

**Contributions to the elaboration  
of the soybean integrated protection system  
from the pests attack**

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**Rezumat**

**Contribuții la elaborarea sistemului de protecție integrată a culturilor de soia împotriva atacului dăunătorilor**

In perioada 1986-1990, în zona Cluj a fost studiată entomofauna culturilor de soia (principalii agenți fitofagi și entomofagi) și măsurile de combatere integrată. Principalii dăunători ai culturilor de soia din România, prezentați în ordine sistematică, sunt: *Tetranychus urticae*, *Sericothrips gracilicornis*, *Thrips tabaci*, *Aphis fabae*, *Sitona sp.*, *Autographa gamma*, *Pyrausta sticticalis*, *Cyntia cardui*, *Delia florilega*. După organele pe care le atacă, insectele dăunătoare sunt împărțite în: dăunători ai semințelor în germinare: *Delia florilega* - larve; dăunători ai rădăcinilor: *Sitona sp.* - larve; defoliatori: *Tetranychus urticae*, *Aphis fabae*, *Autographa gamma*, *Pyrausta sticticalis* și *Cyntia cardui*; florifagi: *Sericothrips gracilicornis*, *Thrips tabaci* și seminifagi: *Etiella zinckenella* - larve. Au fost evidențiate organisme entomopatogene, organisme prădătoare și insectivore, precum și parazitoide, factori de prim ordin în reglarea densității populațiilor de dăunători în culturile de soia.

**Introduction**

The indigenous literature about field studies is rather poor in so far as pests and integrated protection of soybean crops are concerned (ROGOJANU 1940; MANOLACHE 1941; PEIU et al. 1961; PEIU 1965; MEGAHED 1978; RĂDULESCU & PAULIAN 1973; PERJU et al. 1988).

REYES & PERJU (1986) have published recently a first general survey on the soybean pest fauna in Romania. This report introduces the principal pests to this important crop; their year-to-year evolution may negatively affect the expected yield if their presence and deleterious effect are neglected. In order, that the suggested control correspond to the concept of integrated protection of soybean crops, for some of these, they have been illustrating the main biological regulating factors of population density, their natural foes respectively, represented by pathogenic organisms and predaceous and parasitic species of importance in the natural restriction or in the biological combat of pests populations.

**Material and methods**

The biological material - harmful and useful species - has sampled in soybean stands grown in the Cluj area, in 1986-1992. Parallel with the sampling of extend species in the stands, for the phytophagous species, there has been sampled the predacious species too. The

parasitic species in the various development stages of the pests were obtained in the laboratory.

The obtained results on the main pest species and their predaceous pathogenic and parasite species are illustrated by means of charts. A scheme presenting the integrated protection of the soybean crop - taking into account as to priority the nonpolluting means (agrophytotechnical means, resident cultivars, natural foes) and also the chemical ones applied both seeds and stands with relatively selective products, are illustrated by a chart conceived per plant phenophases, from seeding to harvest.

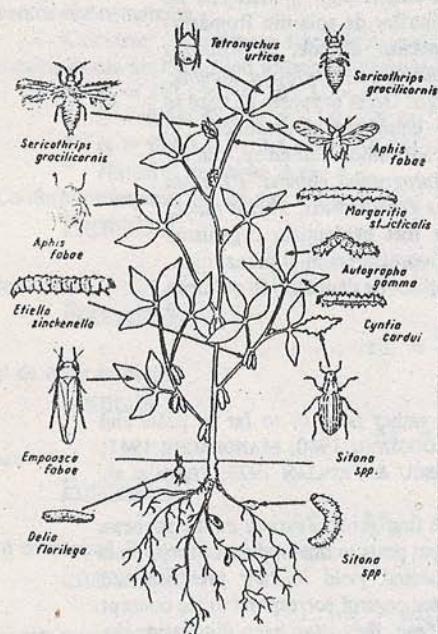
## Results

The results of the performed investigations concerning the main soybean pests and their natural foes in Romania are presented by Figs. 1-5.

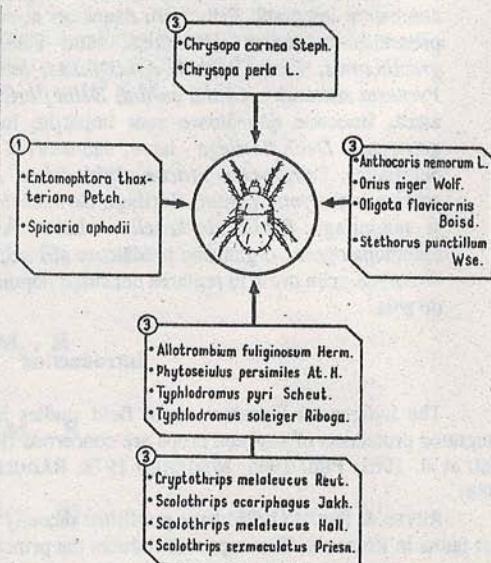
### 1. Results of soybean pest fauna

Main soybean area is introduced in Fig. 1.

The presented data reveal that the main soybean pests in Romania are arranged systematically and by attacked plant organs.



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### TETRANYCHUS URTICAE Koch.

FACTORI BIOLIGICI DE REGLARE A POPULATIILOR:

① - entomopatogeni; ③ - prădători.

Fig. 1. Main soybean pests in Cluj area.

Fig. 2. Biological factors involved in *Tetranychus urticae* KOCH regulation of the populations.

In the systematic order, they are: *Tetranychus urticae* (Acar: Tetranychidae),

*Autographa gamma* (Lepidoptera: Noctuidae), *Pyrausta sticticalis* (Lepidoptera: Pyralidae), *Cynthia cardui* (Lepidoptera: Nymphalidae), *Etiella zinckenella* (Lepidoptera: Phycitidae), *Delia florilega* (Diptera: Anthomyidae), *Aphis fabae* (Homoptera: Aphididae), *Empoasca fabae* (Homoptera: Cicadelidae), *Sitona sp.* (Coleoptera: Curculionidae), *Sericothrips gracilicornis* and *Thrips tabaci* (Thysanoptera: Thripidae).

Per the phenophase development and organs of the host plant, they are:

-Germinating seeds and seedlings: *Delia florilega* (larvae) and *Etiella zinckenella* (larvae).

-Root system: *Sitona sp.* (larvae).

-Leaf system: *Autographa gamma*, *Pyrausta sticticalis* and *Cynthia cardui* (larvae).

-Flowers: *Sericothrips gracilicornis* and *Thrips tabaci* (larvae and imagines).

## 2. Results on the useful flora and fauna in the main soybean pests

### A. Regulating factors of the red mite (*Tetranychus urticae*) populations (Fig. 2).

Between the pathogenic microorganisms in the mites populations are remarkable the following fungi: *Entomophthora thaxteriana* and *Spicaria aphodii*.

The following mites are acarophage: *Allotrombium fuliginosum*, *Phytoseiulus persimilis*, *Typhlodromus pyri* and *T. soleiger* (PERJU et al. 1988). Of the mentioned species, the practical importance is presented by *Phytoseiulus persimilis*, permanently utilised in the biological control of the red mite populations in the soybean crop.

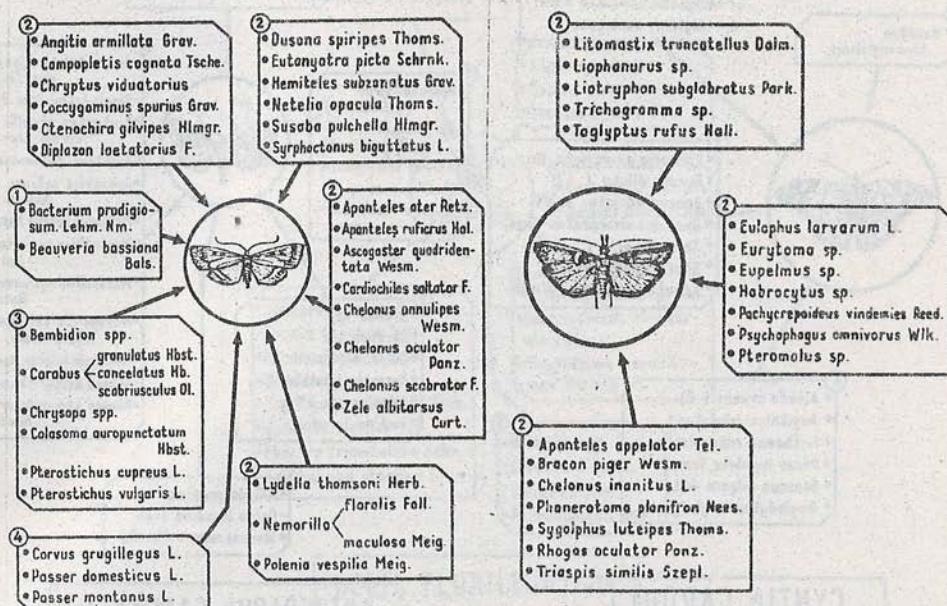


Fig. 3-4. Biological factors involved in *Margarita (Loxostege) sticticalis* L. and *Etiella zinchenella* Tr. regulation of the populations.

Between the acarophage insects, the remarkable are: *Chrysopa carnea* and *C. perla* (Neuroptera: Chrysopidae); *Cryptothrips melaleucus*, *Scolothrips acariphagus* and *S. sexmaculatus* (Tysanoptera: Thripidae), *Anthocoris nemorum* and *Orius niger* (Heteroptera: Anthocoridae), *Stethorus punctillum* (Coleoptera: Coccinellidae).

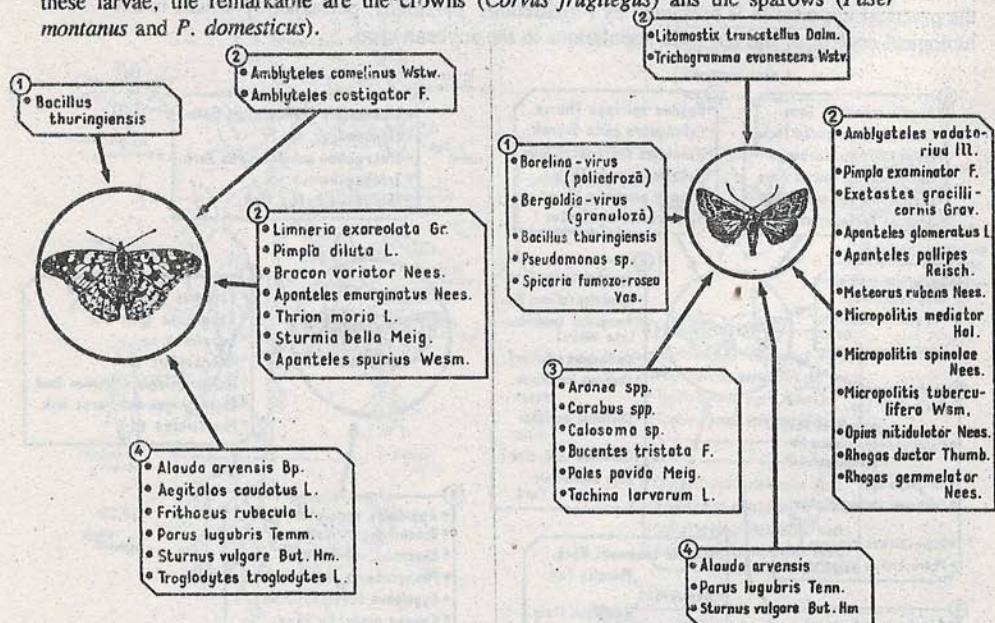
It is worthwhile mentioning the attention payed worldwide to *Scolothrips acariphagus* and *Stethorus punctillum* as potential factors of the biological control in red mite populations.

#### B. Regulating factors in the *Loxostege sticticalis* population density (Fig. 3).

a. The entomopathogenic organisms. In the caterpillar and pupae populations of this species, the epizootic diseases caused by bacteria (*Bacterium prodigiosum*) and fungi (*Beauveria bassiana*) are recorded. Mostly infections caused by the respective fungus in natural conditions, by pupae attack in soil, play an important part in these lepidopteran populations; this fact suggests the efficiency of some treatments applied with biopreparation (Boverin) having as the active substance, this mentioned fungus spores.

b. Predaceous and insectivorous organisms. Numerous predaceous insect species and insectivorous birds play an important role in *Pyrausta sticticalis* population reducing.

Between the main predaceous insects, we are mentioning the Carabidae: (*Bembidion* sp., *Carabus cancellatus*, *C. granulatus*, *C. scabriusculus*, *Calosoma maderae auropunctatum*, *Pterostichus vulgaris* and *Poecilus cupreus*). Between the birds feeding on these larvae, the remarkable are the crows (*Corvus frugilegus*) and the sparrows (*Passer montanus* and *P. domesticus*).



#### FACTORI BIOLOGICI DE REGLARE A POPULAȚIILOR :

① - entomopatogeni ; ② - prădători ; ④ - insectivore .

#### FACTORI BIOLOGICI DE REGLARE A POPULAȚIILOR :

① - epizootii ; ② - paraziți ; ③ - prădători ;  
④ - insectivore .

Fig. 5-6. Biological factors involved in *Autographa gamma* L. and *Cyntia cardui* L. regulation of the populations.

c. Parasitic organisms. An outstanding part is detained by the parasitoid insects in these lepidopterans populations reducing. The most important are the hymenopterans and the

dipterans. The mostly numerous between hymenopterans are the Ichneumonidae (12) and the Braconidae (8) species in this pest larvae and pupae parasiting.

The importance of these hymenopterans has convincingly been underlined by PERJU et al. (1988).

Between the parasitic dipterans *Lydella thomsoni*, *Nemoriella sp.* and *Polenia vespillia* (Tachynidae) infest mostly the pupa stage of this pest.

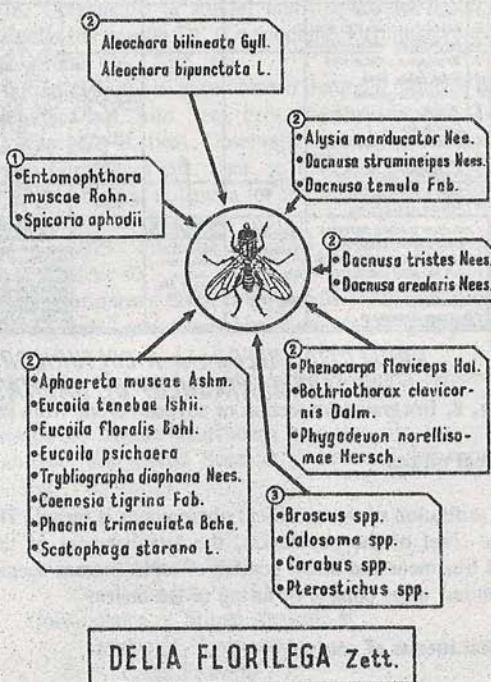
The entomophagous organisms, mostly the hymenopterans and dipterans parasitoids in the *Pyrausta sticticalis* populations have constituted the object of several through autochtonus investigations (BORCEA and SUSTER 1930-1931, MANOLACHE 1953, VOICU 1982, PERJU et al. 1988).

### C. Regulating factors in the soybean pod borer (*Etiella zinckenella*) populations (Fig. 4).

The exaggerated reproduction of this pest is controlled by the activity of its natural foes. The most remarkable of them are the larvae and pupae parasitoid hymenopterans.

Between these, the most practical importance and of expectation too, are the *Trichogramma* and the *Litomastix* oviphagous species (Chalcidoidea). The most important are some other Ichneumonidae and Braconidae species too (PERJU et al. 1983).

### D. Regulating factors in *Autographa gamma*, *Cyntia cardui* and *Delia florilega*. These data are presented in Figs. 5-7.



FACTORI BIOLOGICI DE REGLARE A POPULAȚIILOR:  
① - entomopatogeni; ② - paraziți; ③ - prădători.

Fig. 7. Biological factors involved in *Delia florilega* ZETT. populations regulation.

### **3. Results on the of integrated control of the main soybean pests scheme**

The elaboration of an integrated protection system of soybean crops from disease and pests was the central preoccupation of RĂDULESCU & PAULIAN (1971), BAICU & SĂVESCU (1985) and GOGOAŞA et al. (1988). One scheme taking into account the adequate measures fit for integrated control of pests in the soybean stands is illustrated by Fig. 8. It includes agrophytotechnical, genetical, biological and chemical means.

#### 4. Agrophytotechnical means for prevention and control

Among the agrophyotechnical means of preventing the invasion and combating the soybean crop pests, can enumerate: the yearly, scientifical crop rotation, the adequate soil preparation before sowing and the balanced fertilization; appropriate maintenance and timely harvest of the crop.

## 5. Genetical means

The creation and utilisation of yielding cultivars possessing tolerance or resistance to pest attacks.

NR.CP	NAZIONALITATEA SI BAZAMENTUL DE PRELEVARE	POBLATORI GENERALI SI DE PRELEVARE	ORGANE ATACATE				MASURI SPECIALE DE COMBATERE	
			CARTIȚĂ SI BAZAMENT DE PRELEVARE	RĂDĂCINA	TULPIHĂ	FRUNZA	FLOAREA SI PASTĂCU SEMENTE	
1	Etiopia Zinchenhoff							
2	Thapsus tuberosus Lind.							
3	Ranunculus robustus Wiss.							
4	Sarcococca hispanica							
5	Lathyrus sativus Koch							
6	Apis Fabae Koch							
7	Aleuropteryx gamma L							
8	Marguerite stellata L							
9	Cynodon dactylon L							
10	Sitona spp. (adult)							
11	Agrostis seguntum Desch. Schaff.							
12	Gryllotalpa gryllotalpa L.							
13	Dolia florilega Zett.		O					
14	Sitona spp. (larve)							
ASOCIERI SI BAZATE CULTURALOR			POBLATORI GENERALI SI DE PRELEVARE		POBLATORI SPECIALIZATI SI DE PRELEVARE		POBLATORI GENERALI SI DE PRELEVARE	
1	PISÉTĂRIE SI BAZAMENT DE PRELEVARE		HERBĂTOARE SI FRUZĂ	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	
2	PIȘĂREȚEA SI BAZAMENT DE PRELEVARE		HERBĂTOARE SI FRUZĂ	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	
3	CENTRIFUGA TORCHIARĂ A SIEVELOR		HERBĂTOARE SI FRUZĂ	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	
4	SIEVII TOLERANTE SI RESISTENTE		HERBĂTOARE SI FRUZĂ	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	
5	STRATEGIERA CULGORILOR		HERBĂTOARE SI FRUZĂ	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	
6	RECICLAREA SI REUZINA		HERBĂTOARE SI FRUZĂ	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	
7	UTILIZAREA PERIODICULOR		HERBĂTOARE SI FRUZĂ	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	FRUZĂ SI BAZAMENT DE PRELEVARE	

**PROTECȚIA INTEGRATĂ A CULTURILOR DE SOIA  
ÎMPOTRIVA ATACULUI DE DĂUNĂTORI**

## 6. Biological means

Here, the utilisation of the specifical pheromones is meant. There are to be take into consideration: the level of the population, the establishment of the optimal warning of possible chemical treatment and direct combat of lepidopterans species by means of one of the known procedures: mass control or luring of the males.

## 7. Chemical means of control

Chemotherapy as ultimate means of intervention, on warning or when one pest population is beyond PED, is an alternative which summons the application of the selective pesticides in the soil or to seed and stands in principle with granulate products spread locally per row of plants. Among the pesticides suitable to the purpose are: Dicofol 25 C (acaricide), Carbetox 37 CE, Sinoratox 35 C, Onefon 80 PU, Decis 25 CE, Fastac 100 CE, Carate 25 C relaying on a shorter remanence and a relative selectivity to the natural foes of the pest.

## Conclusions

In the Cluj area in 1986-1988, the soybean entomofauna, the main phytophage and entomophage species as well as the integrated control of the main pests were taken into the study. The principal pests of the soybean crop in Romania are: *Tetranychus urticae*, *Sericothrips gracilicornis*, *Thrips tabaci*, *Aphis fabae*, *Sitona sp.*, *Autographa gamma*, *Pyrausta sticticalis*, *Cyntia cardui*, *Delia florilega*. There were revealed the acaro- and entomopathogen organisms, the predaceous and parasitoid ones and the insectivorous birds, primordial factors in the pest population restrictions.

There has been elaborated a scheme of the integrated control of the main pests of the soybean crops comprising the agrophytotechnical, genetical, biological and chemical means.

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