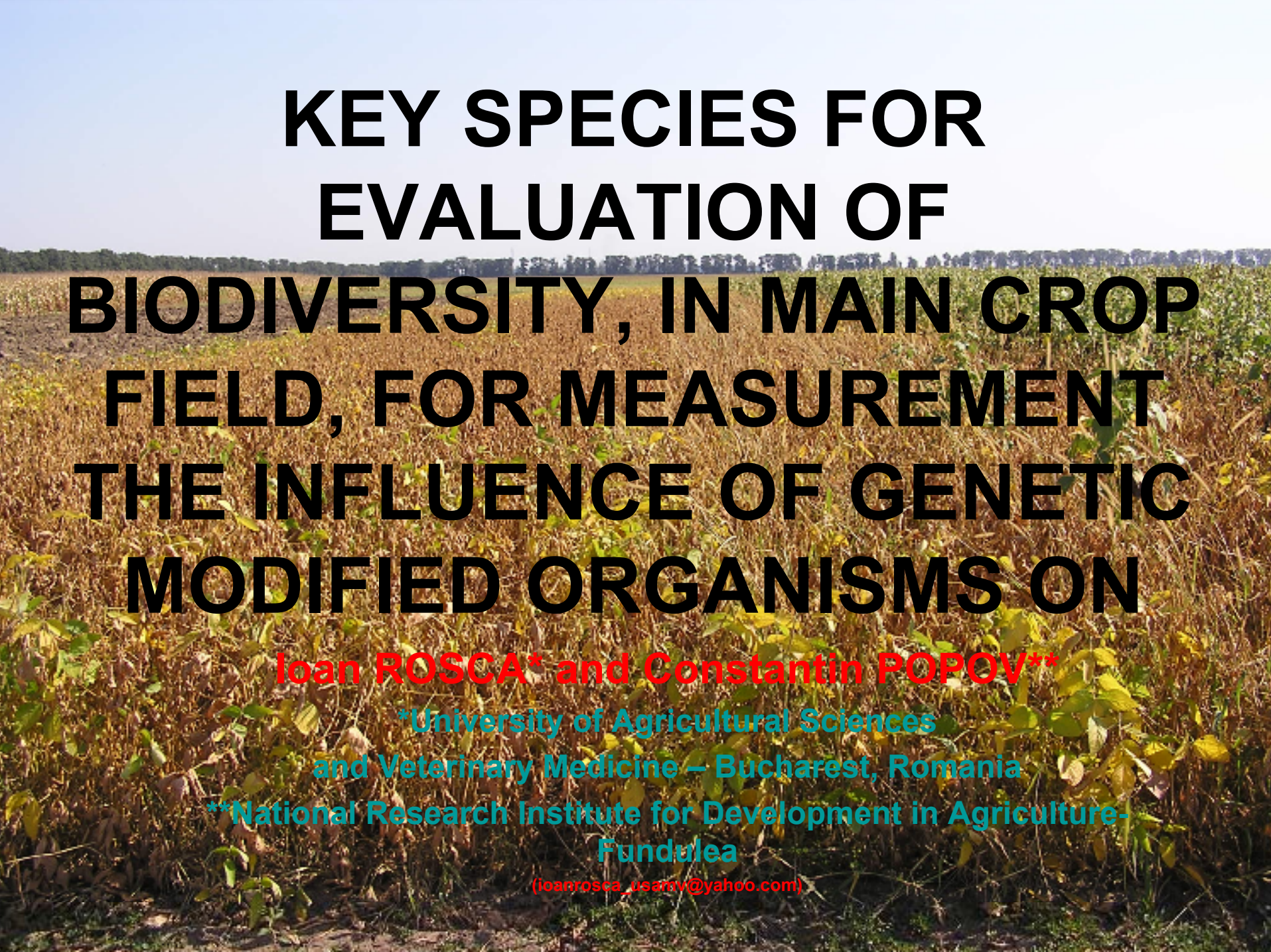
KEY SPECIES FOR EVALUATION OF BIODIVERSITY, IN MAIN CROP FIELD, FOR MEASUREMENT THE INFLUENCE OF GENETIC MODIFIED ORGANISMS ON



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INTRODUCTION

- Agricultural research is engaged increasingly to manipulate genes, among other biological methods. The evaluation of hazards connected with creation and release of GMOs should consider, among other things, environmental impacts. The new technology of soybean and corn cultivation, based on using of genetically modified cultivars, through inducing Roundup Ready® resistance, or Bt genes in corn plants for Insect Pest Management, have offered to us the possibility to observe if there are some influence of this new technology on surface fauna captured in pitfall (Barber) traps or on existing fauna on soybean and corn plants, in field.

- To assess possible environmental effects, we examined epigeic fauna of the soybean and corn fields, knowing that use of chemical pesticides affects both the composition and the abundance of agrocenoses. Our objective was to evaluate potential impact of Roundup soybean and corn, or Bt corn on the epigeic fauna and on the useful fauna on the soybean and corn plants.

- In Romania, till this year GM soybean was commercially grown in preexisting agro-ecological environments, and the direct and indirect ecological effects of the Roundup Ready technology will be broadly similar to those resulting from conventional chemical spraying.

- The Roundup Ready corn and Bt corn have approval only for testing in defined experimentally fields, under the EU and Romanian requirements.

- Results of general surveillance confirmed the lack of any risk for the RR soybean to become persistent in agro-ecosystems or invasive in natural habitats. There have been no significant changes in the RR soybean plants survival capacity since the release approval was granted in Romania since 2000. Soybeen itself never appeared as volunteer crop. Within the naturally occuring plant populations located in the immediate vicinity of the soybean crop fields or in the ruderal areas, feral soybean plants were never observed, a logical situation for Romanian climate which does not allow *Glycine* species owerwintering. The results of the surveillance activities demonstrated that RR soybean has not been altered in growth and development characteristics when compared to conventional soybean cultivars.

- Ministry of Agriculture in Romania, has a data base with all 1.100 farmers who cultivate Soybean RR (on 130.000 ha., including 3.990 ha cultivated without permission for which has

MATERIAL AND METHOD

- **Monitoring has been carried out in 2004-2006, in a soybean experimental field located at the Moara Domnească Didactic Experimental Station and focused on aspects reviewed above.** Experiments with RR corn were done in 200 and in 200 with Bt corn at Moara Domneasca Experimental Station and in 200 at Timisoara with RR corn.

- **Structure and composition of invertebrate population fauna at an interval of 1-2 weeks, Barber traps, 2-4 replications/variant, filled with 4% formaldehide and opened for a 24 hour to 7 days period, were placed in the field.**

- **During the interval of two openings of the Barber traps, adehesive Pherocon traps (1-2/variant) were used additionally.**

- **Before each opening of the Barber traps, Pherocon traps were replaced, recorded and the data was interpreted.**

- **Epigeal fauna was collected two times a week from May until September, from soil traps and captured samples were numbered. Also, samples of useful fauna from 10 plants grown in variants 1 and 2 and from 10 RR soybean plants, or m^2, in 4 replications, were numbered and recorded. Furthermore, acariens (*Tetranichus urticae*) from 10 leaves, in 4 replications/variants were numbered and recorded. Insectes collected from both traps and plants were preserved in 70º alcohol and taxonomically determinated in the laboratory. Where the species level cannot be determined, systematic position for genus, family, order or class were established.**

- **Invertebrate community structure from the variants of conventional and RR technologies was compared by calculating Sörensen Similarity Index according to the following formula:Is= (2c/a+b)*100, where: Is is the Sörensen Index, c is the number of comun species, a is the number of species from one of the fields, and b is the number of species from the other field. 100% inidcates that there does not exist differences between the two faunas compared and 1% - that they are completely different.**

2004

Order	FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha	TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;	ROUNDUP READY 3 l/ha post + 3 l/ha post	Total
Orthoptera	152	128	173	453
Dermaptera	2	4	5	11
Heteroptera	58	72	65	195
Homoptera	10	14	21	45
Hymenoptera	173	129	195	497
Coleoptera	511	432	458	1401
Lepidoptera	0	1	0	1
Diptera	5	8	3	16
TOTAL	911	788	920	2619

In all experimental variants, in 2004-2006, the dominant groups were epigeal *Coleoptera* and *Arahnida*

Structure of the fauna captured in soil traps The most common species of insects collected belonged to orders *Coleoptera*, *Hymenoptera* and *Orthoptera*

Main Coleopterans species captured in soil traps 2004

SPECIES	FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha	TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;	ROUNDUP READY 3 l/ha post + 3 l/ha post	Total
Harpalus pubescens Mull.	123	99	109	331
H. griseus Panz.	81	85	69	235
H. zabroides Dej.	39	25	41	105
H. aeneus F.	2	3	5	10
H. distinguendus Duft.	3	5	6	14
Pterostichus vulgaris L.	117	109	110	336
P. cupreus L.	9	6	10	25
P. melas Creutz.	4	7	9	20
Cicindella soluta Dej.	5	5	8	18
Carabus coriaceus L.	67	54	50	171
C. cancelatus Illig.	44	25	32	101
Drasterius bimaculatus Ross.	3	3	2	8
Amara aenea Deg.	7	5	6	18
Tanymecus dilaticollis Gyll.	5	1	0	6
Bothynoderes punctiventris Germ.	2	0	1	3
TOTAL	*511*	432	*458*	*1401*

2006

SPECIES	RR Soybean	Check	*TOTAL*
Harpalus pubescens Mull.	223	199	422
H. griseus Panz.	101	105	206
H. zabroides Dej.	49	35	84
H. aeneus F.	2	3	5
H. distinguendus Duft.	3	5	8
Pterostichus vulgaris L.	217	209	426
P. cupreus L.	9	6	15
P. melas Creutz.	4	7	11
Cicindella soluta Dej.	9	7	16
Carabus coriaceus L.	81	75	156
C. cancelatus Illig.	40	36	76
Drasterius bimaculatus Ross.	23	27	50
Amara aenea Deg.	7	5	12
Tanymecus dilaticollis Gyll.	11	8	19
Bothynoderes punctiventris Germ.	4	3	7
TOTAL	*783*	730	*1513*

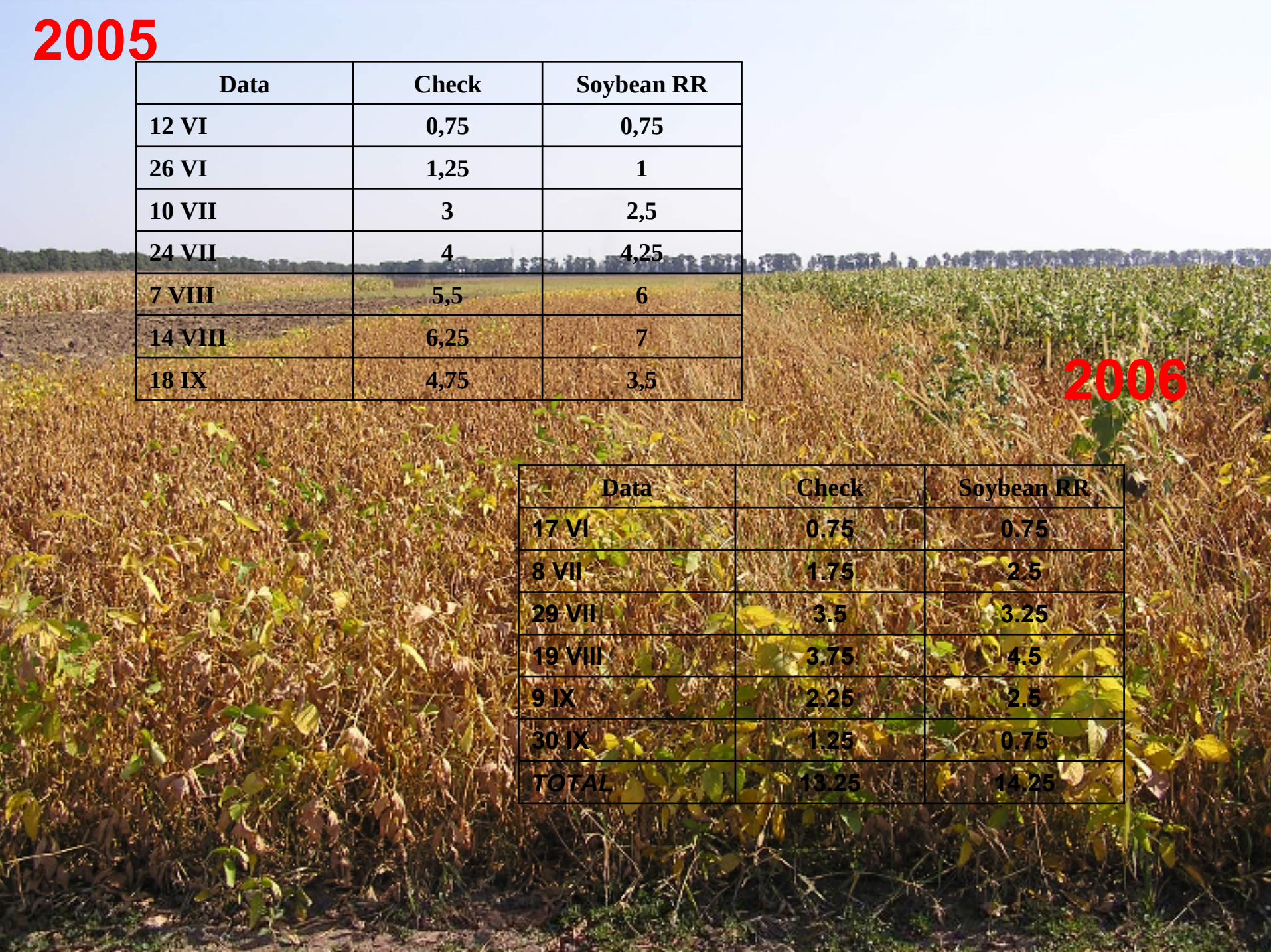
Mean number of beneficial species/plant 2004

SPECIES	FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha		TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;		ROUNDUP READY 3 l/ha post + 3 l/ha post	
	SP 9191 RR	S 2454 RR	SP 9191 RR	S 2454 RR	SP 9191 RR	S 2454 RR
Nabis pseudoferus	1,0	1,25	0,75	1,0	1,0	1,0
Nabis feroides	0,1	0,1	0,02	0,2	0,02	0,2
Nabis ferus	0,5	0,75	1,0	0,5	1,25	0,5
Nabis rugosus	0,1	0,1	0,25	0,1	0,02	0,1
Anthocoris sp.	0,1	0,1	0,1	0,2	0,1	0,1
Orius sp.	0,2	0,1	0,2	0,2	0,2	0,1
Coccinella 7 punctata	0,1	0,02	0,02	0,1	0,02	0,1
Chrysopa sp.	0,07	0,05	0,05	0,05	0,1	0,02
Arachnide	1,0	1,0	1,25	0,5	0,75	0,75

Average number of *Tetranichus urticae*/leaf

2004

DATA	FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha		TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;		ROUNDUP READY 3 l/ha post + 3 l/ha post	
	SP 9191 RR	S 2454 RR	SP 9191 RR	SP 9191 RR	S 2454 RR	SP 9191 RR
30 V	0,75	0,5	0,25	0,75	1	0,75
22 VI	1,5	1,25	1,75	1,5	1,5	1,5
11 VII	1,75	1,75	1,5	1,75	2	1,5
1 VIII	1,75	2	2,25	1,5	1,5	1,75
22 VIII	3,5	4	4,25	4	4,25	3,75
12 IX	1,75	2	1,5	1,5	2,25	1,5
TOTAL	11	11,5	11,5	11	12,5	10,75



2005

Data	Check	Soybean RR
12 VI	0,75	0,75
26 VI	1,25	1
10 VII	3	2,5
24 VII	4	4,25
7 VIII	5,5	6
14 VIII	6,25	7
18 IX	4,75	3,5

2006

Data	Check	Soybean RR
17 VI	0.75	0.75
8 VII	1.75	2.5
29 VII	3.5	3.25
19 VIII	3.75	4.5
9 IX	2.25	2.5
30 IX	1.25	0.75
TOTAL	13.25	14.25

Mean number of insects captured in Pherocon AM traps/72 cm^2 2004

Species and Insect Group	FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha		TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;		ROUNDUP READY 3 l/ha post + 3 l/ha post	
	SP 9191 RR	S 2454 RR	SP 9191 RR	SP 9191 RR	S 2454 RR	SP 9191 RR
Afids	217	325	297	268	301	305
Trips	35	37	21	40	19	48
Cicadelide	57	43	61	50	39	43
Syrphus sp.	12	10	7	8	9	5
Chrysopa sp.	5	7	4	7	8	4
Coccinella 7 punctata	3	2	2	4	1	3
Adalia sp	4	5	4	4	3	5
Subcoccinella 24 punctata	1	1	2	1	1	1
Psyllobora 22 punctata	2	1	1	2	2	2
Ppopylea 14 punctata	2	1	1	1	1	2

2005

Mean number of insects captured in Pherocon AM traps/72 cm^2

ORDER	Check	Soy bean RR	TOTAL
Orthoptera	21	18	**39**
Dermaptera	2	0	**2**
Heteroptera	80	95	**175**
Thysanoptera	527	488	**1015**
Homoptera	690	721	**1411**
Neuroptera	35	31	**66**
Hymenoptera	187	168	**355**
Coleoptera	278	250	**528**
Lepidoptera	11	7	**18**
Diptera nematocera	265	327	**592**
Diptera brachicera	355	327	**682**
TOTAL	*2451*	*2432*	**4883**

Similarity of fauna (Sörensen Index) 2004

	Cultivar (SP 9191 RR) **FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha**	Cultivar (S 2454 RR) **FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha**	Cultivar (SP 9191 RR) **TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;**	Cultivar (S 2454 RR) **TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;**	Cultivar (SP 9191 RR) **ROUNDUP READY 3 l/ha post + 3 l/ha post**	Cultivar (S 2454 RR) **ROUNDUP READY 3 l/ha post + 3 l/ha post**
Cultivar (SP 9191 RR) **FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha**		**81 -100 %**	**81 -100 %**	**81 -100 %**	**81 -100 %**	**81 -100 %**
Cultivar (S 2454 RR) **FRONTIER 900 EC 2l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha**	39;**35**;38 **90,9**		**81 -100 %**	**81 -100 %**	**81 -100 %**	**81 -100 %**
Cultivar (SP 9191 RR) **TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;**	41; **35**;38 **88,6**	41;**33**;39 **82,5**		**81 -100 %**	**81 -100 %**	**81 -100 %**
Cultivar (S 2454 RR) **TREFLAN 48% EC 2 l/ha ppi + BASAGRAN 48 LC 3 l/ha + FURORE 100 EC 1 l/ha;**	35;**31**;38 **84,93**	35;**36**;39 **97,3**	35;**35**;41		**81 -100 %**	**81 -100 %**
Cultivar (SP 9191 RR) **ROUNDUP READY 3 l/ha post + 3 l/ha post**	43;**40**;38 **98,8**	43;**37**;39 **90,24**	43; **37**;41 **88,09**	43;**37**;35 **94,87**		**81 -100 %**
Cultivar (S 2454 RR) **ROUNDUP READY 3 l/ha post + 3 l/ha post**	39;**32**;38 **83,11**	39; 34;39 **94,44**	39;**34**;41 **97,5**	39;**32**;35 **86,48**	39;**38**;43 **92,68**	

2005

	Check (**Corina**) (Basagran 3l/ha)	(**AG 0801 RR**) Roundup **3 l/ha post + 3 l/ha post**
Check (Corina) (Basagran 3l/ha)		**81 -100 %**
(AG 0801 RR) Roundup 3 l/ha post + 3 l/ha post	51;***45;***46 **92,8**	

2006

	RR Soybean (Roundup 3 l/ha poste)	**Conventional Soybean** (Guardian 2 l/ha pree/ppi and Pivot 1 l/ha poste)
RR Soybean (Roundup 3 l/ha poste)		**81 -100 %**
Conventional Soybean (Guardian 2 l/ha pree/ppi and Pivot 1 l/ha poste)	59;**50;*61*** **83,33**	

CONCLUSIONS

- The data collected allow to conclude that no obvious adverse effects on the biodiversity were identified upon cultivation of RR soybean.
- The risk of utilisation of RR soybean technology is neglijable.
- Cultivation of genetically modified soybean RR, has no influence on epigeal fauna or useful fauna existing on soybean plants.
- Data obtained regarding resemblance of whole insect fauna from those cultural variant, taken into consideration, represented by value of *Sorensen* index, confirm idea that genetically modified soybean RR, has no evident influence on insect fauna from soybean field.