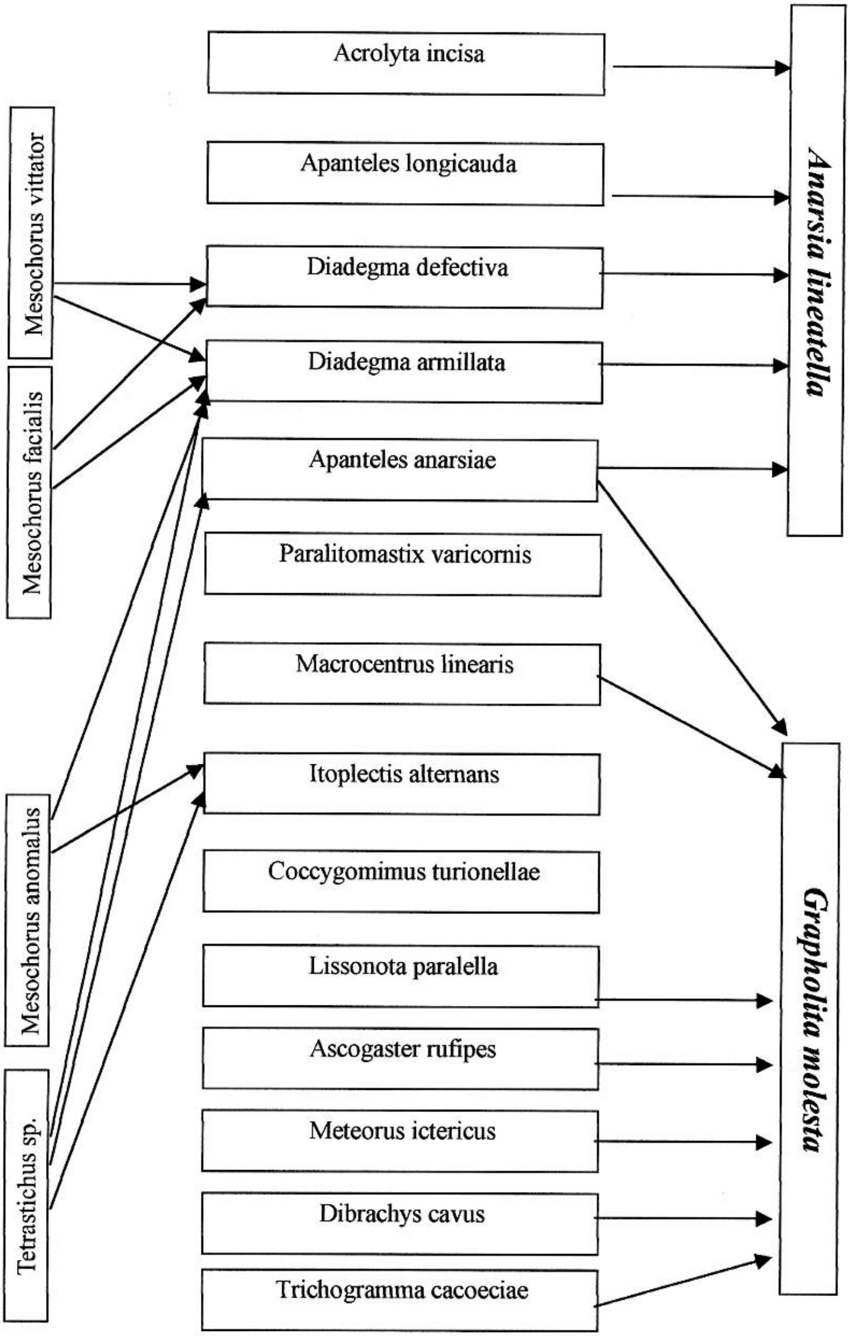

Figure 3. The trophic relationships between *Anarsia lineatella* Zell and *Grapholita molesta* Busck and their natural enemies

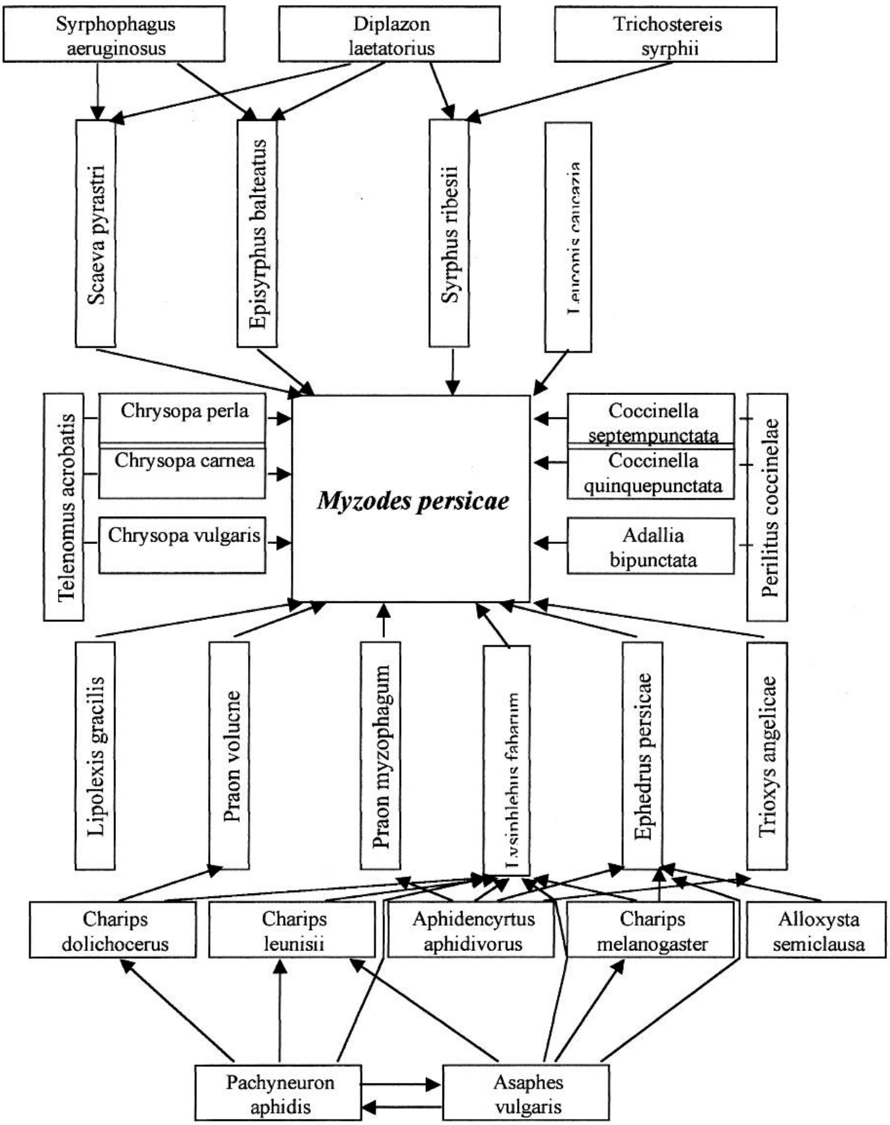

Figure 4. The trophic relationships between *Myzodes persicae* Sulz and its natural enemies

sixty percent. By itself, *Dibrachis cavus* was especially efficient at controlling *G. molesta,* reducing the population by 15 to 35%. The zoophagous wasps *Itoplectis alternans* and *Coccygomimus turionellae* L. were also especially effecient at controlling *G. molesta*. However, the efficiency of the primary parasites was reduced by four secondary parasitoids: *Mesochorus anomalus* Halmgr., *M. facialis* Bridgm., *M. vittator* Zett (Ichneumonidae); and *Tetrastichus* spp. (Pteromalidae).

The trophic relationships between *Myzodes persicae* Sulz. and its natural enemies are presented in Figure 4. Many entomophagous species attack *Myzodes persicae*. The following ten predatory species were the most effective: *Coccinella septempunctata* L., *C. quinquepunctata* L., *Adalia hipunctata* L. (order Coleoptera, family Coccinellidae); *Chrysopa carnea* Steph., *C. perla* L., *C. vulgaris* Schn. (order Neuroptera, family Chrysopidae); *Scaeva pyrastri* L., *Syrphus ribesii* L, *Episyrphus balteatus* De Geer (order Diptera, family Syrphidae); and *Leucopis caucazia* Tanas. (family Chamaemyidae). The following parasitoid species also played a role: *Diplazon letatorius* F. (order Hymenoptera family Ichneumonidae); *Syrphophagus aeruginosus* and *Trichostereis syrphii* (family Encyrtidae); *Perilitus coccinellae* (family Braconidae); and *Telenomus acrobatis* (family Proctotrupidae). An interesting parasitoid complex consisting of thirteen species was also found to play a role in controlling *Myzodes persicae*. In this complex, the primary parasitoids were *Lipolexis gracilis* Forst, *Praon volucre* Hal., *P. myzophagus* Mack., *Lysiphiebus fabarum* Marsh., *Ephedrus persicae* Frogg. and *Trioxys angelicae* (Aphidiidae). However, their efficiency was reduced by the secondary parasitoids: *Charips dolichocerus* Com., *C. leunisii* Hartig., *C. melanogaster* Hartg. (Cynipidae); *Alloxysta semiclausa* Kieffer (Alloxystidae); and *Aphidencyrtus aphidivorus* Mayr. (Encyrtidae). Two species of tertiary parasitoids were also identified: *Asaphes vulgaris* Walk and *Pachyneuron aphidis* Bche (Pteromalidae). These tertiary parasitoids also act as secondary parasitoids, and considering that they also feed on each other, they can even act as quaternary parasitoids as well (Perju et al., 1989).

REFERENCES

Dransfield R.D. 1979. Aspects of host-parasitoid interaction of two parasitoids, *Aphidius urticae* (Haliday) and *Aphidius uzbekistanicus* (Luzhetzki) (Hym. Aphidiidae). ECOL. ENT. 4: 307-316.

Evenhuis H.H. 1966. Host specifity in the parasites and hyperparasites of apple aphids. In Ecology of Aphidophagous Insects. ACAD. PRAHA, pp. 39-40.

Horn D.J. 1988. Secondary parasitism and population dynamics of green peach and cabbage aphids (*Myzus persicae*, *Brevicoryne brasicae*). In ecology and effectiveness of aphidophaga, SPB.Acad. Publ., bv Hague, Netherlands, pp. 305-309.

Iacob N., Lacatusu M., Beratlief C., Mihalache G., Ceianu I. 1975. Combaterea biologica a daunatorilor. Stiintificft Bucuresti, 173 p.

Mustata Gh., Mustata M., Maniu C. 2000. Afide daunatoare si complexul de parazitoizi care le limiteaza populatiile. Rolul biocenozelor parazitoide in pastrarea echilibrului natural. CORSON Iasi, 145 p.

Mustata Gh., Mustata M. 2001. The role of the parasitoid biocenosis in keeping the equilibrium of nature. Univ. "Al. I. Cuza", lasi, 157 p.

Perju T., Lacatusu Matilda, Pisica C., Mustata Gh. 1989.

Entomofagii si utilizarea lor in protectia integrata a ecosistemelor horticole. Ceres Bucuresti, 287, p.

Pisica C., Diaconu A. 1997. The primary parasitoids of the Icheumonidae (Hymenoptera) family obtained from the tortricids (Lepidoptera, Tortricidae) injurious to the fruit trees (I) BULL. SUF. SOC. LEPID. ROM. 8(3-4): 348 - 353.

KOMPLEKS ENTOMOFAGÓW NIEKTÓRYCH SZKODNIKÓW W SADACH JABŁONIOWYCH I BRZOSKWINIOWYCH W POŁUDNIOWO-WSCHODNIEJ RUMUNII

Marioara Trandafirescu, Trandafirescu Iulian, Corina Gavat i Spita Valentin

STRESZCZENIE

Celem badań było prześledzenie występowania entomofagów oraz ich powiązań troficznych z niektórymi szkodnikami sadów i innymi entomofagami w sadach jabłoniowych i brzoskwiniowych w południowo-wschodniej Rumunii.

Badania prowadzono w latach 2000-2003. Zwalczanie szkodników w obserwowanych sadach oparto na stosowaniu metod biologicznych i biotechnicznych oraz opryskiwaniu sadów preparatami selektywnymi i częściowo selektywnymi dla fauny pożytecznej

Stwierdzono, że populacja bawełnicy korówki (*Eriosoma lanigerum* Hausm) była obniżana przez pasożytniczą błonkówkę (*Aphelinus mali* Hald).

Ogranczający wpływ na tarcznika niszczyciela (*Quadraspidiotus perniciosus* Comst) miały 2 gatunki biedronek (*Chilocorus renipostulatus* Scriba., *Ch. bipostulatus* L.) oraz 2 gatunki pasożytniczych błonkówek (*Aphidis diaspidis* i *Prospaltella perniciosi* Tow.).

Na liczebność populacji skośnika brzoskwiniaczka (*Anarsia lineatella* Zell. i owocówki śliwkóweczki (*Grapholita molesta* Buscks) wpływało 14 gatunków pasożytów pierwszego rzędu i 4 gatunki pasożytów drugiego rzędu.

W koloniach mszycy brzoskwiniowo-ziemniaczanej (*Myzodes persicae* Sulz) występowało 10 gatunków owadów drapieżnych i 6 gatunków pasożytów drugiego rzędu.

Uzyskane wyniki pozwoliły także na określenie powiązań troficznych pomiędzy owocówką jabłkóweczką (*Cydia pomonella* L.) i płatkówkówką pstrocineczką (*Haedia nubiferana* Haworth) a ich ważnymi wrogami naturalnymi.

Słowa kluczowe: powiązania troficzne, drapieżce, pasożytnicze błonkówki, zwalczanie biologiczne