Ecologically-Based Participatory and Collaborative Research and Capacity Building in IPM in the Central Asia Region

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Host Countries: Kyrgyzstan, Tajikistan, Uzbekistan

Objective 1. Conduct collaborative research on landscape ecology to enhance biodiversity and biological pest management.

Activity 1.1. Introduction of successful local nectar plants into existing vegetable farming systems in collaboration with local farmers and NGOs.

Ten species of nectar plants were introduced into existing farming systems in various agro-ecological zones of Tajikistan and Kyrgyzstan in collaboration with farmers and NGOs.

Start/End Date: November 1, 2008 – September 30, 2009.
Based on results of our prior studies on the attractiveness of 26 species of nectar plants to natural enemies in Tajikistan and Kyrgyzstan during 2007-2008, we selected the 10 most effective plant species for inclusion in farmer field trials (Table 1).

Table 1. List of selected nectar plant species for establishing nectar strips into farmer fields, April-September 2009.

##	Family	Genus and species	Common name	Plant type
1	Apiaceae (Umbelliferae)	*Anethum graveolens L.*	Dill	annual
2	Apiaceae (Umbelliferae)	*Coriandrum sativum L.*	Coriander	annual
3	Asteraceae (Compositae)	*Calendula officinalis L.*	Marigold	annual
4	Lamiaceae (Labiatae)	*Ziziphora interrupta Juz.*	Interrupta	forb
5	Lamiaceae (Labiatae)	*Ocimum basilicum L.*	Sweet basil	forb
6	Balsaminaceae	*Impatiens balsamina L.*	Balsam	forb
7	Asteraceae (Compositae)	*Pyrethrum carneum L.*	Pyrethrum	forb
8	Asteraceae (Compositae)	*Achillea filipendulina Lam.*	Fernleaf yarrow	Perennial forb
9	Lamiaceae (Labiatae)	*Mentha asiatica Boriss.*	Horse mint	Perennial forb
10	Apiaceae (Umbelliferae)	*Foeniculum vulgare Mill.*	Sweet fennel	Perennial forb

Selected nectar plants were introduced into existing vegetable farming systems in Hissor and Kulob regions of Tajikistan and in the Isiqul region of Kyrgyzstan in collaboration with NARS and local farmers. In addition, nectar plants were also introduced into cotton fields in the Hissor region of Tajikistan. Specifically, mixed nectar plant strips (100 m long and 2,4 m wide) were setup in two vegetable crop fields and one cotton field (see photos on next page).

The main objective was to demonstrate to farmers the advantages of flowering plant strips for natural enemy conservation and their impact on pest suppression in vegetables and cotton through a Farmer Field School approach. The study demonstrated that flowering plants attractive large numbers of natural enemies in comparison to control fields. The most abundant natural

Photos of nectar plants.

enemies included: *Coccinellidae, Nabidae, Anthocoridae, Syrphidae, Tachinidae, Chrysopidae, Vespidae, Sphecidae, Ichneumonidae, Braconidae, and Chalcidoidea* (See details in Table 2 on the next page). The field trial also examined the distance into the field in which suppression of key herbivores occurred including cotton bollworm *(Heliothis armigera Hb.*), spider mite *(Tetranychus telarius L.)* and cotton aphids. The data are under analysis and results will be reported as separate articles by the end of 2009.

Flowering nectar plants.

Capacity Building Activities

The concept of landscape ecology and biodiversity was extended to farmers and other stakeholders during 2009 through a training program and two Farmer Field Days to show farmers the advantage of biological control approaches in comparison to chemical methods (Described in the training section of this report).

Attractiveness of Flowering Plants Strips to Natural Enemies in Vegetable Fields in Tajikistan, 2009

Table 2. List of plant species established at the nectar plant strip in Tajikistan, 2009.

##	Family	Genus and species	Common Name	Plant Type	Predominant beneficial insects attracted by nectar plants	Taxon	Attacked to insects pest
1					Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata* *Scymnus nigrinus* *Exochomus flavipes* *Stethorus puctillum*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger* Orius sp.	Aphids, cotton bollworm, spider mite
					Nabidae	*Nabis palifer*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Hymenoptera (Parasitic wasps)	Ichneumonidae Braconidae Aphidiidae Chalcidoidea	To many caterpillars moth, eggs, leafrollers
					Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite
					Mantidae	Mantidae s	Hunting to many insects pest
	Apiaceae (Umbelliferae)	*Anethum graveolens L.*	Dill	annual	Odonata	Odonata	Hunting to many insects pest
2	Apiaceae (Umbelliferae)	*Coriandrum sativum L.*	Coriander	annual	Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata* *Scymnus nigrinus* *Exochomus flavipes* *Stethorus puctillum*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger*	Aphids, cotton bollworm,

						Orius sp.	spider mite
					Nabidae	*Nabis palifer*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Hymenoptera (Parasitic wasps)	Ichneumonidae Braconidae Aphidiidae Chalcidoidea	To many caterpillars moth, eggs, leafrollers
					Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite
					Mantidae	Mantidae	Hunting to many insects pest
					Odonata	Odonata	Hunting to many insects pest
3					Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata*	Aphids, scale insects, spider mite
					Anthocoridae	Orius niger	Aphids, cotton bollworm, spider mite
					Nabidae	*Nabis palifer*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Hymenoptera (Parasitic wasps)	Ichneumonidae Braconidae Aphidiidae Chalcidoidea	To many caterpillars moth, eggs, leafrollers
	Asteraceae (Compositae)	*Calendula officinalis L.*	Marigold	annual	Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite
4	Lamiaceae (Labiatae)	*Ziziphora interrupta Juz.*	Interrupta	forb	Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger*	Aphids, cotton bollworm, spider mite
					Nabidae	*Nabis palifer*	Aphids, cotton bollworm, spider mite

					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Hymenoptera (Parasitic wasps)	Ichneumonidae Braconidae Aphidiidae Chalcidoidea	To many caterpillars moth, eggs, leafrollers
					Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite
					Odonata	Odonata	Hunting to many insects pest
5	Lamiaceae (Labiatae)	*Ocimum basilicum L.*	Sweet basil	forb	Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger*	Aphids, cotton bollworm, spider mite
					Nabidae	*Nabis palifer*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Hymenoptera (Parasitic wasps)	Ichneumonidae Braconidae Aphidiidae Chalcidoidea	To many caterpillars moth, eggs, leafrollers
					Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite
					Odonata	Odonata	Hunting to many insects pest
6	Balsaminaceae	*Impatiens balsamina L.*	Balsam	forb	Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger*	Aphids, cotton bollworm, spider mite
					Nabidae	*Nabis palifer*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids

					Hymenoptera (Parasitic wasps)	Ichneumonidae Braconidae Aphidiidae Chalcidoidea	To many caterpillars moth, eggs, leafrollers
					Chrysopidae (Lacewings)	Chrisopa carnea	Aphids, scale insects, spider mite
7	Asteraceae (Compositae)	*Pyrethrum carneum*	Pyrethrum	forb	Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite
8	Asteraceae (Compositae)	*Achillea filipendulina Lam.*	Fernleaf yarrow	Perennial forb	Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger* *Orius sp.*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Hymenoptera (Parasitic wasps)	Ichneumonidae Braconidae Aphidiidae Chalcidoidea	To many caterpillars moth, eggs, leafrollers
					Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite
9	Lamiaceae (Labiatae)	*Mentha asiatica Boriss.*	Horse mint	Perennial forb	Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata* *Stethorus puctillum*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger* *Orius sp.*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Hymenoptera (Parasitic	Ichneumonidae	To many caterpillars

					wasps)	Braconidae Aphidiidae Chalcidoidea	moth, eggs, leafrollers
10	Apiaceae (Umbelliferae)	*Foeniculum vulgare Mill.*	Sweet fennel	Perennial forb	Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite
					Coccinellidae (Lady beetles)	*Coccinella septempunctata* *Adonia varigata* *Scymnus nigrinus* *Exochomus flavipes* *Stethorus puctillum*	Aphids, scale insects, spider mite
					Anthocoridae	*Orius niger* *Orius sp.*	Aphids, cotton bollworm, spider mite
					Syrphidae (Syrphid flies)	*Paragus sp.* *Scaeva sp.* *Sphaerophoria sp.*	Aphids
					Hymenoptera (Parasitic wasps)	Ichneumonidae Braconidae Aphidiidae Chalcidoidea	To many caterpillars moth, eggs, leafrollers
					Chrysopidae (Lacewings)	*Chrysopa carnea*	Aphids, scale insects, spider mite

Activity 1.2: Design and publish a brochure/booklet on landscape ecology and habitat management in Russian language.
Start/End Date: January 1, 2009 – June 30, 2009

Based on the results of our research on flowering plants in 2007-2008, we developed and published an extension bulletin titled "Introduction of native flowering plants in agro-landscapes for attracting beneficial insects." Saidov N., D. Landis, A. Fiedler**,** M. Bouhssini, V. Nazirov, A. Jalilov in May 2009, Dushanbe, 12 p. *in Russian language.* This extension material was disseminated to targeted farmers in Tajikistan and Kyrgyzstan as well as during the Third Central Asian IPM Forum held June 1-2, 2009 in Bishkek, Kyrgyzstan.

Objective 2. Enhance efficiency and increase product lines of Central Asian biolaboratories

Activity 2.1. Estimate the best methodology of application of predator mites on cotton against spider mites.

Efficacy of *Amblyseius mckenziei* against *Tetranychus urticae* in cotton (October – November 2008)

Material and methods
Field trials were conducted in September 2008, in Andijan Province on a 500 m^2 cotton field during the time that the cotton plant was in the flowering stage to boll formation. Spider mites were scouted on a 1 ha area on the field according to Beglyarov's method (**1**), and the number of spider mites per 1 m^2 was determined to be 150 -170, a level 1 infestation (>25% leaves damaged). The field was then divided into 6 by 100m^2 plots. *Amblyseius mckenziei* (*Neoseiulus barkeri*) Hughes was reared in the laboratory for the field release. The releases were made at different predator:prey ratios as follows: 1:2, 1:5, 1:7, 1:10, and 1:20, with an equivalent use rate of 7500, 5000, 2100, 1500, and 1000 per 100m^2. Field monitoring was conducted randomly with the leaves of 1 plant carefully inspected with a 20X magnifier every 10 meters. Some leaves were collected at the same time for further examination in the laboratory under a binocular microscope. Data were analyzed using analysis of variance using MS Excel.

Field trials were conducted August 2008 in Kyrgyzstan's Osh Region (left) and July-August 2008 in Uzbekistan's Andijan Province (right) during cotton flowering. Ambliseius were released from 3 l jars.

Results and discussion

Predatory mites of the Acari family Phytoseiidae fauna are common generalist predators in many agroecosystems, but little attention has been paid to their potential as biological control agents. The functional response of *A. mckenziei* on *Tetranychus urticae* Koch has been described in several papers (**2**, **3**) conducted a predation experiment with this *Amblyseiu*s species on *T. urticae* under laboratory condition, showing the significant increase of *A. mckenziei* predation rate on paper leaf discs when providing all stages of *T. urticae*.

T. *urticae* is one of the main pests of Central Asia cotton. In Uzbekistan, it develops on cotton in the summer and outbreaks become apparent in July-September from the cotton plant's flowering stage until its defoliation. Beglyarov et al. (**1**) provided evaluation levels for spider mite infestation based upon the appearance of damaged leaves: 0 is no damages; 1 is 25% of leaves infested (low infestation); 2 is 25-75% of leaves infestation (moderate infestation); 3 is more than 75% of leave infested (high infestation).

Field releases were made at different predator:prey ratios of *A. mckenziei* for spider mite control in the cotton plots in the Andijan region. The predators were supplied by scientists at the Kyrgyzstan Biological Center and from a colony we established on *A. farris* at a biolaboratory in Tashkent. We estimated the optimal predator:prey ratio to be 1:7 and 1:10, with an equivalent use rate of 25 and 20 predator mites per plant at a pest density of 150-250 individuals per plant. Pest numbers declined 7-10 days following these releases. By the 15th day following release, the number of pest mites was reduced by half, and after 20 days, very few spider mites were found. After 30 days, there were no pest mites found in the plots, but the *Amblyseius* predators disappeared as well. Those plants receiving releases at the 1:25 predator:prey ratio had the number of spider mites reduced to 97 mites/plant after 12 days, 75 mites/plant after 20 days, and very few pest mites were found after 30 days. The best efficacy can be achieved when applying *A. mckenziei* when the spider mite population in cotton fields is very low.

The fields were monitored weekly by collecting leaves and counting the number of spider mites per leaf. It was established that the optimal predator:prey ratio of predator mite application at pest density 300 - 400 per plant is 1:7. After 6 days the number of *T. urticae* was significantly greater on the control plants than on the *A. mckenziei* treated plants. Further, at the greatest *T. urticae* densities, more predators (predator:prey ratios of 1:2, and 1:1) needed to be released to reduce the spider mite densities.

References

1. Beglyarov G.A., Vasiliev R.A., Hloptseva R.A., 1967, Methodological recommendations on mass rearing of *Phytoseiulus sp.* and test for its efficiency against spider mites, "Selhozizdat", Moscow, P.24.

2. Akimov I.A., Kolodochka L.A.(1991) Predator mites in greenhouse, "Naukova Dumka", Kiev, P.143.

3. Fan Y.,Pettit F.L. 1994. Functional response of *Neoseiulus barkeri* Hughes on two-spotted spider mite (Acri:Tetranychidae) Experimental and Applied Acarology 18(10): 55-56.

Activity 2.2. Colonization of spider mites in laboratory conditions: Study the effect of the predator mite *Amblyseius cucumeris* on development of spider mites *T. urticae*. (November, 2008, September, 2009)

Materials and methods

In order to establish a stock culture of spider mites, *T. urticae* were collected from cotton leaves gathered in the Fergana Valley, Rishtan District, in October 2007 and August 2008. Ten kidney beans were planted in the laboratory. When the plants had three leaves, the leaves were randomly infested with spider mites. The mites were counted every 24 hours. On the 12th day after infestation, mixed stages of *T. urticae* were transferred onto a rearing unit consisting of an uninfested kidney bean leaf placed on a moistened cotton pad laid on the top of a 0.5 cm sponge in a 15 cm diameter Petri dish. The Petri dishes were kept in an incubator set at 28±1ºC and 60±5% RH. Water was added to the rearing unit when necessary to provide humidity. Predator mites were transferred to the rearing units with a fine brush from a colony maintained on bran infested with *A. farris* (flour mites), and longevity and fecundity determined. After infesting the plants, adult mites were transferred onto healthy kidney bean leaves resting in moistened cotton pads laid on the top of a 0.5 cm sponge in a 15 cm diameter Petri dish to maintain leaf vitality. The Petri dishes were kept in an incubator set at 28±1ºC and 60±5% RH. Water was added to the rearing unit when necessary to keep the cotton pads moist. Senescing leaves were changed by placing the old leaves with mites on top of new ones. The number of *T. urticae* provided was 50 adults per leaf. Then 1, 3, 5, or 10 *Amblyseius cucumeris* females were introduced. There were three replicates per predator density. The experiment was conducted during three generations of *A. cucumeris* development on *T. urticae*. This procedure was done for first generation of *A. cucumeris* female development.

Results and discussion

Table 1 indicates that *A. cucumeris* developmental time and longevity during the three generations are different (Table 1). *A. cucumeris* had a longevity period of 15 to 20 days for the first generation, 20 to 23 days for the second, and 25 to 27 days for the third generation, demonstrating increasing longevity with continued rearing on the same prey. The oviposition period was increased from 9 days in the first generation to 17 days in the second and third. The predator mites laid their eggs randomly on the leaf surface.

Table 1. Effect of *T. urticae* on the development time, oviposition and longevity of *A. cucumeris* at 27 ºC during three generations.

		Developmental time (days)					
Generation	Number	Egg+larvae	Proto-nymph	Deuto-nymph	Total	Ovipo-sition period (days)	Longevity (days)
First	30±0	3,15±0,1	2,12±0,11	2,65±0,06	7,92±0,31	10±1,73	20±2,65
Second	30±0	2,87±0,06	1,96±0,08	2,42±0,05	7,25±0,17	17±2,65	23±1,73

Third	30±0	2,76±0,1	1,67±0,05	2,53±0,06	6,96±0,21	17±2	27±1,15

Mean *A. cucumeris* eggs laid in each generation also differed in subsequent generations (Table 2). During the three generations, we observed that all eggs hatched within 1-2 days and the life cycle was completed on average between 6.5 and 7.5 days. Females laid their first egg 2-3 days after adult emergence. The average number of eggs laid per female from the first to third generation was not significantly different per day but increased from 17 to 27 eggs during a female's lifetime. These results suggest that the development of *A. cucumeris* on *T. urticae* greatly improved from first to the third generation during colony establishment. This study of *A. cucumeris* colony establishment on spider mites during successive generations should be continued for additional generations in the future.

Table 2. Average number of eggs laid by *A. cucumeris* females fed on *T. urticae* at 27 ºC during three generations.

Generation	Number	Number of eggs per female per day	Total number of eggs per female
First	30±0	1,96±0,01	17
Second	30±0	1,67±0,58	21
Third	30±0	1,77±0,69	27

Activity 2.3. Study the survivor ability of predator mite *A. cucumeris* during the winter time.

Overwintering survival of the predator mite *A. cucumeris* (December-February 2009)

Materials and methods

Pollen of sage (*Salvia officinalis*), thyme (*Thymus serpyllum*), camel's-thorn (*Alhagi pseudalhagi*), poppy (*Papaver tatricum*), Mallow (*Malva parviflora*), and the orchard trees cherry (*Cerasus vulgaris*), apple (*Malus domestica*), and apricot (*Prunus armeniaca*), were collected from flowers of these species during spring and summer of 2007 and 2008, and taken to the laboratory of the Botanical Institute of the Uzbek Academy of Sciences. The pollen cones were spread out onto paper and air-dried for 3 days. The pollens were then separated from the pollen cones with a 1 mm plastic mesh to remove large debris followed by separation with a fine mesh to remove all remaining debris. The pollens were then placed into 1.5 ml glass tube vials

and stored at approximately –20ºC. Bee pollen was bought in the commercial market and cleaned of debris with 1 mm plastic mesh 1 mm, and then treated in an oven for 3 hours at 60ºC.

Three liter jars containing 300 g of bran were inoculated with 500 flour mites (*Acfrus farris*) and 100 *A. cucumeris* for the experiment. To determine predator development and survival ability, 100 g of bran with 1 g of each type of pollen was introduced every day, 100 flour mites, and 50 adult female *A. cucumeris* were placed in 1l jars, and maintained at constant laboratory conditions of 27ºC, 65±5% RH, and 16L:8D photoperiod in growth chambers.. Newly hatched *A. cucumeris* larvae were transferred into 1 liter jar containing 150 g of bran and *A. farris*. Every other day 1 mg of pollen grains was added to each 1 liter jar. Thus in the first step, we used two 3 liter jars; in second step, ten 1l jars; and in third step, also ten 1l jars. The developmental stage of all individuals was recorded every 2 hours. Adult longevity was determined by transferring newly molted females and males reared on specific pollen in 1l jars containing 150 g bran with grain mites and fed the same pollen as that used during immature development. The number of flour mites was calculated according to Chumak's method (**4**) by randomly taking samples of bran with pest mites from several places in the container and placing them into the bottle to obtain a total amount of 50 cm^3. The bottles with bran and mites were covered with fabric and turned upside down for 10-12 hours. The number of mites gathered on the surface of the stopper is estimated to be the flour mites' density in 50 cm^2. The number of predators in the substrate was estimated by counting the number of females in a 3-5 cm^3 sample placed into a Petri dish.

A. cucumeris survivorship was recorded daily.

Results and discussion

Table 3 presents the development time of immature stages of *A. cucumeris*. The developmental times did not differ significantly among the different pollens except for the mallow pollen. The total development time of predators reared with pollens of wild and orchard plants was shorter than for those reared with mallow pollens and on flour mites only. It is possible that not all pollens are as efficient a supplemental food for *A. cucumeris*. The total development time also differed when reared on prey with pollen and on prey alone. *A. cucumeris* developed from eggs to adult stage faster on sage, thyme, and camel's thorn pollens and significantly faster with pollens of orchard pollens than with mallow and the prey as food.

Table 3. Mean development time (days) of different stages of A. cucumeris reared on pollen of native fruit orchard plants and bee pollens.

Species	egg-larva	Protonymph	Deutonymph
Sage	2,89±0,04	1,75±0,12	2,32±0,07
Thyme	2,52±0,14	1,50±0,09	2,24±0,12
Cam.th.	2,66±0,10	1,58±0,04	2,47±0,09
Poppy	2,31±0,09	1,29±0,07	2,15±0,07
Mallow	3,09±0,05	2,05±0,11	2,60±0,03
cherry	2,07±0,05	1,42±0,10	2,31±0,05
apple	1,89±0,07	1,14±0,13	2,07±0,08
apricot	2,09±0,09	1,28±0,07	2,16±0,08
Beepolen	3,04±0,10	1,89±0,04	2,29±0,23
Control	3,11±0,06	2,06±0,06	3,18±0,07

A. cucumeris reared from larva through the adult with pollens of orchard and wild plants as well as bee pollen lived longer than those reared with mallow pollen of mallow plant or on its flour mite prey alone (Table 4). Pollens tested as a supplemental food significantly affected the predator's developmental time and adult longevity. Adult longevity was longer with pollens especially of cherry, apple and apricot than on *A. farris* only.

Our experiment also suggested a significant effect on oviposition of *A. cucumeris* (Table 4) when compared to control variance (without pollens). *A. cucumeris* oviposition was higher when any pollen was supplied. The maximum number of eggs laid did not exceed one egg per female per day. However, *A. cucumeris* egg and immature production per day increased over 30 days when 1 mg of plant and bee pollen was supplied daily.

Survivorship during immature development was noticeably more when presented pollens from wild plants. Pollens from thyme, camel's thorn and poppy seemed to improve survival, but greater egg-laying was noted with pollens of thyme, cherry, apple and apricot. *A. cucumeris* survival was increased to 25-33 days in the presence of pollen, confirming that this predator mite species is indeed a facultative feeder.

Table 4. Longevity, survival and daily fecundity (days) of adult *A. cucumeris* at 27ºC with addition of plant and bee pollens.

Species	Adult longevity	Oviposition	Eggs/day	% survival
Sage	26,33±1,53	20,67±2,08	1,23±0,25	98
Thyme	27,33±1,53	28,67±1,53	1,47±0,25	100
Cam.th.	27,67±1,53	21,33±1,53	1,63±0,31	100
Poppy	24,67±2,52	17,67±3,06	1,37±0,15	100
Mallow	19,33±2,52	14,33±2,08	1,07±0,12	93 96
cherry	29,33±2,08	25,00±2,00	1,2±0,1	95
apple	29,67±2,08	25,67±0,58	1,4±0,17	95
apricot	31,33±1,53	28,33±1,15	1,37±0,15	97
Beepolen	23,67±1,15	20,67±1,53	1,47±0,15	
Control	18,00±1,73	14,33±2,52	1,07±0,12	96

References

4. Chumak P.Y. The features on Amblyseius sp. rearing and usage to control thrips. 2006. Plant protection, №12: 18-19:

5. Rashidov M.I., Boltaev B.S. (2008) Integrated plant protection and its prospects on vegetable and potato crops, Proceedings of papers of International scientific applied conference, "Prospects of biocontrol application in plant protection against pest organisms in agriculture", Tashkent, P. 343-346.

6.Suleimanov, B.A. 2008. Biological control of whiteflies in protected culture. pp.133-134, In: Proceedings of paper International conference. 6-7 November, 2008, Almaty-Rahat, Kazakhstan.

7.Rashidov M.I. 2008. Problems of pest control on vegetable crops in the stage of current plant protection. pp. 6-46, In: IPM in vegetable crops. Min.sel.hoz, TashGAU, Tashkent, Uzbekistan.

Activity 2.4. Review literature and study the effect of *A. cucumeris* on whitefly and aphids development in greenhouses in vegetable crops (March – May 2009)

The whitefly *Trialeurodes vaporariorum* Westw (Homoptera:Aleyrodidae), also known as the greenhouse whitefly, is the most economically important arthropod pest on greenhouses crops in

Uzbekistan. Although pesticides are applied to control the pest, after some time the whitefly populations rapidly increase to exceed economic thresholds. There are many publications in the literature indicating the role of biocontrol agents in suppressing *T. vaporariorum* to the levels required for greenhouse crops, but additional studies are needed for promising new biological control agents applicable to Central Asia.

At the biolaboratories of Tashkent Agrarian University, a group of scientists have been conducting research on the predatory bug *Macrolophus nubilis* H.S. and the parasitoid *Encarsia formosa* Gah. (**5**). *E. formosa* kill immature whiteflies both by laying an egg inside of the nymph, providing food for their young, and by killing the nymph and feeding on the fluids inside of it (**6,7**). *M. nubilis* feed directly on the whitefly nymphs.

Greenhouse field trials were conducted on tomato plants in the Tashkent province of Uzbekistan. Before the experiment, observations were made on tomatoes in plastic plots in the greenhouse to estimate the level of greenhouse whitefly infestation. It was estimated that the whitefly infestation was very low (>1 pest per plant). The study was conducted on 25 March, 2007; 1 April, 2008; and 20 March, 2009, when the tomato plants began flowering and were approximately 25-30 cm tall. *A. cucumeris* were released on an area of 500 m^2 that was divided into 5 plots. The predatory mites were released once a week at rates of 5, 10, 20, or 30 individuals per m^2 in order to establish predator:prey ratios of 3:1, 1:1; 1:2 and 1:1.

The whitefly population density was determined in each row of each plot by examining a top, middle and bottom leaf daily, and collecting 2 leaves per tomato plant weekly. Each leaf was examined under a dissecting microscope, and the number of whitefly eggs, nymphs and pupae were recorded. The experiments were carried out for 35 consecutive days. Analysis of variance was used to analyze the data using MS Excel.

Average number of whiteflies per plant was reduced relative to the no release control in both the laboratory and field studies for the 35-day post release period.

The average number of whiteflies per plant at release ratios of 3:1, 1:1, and 1:2 were reduced relative to the no release control in both the laboratory and field studies for the 35 day post release period. However, whitefly egg densities continued to increase following the release at all release ratios and in the no release control. The 3:1 release ratio provided the best control in both the laboratory and field study (Table 5).

Table 5. Changes in the number of whitefly eggs per plant in the greenhouse over time in response to different initial *A. cucumeris* release ratios.

Days	Number of whitefly eggs/plant			
	Control	Predator:prey ratio		
		3:1	1:1	1:2
5	5-7	3-7	3-6	5-6
10	15-17	5-7	5-9	7-9
15	25-27	9-11	13-16	19-22
20	33-36	10-12	23-25	27-30
25	53-55	9-11	25-29	33-36
30	72-76	9-11	33-36	47-50
35	95-107	10-12	50-52	51-53

Also, during June-July 2009, Dr. Tashpulatova found 10 articles and 20 abstracts regarding biology and use of *Amblyseius* species predator mites as biological control agents.

Activity 2.5. Laboratory experiments on vegetable plots in Uzbekistan and Kyrgyzstan regions.

Dr. Tashpulatova received 10 pheromone traps for *Helicoverpa armigera* from the IPM CRSP HQ which were produced in India at Pest Control Pvt. Ltd. PCI, Division: Bio-Control Research Laboratories (BCRL). In a field experiment, her group tested effectiveness of pheromone traps produced in India in comparison with triangular Uzbekistan pheromone traps made at the Tashkent Institute of Bioorganic Chemistry. The traps from Uzbekistan are traditionally used by farmers in cotton production areas, but are rarely used in tomato crops in any Central Asian countries. Moth samples were counted every 24 hours. Five of the Indian pheromone traps where tested on 25 ha of tomato fields in Namangan region and 5 on 50 acres in the Tashkent. Traps in the Namangan region were counted from June 25 through July 5, and in the Tashkent region from June 28 through July 20. Fruit worm were present in all of the tomato field plots.

More moths were caught with the Indian traps. The average number for the first sampling date was 56 individuals, whereas the Uzbekistan traps attracted on average 3 moths per night. However, moths were attracted on only 5-6 days in the Indian pheromone traps as compared to 20-23 days for the traps made in Tashkent. The total number of moths caught in the Namangan region with the imported Indian traps was on average 232 individuals, compared with 23 in the local traps. Only male fruitworms should be attracted to the traps, but the team noticed some differences between *Helicoverpa armigera* captured in the Namangan and in Tashkent regions.

Table 1. Attractiveness of Indian pheromones produced in India in comparison to those produced in Uzbekistan in tomato fields in the Namangan region.

Plot number	Sampling dates										Total	
	26.06.2009		27.06.2009		29.06.2009		30.06.2009		01.07.2009			
	Number of moths per trap											
	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**
Plot 1	53	3	57	2	34	5	10	2	7	3	211	18
Plot 2	57	2	59	-	42	2	16	3	6	2	232	11
Plot 3	56	-	60	1	47	3	15	5	5	3	238	15
Plot 4	55	2	53	2	42	-	33	1	9	5	239	13
Plot 5	59	1	57	3	41	1	25	2	9	-	236	8

*Indian pheromones

**Uzbekistan pheromones producer is Uzbekistan Bioorganic Research Institute, Tashkent, Uzbekistan.

Table 2. Attractiveness of Indian pheromones produced in India in comparison to those produced in Uzbekistan in tomato fields in Tashkent region.

Plot number	Sampling dates										Total	
	19.06.2009		22.06.2009		24.06.2009		26.06.2009		01.07.2009			
	Number of moths per trap											
	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**
Plot 1	35	-	52	2	23	1	16	2	-	2	133	8
Plot 2	60	3	50	-	32	3	20	2	1	4	161	7
Plot 3	53	2	57	3	30	-	25	2	5	3	181	6
Plot 4	57	1	49	2	35	4	19	-	3	1	172	10
Plot 5	55	2	57	4	46	2	34	3	-	1	207	15

The team also received 10 blue sticky traps from the IPM CRSP HQ to evaluate for thrips monitoring in tomato fields in the Tashkent region. Observations of the experimental field plots were conducted every 24 hours during 10 days. There were no thrips found after 10 days of checking the sticky traps, but the traps attracted some other small flying insects and a few beneficial insects including ladybird beetles, syrphid flies, lacewings, etc.

Objective 3. Develop and implement IPM extension/outreach and university education programs

Activity 3.1: Implementation of IPM training programs for faculty and advisory groups at Kyrgyz Agrarian University

(1) One of our key objectives was to analyze the working programs of the basic agrarian high schools that were accessible to us in Uzbekistan, Kazakhstan, Tajikistan, Russia and other former Soviet Union countries with a specialty in entomology in biological pest management as well as courses on agroecology and a summer ecological school.

We were unable to get access to the Tashkent state agrarian university's working program on entomology course and biological pest management. However, we were able to do significant work; in particular we have analyzed working programs on the above-stated specialty from the Kazakh national agrarian university, the Tajik agrarian university, Belarusian state agrarian university, the Russian state university named after A.I. Herzen, the Russian state agrarian university named after K.A. Timirjazev, the Kemerov state university, and a local university. Because the economic status and organization of the states including agricultural direction has changed, all working programs have essentially changed, and their maintenances reflect the direction and needs of the states.

The analysis of the maintenance of collected working programs was conducted by a working group under the direction of Dr. Dzhunusov K.K. from the Kyrgyz agrarian university (KAU). The working group met five times with the director of the biolaboratory of Kyrgyzstan and the dean of agronomical faculty about opening on the basis of the Kyrgyz agrarian university in 2010, a specialization of Agronomy with specialization biological protection of plants. The biolaboratory director of the Kyrgyz Ministry of Agriculture is interested in classes and the expertise from the Central Asia IPM CRSP project. The effort to open entomology and plant protection departments remains open because of absence of scientific expertise in this narrow area.

As part of Phase 2 of the IPM CRSP Central Asia Project, KAU management plans to take further steps in 2010-2011 and has charged the project and working group to prepare corresponding educational documents for legalization in the Ministry of Education and to prepare posters for distribution through the KAU website, also in republic high schools. The future department will be called Entomological and Biological Protection of Plants. This new department will prepare experts to be agriculturist with specialization in the biological protection of plants. This special study program with specialization will begin with four courses. We estimate 10 to 12 students will pass intensive study curriculums on the basis of the biolaboratory of the Ministry of Agriculture and KAU. The working group has specifically suggested a special summer ecological school be included.

The summer biological practices training has ecological emphasis and will allow students to implement individual work on a specific narrower theme related to the research objectives (for example, learning the impact of ecological features). Or, students may study an environmental problem such as the influence of one of the factors of environment and anthropogenic loading, in particular, on dynamics of any morphological or bioceonotic changes of ecosystem components.

(2) On October 1, 2008 a meeting and discussion on the Field School of Students Results for Years 2007-2008 took place at KAU. The director of agroengineering faculty prof. Karabaev, Dr. Zhunusov, prof. Ashimov K and prof. Ergesheva K.E. and third year students of agronomical faculty participated. We discussed:

- Successes and weaknesses of SFS in the years 2007-2008.
- The admission of students for SFS for years 2008-2009.
- Subject matter of SFS.

Advantages and disadvantages of SFS during 2007-2008

Advantages	Disadvantages
• SFS is a new program for both for students and KAU; Each student is the experimenter himself; • Students are trainee; • Students see the mutual relationship of plants and insects; • Have seen pests and diseases of a tomato and used biomethods (bordeaux, immunostimulant, pheromones) • Agroecoanalysis; • Have participated in managing IPM at the SFS; • The actual materials were collected for student's graduation paper; • Everyone has his/her own task as we work toward common goals as a team. • Learned about seed germination and energy of germination	• Not activity of students; • Lack a specialist-teacher of entomology; very short course on entomology; • Weak training of teachers; • Not completely understanding the significance of nectar plants; • Not enough experience and experimenting with plant pesticides; • Not enough practice with weed management; • Not enough laboratory research

Students with Dr. Aitmatov after touring their plantings with IPM Forum participants.

We are optimistic there can be improvement in the SFS because there is interest by international projects in the SFS results, KAU is developing related programming and we may be able to use SFS results at a Farmer Field School as consulting services.

The main objective of opening the SFS with KAU was:

- To involve students in scientific work through field schools of students;
- To create the a base of study at KAU to prepare students for a Masters in the field of IPM;
- To involve students in creating and initiating a Student Field School (SFS) on the Integrated Protection of Plants (IPP) at Kyrgyz Agrarian University (KAU): its approaches, methods, and necessary tools of management, as well other important skills, knowledge which are required from the Trainer of Field School of Farmers on IPP at carrying out not the big experiments for farmers and training of adults (SFS Program is applied)

(3) From November 2008 until March 2009, six students from the third year course of agronomical faculty passed the planned studies and have been doing scientific research on the farm of Tazhamatova K.K. under the of Dr. Ergeshovoj K.E. and Aitmatov of M. For the general

studies, students learn general and agricultural entomology along with the methodology of conducting scientific IPM research. The student's practical training includes conducting experiments on IPM of tomatoes. Students enhance their skills and knowledge along with adults by conducting the experiments, supervising certain aspects, discussions and decision making.

With the knowledge they have gained from their experiments, students will participate at student conferences at high schools in the city of Bishkek in the end of the second year of training. Every week on Wednesday in the afternoon, six students study at winter school courses of SFS on IPM.

Cultivating agricultural crops, especially vegetables, depends on exogenous factors such as temperature, light, water, quality and properties of soil, and also a choice of steady grades. These are very important factors for farmers to weigh, however many are not aware of the implications for cultivation of vegetable crops, especially early grades. For this reason, we have made the following experiments on SFS with students.

As an alternative to a chemical method seed treatment of vegetable crops on KAU SFS, we have used infusions of vegetative pesticides: a wormwood, garlic and 3 % (3gr. on 1 liter of water) KMnO 4 (a solution manganese sour kali). Such alternative treatments offer the advantage of vegetative preparations with less toxicity (safer) for people, animals and environment in the recommended concentrations, and their toxicity is less persistent in the environment. The crushed vegetative raw materials are put in a clean, dry, enameled dish; filled with boiled water and allowed to cool for 45 minutes; then filtered through layers of gauze. Next the vegetable crop seeds are placed in fabric sacks and slowly released to the infusions of the vegetative pesticides and held in it for 25 minutes. From one weight part of vegetative raw materials, we got 10 volume parts of infusion.

Seeds can be protected from the fungi (which are transferred through soil) and from caterpillars (winter cutworm) by treating seeds with crushed garlic. The pungent smell of the garlic deters insects and birds, and helps prevent disease. Students made a garlic infusion for this purpose. With 1 liter of water, we mix 5-10 gr. of crushed or grated garlic cloves. Sacks of seeds were soaked in the infusion for 20-30 minutes. Unprocessed seeds of a tomato served as the control.

The next stage of work in SFS was devoted to testing temperature conditions of different types of hotbeds during the winter months. We chose three kinds of hotbeds to test for suitability of cultivating vegetable sprouts and plants in extreme conditions. The three hotbed types are:
Type 1) The Land warm hotbed, which uses a mound of fresh cow manure stacked with scraps of straw from alfalfa hay. The width of a stack is 50 sm, height of 50 sm. The stack is covered with thick polyethylene film. Distance between layers is 10 centimeters.
Type 2) The common hotbed, which has a depth 50 centimeters covered on top with two double layers of polyethylene film. The distance between layers is 20 centimeters.
Type 3) The deep, warm hotbed has a depth of 70 centimeters and the bottom of the hotbed is filled with fresh cow manure the Lucerne rests of 50sm, and is also covered with biserial polyethylene films. The distance between layers is 30 centimeters.

After preparing the hotbeds as described above, processed seeds were placed separately in different hotbeds.

During October 2008 through March 2009, we measured the temperature of the top and bottom layers of the hotbed film twice a day (morning and evening) with thermometers.

The results show that in the hotbed №1, the average air temperature of the top layer in December was 4.6 ˚C, the mean air temperature of the bottom layer was 6.3 ºC, whereas in hotbed № 2 and 3, 2. 9ºC, 4.1 ºC and 3.3ºC, 4.7 ºC accordingly. It is necessary to notice that in the top layer of the hotbed № 2, we noticed negative temperatures (-3.3 ºC) in the morning measurement, and by the evening the temperature in the bottom layer was + 3.3 ºC. There was also interesting data concerning the air temperature in the top and bottom layers of a hotbed in January. In contrast to the indicators shown in December, in January we noticed a considerable rise in temperature of the top layers of all hotbeds, in comparison with the bottom layers and accordingly the temperature in a hotbeds: № 1 at 5.3 ºC, № 2 at 6.5 ºC, № 3 at 5.9 ºC, whereas the temperature in bottom layer reached to 5.5 ºC, 2.2 ºC and 3.9ºC. While, in March on the first type of hotbed, there was a temperature much more above than in others.

In February we observed the considerable rise in temperature in the bottom layers of a hotbed and average index was in № 1 9,9 ºC, № 2 5,7 ºC and № 3-7,4 ºC accordingly.

As a result of this data we can draw the following conclusions:

- One can use all types a hotbed (№№ 1, 3) for cultivating sprouts and early vegetables of thermophilic crops, and also greenery. Experiments will be continued on the second phase of the project and will be recommended to CEC (Advisory Training Center)
- Cold-resistant vegetables can grow in winter, earlier - in the spring and later in autumn in these above mentioned hotbeds.

On April 14, 2009, Dr. Aitmitov organized a field day for KAU teachers, students, Advisory Training Center (ATC) and farmers.

Table 1. Field day participants – totals and gender breakdown

Participants of field day at SFS									
KAU Teachers		**KAU Students**		**ATC Trainers**		**Farmers**		**Total**	
6		10		6		9		31	
male	female	male	female	male	female	male	female	male	female
4	2	6	4	5	1	4	5	19	12

All participants discussed results of the hotbed experiments with great interest. Students made four presentations. Farmers were very interested in hotbeds and the effects the different types of hotbeds can have on the condition of tomato. Thus, the Field day was instructive for farmers and other participants, and teachers have approved results of the research and have recommended participation in a KAU scientific conference.

On April 30, 2009, five students from SFS have made two reports at the International scientific conference in KAU about the project:

Report 1. Experiences of Field School of Students: The Device and Use of Kinds of Vegetative Hotbeds. Mambetova S., Temirova N., Kerimbaeva A. Students of three agronomical faculty (Ergeshova K.E., KAU senior lecturer, Aitmatov M. ICARDA-IPM CRSP).

Report 2. Experiences of Field School of Students: Influence of Vegetative Pesticides and Stimulators on Growth and Similarity of Various Grades of the Tomato. Karieva E., Abdyrasulov K., Ishimova N. Students of three agronomical faculty (Ergeshova K.E., KAU senior lecturer, Aitmatov M. ICARDA-IPM CRSP)

Student, Saiakbaeva, a participant of SFS 2007-2008, has successfully passed degree work on a theme: Developing of the students' knowledge of IPM by Students Field School. She was also was highly acknowledged by a certifying commission. Her degree work has been prepared under the direction of Masaidov B.U, M.B. Aitmatov. She participated in the IPM Short Course at Michigan State University in June 2009 and now successfully works in the consulting service ATC, as the trainee - the Master of the trainer on IPM wheat.

Activity 3.2: Transfer knowledge and disseminate information to clients

On November 11, 2008, under invitation of the NGO Ak-Terek, Dr. Aitmatov conducted a one-day training on application of a biomethod and cultivation of sprouts of tomatoes in hotbeds for farmers of NGO "Shoola" in the village Tuura-Suu of Ton district of Issyk-Kul province, Kyrgyzstan. Thirteen people (4 women) took part in the seminar. We discussed with advisers of NGO Shoola the potential for joint work and opening one FSF on IPM-tomato together with CTAI. Our project has transferred to NGO Shoola two varieties of tomato and two of pepper, and pheromone against cotton winter scoops from Scientific Research Institute of vegetable of Uzbekistan, also has recommended to grow seeds of vegetable crops in hotbeds on methods of the FSF at KAU developed through the IPM CRSP.

On December 27, 2008, Dr. Aitmatov was invited by NGO "Ak-Terek " to present a day-long training for inhabitants of the village Toluk of Naryn province, Kyrgyzstan. There were 23 farmers (14 women) who took part in the seminar. The theme was "Introducting Innovations into Activities of FSF - strengthening agro-landscapes by means of nectariferous plants."

During March 30 - April, 3, 2009, Dr. Aitmatov participated in training for trainers by the Aga Khan Foundation in southern Kyrgyzstan. Thirteen trainers (10 men and 3 women) attended. Participants learned skills for group facilitation in teaching IPM approaches.

On March 10, 2009 Dr. Aitmatov organized an exchange experience for trainers of ATC and the Japanese project JAICA from Tajikistan. Visitors were very interested in the kinds of hotbeds constructed for warming vege seedlings. Students of the SFS gave short presentations about their research results at the SFS. Five people from Project JAICA (1 man), two representatives ATC, 6 students of KAU (5 women and 1 man), two farmers (1 man and 1 woman) participated in the session. Participants received leaflets about the three components of the Central Asia IPM CRSP Project.

July 14-16, 2009 was the opening ceremony for the Center of Training of Trainers (CoToT). NGO, the Agrolead, working with potato IPM along with Dr. Aitmatov presented the CoToT concept. The seminar was attended by 53 people (see the following Table 2).

Table 2. Participants of the CoToT seminar

Aga Khan Foundatn MSDSP-KG		NGO AgroLead		Project JAICA (Japan)		FSF Trainers		HGO RAC		Biofactory		TV	
M	F	M	F	M	F	M	F	M	F	M	F	M	F
5	2	9	4	2	1	15	4	3	1	3	1	2	1

During the seminar, participants learned the basic approaches and principles of the Center of Training of Trainers.

The official meeting with the director of FAO in Kyrgyzstan, Dr. Sangiba Razhapovich, took place April 8, 2009. We discussed IPP questions and preparation together with KAU for the project on Fitiftoros of potato. The collaborators in the project are Dr. Anvar Umarovich-trainer (IPM CRSP), KAU scientists and the Agrolead NGO have been involved from Tajikistan. The first variant of the project has been written and has been sent to Tajikistan for completion.

Activity 3.3: Design and publish brochures and leaflets on various IPM issues.

1) Aitmatov M.B., George Bird, Jalilov A.U., Kasymova Kyjal. Farm Field School and ecology problem. Beatnik Kyrgyz agrarian university. № 3 (11), 2008. 10-14 pg.((in Russian)
.
Dictionaries of terminological on pest, diseases and weed:

1) Hamraev A.S., Saidov N.S., Aitmatov M. B, Azimov S.A., Ulmesbaev S. B, Tashpulatova B.A. Books: Agroentomological cartogram for Central Asia and Caucasus regions. ICARDA-Michigan and Uzbek zoology institute of academy of sciences. Tashkent, 2008. 123 p, in Russian, published copies 500 units.

2) Junusuv Kubat, Rashidov Murod, Aitmatov Murat. Russian, Kirghiz, Latin, Uzbek and English Terminological dictionary on plant protection. Kyrgyz agrarian university (Kyrgyzstan) and Tashkent State agrarian university (Uzbekistan), Bishkek, 2008. 56 pg.

Table 3. Summary of participants of the seminar, Field day and other project activities of the IPM CRSP project team based in Kyrgyzstan.

№	Activities	Participants	
		Male	**Female**
1	Student Field School (SFS)	1	5
2	SFS field day	19	12
3	Preparation of scheme of experiment for SFS	2	6
4	1st step of NGO Ak-Terek training	9	4
5	2nd step NGO Ak-Terek training	9	14
6	TOT for trainers Foundation Aga Khan	10	3
7	Project presentation for "JAICA" from Tajikistan	5	8
8	CoToT seminar	39	14
Total		**94**	**66**

Objective 4. Evaluate wheat nursery for resistance to cereal leaf beetle (CLB).

Activity 4.1. Screening of wheat varieties for resistance to Cereal leaf beetle (CLB)

Start/End Date: November 1, 2008 - July 31, 2009.

In the last decade, cereal leaf beetle (*Oulema melanopus L.)* became one of the most dangerous pests of wheat in Central Asia. During the last several years, researchers at ICARDA have selected different wheat lines with low levels of infestation to this pest. Therefore, the objectives of this study were to identify sources of resistance to cereal leaf beetle to be used in breeding programs to develop resistant cultivars to this pest. This is the second year that the IPM CRSP MSU research program and the Biodiversity and Integrated Gene Management Program (BIGMP) of ICARDA have collaborated on this project. The research plot on "Screening of wheat lines resistance to Cereal Leaf Beetle (CLB)" for 2008-2009 seasons included 130 bread wheat lines with potential CLB resistance and susceptible checks repeated after every nine entries. The wheat seeds were planted November 30, 2008, in a research plot site of Research Institute of Farming "Zemledeliya" of the Academy of Agricultural Science of Tajikistan. The local wheat variety "Sadoqat" was used as the control. The plot size was 1 running meter. The plots with numbers are 246, 446, 301, 501, 646 were culled by reason of bad sprouting.

Spring (March-May 2009) conditions were very humid and cool with approximately twice the normal amount of precipitation, creating favorite circumstances for cereal leaf beetle. Infestations in control plots were high creating the opportunity to clearly evaluate resistant lines. The following lines: Erythrospermum 13\ Erythrospermum 165; Ferrugineum 205\ Frunsenskaya 60 (2 lines); Lutescencs 42\ Odesskaya krasnokolosaya; Intensivnaya\Norin 38\\Krasnovodopadsk; Lutescencs 6300\ Ilichevka\Selinnaya 21; Frunsenskaya 60; Krasnovodopadskaya 210\ Peressvet (2 lines); Erythrospermum 1185\1; Lutescencs 1207\1 (3

lines); Erythrospermum 760\1 showed high levels of resistance to CLB. The lamina of all above mentioned wheat lines were less than 10% infected.

Moderate resistance was observed in the following lines: Erythrospermum8945\Taragi; Erythrospermum6253\2\Stoparka; Erythrospermum13\Erythrospermum 165; Erythrospermum 13\7\Stoparka; Ferrugineum 205\Krasnovodopadskaya 210; Erythrospermum13\Promin; Polucarlik 49\ Krasnovodopadskaya 210\P (2 lines); Albidium 202\2 (only 1 line); Odesskaya (3 lines); Erythrospermum 13\Obriy; Frunsenskaya60\Tardo\ Intensivnaya\Eryt.; Ferrugineum205\ Frunsenskaya 60 (2 lines); Lutescencs 42\Berezina; Polucarlik 49\ Krasnovodopadskaya 210\P. We intend to continue this study for confirmation in 2009-2010 seasons in Tajikistan.

Objective 5. Develop and implement regionalization and globalization strategy

Activity 5.1. Membership in the International Association of Plant Protection Sciences (IAPPS)

To foster networking and information access, the project has provided membership to 10 IPM specialists from Central Asia in the International Association of Plant Protection Sciences (IAPPS). These specialists include: 1) Barakanova Natalia (Kyrgyzstan); 2) Bekboeva Rosa (Kyrgyzstan); 3) Nasirov Vohidin (Tajikistan); 4) Jalilov Anvar (Tajikistan); 5) Ceiidanov Bairammurat (Turkmenistan); 6) Saparmurad Durdiev (Turkmenistan); 7) Ahror Sagdullaev (Uzbekistan); 8) Khalikulov S. Turdukulovich (Uzbekistan); 9) Dr. Galia Zharmuhamedova (Kazakhstan); 10) Dr. Mustapha El Bouhssini (ICARDA).

Activity 5.2. Facilitate participation in regional IPM meetings and forums organized by National, International NGOs and other IPM CRSP Regional Programs and Global Themes.

On November 4-8, 2008, Dr. Tashpulatova attended the Conference for the 50th anniversary of Kaz. Scientific Res. Institute of Plant Protection and Quarantine, Almaty-Kazakhstan. She made a presentation and submitted the paper “Biological control of *Thrips tabaci* (Thysanoptera: Thripidae) using *Ambliseius mckenziei* (Acarina:Phytoseiidae) on onion crop in Kyrgyzstan and Uzbekistan.”

Dr. Tashpulatova also attended the International scientific-applied conference "Application of methods of biological control in agriculture" in Tashkent, Uzbekistan on November 25-26, 2008. She made a presentation and submitted two papers: 1) “Studies of the predaceous mites *Amblyseius cucumeris* and *Amblyseius mckenziei* (Acari:Phytoseiidae) in Uzbekistan,” and 2) “Study of the possibility for introduction and application in Uzbekistan predator mites of the family Phytoseiidae.”

On September 10-11, 2009, Dr. Saidov participated in the 2nd International Conference on organic sector development in Central/Eastern European and Central Asian countries held in Tbilisi, Georgia. He presented a talk entitled: “Enhancing pest management in organic farming via conservation biological control,” N. Sh. Saidov and Douglas A. Landis. The Abstracts of oral presentations were published in the Conference CD Materials 2 p. *(in Russian).* The conference

attracted more than 250 participants from 22 countries. *All expenses related to participation in Conference were covered by conference supporter an Oxfam Novib, The Netherlands.*

During December 19-20, 2008, Dr Saidov took part in a Conference dedicated to the 60th Anniversary of Department of Biology of National University of Tajikistan in Dushanbe city. He presented a talk entitled "The role of nectar plants on attraction natural enemies in agro-landscapes," Saidov N.Sh., Landis D.A., Fiedler A., Nazirov V.K., Khalimov A. The Proceeding materials will be published in the University newsletter.

On November 7-10, 2008, Dr. Saidov participated in the 9th International Conference on Dryland Development, Sustainable Development in the Drylands Meeting the Challenge of Global Climate Change, which was held in Alexandria, Egypt. He presented a talk entitled "Landscape ecology and biodiversity to enhance biodiversity and biological pest management" Nurali Sh. Saidov and Douglas A. Landis. The abstracts of oral presentations were published in the Conference Materials on p. 82-83 (in English). The conference attracted more than 450 participants from 55 countries. *All expenses related to participation in Conference were covered by funding from Tajik Academy of Science.*

Activity 5. 3. Organize the Third Regional IPM Forum in Central Asia, Spring 2009 in Bishkek, Kyrgyzstan.

In order to foster networking and share the research results and experiences of the Central Asia IPM CRSP project, a regional IPM Forum was organized in Bishkek, Kyrgyzstan from June 1-5, 2009. This Third regional IPM CRSP Forum was co-hosted by the Kyrgyz Agrarian University and the Ministry of Agriculture, Water Resources and Processing Industry in Kyrgyzstan in collaboration with ICARDA-CAC Regional Program. Fifty-eight stakeholders (21 females and 37 males) representing various government research institutions, universities and NGOs from Kyrgyzstan, Tajikistan, Uzbekistan and Kazakhstan attended the forum program in Bishkek. Nine representatives from the U.S. including IPM CRSP Global Program, Michigan State University, University of California Davis, Ohio State University, and Montana State University attended the forum along with two representatives from ICARDA and AVRDC. This regional forum provided excellent opportunity for networking and information exchange.

The Forum program was divided in two parts. The first part included sharing of research results of Central Asia IPM CRSP program, IPM programs and experiences of various countries in the region, and stakeholders input on the enhancing IPM programs in the region and the second part was a special workshop on Pest Diagnostics. During the first part, the IPM CRSP team members gave presentations on their research and outreach programs and achievements in: (1) landscape ecology to enhance biodiversity and biological pest management, (2) enhancing the efficiency and product lines of biolaboratories, and (3) development and dissemination of IPM educational and other information in the region. In addition, government and NGO representatives from the region shared information on their IPM activities and approaches to extension/outreach to farmers.

In the second half of the Forum (June 3-4), attendees participated in a Pest Diagnostics Training Workshop. The workshop was organized in collaboration with the IPM CRSP Global Theme

program on Pest Diagnostics led by Dr. Sally Miller from Ohio State University. Twenty-two participants (10 females and 12 males) from Kyrgyzstan, Tajikistan and Uzbekistan attend this training workshop. The main training facilitators were Dr. Sally Miller (The Ohio State University) and Dr. Barry Jacobsen (Montana State University). Instructors included Dr. Miller (overview, bacterial and viral pathogens); Dr. George Bird (Nematology); Drs. Doug Landis, Mustafa Bohssini and Frank Zalom (insects and mites); and Dr. Jacobsen (fungal plant pathogens and specimen triage). Presentations included information on emerging and endemic diseases caused by fungi, bacteria, viruses, nematodes and insect pests, and beneficial organisms. There is a strong need for pest diagnostic capacity building in the region including training of scientists, extension specialists and laboratory facilities for pest diagnostics.

During the Forum program, the IPM CRSP Team members met with the Minister of Agriculture in Bishkek and visited Kyrgyz Agrarian University (KAU), IPM Student Field School at KAU, and Kyrgyz-Turkish Manas International University. It was proposed that the next regional forum be held in Kazakhstan in 2010 or 2011.

Ms. Joy Landis, IPM Communication Specialist from MSU also established a blog documenting the team's travel and meetings in Central Asia in connection with the Forum (see http://www.ipmglobal.blogspot.com/). The blog is intended to help the public understand how American science (specifically in IPM) can be leveraged to help raise the standard of living and improve the environment in countries like those in Central Asia. Blog entries feature collaborations between the people of the region and the U.S. based project team. The blog has received over 420 visitors with more than 680 page views since June 1, 2009.

Activity 5.4. Facilitate participation of IPM specialists from the Central Asia region in the MSU's International Agroecology, IPM and Sustainable Agriculture Short Course.

Mr. Ibroim Sharifov from the Agriculture Training Advisory Center (ATAC) NGO in Tajikistan, and Ms. Aidai Saiakbaeva from the Kyrgyz Agrarian University in Kyrgyzstan participated in the Agroecology, Integrated Pest Management (IPM) and Sustainable Agriculture short course at Michigan State University from June 14-24, 2009. This short course provides training in principles and practices on ecologically based approaches in IPM. The overall goal of this training is to contribute towards building human resources in IPM in Central Asia.

Objective 6. Conduct baseline survey of the regional IPM programs

Activity 6.1. Initiate baseline survey of pest management practices in Kyrgyzstan and Uzbekistan or Tajikistan.

Wheat, potato and tomato are the key food security crops in Central Asia. The three IPM CRSP research fellows in Central Asia (Dr. Nurali Saidov, Dr. Barno Tashpulatova, and Dr. Murat Aitmatov) conducted a systematic survey of key pests of wheat, potato and tomato in Kyrgyzstan, Tajikistan and Uzbekistan. Using this information, a pest matrix has been developed on these three crops for focusing future IPM research and outreach activities. In addition, the IPM CRSP research fellows inventoried pest management methods and practices used by farmers in these countries. These practices cover: (1) seed treatments,(2) soil treatments, (3) pheromone traps and sticky traps, (4) cultural control, (5) biopesticides, (6) biological control

through conservation and/or release of parasitoids and predators, (7) grafting for soil borne pathogens, (8) pest resistant varieties, (9) Chemical control, and (10) quarantine measures. This inventory will be utilized for designing IPM Packages for wheat, potato and tomato cropping systems.

Through the international links facilitated by Dr. Muniappan, Director of IPM CRSP, a private biocontrol research laboratory in Banglore, India supplied pheromone traps for *Heiocoverpa, sp*., and for Thrips. These traps were tested in three countries in Central Asia by the IPM CRSP Research Fellows in collaboration with the local research institutions. The pheromone traps for *Helicoverpa sp.* were found to be very effective. The Central Asia IPM CRSP project will make efforts to enhance linkages between IPM specialists in Central Asia and South Asia so that Central Asian counties can access appropriate IPM technologies from India and other countries.

Field experiment on testing sex pheromone traps of *Helicoverpa armigera* (American bollworm) moth in Tajikistan. We received 10 pheromone trap completes from IPM CRSP HQ produced in India at Pest Control Pvt. Ltd. PCI, Division: Bio-Control Research Laboratories (BCRL). From June 17 through July 1, 2009, we tested Indian pheromones in Hissor and Kulob region of Tajikistan in cotton and tomato fields. In the field experiment we tested the effectiveness of Indian pheromone traps in comparison to Uzbekistan pheromone traps which traditionally farmers used in cotton areas and rarely in tomato crops in all Central Asian countries. Therefore we conducted pheromone testing in both cotton and tomato fields. Table 1 shows the attractiveness of Indian pheromones in comparison to Uzbekistan pheromones in the cotton field. The obtained data from Indian pheromones showed they caught very high numbers of moths of American bollworm compared to Uzbekistan pheromones.

Indian pheromone trap with two days capture of moths.

Table 1. Attractiveness of Indian pheromones in comparison to Uzbekistan pheromones in a cotton field.

Number of pheromones in cotton field	Date of set up pheromones in field	Accounting dates												Total	
		19.06.2009		22.06.2009		24.06.2009		26.06.2009		29.06.2009		01.07.2009			
		Number of moths per account in pheromones													
		Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**
1	17.06.2009	136	5	102	7	116	4	107	0	103	1	97	1	661	18
2	17.06.2009	127	6	101	4	110	5	100	2	121	2	118	0	677	19
3	17.06.2009	145	4	111	5	117	3	105	3	101	0	103	0	682	15
4	17.06.2009	133	5	107	4	112	3	103	1	90	0	92	0	637	13
5	17.06.2009	130	3	102	3	106	2	91	1	87	2	90	1	606	12
6	17.06.2009	125	3	99	4	101	1	90	0	83	1	85	1	583	10

*Indian pheromones

**Uzbekistan pheromone producer is Uzbekistan Bioorganic Research Institute, Tashkent, Uzbekistan.

Table 2. Attractiveness of Indian pheromones in comparison to Uzbekistan pheromones in a tomato field.

Table 2.

Number of pheromones in tomato field	Date of set up pheromones in field	Accounting dates												Total	
		19.06.2009		22.06.2009		24.06.2009		26.06.2009		29.06.2009		01.07.2009			
		Number of moths per account in pheromones													
		Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**
1	17.06.2009	65	3	62	2	59	1	61	1	53	1	47	0	347	8
2	17.06.2009	61	3	60	1	60	0	57	2	49	1	52	0	339	7
3	17.06.2009	63	2	58	2	61	0	55	1	51	1	50	0	338	6
4	17.06.2009	67	4	62	2	63	2	59	1	50	1	63	0	364	10

Field experiment on testing sex pheromone for Western Flower Thrips, *Franklineilla occidentalis* in Tajikistan. We received 10 pheromone completes from IPM CRSP HQ which were marketed under agreement with the University of Keele. In the field experiment, we tested the effectiveness of the pheromone in cotton and in a flowering area.

Table 1. Attractiveness of pheromones in cotton field

Number of pheromones in cotton field	Date of set up pheromones in field	Accounting dates		Total
		19.06.2009	22.06.2009	
		Number of thrips per account in pheromones		
1	17.06.2009	3	2	5
2	17.06.2009	4	2	6
3	17.06.2009	3	2	5
4	17.06.2009	4	1	5
5	17.06.2009	3	2	5
6	17.06.2009	2	1	3

Table 2. Attractiveness of pheromones in flowers field.

Number of pheromones in flowers field	Date of set up pheromones in field	Accounting dates		Total
		19.06.2009	22.06.2009	
		Number of thrips per account in pheromones		
1	17.06.2009	15	12	27
2	17.06.2009	17	11	28
3	17.06.2009	18	9	27
4	17.06.2009	14	10	24

We measure the number of thrips attracted to pheromones only two times, because of pheromones sheets in the second accounting were fully covered by insects. Along with thrips, these pheromones traps attracted a number of beneficial insects such as ladybird beetles (Coccinellidae), syrphid flies (Syrphidae), lacewing (Chrysopidae) and others.

Field experiment on testing sex pheromone traps for *Helicoverpa armigera* (American bollworm) moth in Uzbekistan. We received 10 pheromone traps from IPM CRSP HQ which were produced in India at Pest Control Pvt. Ltd. PCI, Division: Bio-Control Research Laboratories (BCRL). In the field experiment, we tested the effectiveness of Indian pheromone traps in comparison to triangular Uzbekistan pheromone traps which traditionally farmers used in cotton areas and rarely in tomato fields in all Central Asian countries. Our testing procedures used standard Indian traps for *Helicoverpa armigera* (10 traps) and 10 triangular traps made at the Tashkent Institute of Bioorganic Chemistry out of cardboard with paper inserted inside with sticky glue for fixation of captured male butterflies. We counted the number of butterflies inside of the traps every 24 hours. On 25 ha of tomato field, 5 Indian pheromone traps where tested in the Namangan region. In the Tashkent region, the total area for insect measurement was 50 ha (for Indian and Uzbek traps). Traps were checked in Namangan region from June 25through July 5 and in Tashkent region from June 28 to July 20. There were fruit worm available in all tested tomato field plots. The same experiments at the same dates were conducted for Uzbekistan

pheromone traps. Most of butterflies were caught with Indian traps (average number for the first day was 56 individuals), whereas Uzbekistan traps' attractiveness was in average 3 butterflies per day. However the active term of Indian pheromone traps was 5-6 days, and traps made in Tashkent was 20-23 days The total number of butterflies caught in Namangan region with import traps was an average 232 individuals, and with local traps was 23 individuals. There are only male butterflies of fruit worms we checked in the traps, but we also noticed some differences between species of *Helicoverpa armigera* in Namangan and in Tashkent regions.

At left, fruit worm butterflies caught during the first day after the trap was placed in a tomato field intercropped with maize. (Namangan region, Uzbekistan).

Lower left, the samples of fruit worm *Helicoverpa (Heliothis) armigera* caught in Namangan region; Lower right, Uzbekistan pheromone trap for *Helicoverpa (Heliothis) armigera* made at the Tashkent Institute.

Full results are shown in Tables 1 and 2 on the next page.

Field experiment on testing sex pheromone for Western Flower Thrips, *Franklineilla occidentalis* in Uzbekistan. We also received completes with 10 blue sticky traps from IPM CRSP HQ, which were tested in a tomato field in the Tashkent region. Observations of the experimental field plots were conducted every 24 hours during 10 days. There were no thrips observed after 10 days in checking sticky traps (see photo). But the traps attracted some numbers of small flying insects including a few numbers of beneficial insects (ladybird beetles, syrphid flies, lacewings, etc.)

Table 1. Result of effectiveness of Indian and Tashkent pheromone traps on tomato field in Namangan region for 6 days

Number of pheromones in tomato field plots	Date of set up pheromones in field	Accounting dates												Total	
		26.06.2009		27.06.2009		28.06.2009		29.06.2009		30.06.2009		01.07.2009			
		Number of moths per account in pheromones													
		Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**
Plot 1	25.06.2009	53	3	57	2	50	3	34	5	10	2	7	3	211	18
Plot 2	- // -	57	2	59	-	52	2	42	2	16	3	6	2	232	11
Plot 3	- // -	56	-	60	1	55	3	47	3	15	5	5	3	238	15
Plot 4	- // -	55	2	53	2	47	3	42	-	33	1	9	5	239	13
Plot 5	- // -	59	1	57	3	45	1	41	1	25	2	9	-	236	8

*Indian pheromones

**Uzbekistan pheromones producer is Uzbekistan Bioorganic Research Institute, Tashkent, Uzbekistan.

Table 2. Attractiveness of Indian pheromones in comparison to Uzbekistan pheromones in tomato field in Tashkent region.

Table 2.

Number of pheromones in tomato field	Date of set up pheromones in field	Accounting dates												Total	
		19.06.2009		22.06.2009		24.06.2009		26.06.2009		29.06.2009		01.07.2009			
		Number of moths per account in pheromones													
		Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**	Ind*	Uzb**
Plot 1	28.06.2009	35	-	52	2	23	1	16	2	7	2	-	2	133	8
Plot 2	- // -	60	3	50	-	32	3	20	2	5	-	1	4	161	7
Plot 3	- // -	53	2	57	3	30	-	25	2	11	4	5	3	181	6
Plot 4	- // -	57	1	49	2	35	4	19	-	9	3	3	1	172	10
Plot 5	- // -	55	2	57	4	46	2	34	3	15	3	-	1	207	15

Field test of pheromone traps on *Helicoverpa armigera* in Kyrgyzstan. Testing of pheromone traps against *Helicoverpa armigera* was conducted in two areas: Issyk-Kul and и Chui. In Issyk-Kul area, traps were checked daily from July 4-14. In the Chui area, traps were checked July 14-25. The number of butterflies found in traps was higher in the Chui area.

Table 1. Efficiency of pheromone traps on a tomato field in Issyk-Kuls area.

№ Area with pheromone on a tomato field	Installation date of pheromone in the field	Account dates						Total
	3.07. 2009	4.07. 2009	6.07. 2009	8.07. 2009	10.07. 2009	12.07. 2009	14.07. 2009	
Area1	-//-	2	1	2	-	3	2	10
Area2	-//-	4	2	1	3	1	1	12
Area 3	-//-	1	2	2	2	2	-	9

Table 2. Efficiency of pheromone on a tomato field in Chui area.

№ Area with pheromone on a tomato field	Installation date of pheromone in the field	Account dates						Total
	14.07. 2009	15.07. 2009	17.07. 2009	19.07. 2009	21.07. 2009	23.07. 2009	25.07. 2009	
Area1	-//-	4	3	2	3	2	4	18
Area 2	-//-	3	4	7	4	2	3	23
Area 3	-//-	7	2	1	3	5	1	19

We also tested pheromone for thrips in these areas, however entomology - scientists could not identify the kind of thrips, therefore, we could not cite this data.

Degree Training

Dr. Saidov supervised one post-graduate student in Tajikistan and 3 students for essay graduation level in the Kyrgyz Agrarian University under Student Farm School IPM course program as follows:

- Introduction of nectar plant into existing vegetable farm systems as a method for the conservation of natural enemies in agro-landscapes – 1 post graduate student and 2 students involved in research under IPM CRSP program.
- Agro-landscape design – 1 student involved in research under IPM CRSP program.

Other Training

On September 5, 2009, in Kibray region in Uzbekistan, “Yangiobod Husanov Durbek” farmers’ district, the Farmers association, AVRDC and the IPM CRSP collaborated to conduct a seminar

on “Multiplication of new vegetable seeds, and management of diseases and pests on the crops.” About 60 farmers and 10 region leaders (mayor, head of farmers association, chairman of farms, director of AVRDC, and others) attended. Among them there were 10 female and 60 male participants. During seminar the opening address was made by Hokim (mayor) N. Myhamedov; Head of the Farmers association T. Bozorov; and AVRDC Director R. Mavlyanova. Researchers from the Institute of Plant Industry J. Alimov, G. Airapetov, and E. Suleimanov presented a small exhibition, reports and a field demonstration of new vegetable varieties (corn, sunflower and soybean) produced at the institute. Biological disease management was presented by Dr. G. Jumaniazova (Institute of Microbiology). Dr. Tashpulatova made a presentation to the farmers and gave a speech to a radio correspondent about biological control of spider mites and thrips using predator mites, *Amblyseius* sp., and about methods of rearing the entomophages in the biolaboratory. Farmers and other participants were interested in new vegetable varieties, and biological control of diseases and pests in vegetable crops.

Dr. Saidov helped organize the following events:

- Training for Farmers Leader and NGO representatives, April 17, 2009, in Dushanbe, Tajikistan on “Introducing native flowering plants into existing agro-landscapes.” (Attendance 20 males and 5 females for a total of 25)
- Training for Farmers Leader and NGO representatives, April 18, 2009, in Kulob region of Tajikistan on “Introducing native flowering plants into existing agro-landscapes.” (Attendance 25 males total.)
- Field day for farmers on IPM Farmer Field School in July 22-23, 2009 featuring tomato pest control through IPM. Participants were from the Kulob and Hissor region. (Attendance 15 females, 55 males for a total of 70)

Publications

Referred journals

Saidov N.SH., A.D. Landis (2008): Evaluation of flowering plants to attract natural enemies in Tajikistan. News of the Academy of sciences of the Republic of Tajikistan, № 4 (165), p. 19-28 *(in Russian).*

Saidov N.SH., A.D. Landis (2008): Evaluation of flowering plants to attract natural enemies in Tajikistan. Proceeding of the Conference devoted to 50 years Kazakh Research Institute of Plant Protection and Quarantine, Almata, Kazakhstan, November 2008, vol. I, p.127-132 *(in English).*

Book chapters (none)

Proceedings

Tashpulatova B., F. Zalom, J.T. Tumanov. 2008, Biological control of *Thrips tabaci* (Thysanoptera:Thripidae) using *Amblyseius mckenziei (*Acarina:Phytoseiidae) on onion crop in Kyrgyzstan and Uzbekistan. Proceedings of the International Scientific-Practical Conference "Achievements and problems of plant protection and quarantine" dedicated to the 50th Anniversary of Kazakh Research Institute of Plant Protection and Quarantine. Almaty - Rakhat, Kazakhstan. November 6-8, part 1, pp. 156-158 (in English);

Tashpulatova, B., and F. Zalom. 2008, Studies of the predaceous mites *Amblyseius cucumeris* and *Amblyseius mckenziei* (Acari:Phytoseiidae) in Uzbekistan. International scientific-applied conference "Application of methods of biological control in agriculture". Tashkent, Uzbekistan November 25-26, pp. 38-40 (English)

Pulatov A., B.A.Tashpulatova, M.I. Rashidov. 2008, Study the possibility for introduction and application in Uzbekistan predator mites of Phytoseiidae family, Proceedings of Republic scientific-applied conference of young scientists "Modern technologies of ecologically safe production" Devoted to Youth Year, Tashkent, Uzbeistan pp.54-57. (in Russian)

Tashpulatova B.A. 2009, Mass production and application of *Amblyseius* species predator mites in Uzbekistan. Proceedings of Republic scientific-applied conference of farmers, Tashkent, Uzbekistan April 6-7, 2009. (in Russian)

Saidov N.Sh., D.A. Landis, A. Fiedler, V.K. Nazirov, A. Khalimov (2008): The role of nectar plants on attraction natural enemies in agrolandscapes. Proceedings of the International Scientific-Practical Conference dedicated to the 60th Anniversary of Department of Biology of National University of Tajikistan. Dushanbe (Душанбе), December 19-20, 2008, p. 27-28 *(in Russian).*

Saidov A.S., N.Sh. Saidov, B.R. Nakhshiniev (2008): Effect of some aspects of climate change on fauna of Tajikistan. Ninth International Conference on Dryland Development, Sustainable Development in the Drylands Meeting the Challenge of Global Climate Change, 7-10 November 2008, Alexandria, Egypt. Abstracts of oral presentations, p. 38-39 *(in English).*

Saidov N.Sh., D.A. Landis (2008): Landscape ecology and biodiversity to enhance biodiversity and biological pest management. Ninth International Conference on Dryland Development, Sustainable Development in the Drylands Meeting the Challenge of Global Climate Change, 7-10 November 2008, Alexandria, Egypt. Abstracts of oral presentations, p. 82-83 *(in English).*

Bulletins

Saidov N.SH., A.U. Jalilov, V.K. Nazirov (2009): Russian-Tajik-English terminological dictionary on plant protection. Dushanbe 60 p., *(in Russian).*

Khamraev A.Sh., N.SH. Saidov, M.B. Aitmatov, D.A. Azimov, Sh.B. Ulmasbaev, B.A. Tashpulatova (2008): Agroetomological cartogram for Central Asia and Caucasus countries. Scientific-practical recommendation, Tashkent, 125 p., *(in Russian).*

Aitmatov M.B., George Bird, Jalilov A.U., Kasymova Kyjal. Farm Field School and ecology problem. Beatnik Kyrgyz agrarian university. № 3 (11), 2008. 10-14 pj.((in Russian)

Extension publications

Hamraev A.S., Saidov N.S., Aitmatov M. B, Azimov S.A., Ulmesbaev S. B, Tashpulatova B.A. Books: Agroentomological cartogram for Central Asia and Caucasus regions. ICARDA-Michigan and Uzbek zoology institute of academy of sciences. Tashkent, 2008. 123 p, in Russian, published copies 500 units.

Junusuv Kubat, Rashidov Murod, Aitmatov Murat. Russian, Kirghiz, Latin, Uzbek and English Terminological dictionary on plant protection. Kyrgyz agrarian university (Kyrgyzstan) and Tashkent State agrarian university (Uzbekistan), Bishkek, 2008. 56 pg.

Saidov N., D. Landis, A. Fiedler**,** M. Bouhssini, V. Nazirov, A. Jalilov (2009): Introduction of native flowering plants in agro landscapes for attracting beneficial insects. Extension Bulletin, Dushanbe, 12 p., *(in Russian).*

Manuals

Tashpulatova B.A., F. Zalom, M.I. Rashidov, B. Suleimanov. 2009, Methodological recommendation on rearing of predator mites (Phytoseiidae family) for biological control of greenhouse pests, Handbook. Tashkent-2009, Tashkent, 18 p, published copies 100 units (in Russian)

Thesis (none)

Other

In January 2009, through the support of Ms. Joy Landis, IPM communications manager at MSU, the Project established a new web site featuring its work and collaborators. The address of the web site is: http://ipm.msu.edu/central-asia.htm. The site features a description of each project component, reports and publications, photos and blog entries along with an IPM directory of IPM specialists and stakeholders in Central Asia.

Joy Landis also established a blog documenting the team's travel and meetings in Central Asia during spring 2009: http://www.ipmglobal.blogspot.com/. The blog is intended to help the general public understand how American science (specifically in IPM) can be leveraged to help raise the standard of living and improve the environment in countries like those in Central Asia. The blog features collaborations between the people of the region and the U.S. based project team. The blog has received over 425 visits from 293 visitors with more than 700 page views since June 1, 2009. The blog will be continued during the next phase of the Central Asia project and will be positioned to send traffic to the web site.

Presentations

Saidov, N. and D. Landis. Enhancing pest management in organic farming via conservation biological control. September 2009. 2nd International Conference on Organic Sector Development in Central/Eastern European and Central Asian countries, Tbilisi, Georgia.

Tashpulatova, B. and F. Zalom. June 2009. Enhancing the Efficiency and Product Lines of Biolaboratories in Central Asia. Central Asia Stakeholders Forum, Bishkek, Kyrgyzstan.

Saidov, N. and D. Landis, A. Fiedler, V.K. Nazirov, A. Khalimov. December 2008. The Role of Nectar Plants on Attraction Natural Enemies In Agro-Landscapes. 60th Anniversary of the Department of Biology of National University of Tajikistan, Dushanbe, Tajikistan.

Tashpulatova, B. and F. Zalom. November 2008. Biological control of *Thrips tabaci* (Thysanoptera: Thripidae) using *Ambliseius mckenziei* (Acarina:Phytoseiidae) on onion crop in Kyrgyzstan and Uzbekistan. Conference for the 50th anniversary of Kaz. Scientific Res. Institute of Plant Protection and Quarantine, Almaty, Kazakhstan.

Tashpulatova, B. November 2008. “Application of methods of biological control in agriculture," Tashkent, Uzbekistan.

Saidov, N. and D. Landis. Landscape ecology and biodiversity to enhance biodiversity and biological pest management. November 2008. 9th International Conference on Dryland Development, Sustainable Development in the Drylands Meeting the Challenge of Global Climate Change, Alexandria, Egypt.

Dr. Karim Maredia, Dr. Frank Zalom, and Dr. Dieudonne Baributsa attended the Sixth International IPM Symposium in Portland, Oregon from March 22 - 25, 2009. Two posters were presented covering research results and outcomes of the Central Asia IPM CRSP project.

Awards

The Central Asia regional IPM CRSP project has been implemented through the CGIAR/ ICARDA PFU Consortium. This consortium was awarded the **CGIAR King Baudouin Science Award for Outstanding Partnership for sustainable agriculture in Central Asia** in 2008.